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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
13/466,509	05/08/2012	David TIKKANEN	MAT-3	177143

Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 10/28/2022 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant asserting small entity status. See 37 CFR 1.27.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Bruce Young/
Name:	Bruce Young
Registration Number:	45656

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	6008.015

CONFIRMATION NO. 8469

POWER OF ATTORNEY NOTICE

30589
DUNLAP CODDING, P.C.
PO BOX 16370
OKLAHOMA CITY, OK 73113

OC00000136688274

Date Mailed: 10/27/2022

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/21/2022.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tmwilliams/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	6008.015

CONFIRMATION NO. 8469

POA ACCEPTANCE LETTER

59342
BRUCE YOUNG
12205 NW 85th Ave
Grimes, IA 50111

OC000000136688296

Date Mailed: 10/27/2022

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/21/2022.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tmwilliams/

PATENT APPLICATION

Docket No. MAT-3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	David Tikkanen
Patent No.	8,957,601
Serial No.	13/466,509
Confirmation No	8469
Filed:	2012-05-08
For:	Configurable Led Driver/Dimmer For Solid State Lighting Applications
Date:	10/21/2022

To: Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Notification of Entitlement to Small Entity Status

The above identified patent is now entitled to small entity status.

Respectfully submitted,

/Bruce A Young/
Bruce A Young, Reg. # 45656
12205 NW 85th Ave
Grimes, IA 50111
bruce@youngspatentservices.com
(712) 541-9822

Electronic Acknowledgement Receipt

EFS ID:	46866975
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	30589
Filer:	Bruce A. Young
Filer Authorized By:	
Attorney Docket Number:	6008.015
Receipt Date:	21-OCT-2022
Filing Date:	08-MAY-2012
Time Stamp:	12:31:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	MAT-3_POA.pdf	250531 996d9c7e9493856587b84b70a973f5bd5212cb0e	no	4

Warnings:

Information:					
2	Miscellaneous Incoming Letter	MAT-3_ClaimtoSmallEntityTemplate_20221021.pdf	92117 0ac2e54c439d0241a83328b4c6cd78cc7c6bc814	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	342648	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/80 (07-17)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no person is required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 59342

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 59342

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: Mate, LLC, 2218 Wilshire Blvd, Suite 104D, Oklahoma City, Oklahoma 73116

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	Date 10.17.22
Name Mate, LLC	Telephone 720-600-4430
Title President	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Mate. LLC

Application No./Patent No.: 8,957,601 Filed/Issue Date: 2015-02-17

Titled: Configurable Led Driver/Dimmer For Solid State Lighting Applications

Mate. LLC, a Limited Liability Company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. [x] The assignee of the entire right, title, and interest.

2. [ ] An assignee of less than the entire right, title, and interest (check applicable box):

   [ ] The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   [ ] There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. [ ] The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. [ ] The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. [ ] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. [x] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: TIKKANEN, DAVID;BOOTH, CHRISTOPHER DOUGLAS To: LUMASTREAM CANADA ULC

   The document was recorded in the United States Patent and Trademark Office at
   Reel 028705, Frame 0467, or for which a copy thereof is attached.

2. From: LUMASTREAM CANADA ULC To: LUMASTREAM, INC.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 054134, Frame 0089, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: LUMASTREAM, INC. To: E CRAFTSMEN CORPORATION

The document was recorded in the United States Patent and Trademark Office at
Reel 054134, Frame 0330, or for which a copy thereof is attached.

4. From: E CRAFTSMEN CORPORATION To: MATE. LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 054709, Frame 0940, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Bruce A. Young/	2022-10-07
Signature	Date
Bruce A Young	45656
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: PET.POA.WDRW
Document Description: Petition to withdraw attorney or agent (SB83)

PTO/AIA/83 (04-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/466,509, Patent No. 8,957,601
Filing Date	May 6, 2012
First Named Inventor	David Tikkanen
Art Unit	2844
Examiner Name	Vibol Tan
Practitioner Docket Number	6008.015

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Please withdraw me as attorney or agent for the above-identified patent application, and

☐ all the practitioners of record;

☐ the practitioners (with registration numbers) of record listed on the attached paper(s); or

☒ the practitioners of record associated with Customer Number: 30589

NOTE: The immediately preceding box should only be marked when the practitioners were appointed using the listed Customer Number.

The reason(s) for this request are those described in 37 CFR:

☐ 11.116(a)(1) ☐ 11.116(a)(2) ☒ 11.116(a)(3)
☒ 11.116(b)(1) ☐ 11.116(b)(2) ☐ 11.116(b)(3)
☐ 11.116(b)(4) ☐ 11.116(b)(5) ☐ 11.116(b)(6)
☐ 11. 116(b)(7) Please explain below:

Certifications

Check each box below that is factually correct. WARNING: If a box is left unchecked, the request will likely not be approved.

1. ☒ I/We have given reasonable notice to the client, prior to the expiration of the response period, that the practitioner(s) intend to withdraw from employment.

2. ☒ I/We have delivered to the client or a duly authorized representative of the client all papers and property (including funds) to which the client is entitled.

3. ☒ I/We have notified the client of any responses that may be due and the time frame within which the client must respond.

Please provide an explanation, if necessary:

This collection of information is required by 37 CFR 1.36. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/83 (04-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

Complete the following section only when the correspondence address will change. *Changes of address will only be accepted to an applicant.*

Change the correspondence address and direct all future correspondence to:

A. ☐ The address of the applicant associated with Customer Number: _____

OR

B. ☒ Applicant

Address 219 W. Wilshire Blvd. Suite 104D

City	State	Zip	Country
Oklahoma City	OK	73116	US

Telephone 405-520-9220 Email Jenn@onyxtheater.com

I am authorized to sign on behalf of myself and all withdrawing practitioners.

Signature /Ann M. Robl/

Name Ann M. Robl Registration No. 71541

Address 609 W. Sheridan

City	State	Zip	Country
Oklahoma City	OK	73102	US

Date April 28, 2021 Telephone No. 405-607-8600

NOTE: Withdrawal is effective when approved rather than when received.

This collection of information is required by 37 CFR 1.36. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	42582136
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	30589
Filer:	Ann M. Robl/Bradley Thompson
Filer Authorized By:	Ann M. Robl
Attorney Docket Number:	6008.015
Receipt Date:	28-APR-2021
Filing Date:	08-MAY-2012
Time Stamp:	16:51:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	6008015_SB21Transmittal_04282021.pdf	165419 13972d38f67d0c203b8070ecb30c5424c4b396c4	no	1

Warnings:

Information:					
2	Petition to withdraw attorney or agent (SB83)	6008015_AIA83Withdrawal_04282021.pdf	177052 100019b20df953d2b9351a355223d27b9b18e234	no	3
Warnings:					
Information:					
			Total Files Size (in bytes):	342471	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 12/31/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	13/466,509, Patent No. 8,957,601
Filing Date	May 8, 2012
First Named Inventor	David Tikkanen
Art Unit	2884
Examiner Name	Vibol Tan
Attorney Docket Number	6008.015

Total Number of Pages in This Submission

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☑ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please identify below):

Remarks

Electronically Transmitted:

1) sb21 Transmittal (1 page); and,
2) aia83 Request for Withdrawal as Attorney or Agent and Change of Correspondence Address (2 pages)

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Dunlap Codding, P.C.		
Signature	/Ann M. Robl/		
Printed name	Ann M. Robl		
Date	April 28, 2021	Reg. No.	71,541

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	/Ann M. Robl/		
Typed or printed name	Ann M. Robl	Date	April 28, 2021

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	18154

CONFIRMATION NO. 8469

POA ACCEPTANCE LETTER

30589
DUNLAP CODDING, P.C.
PO BOX 16370
OKLAHOMA CITY, OK 73113

OC000000122531757

Date Mailed: 01/11/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/04/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hteffera/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	18154

CONFIRMATION NO. 8469

POWER OF ATTORNEY NOTICE

293
DOWELL & DOWELL, P.C.
2560 HUNTINGTON AVE, SUITE 406
ALEXANDRIA, VA 22303

OC00000122531740

Date Mailed: 01/11/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/04/2021.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hteffera/

PTO/AIA/80 (07-17)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 30589

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 30589

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: Mate, LLC
219 W. Wilshire Blvd, Suite 104D
Oklahoma City, Oklahoma 73116

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature Jon Upton	Date 12/20/20
Name Jon Upton	Telephone 405-520-9220
Title Manager, Mate. LLC	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Lumastream Canada ULC

Application No./Patent No.: 8,957,601 Filed/Issue Date: February 17, 2015

Titled: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

Mate. LLC, a limited liability corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: David Tikkanen and Christopher Booth To: Lumastream Canada ULC

The document was recorded in the United States Patent and Trademark Office at
Reel 028705, Frame 0467, or for which a copy thereof is attached.

2. From: Lumastream Canada ULC To: Lumastream, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 054134, Frame 0089, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Lumastream, Inc. To: E Craftsmen Corporation

The document was recorded in the United States Patent and Trademark Office at
Reel 054134, Frame 0330, or for which a copy thereof is attached.

4. From: E Craftsmen Corporation To: Mate. LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 054709, Frame 0940, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Ann M. Robl/	January 4, 2021
Signature	Date
Ann M. Robl	71,541
Printed or Typed Name	Title or Registration Number

Electronic Acknowledgement Receipt

EFS ID:	41543900
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Ann M. Robl/Anne Burns
Filer Authorized By:	Ann M. Robl
Attorney Docket Number:	18154
Receipt Date:	04-JAN-2021
Filing Date:	08-MAY-2012
Time Stamp:	14:30:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	6008015_sb21_Transmittal_01042021.pdf	170670 4851e70a807f5a93fbf0f04fcb6897ad497896ab	no	1

Warnings:

Information:					
2	Power of Attorney	6008015_AIA80_POA_01042021.pdf	109225 0f4e780ee51223a10b5d9e0665cd0a62fcf01430	no	1
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73	6008015_AIA96_Statement_01042021.pdf	80806 c758fb21f2cceaef31be29e715d3aa1e2d9323c7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	360701		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	13/466509
Filing Date	May 8, 2012
First Named Inventor	David Tikkanen
Art Unit	2844 (conf. 8469)
Examiner Name	Vibol Tan
Attorney Docket Number	6008.015

Total Number of Pages in This Submission

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☑ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) (please identify below):
  See Remarks

Remarks

Electronically Transmitted: January 4, 2021

1) sb21 Transmittal (1 page);
2) AIA60 Power of Attorney (1 page); and
3) AIA96 Statement Under 37 CFR 3.73(c) (2 pages).

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	DUNLAP CODDING, P.C.		
Signature	/Ann M. Robl/		
Printed name	Ann M. Robl		
Date	January 4, 2021	Reg. No.	71,541

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being electronically transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	/Ann M. Robl/		
Typed or printed name	Ann M. Robl	Date	January 4, 2021

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	02/17/2015	8957601	18154	8469

293 7590 01/27/2015

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 129 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

David TIKKANEN, Waterloo, CANADA;
Christopher Douglas Booth, Saint Petersburg, FL;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Receipt date: 10/02/2012
Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	~~2824~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/N.T./	1	5420780		1995-05-30	Bernstein et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/N.T./ Change(s) applied to document, /J.L.B./ /N.T./ 11/12/2014	1	20020047642		2002-04-25	Miyagawa ~~ROHM CO., LTD.~~	Figs. 6, 7
	2	20080018261		2008-01-24	Kastner	Fig. 20; Para. 102
/N.T./	3	20090179594		2009-07-16	Yang	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
/N.T./	1	2009039112	WO		2009-03-26	EXCLARA, INC.	Figs. 1, 10	☐

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

203 75091 10/06/2014
DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

TITLE OF INVENTION: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/06/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
TAN, VIBOL	2844	315-294000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 .....
2 .....
3 .....

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: LUMASTREAM CANADA ULC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): CALGARY, CANADA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
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5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Wendy M. Slade/ Date January 6, 2015

Typed or printed name Wendy M. Slade Registration No. 53604

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	13466509
Filing Date:	08-May-2012
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Filer:	Ralph A. Dowell/Wendy Slade
Attorney Docket Number:	18154

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**960**

Electronic Acknowledgement Receipt

EFS ID:	21127675
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Ralph A. Dowell/Wendy Slade
Filer Authorized By:	Ralph A. Dowell
Attorney Docket Number:	18154
Receipt Date:	06-JAN-2015
Filing Date:	08-MAY-2012
Time Stamp:	11:52:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	9097
Deposit Account	
Authorized User	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	18154if.pdf	401495 3732fbb2f0315e56db46554ef3edbc104e5822d1	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30839 b5803401124701332390df3bc2f90bbd2d17686f	no	2
Warnings:					
Information:					
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 11/25/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
11/25/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Supplemental Notice of Allowability	Application No. 13/466,509	Applicant(s) TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 9/24/14*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *2-5,8-18,20-22,24 and 25*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

CPC						
Symbol					**Type**	**Version**
H05B		33	/	0803	F	2013-01-01
H05B		33	/	0809	I	2013-01-01
H05B		37	/	0245	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844	11/14/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	12

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
315	294

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
315	299	77			
362	85	147			

INTERNATIONAL CLASSIFICATION											
CLAIMED						**NON-CLAIMED**					
H	0	5	B	37 / 02 (2006.01.01)							
F	2	1	V	33 / 00 (2006.01.01)							

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844	11/14/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	12

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	Examiner	**Art Unit**
	VIBOL TAN	2844

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	12	17												
1	2	13	18												
2	3		19												
3	4	14	20												
4	5	15	21												
	6	17	22												
	7		23												
5	8	19	24												
16	9	20	25												
6	10														
18	11														
7	12														
8	13														
9	14														
10	15														
11	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844 (Primary Examiner)	11/14/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 12

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/30/2014	11/24/2014							
	1	-	-							
1	2	=	=							
2	3	=	=							
3	4	=	=							
4	5	=	=							
	6	-	-							
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17	22	=	=							
	23	-	-							
19	24	=	=							
20	25	=	=							

Receipt date: 08/31/2012

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	~~2821~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/V.T./	1	8197079		2012-06-12	RUUD ET AL	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

Receipt date: 08/31/2012

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	~~2824~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/Vibol Tan/ (11/14/2014)	Date Considered	11/14/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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H05B		33	/	0803	F	2013-01-01
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H05B		37	/	0245	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	21	
/VIBOL TAN/ Primary Examiner.Art Unit 2844	11/14/2014	O.G. Print Claim(s)	O.G. Print Figure
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F	2	1	V	33 / 00 (2006.01.01)	

NONE		**Total Claims Allowed:**	
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/VIBOL TAN/ Primary Examiner.Art Unit 2844 (Primary Examiner)	11/14/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 12

Receipt date: 10/02/2012

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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First Named Inventor	David TIKKANEN
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Examiner Name	V.Tan
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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	~~1~~	~~5428780~~		~~1995-05-30~~	~~Bernstein et al.~~	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020047642		2002-04-25	ROHM CO., LTD.	Figs. 6, 7
	2	20080018261		2008-01-24	Kastner	Fig. 20; Para. 102
	3	20090179594		2009-07-16	Yang	

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	1	2009039112	WO		2009-03-26	EXCLARA, INC.	Figs. 1, 10	☐

Receipt date: 10/02/2012

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Art Unit	~~2821~~ 2844
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Attorney Docket Number	PAT 67545AW-2

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/V.T./	1	UKIPO (Examiner HUNT), SEARCH AND EXAMINATION REPORT UNDER SECTIONS 17 & 18(3), Patent Application No. GB1102782.8, 2012-09-06	☐

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EXAMINER SIGNATURE

Examiner Signature	/Vibol Tan/ (11/14/2014)	Date Considered	11/14/2014

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 11/18/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
11/18/2014	PAPER

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2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *2-5,8-22,24 and 25*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 8/31/12; 10/02/12
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/30/2014								
	1	-								
1	2	=								
2	3	=								
3	4	=								
4	5	=								
	6	-								
	7	-								
5	8	=								
17	9	=								
6	10	=								
19	11	=								
7	12	=								
8	13	=								
9	14	=								
10	15	=								
11	16	=								
12	17	=								
13	18	=								
15	19	=								
14	20	=								
16	21	=								
18	22	=								
	23	-								
20	24	=								
21	25	=								

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

293 7590 10/06/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER
TAN, VIBOL

ART UNIT	PAPER NUMBER
2844	

DATE MAILED: 10/06/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

TITLE OF INVENTION: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/06/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

293 7590 10/06/2014
DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

TITLE OF INVENTION: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/06/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
TAN, VIBOL	2844	315-294000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 10/06/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

DATE MAILED: 10/06/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/466,509	Applicant(s) TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 9/24/14*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *2-5,8-18,20-22,24 and 25*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 9/24/14
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ralph A Dowell on 9/30/14.

The application has been amended as follows: Please cancel claim 19.

3. The following is an examiner's statement of reasons for allowance: in combination with other limitations of the claims, the cited prior arts fail to teach a break-out module electrically connected to an output of the LED driver and the set of light fixture loads, the break-out module including power connectors; wherein the break-out module receives power from the LED driver via a set of input channels and delivers power to the set of light fixture loads via a set of output channels, as required by amended claims 2 and 21.

4. Claims 2-5, 8-18, 20-22, 24 and 25 are now in condition for allowance.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vibol Tan whose telephone number is (571)272-1811. The examiner can normally be reached on Monday-Friday (7:00 AM-4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alex Taningco can be reached on (571) 272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	13/466,509	TIKKANEN ET AL.	
	Examiner	Art Unit	
	Vibol Tan	2844	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Vibol Tan*. (3)_____.

(2) *Ralph A Dowell*. (4)_____.

Date of Interview: *30 September 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☒102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *19*.

Identification of prior art discussed: *US 2011/0309746*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative authorized cancellation of claim 19 by Examiner's Amendment, in order to place the application in condition for allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

Notice of References Cited	Application/Control No. 13/466,509	Applicant(s)/Patent Under Reexamination TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2011/0309746	12-2011	Eckel et al.	315/77
*	B	US-7,961,113	06-2011	Rabiner et al.	340/4.21
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/30/2014								
	1	-								
1	2	=								
2	3	=								
3	4	=								
4	5	=								
	6	-								
	7	-								
5	8	=								
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19	24	=								
20	25	=								

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BIB DATA SHEET

CONFIRMATION NO. 8469

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/466,509	05/08/2012 **RULE**	315	2844	18154

APPLICANTS

INVENTORS

David TIKKANEN, Waterloo, CANADA;
Christopher Douglas Booth, Saint Petersburg, FL;

** **CONTINUING DATA** *************************

This application is a CIP of 13/059,336 03/22/2011 PAT 8525446 *
which is a 371 of PCT/CA2009/001295 09/17/2009
which claims benefit of 61/097,963 09/18/2008
(*)Data provided by applicant is not consistent with PTO records.

** **FOREIGN APPLICATIONS** *************************

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
05/21/2012

Foreign Priority claimed / 35 USC 119(a-d) conditions met / Verified and Acknowledged		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /VIBOL TAN/ Examiner's Signature	☐ Met after Allowance VTan Initials	CANADA	20	18	2

ADDRESS

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314
UNITED STATES

TITLE

CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1880	No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

CPC						
Symbol					**Type**	**Version**
H05B		33	/	0803	F	2013-01-01
H05B		33	/	0809	I	2013-01-01
H05B		37	/	0245	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
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			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	12

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
315	294

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
315	299	77			
362	85	147			

INTERNATIONAL CLASSIFICATION														
CLAIMED						**NON-CLAIMED**								
H	0	5	B	37 / 02 (2006.01.01)										
F	2	1	V	33 / 00 (2006.01.01)										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	12

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	**Art Unit**
	VIBOL TAN	2844

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	14	17												
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13	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/VIBOL TAN/ Primary Examiner.Art Unit 2844 (Primary Examiner)	09/30/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 12

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	Art Unit
	VIBOL TAN	2844

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
315	294, 152, 155, 210, 246, 291	12/10/13	VTan
362	85, 147, 148, 150, 240, 576	12/10/13	VTan
315	77, 299	9/30/2014	VTan

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	12/10/13	VTan
EAST text update	2/19/14	VTan
review tagged references in EAST	6/24/14	VTan
EAST text update	9/29/2014	VTan

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
uspgpub, uspat & upad		9/30/2014	VTan

Receipt date: 09/24/2014

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	2844
Examiner Name	TAN, Vibol
Attorney Docket Number	18154

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/V.T./	1	7804189		2010-09-28	Koehler et al	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

Receipt date: 09/24/2014	Application Number	13466509
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2012-05-08
(Not for submission under 37 CFR 1.99)	First Named Inventor	David TIKKANEN
	Art Unit	2844
	Examiner Name	TAN, Vibol
	Attorney Docket Number	18154

	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/Vibol Tan/ (09/30/2014)	Date Considered	09/30/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. :	13/466,509
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLIATIONS
Applicant :	TIKKANEN, David; BOOTH, Christopher, Douglas
Filed :	September 17, 2009
Art Unit :	2844
Examiner :	TAN, Vibol
Docket No. :	18154
Customer No. :	293

MAIL STOP AMENDMENT
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria VA 22313-1450
USA

RESPONSE AND AMENDMENT

In response to the Office Action of June 27, 2014, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page **2** of this paper.

Remarks/Arguments begin on page **6** of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Cancelled)

2. (Currently Amended) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads, the break-out module including power connectors;

wherein the break-out module receives power from the LED driver via a set of input channels and delivers power to the set of light fixture loads via a set of output channels; and splits the set of input channels into individual output channels;

wherein the LED driver is located remotely from the set of light fixture loads.

3. (Previously presented) The apparatus of Claim 2 wherein the set of output current drivers are connected to the break-out module via cabling.

4. (Previously Presented) The apparatus of Claim 3 further comprising:
a set of series connect modules, each of the set of series connect modules associated with one of the set of light fixture loads and connected to an output of the break-out module.

5. (Previously presented) The apparatus of Claim 3 wherein the power cabling includes the set of input channels.

Claims 6 and 7 (Cancelled)

8. (Previously presented) The apparatus of Claim 2 wherein the break-out module connects to multiple light fixture loads via cabling.

9. (Previously Presented) The apparatus of Claim 21 wherein the break-out module connects to multiple light fixture loads via cabling.

10. (Currently Amended) The apparatus of Claim 2 wherein the break-out module comprises:

at least one printed circuit board (PCB) ~~having power connectors~~.

11. (Previously presented) The apparatus of Claim 22 wherein the at least one PCB assists in regrouping the set of input channels into a different grouping of output channels.

12. (Previously presented) The apparatus of Claim 10 wherein the at least one PCB assists in splitting the set of input channels into individual output channels.

13. (Currently Amended) The apparatus of Claim [[10]]2 wherein the power connectors include apparatus to enable quick connection and release of ~~with~~ the cabling.

14. (Previously presented) The apparatus of Claim 4 wherein at least one of the set of series connect modules comprises:

at least one printed circuit board (PCB) assembly for connecting to an output from the break-out module.

15. (Previously Presented) The apparatus of Claim 4 wherein the break-out module and the set of series connect modules are integrated together.

16. (Previously presented) The apparatus of Claim 2 wherein the LED driver and the break-out module are integrated together.

17. (Previously presented) The apparatus of Claim 2 wherein the LED driver further comprises a communication interface for receiving data from an external transmitter.

18. (Previously Presented) The apparatus of Claim 2 wherein the at least one current driver comprises a buck topology power stage with hysteretic control.

19. (Currently Amended) A method of configuring and powering a set of light fixture loads in a LED low voltage distribution system comprising:

converting ~~limiting~~ power for powering the set of light fixture loads;

~~converting~~ limiting~~ed~~ converted power to multiple constant current outputs to limit amount of power supplied to the set of light fixture loads; and

splitting or regrouping the constant current outputs prior to delivery of the multiple constant outputs to the set of light fixture loads.

20. (Previously presented) The apparatus of Claim 2 further comprising a DC/DC converter.

21. (Currently Amended) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads, the break-out module including power connectors;

wherein the break-out module receives power from the LED driver via a set of input channels and delivers power to the set of light fixture loads via a set of output channels;

wherein the break-out module ~~changes~~ regroups the number of output channels from the number of input channels

wherein the LED driver is located remote from the set of light fixture loads.

22. (Currently Amended) The apparatus of Claim 21 wherein the break-out module comprises:

at least one printed circuit board (PCB) ~~having power connectors~~.

23. (Cancelled)

24. (New) The apparatus of Claim 3 wherein the cabling comprises at least four conductors.

25. (New) The apparatus of Claim 3 wherein the cabling comprises at least two twisted pairs of conductors.

Remarks/Arguments

Your Ref.: 78766-80 Our Docket: 16918

In response to the Interview Summary of September 9, 2014, Applicant respectfully agrees with the Examiner's assessment that 1) no exhibit was shown and no demonstration conducted; 2) Claims 2, 19 and 21 were discussed; 3) US Patent Publication No. 2011/0018464 to Lo was discussed; 4) the proposed amendments were directed at clarifying the terms "break-out module" and "limiting power"; 5) it was submitted that Lo does not disclose the subject matter of a break-out module which Examiner indicated he had not appreciated during the previous search and response and that Lo did not disclose the subject matter of limiting power; 6) no other matters were discussed; and 7) the results are as described by the Examiner in the Interview Summary.

Claims 2 to 5, 8 to 22 and 24 to 25 remain in the present application. Claims 24 and 25 are new, Claims 2, 10, 13, 19 and 21 have been amended and Claim 23 cancelled. Claim 23 has been cancelled in order to accelerate prosecution of the current application. Claims 1, 6 and 7 were previously cancelled.

Claims 2, 3, 8, 9, 16, 19 to 21 and 23 are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by US Patent Publication No. 2011/0018464 to Lo et al. ("Lo"). Applicant respectfully disagrees, however, Applicant has amended independent Claim 2 to include the subject matter of the break-out module including power connectors to more clearly differentiate the claimed subject matter from Lo.

Lo is directed at a DC low voltage distribution box for indoor multi LEDs lamp which includes a power converting module (2) which is connected to a set of output ports (3) having different output voltages. In other words, each output port delivers a different output voltage which is supplied by the power converting module. The distribution box further includes a set of selection switches (4) for supplying the voltages from the output ports (3) to current regulators (5) connected to load connectors (6).

Independent Claim 2 includes the subject matter of a break-out module that "splits the set of input channels into individual output channels". It is respectfully submitted that there is no such disclosure or suggestion of this subject matter in Lo. The Examiner has pointed to the set of selection switches (4) as being equivalent to the claimed subject matter. Applicant respectfully

disagrees.

A switch simply performs the functionality of connecting a set of outputs to a set of inputs such as the set of output ports (3) to the current regulators (5) in a one-to-one fashion. The functionality of switches is well known. Switches do not provide the functionality of "split(ting) the set of inputs channels into individual output channels" as claimed. Support for the subject matter of the functionality of the break-out module can be found in at least paragraphs 100 (first occurrence), 101 (first occurrence) and 103 of the specification as filed. For at least these reasons, it is respectfully submitted that the subject matter of "wherein the break-out module regroups the number of output channels from the number of input channels", as claimed in Claim 21, is also patentable over Lo.

As such, it is respectfully submitted that those claims which are directly or indirectly dependent on Claims 2 and 21 are also patentable for at least these reasons.

With respect to independent Claim 19, Claim 19 has been amended to more clearly identify the claimed subject matter. Claim 19 is now directed at:

A method of configuring and powering a set of light fixture loads in a LED low voltage distribution system comprising:

converting power for powering the set of light fixture loads;

limiting converted power to multiple constant current outputs to limit amount of power supplied to the set of light fixture loads; and

splitting or regrouping the constant current outputs prior to delivery of the multiple constant outputs to the set of light fixture loads.

It is respectfully submitted that amended Claim 19 is now patentable over Lo. Lo discloses the subject matter of converting a power input (via power converting module 2) but there is no discussion of any further processing of this signal. The converted power is transmitted to the outputs (3) and then transmitted through the switches which do not perform any power limiting function. Pre-determined voltages are being provided by the outputs and there is no further power limiting of the these pre-determined voltage outputs as now claimed. Furthermore, Claim

19 has further been amended to more clearly define the power limiting functionality in order to differentiate Claim 19 from the teachings of Lo. Claim 23 has been cancelled. Retraction of Examiner's rejection of Claims 2, 3, 8, 9, 16, 19 to 21 and 23.

Claim 5 has been rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo. Applicant respectfully submits that the Examiner's rejection is now moot in view of the arguments outlined above. Retraction of Examiner's rejection of Claim 5 is respectfully requested.

Claim 17 has been rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo in view of US Patent Publication No. 2010/0066267 to Meyer ("Meyer"). Applicant respectfully submits that Meyer is silent with respect to the subject matter lacking in Lo to obviate Claim 2 from which Claim 17 is directly dependent. Retraction of Examiner's rejection of Claim 17 is respectfully requested.

Claim 18 has been rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo in view of US Patent Publication No. 2010/0018261 to Kastner ("Kastner"). Applicant respectfully submits that Kastner is silent with respect to the subject matter lacking in Lo to obviate Claim 2 from which Claim 18 is directly dependent. Retraction of Examiner's rejection of Claim 18 is respectfully requested.

For the above reasons, it is respectfully submitted that the application is now in condition for allowance, which is requested. If there are any outstanding issues, the Examiner is invited to contact the undersigned to discuss this matter further. The Commissioner is hereby authorized to charge any additional fees, and credit any payments, necessitated by the filing of this response to Deposit Account No. 041577, in the name of Dowell & Dowell, P.C.

Respectfully submitted,

By:/Ralph A Dowell/
Ralph A. Dowell
Reg. No.: 26868

Dated: September 24, 2014

Dowell & Dowell, P.C.
103 Oronoco Street
Suite 220
Alexandria, VA 22314
Tele: 703-739-9888
Email: dowell@dowellpc.com

Electronic Acknowledgement Receipt

EFS ID:	20232694
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Ralph A. Dowell
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	24-SEP-2014
Filing Date:	08-MAY-2012
Time Stamp:	15:32:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	18154rnfoa.pdf	54399 77a7e8964a1e4bac5143f7d3dbfadab87d691cfb	no	9

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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	2844
Examiner Name	TAN, Vibol
Attorney Docket Number	18154

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7804189		2010-09-28	Koehler et al	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13466509
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	First Named Inventor	David TIKKANEN
	Art Unit	2844
	Examiner Name	TAN, Vibol
	Attorney Docket Number	18154

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Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	2844
Examiner Name	TAN, Vibol
Attorney Docket Number	18154

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Ralph A Dowell/	Date (YYYY-MM-DD)	2014-09-24
Name/Print	Ralph A. Dowell	Registration Number	26868

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	13466509
Filing Date:	08-May-2012
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Filer:	Ralph A. Dowell
Attorney Docket Number:	18154

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	20233479
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Ralph A. Dowell
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	24-SEP-2014
Filing Date:	08-MAY-2012
Time Stamp:	15:59:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	2567
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal Letter	18154ids6trans.pdf	36612 4cd5f0a0de9c191a43d44c3d6b3920bb2cf90166	no	2
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	18154sb08no6.pdf	611971 b5e02553ba1a19c3636aa0ae942a40ff41b276ea	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30725 de10eeb2f64fb9120e3aaa52ab69eb563b5f5785	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	679308		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor	:	TIKKANEN, David et al.
Appl. No.	:	13/466,509
Filed	:	May 08, 2012
Title	:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Confirm. No.	:	8469
Grp./A.U.	:	2844
Examiner	:	TAN, Vibol
Docket No.	:	18154

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

INFORMATION DISCLOSURE STATEMENT

In accordance with 37 C.F.R. §§ 1.97-1.99, the Applicants, through and by counsel, submit the following information which may be of interest to the Examiner in charge of the above-referenced application for patent.

Since the Applicants are submitting this information after the non-final office action mailed June 27, 2014, the fee required is being submitted herewith. Any deficiency in fees necessitated by the filing of this IDS may be charged to deposit account no. 04-1577 to Dowell & Dowell, P.C.

Should the Examiner have any questions regarding this Information Disclosure Statement or the references cited therein, the Applicants invite the Examiner to contact the undersigned attorney of record at the telephone number provided below.

Respectfully submitted,

DOWELL & DOWELL, P. C.

/Ralph A Dowell/
Ralph A. Dowell
Reg. No.: 26868
Date: September 24, 2014

DOWELL & DOWELL, P. C.
103 Oronoco Street, Suite 220
Alexandria, VA 22314
U.S.A.

Telephone: 703-739-9888
Facsimile: 703-739-9889
Email: dowell@dowellpc.com

Customer No.: 00293

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/466,509	05/08/2012	

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **09/24/2014**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 21	Minus	** 20	= 1	X $80 =	80
Independent (37 CFR 1.16(h))	* 3	Minus	***4	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	**80**

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/TRINA STEPTOE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 09/29/2014

TSTEPTOE SALE #00000001 Mailroom Dt: 09/24/2014 041577 13466509
01 FC : 1202 80.00 DA

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 09/09/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
09/09/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/466,509	TIKKANEN ET AL.	
	Examiner	Art Unit	
	Vibol Tan	2844	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Vibol Tan*.

(2) *Ralp A. Dowell*.

(3) *Jeffrey Wong*.

(4) *David Tikkanen*.

Date of Interview: *04 September 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☒102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *2,19 and 21*.

Identification of prior art discussed: *2011/0018464 to Lo*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative discussed over the limitation of "break out module" with respect to claims 2 and 21 and contended that Lo fails to teach or suggest the limitation. Applicant's representative proposed to add language that would define "limiting power" with respect to claim 19. And, Applicant would cancel Claim 23. The Examiner agreed to consider what were discussed in the interview. The Office anticipates a written response in reply to the last office action .

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/Vibol Tan/ Primary Examiner, Art Unit 2844	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

RECEIVED
CENTRAL FAX CENTER

AUG 27 2014

THE LAW OFFICES OF DOWELL & DOWELL PATENT AND TRADEMARK

Ralph A. Dowell
Alyssa Ann Finamore
Jorie L. Stroup

Wendy M. Slade
Registered Patent Agent

August 27, 2014

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2844
Examiner:	TAN, Vibol
Attorney Ref.:	18154

PROPOSED AGENDA FOR TELEPHONE INTERVIEW SCHEUDLED FOR SEPTEMBER 4, 2014 AT 1PM

Dear Examiner Tan,

We would like to discuss the matters listed below based on the Office Action issued June 27, 2014, by you.

1. Discussion on Examiner's assessment of US Patent No. 2011/0018464 to Lo.
2. Discussion re: Examiner's definition of the "power circuit" and "break out module" with respect to Claims 2 and 21 with aim to more clearly define the patentable subject matter.
3. Discussion re: Examiner's position on "limiting power" with respect to Claim 19 with aim to more clearly define the patentable subject matter.

At the appropriate time, please call 1-866-906-0040 when prompted please input the following 8514071#.

Ralph A. Dowell, 26868, attorney on the application will be joined by the client's Canadian Representative Jeffrey Wong 46,414, and Inventor David Tikkanen.

As requested, this agenda is being faxed to the main facsimile for the art unit 571-273-8300 and sent via email. If you have any questions, please feel free to contact our office at the number below.

Respectfully submitted,
/Ralph A. Dowell/
Ralph A. Dowell
Attorney for Applicant, Reg. No. 26868

PAGE 1/1 * RCVD AT 8/27/2014 10:43:10 AM [Eastern Daylight Time] * SVR:W-PTOFAX-003/20 * DNIS:2738300 * CSID:7037399889 * DURATION (mm-ss):00-28

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 06/27/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
06/27/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 13/466,509	Applicant(s) TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6/19/14*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *2-5 and 8-23* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *2,3,5,8,9,16-21 and 23* is/are rejected.

8)☒ Claim(s) *4,10-15 and 22* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 2-3, 8, 9, 16, 19-21 and 23 are rejected under pre-AIA 35 U.S.C. 102 (b) as being anticipated by Lo et al. (US 2011/0018464).

In claim 2, Lo teaches all claimed features in Figs. 1-3, apparatus for configuring and powering a set of light fixture loads (LED lamps; [0031]) in a light emitting diode (LED) low voltage distribution system (title) comprising:

an LED driver including a power circuit (2) having at least one power limit (3) and a set of output current drivers (5s) connected to the at least one power limit in the power circuit; and

a break-out module (4) electrically connected to an output (from 3) of the LED driver and the set of light fixture loads (LED lamps; [0031]; not shown); wherein the break-out module (4) receives power from the LED driver (2) via a set of input channels (inputs to 4) and delivers power to the set of light fixture loads via a set of output channels (output of 4); and splits the set of input channels into individual output channels (for individual LED lamp);

wherein the LED is located remotely from the set of light fixture loads (LED lamps mounted on ceiling or wall far away from box casing 7).

In claim 3, Lo further teaches the apparatus of Claim 2 wherein the set of output current drivers (5s) are connected to the break-out module (4) via cabling (wires).

In claim 8, Lo further teaches the apparatus of Claim 2 wherein the break-out module (4) connects to multiple light fixture loads (LED lamps; [0031]; not shown) via cabling (wires).

In claim 16, Lo further teaches the apparatus of Claim 2 wherein the LED driver (2) and the break-out module (4) are integrated together (Fig. 1).

In claim 19, Lo teaches all claimed features in Figs. 3, a method of configuring and powering a set of light fixture loads (LED lamps; [0031]; not shown) in a LED low voltage distribution system (title) comprising:

limiting power (2) for powering the set of light fixture loads (LED lamps; [0031]);

converting limited power to multiple constant current outputs (3) and splitting (4) or regrouping constant current outputs; and

splitting or regrouping the constant current outputs (3) prior to delivery of the multiple constant outputs to the set of light fixture loads (LED lamps; [0031]; not shown).

In claim 20, Lo further teaches the apparatus of Claim 2 further comprising a DC/DC converter (in Fig. 3).

In claim 21, Lo teaches all claimed features in Figs. 1-3, apparatus for configuring and powering a set of light fixture loads (LED lamps; [0031]; not shown) in a light emitting diode (LED) low voltage distribution system (title) comprising:

an LED driver including a power circuit (2) having at least one power limit (3) and a set of output current drivers (5s) connected to the at least one power limit in the power circuit; and

a break-out module (4) electrically connected to an output (from 3) of the LED driver and the set of light fixture loads (LED lamps; [0031]; not shown); wherein the break-out module (4) receives power from the LED driver (2) via a set of input channels (inputs to 4) and delivers power to the set of light fixture loads via a set of output channels (outputs of 4);

wherein the break-out module (4) changes the number of output channels (the outputs from 4) from the number of input channels (the inputs to 4);

wherein the LED is located remotely from the set of light fixture loads (LED lamps mounted on ceiling or wall far away from box casing 7).

In claim 23, Lo teaches all claimed features in Figs. 1-3 apparatus for configuring and powering a set of light fixture loads (LED lamps; [0031]; not shown) in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver (2) including:

a single output voltage bus (power input 1), a set of output current drivers (5s), and at least one power limit (3) connected to the single output voltage bus (1 via 2) and the set of output current drivers; and

a break-out module (4) electrically connected to an output of the LED driver (2) and the set of light fixture loads (LED lamps; [0031]; not shown);

wherein the LED driver is located remote from the set of light fixture loads (LED lamps mounted on ceiling or wall far away from box casing 7).

In claim 9, the apparatus of Claim 21 wherein the break-out module (4) connects to multiple light fixture loads (LED lamps; [0031]; not shown) via cabling (wires).

Claim Rejections - 35 USC § 103

4. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 5 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo et al.

In claim 5, Lo teaches the apparatus of Claim 3, with the exception of teaching wherein the power cabling includes a set of input channels. However, it is known in the art that the power cabling includes a set of input channels such as data wires.

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to include a set of channels in the power cabling for carrying communication data.

6. Claim 17 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo et al. in view of Meyer (US 2010/0066267).

In claim 17, Lo teaches the apparatus of Claim 2; with the exception of teaching wherein the LED driver further comprises a communication interface for receiving data

from an external transmitter. However, Meyer teaches in Fig. 2, an LED driver (54) comprises a communication interface (52) for receiving data from an external transmitter (40).

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to combine the teachings to provide an intelligent lighting system that can be remotely controlled.

7. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo et al. in view of Kastner (US 2010/0018261).

In claim 18, Lo teaches the apparatus of Claim 2; with the exception of teaching wherein the at least one current driver comprises a buck topology power stage with hysteretic control. However, Kastner teaches in Figs. 3, 4 or 6, at least one current driver comprises a buck topology power stage with hysteretic control.

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to combine the teachings to provide LED power supply with options for dimming that can be used in a DC low voltage distribution box for indoor multi LEDs lamp.

Allowable Subject Matter

8. Claims 4, 10-15 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vibol Tan whose telephone number is (571)272-1811. The examiner can normally be reached on Monday-Friday (7:00 AM-4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alex Taningco can be reached on (571) 272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	Art Unit
	VIBOL TAN	2844

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
315	294, 152, 155, 210, 246, 291	12/10/13	VTan
362	85, 147, 148, 150, 240, 576	12/10/13	VTan

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	12/10/13	VTan
EAST text update	2/19/14	VTan
review tagged references in EAST	6/24/14	VTan

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/466,509	Filing Date	2012-05-08	Docket Number (if applicable)	18154	Art Unit	2844
First Named Inventor	David TIKKANEN			Examiner Name	VIBOL TAN		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☒ Other Amendment After-Final dated April 11, 2014

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Jorie L. Stroup/	Date (YYYY-MM-DD)	2014-06-19
Name	Jorie L. Stroup	Registration Number	57532

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/SB/22 (03-13)
Approved for use through 3/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 18154

Application Number: 13/466,509

Filed: May 8, 2012

For: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

Art Unit: 2844

Examiner: VIBOL TAN

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	Micro Entity Fee	
☑ One month (37 CFR 1.17(a)(1))	$200	$100	$50	$ 200
☐ Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐ Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐ Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐ Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number _____.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration number 57532.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Jorie L. Stroup/ — Signature

2014-06-19 — Date

Jorie L. Stroup — Typed or printed name

703-739-9888 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	13466509
Filing Date:	08-May-2012
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Filer:	Jorie Loraine Stroup
Attorney Docket Number:	18154

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	420	420
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1820**

Electronic Acknowledgement Receipt

EFS ID:	19355903
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Jorie Loraine Stroup
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	19-JUN-2014
Filing Date:	08-MAY-2012
Time Stamp:	16:18:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1820
RAM confirmation Number	2895
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Amendment Submitted/Entered with Filing of CPA/RCE	18154RCE_Resp.pdf	37782 18787cb6bd07677eeaa75860395a489ca403b9a3	no	8
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	18154RCE.pdf	697620 03b62bde8245f3c5e8fbd953dfcec4393a4135ab	no	3
Warnings:					
Information:					
3	Extension of Time	18154EOT_June.pdf	186412 201cf17fe0dc2983eb5908617b714fde4d0fb3de	no	2
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	34224 a300ac20b9a339ef884d21533a296215ebb9b6e5	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	956038		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2844
Examiner:	TAN, Vibol
Attorney Ref.:	18154

June 19, 2014

MAIL STOP RCE
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria VA 22314-1450
USA

REQEUST FOR CONTINUED EXAMINATION AND RESPONSE

In response to the Office Action of February 21, 2014, please amend the above-identified application as outlined below. A request for continued examination (RCE) and a one–month extension of time are being requested under separate cover.

Amendments to the Claims are reflected in the listing of claims which begins on page **2** of this paper.

Remarks/Arguments begin on page **6** of this paper.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Cancelled)

2. (Currently Amended) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads;

wherein the break-out module receives power from the LED driver via a set of input channels and delivers power to the set of light fixture loads via a set of output channels; and splits the set of input channels into individual output channels;

wherein the LED driver is located remotely from the set of light fixture loads.

3. (Previously presented) The apparatus of Claim 2 wherein the set of output current drivers are connected to the break-out module via cabling.

4. (Previously Presented) The apparatus of Claim 3 further comprising:

a set of series connect modules, each of the set of series connect modules associated with one of the set of light fixture loads and connected to an output of the break-out module.

5. (Currently Amended) The apparatus of Claim 3 wherein the power cabling includes [[a]]the set of input channels.

Claims 6 and 7 (Cancelled)

8. (Currently Amended) The apparatus of Claim [[6]]2 wherein the break-out module connects to multiple light fixture loads via cabling.

9. (Currently Amended) The apparatus of Claim [[7]]21 wherein the break-out module connects to multiple light fixture loads via cabling.

10. (Currently Amended) The apparatus of Claim [[3]]2 wherein the break-out module comprises:

at least one printed circuit board (PCB) having power connectors.

11. (Currently Amended) The apparatus of Claim [[10]]22 wherein the at least one PCB assists in regrouping the set of input channels into a different grouping of output channels.

12. (Currently Amended) The apparatus of Claim 10 wherein the at least one PCB assists in splitting the set of input channels into individual output channels.

13. (Previously Presented) The apparatus of Claim 10 wherein the power connectors include apparatus to enable quick connection and release with the cabling.

14. (Currently Amended) The apparatus of Claim 4 wherein at least one of the set of series connect modules comprises:

at least one printed circuit board (PCB) assembly for connecting to an output from the break-out module.

15. (Previously Presented) The apparatus of Claim 4 wherein the break-out module and the set of series connect modules are integrated together.

16. (Previously presented) The apparatus of Claim 2 wherein the LED driver and the break-out module are integrated together.

17. (Previously presented) The apparatus of Claim 2 wherein the LED driver further comprises a communication interface for receiving data from an external transmitter.

18. (Previously Presented) The apparatus of Claim 2 wherein the at least one current driver comprises a buck topology power stage with hysteretic control.

19. (Currently Amended) A method of configuring and powering a set of light fixture loads in a LED low voltage distribution system comprising:

limiting power for powering the set of light fixture loads;

converting limited power to multiple constant current outputs; and

splitting or regrouping the constant current outputs prior to delivery of the multiple constant outputs to the set of light fixture loads.

20. (Previously presented) The apparatus of Claim 2 further comprising a DC/DC converter.

21. (New) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads;

wherein the break-out module receives power from the LED driver via a set of input channels and delivers power to the set of light fixture loads via a set of output channels;

wherein the break-out module changes the number of output channels from the number of input channels;

wherein the LED driver is located remote from the set of light fixture loads.

22. (New) The apparatus of Claim 21 wherein the break-out module comprises:

at least one printed circuit board (PCB) having power connectors.

23. (New) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including:

a single output voltage bus,

a set of output current drivers, and

at least one power limit connected to the single output voltage bus and the set of output current drivers; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads;

wherein the LED driver is located remote from the set of light fixture loads.

REMARKS/ARGUMENTS

Claims 2 to 5 and 8 to 23 remain in the current application. Claims 2, 5, 8 to 12, 14 and 19 have been amended, Claims 6 and 7 cancelled and Claims 21 to 23 added. Claim 1 was previously cancelled. No new matter has been added as a result of these amendments.

It is respectfully assumed that the amendments to Claims 16 and 17 submitted in Applicant's April 11, 2014 response have been accepted by the Examiner.

In the Final Office Action of February 21, 2014 and the Advisory Action of April 23, 2014, Claims 2, 3, 16, 19 and 20 have been rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by US Patent Publication No. 2011/0018464 to Lo et al. ("Lo"). Applicant has amended independent Claim 2 to include the subject matter of previous Claim 7 which was deemed patentable over the cited art. New Claim 21 is a combination of original independent Claim 2 and dependent Claim 6, the subject matter of which was deemed patentable over the cited art by the Examiner. New Claim 23 has also been added.

While amended Claim 2 and new claim 21 do not include the subject matter of the intervening claims, it is respectfully submitted that including this subject matter would unnecessarily narrow the scope of protection to which the Applicant is entitled. It is respectfully submitted that the subject matter of as claimed in original Claim 6 and as claimed in original Claim 7 are individually patentable over the cited art without including the subject matter of the intervening claims. Lo does not disclose the subject matter of either "the break-out module splitting the set of input channels into individual output channels" (Claim 7) or "the break out module changes the number of output channels from the number of input channels" (Claim 6). For at least these reasons, it is respectfully submitted that amended independent Claim 2 and new independent Claim 21 and each of their dependent claims are patentable over the cited art. Retraction of Examiner's rejection of Claims 2, 3, 16, 19 and 20 is respectfully requested.

Claim 5 has been rejected under pre-AIA U.S.C. 103(a) as being unpatentable over Lo. Applicant respectfully submits that the Examiner's rejection is now moot in view of the arguments outlined above. Retraction of Examiner's rejection of Claim 5 is respectfully requested.

Claim 18 has been rejected under pre-AIA U.S.C. 103(a) as being unpatentable over Lo in view of US Patent Publication No. 2010/0018261 to Kastner ("Kastner"). Applicant respectfully submits that Kastner is silent with respect to the subject matter lacking in Lo to obviate amended independent Claim 2 from which Claim 18 is directly dependent. Retraction of Examiner's rejection of Claim 18 is respectfully requested.

New Claim 23 is directed at apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including:

a single output voltage bus,

a set of output current drivers, and

at least one power limit connected to the single output voltage bus and the set of output current drivers; and

a break-out module electrically connected to an output of the LED driver and the set of light fixture loads;

wherein the LED driver is located remotely from the set of light fixture loads.

It is respectfully submitted that Lo is silent with respect to the subject matter of a single output voltage bus. Instead, Lo discloses, at paragraph 32, the subject matter of a "power converting module (2) may generate a number of different voltages to each of the output ports (3)." As clearly suggested and disclosed in Lo, there are multiple voltages being supplied rather than the claimed "single output voltage bus". It is respectfully submitted that for at least this reason, Claim 23 is patentable.

For the above reasons, it is respectfully submitted that the application is now in condition for allowance, which is requested. If there are any outstanding issues, the Examiner is invited to contact the undersigned to discuss this matter further.

The Commissioner is hereby authorized to charge any additional fees, and credit any over payments, to Deposit Account No. 041577, in the name of Dowell & Dowell, P.C.

Respectfully submitted,
TIKKANEN, David, et al.

By: /Jorie L. Stroup/
Respectfully submitted,
Jorie L. Stroup

Attorney for Applicant
Reg. No. 57532
Date:June 19, 2014

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/466,509	Filing Date 05/08/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)		
	06/19/2014	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***3	= 1	X $420 =	420
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**420**

		(Column 1)		(Column 2)	(Column 3)		
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/VICTORIA BROWN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 04/23/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
04/23/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 13/466,509	**Applicant(s)** TIKKANEN ET AL.	
	Examiner Vibol Tan	**Art Unit** 2844	**AIA (First Inventor to File) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 11 April 2014 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☐ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: applicants' arguments in regard to claims 2 and 19 are not persuasive. Applicants argue that the applied ref. of LO does not teach the power limit circuit is used to limit the power output of each of the output current drivers, wherein the power limit circuits limit the energy to the loads; and the breakout modules are used to split or regroup output channels into individual channels. However, applicants argue the features that are not recited in claims 2 and 19. The Examiner would like to point out that claims are exmamined in light of the specification, but the features in the specification are not read into the claims. Furthermore, the features recited in claims 2 and 19 are fully adressed and believed to be anticipated by the applied ref. of Lo (see final rejection dated 2/21/14).
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

/Vibol Tan/
Primary Examiner, Art Unit 2844

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2844
Examiner:	TAN, Vibol
Attorney Ref.:	18154

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Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria VA 22314-1450
USA

AMENDMENT AFTER-FINAL

In response to the Office Action of February 21, 2014, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page **2** of this paper.

Remarks/Arguments begin on page **5** of this paper.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Cancelled)

2. (Previously presented) Apparatus for configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver;

wherein the LED driver is located remotely from the set of light fixture loads.

3. (Previously presented) The apparatus of Claim 2 wherein the set of output current drivers are connected to the break-out module via cabling.

4. (Previously Presented) The apparatus of Claim 3 further comprising:

a set of series connect modules, each of the set of series connect modules associated with one of the set of light fixture loads and connected to an output of the break-out module.

5. (Previously Presented) The apparatus of Claim 3 wherein the power cabling includes a set of input channels.

6. (Previously Presented) The apparatus of Claim 5 wherein the break-out module changes the number of output channels from the number of input channels.

7. (Previously Presented) The apparatus of Claim 5 wherein the break-out module splits the set of input channels into individual output channels.

8. (Previously Presented) The apparatus of Claim 6 wherein the break-out module connects to multiple light fixture loads via cabling.

9. (Previously Presented) The apparatus of Claim 7 wherein the break-out module connects to multiple light fixture loads via cabling.

10. (Previously Presented) The apparatus of Claim 3 wherein the break-out module comprises:

at least one printed circuit board (PCB) having power connectors.

11. (Previously Presented) The apparatus of Claim 10 wherein the at least one PCB assist in regrouping the set of input channels into a different grouping of output channels.

12. (Previously Presented) The apparatus of Claim 10 wherein the at least one PCB assist in splitting the set of input channels into individual output channels.

13. (Previously Presented) The apparatus of Claim 10 wherein the power connectors include apparatus to enable quick connection and release with the cabling.

14. (Previously Presented) The apparatus of Claim 4 wherein at least one of the set of series connect modules comprises:

at least one printed circuit board (PCB) assembly for connecting an output from the break-out module.

15. (Previously Presented) The apparatus of Claim 4 wherein the break-out module and the set of series connect modules are integrated together.

16. (Currently Amended) The apparatus of Claim 2 wherein the LED driver~~/dimmer~~ and the break-out module are integrated together.

17. (Currently Amended) The apparatus of Claim 2 wherein the LED driver~~/dimmer~~ further comprises a communication interface for receiving data from an external transmitter.

18. (Previously Presented) The apparatus of Claim 2 wherein the at least one current driver comprises a buck topology power stage with hysteretic control.

19. (Previously presented) A method of configuring and powering a set of light fixture loads in a LED low voltage distribution system comprising:

limiting power for powering the set of light fixture loads;

converting limited power to multiple constant current outputs; and

splitting or regrouping constant current outputs.

20. (Previously presented) The apparatus of Claim 2 further comprising a DC/DC converter.

REMARKS/ARGUMENTS

Claims 2 to 20 remain in the current application. Claims 16 and 17 have been amended. Claim 1 was previously cancelled. No new matter has been added by way of this amendment.

Claims 16 and 17 have been objected to since the Examiner has stated that the claims include informalities. Applicant has amended Claims 16 and 17 as suggested by the Examiner. Retraction of Examiner's objection to Claims 16 and 17 is respectfully requested.

Claims 2, 3, 16, 19 and 20 have been rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by US Patent Publication No. 2011/0018464 to Lo et al. ("Lo"). Applicant respectfully disagrees.

Lo is directed at a low-voltage DC distribution board for indoor LED lighting with multiple LED lamps including a power converting module (2), the power converting module including a set of output ports (3) and a set of selection switches (4) connected between the output ports (3). The board further includes a plurality of current regulators (5) connected to load connectors (6).

In the Office Action, the Examiner has equated the set of output ports (3) of Lo with the claimed power limit. As disclosed in paragraph 55 of the specification as filed, the power limit circuit is used to limit the power output of each of the output current drivers. Furthermore, the power limit circuits limit the energy to the loads. It is respectfully submitted that this is not the function of the output ports of Lo. In fact, the ports appear to simply be used to receive different voltages from the power converting module (paragraph 32). More specifically, the ports are seen as multiple output ports consisting of DC power sources with output voltages of between 3V and 36V as cited in paragraphs 18 and 33 of Lo. There is no discussion in Lo about the use of the output ports for limiting power to the loads as they appear to be used for the delivery of a set voltage received from the converting module. In fact, the way to change voltage supply in Lo is to use the switches to electrical connect the different output ports with current regulators depending on load requirements.

Furthermore, the Examiner has equated the claimed break-out module Claim 2 with the selection switches (4) of Lo. As disclosed in at least paragraphs 100 and 101 of the specification as filed, the breakout modules are used to split or regroup output channels into individual channels. Lo teaches the implementation of selection switches to connect various DC voltage outputs (3) with some aspects of configurability, however, there is no disclosure or suggestion in Lo that the selection switches perform channel splitting or regrouping. For at least these reasons, it is respectfully submitted that Lo does not anticipate independent claim 2.

It is respectfully submitted that independent Claim 19 is also patentable for at least the same reasons. Lo does not disclose the subject matter of splitting or regrouping constant current outputs as claimed in Claim 19.

Also, with respect to Claim 20, it is respectfully submitted that a power converting module is not the same as the claimed DC/DC converter.

It is respectfully submitted that Claims 3, 16, 19 and 20 are also patentable over the cited art for at least the reasons set forth above. Retraction of Examiner's rejection to Claims 2, 3, 16, 19 and 20 is respectfully requested.

Claim 5 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo. Applicant respectfully submits that the Examiner's rejection is now moot in view of the arguments outlined above with respect to Claim 2 (from which Claim 5 is dependent). Retraction of Examiner's rejection of Claim 5 is respectfully requested.

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo in view of US Patent Publication No. 2010/0018261 to Kastner. Applicant respectfully submits that Kastner is silent with respect to the subject matter lacking in Lo to obviate Claim 2 from which Claim 18 is dependent. Retraction of Examiner's rejection of Claim 18 is respectfully requested.

For the above reasons, it is respectfully submitted that the application is now in condition for allowance, which is requested. If there are any outstanding issues, the Examiner is invited to contact the undersigned to discuss this matter further.

The Commissioner is hereby authorized to charge any additional fees for this response only, and credit any over payments, to Deposit Account No. 041577, in the name of Dowell & Dowell, P.C.

Respectfully submitted,

/Jorie L. Stroup/
Jorie L. Stroup
Attorney for Applicant
Reg. No. 57,532

Date: April 11, 2014

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Electronic Acknowledgement Receipt

EFS ID:	18736058
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Jorie Loraine Stroup
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	11-APR-2014
Filing Date:	08-MAY-2012
Time Stamp:	10:22:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response After Final Action	18154FOA_Resp.pdf	37368 943df154726635901d6cb95ec0ff5bbabfcef61d	no	7

Warnings:	
Information:	

Total Files Size (in bytes):	37368

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/466,509	05/08/2012	

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **04/11/2014**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/ZURIASHWORK ZENEBE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 02/21/2014

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	

ART UNIT	PAPER NUMBER
2844	

MAIL DATE	DELIVERY MODE
02/21/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 13/466,509	Applicant(s) TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2/12/14*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *2-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *2,3,5,16 and 18-20* is/are rejected.

8)☒ Claim(s) *4, 6-15 and 17* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Claim Objections

2. Claims 16-17 are objected to because of the following informalities: the LED driver/dimmer should read as the LED driver. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 2, 3, 16, 19 and 20 are rejected under pre-AIA 35 U.S.C. 102 (b) as being anticipated by Lo et al. (US 2011/0018464).

In claim 2, Lo teaches all claimed features in Figs. 1-3, apparatus for configuring and powering a set of light fixture loads (LED lamps; [0031]) in a light emitting diode (LED) low voltage distribution system (title) comprising: an LED driver including a power circuit (2) having at least one power limit (3) and a set of output current drivers (5s) connected to the at least one power limit in the power circuit; and a break-out module (4) electrically connected to an output (from 3) of the LED; wherein the LED is located remotely from the set of light fixture loads (LED lamps mounted on ceiling or wall far away from box casing 7).

In claim 3, Lo further teaches the apparatus of Claim 2 wherein the set of output current drivers (5s) are connected to the break-out module (4) via cabling (wires).

In claim 16, Lo further teaches the apparatus of Claim 2 wherein the LED driver (2) and the break-out (4) module are integrated together (in 7).

In claim 19, Lo teaches all claimed features in Figs. 3, a method of configuring and powering a set of light fixture loads (LED lamps; [0031]) in a LED low voltage distribution system (title) comprising: limiting power (2) for powering the set of light fixture loads (LED lamps; [0031]); converting limited power to multiple constant current outputs (3) and splitting (4) or regrouping constant current outputs.

In claim 20, Lo further teaches the apparatus of Claim 2 further comprising a DC/DC converter (in Fig. 3).

Claim Rejections - 35 USC § 103

5. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 5 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo.

In claim 5, Lo teaches the apparatus of Claim 3, with the exception of teaching wherein the power cabling includes a set of input channels. However, it is known in the art that the power cabling includes a set of input channels such as data wires.

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to include a set of channels in the power cabling for carrying communication data.

7. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lo et al. in view of Kastner (US 2010/0018261).

In claim 18, Lo teaches the apparatus of Claim 2; with the exception of teaching wherein the at least one current driver comprises a buck topology power stage with hysteretic control. However, Kastner teaches in Figs. 3, 4 or 6, at least one current driver comprises a buck topology power stage with hysteretic control.

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to combine the teachings to provide LED power supply with options for dimming that can be used in a DC low voltage distribution box for indoor multi LEDs lamp.

Allowable Subject Matter

8. Claims 4, 6-15 and 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

9. Applicant's arguments with respect to claims 2 and 19 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vibol Tan whose telephone number is (571)272-1811. The examiner can normally be reached on Monday-Friday (7:00 AM-4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alex Taningco can be reached on (571) 272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Notice of References Cited	Application/Control No. 13/466,509	Applicant(s)/Patent Under Reexamination TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2011/0018464	01-2011	Lo et al.	315/294
*	B	US-8,436,555	05-2013	Lo et al.	315/299
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	("20080018261").PN.	US-PGPUB; USPAT	OR	OFF	2013/12/04 17:02
S2	49405	led.u/c. adj (loads or strings or array or modules)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:20
S3	1	(led.u/c. adj (loads or strings or array or modules)) same ((break or fin) adj out adj module)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:21
S4	2	(led.u/c. adj (loads or strings or array or modules)) same ((break or fin) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:21
S5	10	(("20050289279") or ("20050218838") or ("20080018261") or ("8197079") or ("20020047642") or ("20080018261") or ("20090179594") or ("5420780") or ("20100164403") or ("20080025028") or ("20060132063")).PN.	US-PGPUB; USPAT	OR	OFF	2013/12/04 17:25
S6	71	("20010022301" | "20020014867" | "20020086567" | "20030057884" | "20030137258" | "20040105264" | "20040164619" | "20040207341" | "20040212993" | "20050062446" | "20050122065" | "20050122705" | "20050128751" | "20050169015" | "20050236998" | "20050285547" | "20060002110" | "20060070763" | "20060267028" | "20070008710" | "20070045524" | "20080197790" | "4367417" | "4667133" | "5008595" | "5577832" | "5580155" | "5661374" | "5803579" | "6016038" | "6150774" | "6161496" | "6166496" | "6283612" | "6340868" | "6346777" | "6392368" | "6424248" | "6459919" | "6505958" | "6528954" | "6540373" | "6548967" | "6597179" | "6600324" | "6608453" | "6608485" | "6624638" | "6720745" | "6762563" | "6764196" | "6781329" | "6788011" | "6806659" | "6869204" |	US-PGPUB; USPAT; USOCR	OR	OFF	2013/12/04 17:30

		"6936978" | "6965205" | "6967448" | "6995355" | "7014336" | "7038399" | "7042172" | "7064498" | "7102172" | "7145125" | "7148470" | "7161313" | "7186003" | "7187141" | "7202613" | "7204622").PN.				
S7	36	(led.u/c. adj (loads or strings or array or modules)) same distributor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 16:53
S8	6	(led.u/c. adj (loads or strings or array or modules)) same ((branch or break) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 16:59
S9	3686	(led.u/c. adj (loads or strings or array or modules)) same (cabling or wire)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:00
S10	421	(led.u/c. adj (loads or strings or array or modules)) same (cabling or wire) same driver	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:01
S11	3	(led.u/c. adj (loads or strings or array or modules)) same (light adj fixture adj loads)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:22
S12	0	(led.u/c. adj fixture) same loads same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:35
S13	7	(light adj fixture) same loads same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:35
S14	107	(light adj fixture) and loads and (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2013/12/06 06:37

			IBM_TDB			
S15	98	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:38
S16	12	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and (lighting adj panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:06
S17	0	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and (lighting adj track)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:09
S18	0	(light adj track adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:11
S19	0	(track adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:15
S20	48	track and fixture and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:15
S21	24	fixture and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and dmx512	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:37
S22	262	(led.u/c. adj (driver or dimmer)) same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:49
S23	26	(led.u/c. adj (driver or dimmer)) same (current adj drivers) same loads	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2013/12/06 07:49

			EPO; JPO; DERWENT; IBM_TDB			
S24	3	(led.u/c. adj (driver or dimmer)) and (current adj drivers) and loads and ((fan or fin or break) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:57
S25	50	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and track$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:39
S26	1751	vibol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:49
S27	83464	("315").CLAS.	USPAT; USOCR	OR	OFF	2013/12/10 08:49
S28	119	S26 and S27	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:49
S29	27	("20010000422" | "20030107888" | "20030179578" | "20050231134" | "20050243549" | "20060067089" | "20070268701" | "4656398" | "4688154" | "4822292" | "5072216" | "5347431" | "5637964" | "6037721" | "6175201" | "6310440" | "6655817" | "6667578" | "6794830" | "7024119" | "7027736" | "7070293" | "7335523" | "7355523" | "7391297" | "7507005" | "7764162").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/12/10 08:58
S30	1	("20080018261").PN.	US-PGPUB; USPAT	OR	OFF	2013/12/10 11:24
S31	1	("20080018261").PN.	US-PGPUB; USPAT	OR	OFF	2014/02/19 12:01
S32	5	(low adj voltage adj distribution adj system) same (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/02/19 12:08
S33	21	(low adj voltage adj distribution adj system) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2014/02/19 12:08

			IBM_TDB			
S34	0	(low adj voltage adj distribut$3) same ((led.u/c. or (light adj emitting adj diode)) adj load)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/02/19 12:11
S35	21	(low adj voltage adj distribut$3) same (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2014/02/19 12:12
S36	0	("8436555").URPN.	USPAT	OR	OFF	2014/02/19 12:18
S37	0	("8436555").URPN.	USPAT	OR	OFF	2014/02/19 12:18
S38	3	("5534768" | "7274175" | "7358707").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/02/19 12:18
S39	0	("20110018464").PN.	USPAT; USOCR	OR	OFF	2014/02/19 14:21
S40	1	("20110018464").PN.	US-PGPUB; USPAT	OR	OFF	2014/02/19 14:21

EAST Search History (Interference)

< This search history is empty>

2/ 19/ 2014 4:24:00 PM
C:\ Users\ vtan\ Documents\ EAST\ Workspaces\ 13466509.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	Art Unit
	VIBOL TAN	2844

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
315	294, 152, 155, 210, 246, 291	12/10/13	VTan
362	85, 147, 148, 150, 240, 576	12/10/13	VTan

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	12/10/13	VTan
EAST text update	2/19/14	VTan

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2844
Examiner:	TAN, Vibol
Attorney Ref.:	18154

February 12, 2014

Mail Stop Amendment
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria VA 22314-1450
USA

AMENDMENT

In response to the Office Action of **December 13, 2013**, please amend the above-identified application as follows:

Amendments to the Specification begin on page **2** of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page **3** of this paper.

Remarks/Arguments begin on page **6** of this paper.

Amendments to the Specification

Please replace paragraph [0110] with the following amended paragraph:

[0110] Turning to Figure 15, a block diagram of another embodiment of a configurable dimmer implemented in a low voltage DC distribution LED lighting system is shown. In this embodiment, the series connect module is excluded from the low voltage DC distribution LED lighting system 600. The series connect means is completed within an electrical junction box 602 associated with each LED load 56. As before, the system 600 includes a dimmer 10 connected to a break out module 51 via cabling 202 and 204. The typical number of LED loads connected in series is two, and ~~wire nuts~~ twist-on wire connectors are used to make the electrical series connections between the LED loads 56 and the cable 206.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Cancelled)

2. (Currently Amended) Apparatus for ~~controlling~~ configuring and powering a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver~~/dimmer~~ including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module electrically connected to an output of the LED driver~~/dimmer~~;

wherein the LED driver~~/dimmer~~ is located remotely from the set of light fixture loads.

3. (Previously presented) The apparatus of Claim 2 wherein the set of output current drivers are connected to the break-out module via cabling.

4. (Previously Presented) The apparatus of Claim 3 further comprising:

a set of series connect modules, each of the set of series connect modules associated with one of the set of light fixture loads and connected to an output of the break-out module.

5. (Previously Presented) The apparatus of Claim 3 wherein the power cabling includes a set of input channels.

6. (Previously Presented) The apparatus of Claim 5 wherein the break-out module changes the number of output channels from the number of input channels.

7. (Previously Presented) The apparatus of Claim 5 wherein the break-out module splits the set of input channels into individual output channels.

8. (Previously Presented) The apparatus of Claim 6 wherein the break-out module connects to multiple light fixture loads via cabling.

9. (Previously Presented) The apparatus of Claim 7 wherein the break-out module connects to multiple light fixture loads via cabling.

10. (Previously Presented) The apparatus of Claim 3 wherein the break-out module comprises:

at least one printed circuit board (PCB) having power connectors.

11. (Previously Presented) The apparatus of Claim 10 wherein the at least one PCB assist in regrouping the set of input channels into a different grouping of output channels.

12. (Previously Presented) The apparatus of Claim 10 wherein the at least one PCB assist in splitting the set of input channels into individual output channels.

13. (Previously Presented) The apparatus of Claim 10 wherein the power connectors include apparatus to enable quick connection and release with the cabling.

14. (Previously Presented) The apparatus of Claim 4 wherein at least one of the set of series connect modules comprises:

at least one printed circuit board (PCB) assembly for connecting an output from the break-out module.

15. (Previously Presented) The apparatus of Claim 4 wherein the break-out module and the set of series connect modules are integrated together.

16. (Previously Presented) The apparatus of Claim 2 wherein the LED driver/dimmer and the break-out module are integrated together.

17. (Previously Presented) The apparatus of Claim 2 wherein the LED driver/dimmer further comprises a communication interface for receiving data from an external transmitter.

18. (Previously Presented) The apparatus of Claim 2 wherein the at least one current driver comprises a buck topology power stage with hysteretic control.

19. (Currently Amended) A method of ~~controlling~~ configuring and powering a set of light fixture loads in a LED low voltage distribution system comprising:

~~receiving light control information;~~

limiting power for powering the set of light fixture loads;

converting limited power to multiple constant current outputs ~~based on light control information~~; and

splitting or regrouping constant current outputs.

20. (New) The apparatus of Claim 2 further comprising a DC/DC converter.

REMARKS/ARGUMENTS

Claims 2 to 20 remain in the current application. Claims 2 and 19 have been amended and Claim 20 added. Claim 1 was previously cancelled.

Paragraph [0110] has been amended to replace the trade-marked term "wire nuts" with the generic term "twist-on wire connectors". No new matter has been added as a result of this amendment.

Applicant thanks the Examiner for indicating that the subject matter of Claims 10 to 15 and 18 are deemed patentable over the cited art.

Claims 2 to 9, 16, 17 and 19 have been rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over US Patent Publication No. 2010/0231136 to Reisenauer et al. ('136) in view of US Patent Publication No. 2010/0066267 to Meyer ('267). Applicant respectfully disagrees with the Examiner's assessment.

'136 is directed at a line voltage dimmable constant current LED driver for driving LEDs at a constant current and for dimming the LEDs. The circuit driver further includes a temperature compensation feature for controlling the on time. According to the Examiner, '136 discloses the subject matter of a power circuit including at least one power limit which the Examiner equates to the electronic transformer 310. At paragraph 50, '136 discloses the subject matter of "An electronic transformer 310 (Hatch RS24-60M) reduces the higher voltage input to a 24 VAC waveform 312". While there is a discussion in '136 about reducing the voltage, there is no suggestion or disclosure in '136 about limiting power as claimed in Claim 1. In fact, it is more likely that with the decreased VAC waveform, it is likely that the current is increased thereby maintaining a constant power rather than limiting power as claimed.

It is respectfully submitted that '136 does not teach a "power circuit having at least one power limit". Support for this subject matter can be found in paragraphs 95 and 96 of the specification.

'267 is directed at a remotely controllable track lighting system which includes a set of lights and a track system 30 which simply houses individual wires 22 between the lamps 20 and the

canopies 56. While the Examiner has equated the track system 30 of '267 with the claimed break-out module, Applicant respectfully submits that one skilled in the art would not make this comparison. The track system 30 of '267 is simply a housing and there is no functionality to the track system unlike the claimed break-out module. As discussed in paragraph 100 and as shown in Figures 18a, 18b and 18c, the break-out module is used to regroup or split individual power channels which indicates that the break-out module is electronically involved in operating the system rather than being a housing structure like the track system of '267.

In order to accelerate prosecution, Applicant has amended Claim 1 to include the subject matter of the break out module being "electronically" connected to the output of the LED driver. It is respectfully submitted that the track system of '267 is in no way electronically connected to the LEDs. It is simply a physical track system. For at least these reasons, it is respectfully submitted that Claims 2 to 9, 16 and 17 are patentable over the cited art.

With respect to independent Claim 19, it is respectfully submitted that neither '136 nor '267 disclose the subject matter of splitting or regrouping constant current outputs. Further amendments have been made to Claim 19 to more clearly identify the claimed subject matter.

There is no such disclosure of this subject matter in the '136 reference and the track system of '267 simply maintains the 1 to 1 relationship between power outlet 56 and the individual lams 20a to 20e as shown in Figure 2. There is no splitting or regrouping of these current outputs. For at least these reasons, it is respectfully submitted that Claim 19 is patentable over the cited art. Retraction of Examiner's rejection of Claims 2 to 9, 16, 17 and 19 is respectfully requested.

Claim 18 has been rejected under pre-AIA U.S.C. 103(a) as being unpatentable over '136 in view of '267 as applied to Claim 2 and, further in view of US Patent Publication No. 2010/0018261 to Kastner ('261). Applicant respectfully submits that '261 does not disclose the subject matter lacking in '136 and '267 to anticipate or obviate Claim 2, from which Claim 18 depends. Retraction of Examiner's rejection of Claim 18 is respectfully requested.

The Commissioner is hereby authorized to charge any additional fees, and credit any over payments, to Deposit Account No041577, in the name of Dowell & Dowell P.C.

Respectfully submitted,
TIKKANEN, David, et al.

By: /Jorie L. Stroup/
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Electronic Acknowledgement Receipt

EFS ID:	18185740
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Jorie Loraine Stroup
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	12-FEB-2014
Filing Date:	08-MAY-2012
Time Stamp:	13:54:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	18154NFOAResp.pdf	44302 6957301e512cc2a37f51017ed693c4ac82e2dcf0	no	8

Warnings:	
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Total Files Size (in bytes):	44302

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/466,509	05/08/2012	

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **02/12/2014**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/DEANNA RORIE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/466,509	05/08/2012	David TIKKANEN	18154	8469

293 7590 12/13/2013

DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

EXAMINER	
TAN, VIBOL	
ART UNIT	PAPER NUMBER
2844	
MAIL DATE	DELIVERY MODE
12/13/2013	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 13/466,509	Applicant(s) TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 5/8/12.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) 2-19 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) 2-9 and 16-19 is/are rejected.

8)☒ Claim(s) 10-15 is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 5/8/12; 8/31/12;10/2/12; 4/5/13;10/4/13.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 103

2. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 2-9, 16, 17 and 19 are rejected under pre-AIA 35 U.S.C. 103 (a) as being unpatentable over Reisenauer et al. (US 2010/0231136) in view of Meyer (US 2010/0066267).

In claim 2, Reisenauer teaches all claimed features in Fig. 7, apparatus for controlling a set of light fixture loads (318s) in a light emitting diode (LED) low voltage distribution system comprising: an LED driver/dimmer (Fig. 7) including a power circuit having at least one power limit (310) and a set of output current drivers (314s) connected to the at least one power limit in the power circuit; with the exception of teaching a break-out module connected to an output of the LED driver/dimmer; wherein the LED driver/dimmer is located remotely from the set of light fixture loads. However, in the same field of endeavor, Meyer teaches in Fig. 2, a break-out module (30) connected to an output of the LED driver/dimmer (54); wherein the LED driver/dimmer (54) is located remotely from the set of light fixture loads (20a-20f).

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to combine the teachings in order to provide multiple lamps system supported on a track that itself mounted a support structure such as a ceiling or a wall.

In claim 3, Meyer further teaches the apparatus of Claim 2 wherein the set of output current drivers (56) are connected to the break-out module (30) via cabling (power lines).

In claim 4, Meyer further teaches the apparatus of Claim 3 further comprising: a set of series connect modules (power lines extended from 56), each of the set of series connect modules associated with one of the set of light fixture loads (20a-20f) and connected to an output of the break-out module (30).

In claim 5, Meyer further teaches the apparatus of Claim 3 wherein the power cabling (power lines) includes a set of input channels (22a-22f).

In claim 6, it is obvious for the apparatus of Claim 5 wherein the break-out module (30) changes the number of output channels from the number of input channels.

In claim 7, Meyer further teaches the apparatus of Claim 5 wherein the break-out module (30) splits the set of input channels (22a-22f) into individual output channels.

In claim 8, Meyer further teaches the apparatus of Claim 6 wherein the break-out module connects to multiple light fixture loads (20a-20f) via cabling (22a-22f).

In claim 9, Meyer further teaches the apparatus of Claim 7 wherein the break-out module connects to multiple light fixture loads (20a-20f) via cabling (22a-22f).

In claim 16, it would have been obvious to one having ordinary skill in the art at the time the invention was made for the apparatus of Claim 2 wherein the LED driver/dimmer (54) and the break-out module (30) are integrated together; since it has been held that forming in one piece an article which has formerly been formed in two pieces and put together involves only routine skill in the art. Howard v. Detroit Stove Works, 150 U.S. 164 (1893).

In claim 17, Meyer further teaches the apparatus of Claim 2 wherein the LED driver/dimmer further comprises a communication interface (52) for receiving data from an external transmitter (40).

Method claim 19 corresponds to detailed circuitry already discussed similarly with regard to claim 2.

4. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Reisenauer et al. in view of Meyer as applied to claim 2 above, and further in view of Kastner (US2010/0018261).

In claim 18, Reisenauer in view of Meyer teaches the apparatus of Claim 2; with the exception of teaching wherein the at least one current driver comprises a buck topology power stage with hysteretic control. However, Kastner teaches in Figs. 3, 4 or 6, at least one current driver comprises a buck topology power stage with hysteretic control.

Therefore; it would have been obvious to one ordinary skill in the art at the time of the invention was made to combine the teachings to provide LED power supply with

options for dimming that can be used to power multiple lamps supported on track mounted on a ceiling or a wall.

Allowable Subject Matter

5. Claims 10-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vibol Tan whose telephone number is (571)272-1811. The examiner can normally be reached on Monday-Friday (7:00 AM-4:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alex Taningco can be reached on (571) 272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Vibol Tan/
Primary Examiner, Art Unit 2844

Notice of References Cited	Application/Control No. 13/466,509	Applicant(s)/Patent Under Reexamination TIKKANEN ET AL.	
	Examiner Vibol Tan	Art Unit 2844	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0231136	09-2010	Reisenauer et al.	315/276
*	B	US-2010/0066267	03-2010	MEYER, A. Corydon	315/294
*	C	US-8,604,712	12-2013	Bloom et al.	315/294
*	D	US-8,310,171	11-2012	Reisenauer et al.	315/287
*	E	US-8,258,721	09-2012	Meyer, A. Corydon	315/294
*	F	US-7,405,523	07-2008	Wilhelm et al.	315/291
*	G	US-7,310,074	12-2007	Chen, Chih-Hsiung	345/46
*	H	US-6,720,745	04-2004	Lys et al.	315/312
*	I	US-5,008,595	04-1991	Kazar, Dennis M.	315/178
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Receipt date: 05/08/2012
Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13466509 - GAU: 2844
Filing Date	
First Named Inventor	TIKKANEN, David
Art Unit	2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/V.T./	1	20050289279		2005-12-29	FAILS ET AL.	
/V.T./	2	20050218838		2005-10-06	LYS	
/V.T./	3	20080018261		2008-01-24	KASTNER	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
/V.T./	1	2008052293	WO		2008-05-08	QUICK ET AL.		☐

Receipt date: 05/08/2012	Application Number	13466509 - GAU: 2844
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	2844
	Examiner Name	V.Tan
	Attorney Docket Number	PAT 67545AW-2

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/V.T./	1	ERICSSON AB, Power Supplies Goes Digital White Paper, October 2006	☐
/V.T./	2	SKANDA; MICROCHIP TECHNOLOGY INC., Power Factor Correction in Power Conversion Applications using the dsPIC® DSC", AN1106, June 2007	☐
/V.T./	3	TRAXON TECHNOLOGIES, LED Engine XB 3W-108 Technical Specifications and User Manual Version 1.1, 2007	☐
/V.T./	4	PENWELL CORPORATION, Dialight Lumidrives Launches Colurdriver XP for High-Power LEDs, LEDs MAGAZINE, downloaded from http://www.ledsmagazine.com/press/15469, 2007-09-25	☐
/V.T./	5	Colourdriver XP data sheet, 2008-07-30	☐
/V.T./	6	US-TECH ONLINE, Dialight: New High Power LED Driver, downloaded from http://www.us-tech.com, October 2007	☐
/V.T./	7	IST LTD., iDrive™ 1000 The Intelligent 210W LED Driver User Manual, v. 1.7, 2008-06-20	☐
/V.T./	8	ROAL ELECTRONICS, S.P.A, Programmable RGB LED Driver 200 Watts Model RHPS180 Product Details, Rev. 2, 2007-10	☐
/V.T./	9	INTERNATIONAL SEARCHING AUTHORITY (CA), International Search Report and Written Opinion for International Patent Application No. PCT/CA2009/001295, 2010-01-13	☐

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Receipt date: 05/08/2012	Application Number	13466509 - GAU: 2844
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	2844
	Examiner Name	V.Tan
	Attorney Docket Number	PAT 67545AW-2

EXAMINER SIGNATURE			
Examiner Signature	/Vibol Tan/ (12/10/2013)	Date Considered	12/10/2013

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	
	Examiner Name	
	Attorney Docket Number	PAT 67545AW-2

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey W. Wong/	Date (YYYY-MM-DD)	2012-05-08
Name/Print	Jeffrey W. Wong	Registration Number	46414

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(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	~~2824~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

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/V.T./	1	5420780		1995-05-30	Bernstein et al.	

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/V.T./	1	20020047642		2002-04-25	ROHM CO., LTD.	Figs. 6, 7
/V.T./	2	20080018261		2008-01-24	Kastner	Fig. 20; Para. 102
/V.T./	3	20090179594		2009-07-16	Yang	

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/V.T./	1	2009039112	WO		2009-03-26	EXCLARA, INC.	Figs. 1, 10	☐

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(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	David TIKKANEN
Art Unit	~~2821~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

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	1	UKIPO (Examiner HUNT), SEARCH AND EXAMINATION REPORT UNDER SECTIONS 17 & 18(3), Patent Application No. GB1102782.8, 2012-09-06	☐

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Receipt date: 10/04/2013

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Doc description: Information Disclosure Statement (IDS) Filed

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(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	~~2837~~ 2844
Examiner Name	~~ISMAIL, SHAWKI SAIF~~ V.Tan
Attorney Docket Number	18154

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/V.T./	1	20060132063		2006-06-22	HUNG ET AL.	

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Receipt date: 10/04/2013

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(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	~~2857~~ 2844
Examiner Name	~~ISMAIL, SHAWKI GAIF~~ V.Tan
Attorney Docket Number	18154

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Receipt date: 08/31/2012

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

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First Named Inventor	TIKKANEN, David
Art Unit	~~2824~~ 2844
Examiner Name	V.Tan
Attorney Docket Number	PAT 67545AW-2

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	1	8197079		2012-06-12	RUUD ET AL	

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	Examiner Name	V.Tan
	Attorney Docket Number	PAT 67545AW-2

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	("20080018261").PN.	US-PGPUB; USPAT	OR	OFF	2013/12/04 17:02
S2	49405	led.u/c. adj (loads or strings or array or modules)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:20
S3	1	(led.u/c. adj (loads or strings or array or modules)) same ((break or fin) adj out adj module)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:21
S4	2	(led.u/c. adj (loads or strings or array or modules)) same ((break or fin) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/04 17:21
S5	10	(("20050289279") or ("20050218838") or ("20080018261") or ("8197079") or ("20020047642") or ("20080018261") or ("20090179594") or ("5420780") or ("20100164403") or ("20080025028") or ("20060132063")).PN.	US-PGPUB; USPAT	OR	OFF	2013/12/04 17:25
S6	71	("20010022301" | "20020014867" | "20020086567" | "20030057884" | "20030137258" | "20040105264" | "20040164619" | "20040207341" | "20040212993" | "20050062446" | "20050122065" | "20050122705" | "20050128751" | "20050169015" | "20050236998" | "20050285547" | "20060002110" | "20060070763" | "20060267028" | "20070008710" | "20070045524" | "20080197790" | "4367417" | "4667133" | "5008595" | "5577832" | "5580155" | "5661374" | "5803579" | "6016038" | "6150774" | "6161496" | "6166496" | "6283612" | "6340868" | "6346777" | "6392368" | "6424248" | "6459919" | "6505958" | "6528954" | "6540373" | "6548967" | "6597179" | "6600324" | "6608453" | "6608485" | "6624638" | "6720745" | "6762563" | "6764196" | "6781329" | "6788011" | "6806659" | "6869204" |	US-PGPUB; USPAT; USOCR	OR	OFF	2013/12/04 17:30

		"6936978" | "6965205" | "6967448" | "6995355" | "7014336" | "7038399" | "7042172" | "7064498" | "7102172" | "7145125" | "7148470" | "7161313" | "7186003" | "7187141" | "7202613" | "7204622").PN.				
S7	36	(led.u/c. adj (loads or strings or array or modules)) same distributor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 16:53
S8	6	(led.u/c. adj (loads or strings or array or modules)) same ((branch or break) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 16:59
S9	3686	(led.u/c. adj (loads or strings or array or modules)) same (cabling or wire)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:00
S10	421	(led.u/c. adj (loads or strings or array or modules)) same (cabling or wire) same driver	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:01
S11	3	(led.u/c. adj (loads or strings or array or modules)) same (light adj fixture adj loads)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/05 17:22
S12	0	(led.u/c. adj fixture) same loads same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:35
S13	7	(light adj fixture) same loads same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:35
S14	107	(light adj fixture) and loads and (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2013/12/06 06:37

			IBM_TDB			
S15	98	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 06:38
S16	12	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and (lighting adj panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:06
S17	0	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and (lighting adj track)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:09
S18	0	(light adj track adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:11
S19	0	(track adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:15
S20	48	track and fixture and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:15
S21	24	fixture and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and dmx512	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:37
S22	262	(led.u/c. adj (driver or dimmer)) same (current adj drivers)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:49
S23	26	(led.u/c. adj (driver or dimmer)) same (current adj drivers) same loads	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2013/12/06 07:49

			EPO; JPO; DERWENT; IBM_TDB			
S24	3	(led.u/c. adj (driver or dimmer)) and (current adj drivers) and loads and ((fan or fin or break) adj out)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/06 07:57
S25	50	(light adj fixture) and loads and (current adj drivers) and (led.u/c. or (light adj emitting adj diode)) and track$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:39
S26	1751	vibol	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:49
S27	83464	("315").CLAS.	USPAT; USOCR	OR	OFF	2013/12/10 08:49
S28	119	S26 and S27	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/12/10 08:49
S29	27	("20010000422" | "20030107888" | "20030179578" | "20050231134" | "20050243549" | "20060067089" | "20070268701" | "4656398" | "4688154" | "4822292" | "5072216" | "5347431" | "5637964" | "6037721" | "6175201" | "6310440" | "6655817" | "6667578" | "6794830" | "7024119" | "7027736" | "7070293" | "7335523" | "7355523" | "7391297" | "7507005" | "7764162").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/12/10 08:58
S30	1	("20080018261").PN.	US-PGPUB; USPAT	OR	OFF	2013/12/10 11:24

EAST Search History (Interference)

< This search history is empty>

12/ 10/ 2013 12:58:43 PM
C:\ Users\ vtan\ Documents\ EAST\ Workspaces\ 13466509.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13466509	TIKKANEN ET AL.
	Examiner	Art Unit
	VIBOL TAN	2844

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
315	294, 152, 155, 210, 246, 291	12/10/13	VTan
362	85, 147, 148, 150, 240, 576	12/10/13	VTan

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	12/10/13	VTan

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Receipt date: 04/05/2013
Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN et al.
Art Unit	~~2821~~ 2844
Examiner Name	~~n/a~~ V.Tan
Attorney Docket Number	18154

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/V.T./	1	20100164403		2010-07-01	Liu	
/V.T./	2	20080025028		2008-01-31	Gloisten et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN et al.
Art Unit	~~2824~~ 2844
Examiner Name	~~n/a~~ V.Tan
Attorney Docket Number	18154

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/V.T./	1	13/059,336 United States Patent and Trademark Office. Non-Final Office Action dated January 23, 2013.	☐

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Examiner Signature	/Vibol Tan/ (12/10/2013)	Date Considered	12/10/2013

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	2837
Examiner Name	ISMAIL, SHAWKI SAIF
Attorney Docket Number	18154

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20060132063		2006-06-22	HUNG ET AL.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13466509
	Filing Date	2012-05-08
	First Named Inventor	TIKKANEN, David
	Art Unit	2837
	Examiner Name	ISMAIL, SHAWKI SAIF
	Attorney Docket Number	18154

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	2837
Examiner Name	ISMAIL, SHAWKI SAIF
Attorney Docket Number	18154

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jorie L. Stroup/	Date (YYYY-MM-DD)	2013-10-03
Name/Print	Jorie L. Stroup	Registration Number	57532

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor	:	TIKKANEN, David et al.
Appl. No.	:	13/466,509
Filed	:	May 08, 2012
Title	:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Confirm. No.	:	8469
Grp./A.U.	:	2837
Examiner	:	ISMAIL, SHAWKI SAIF
Docket No.	:	18154

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

INFORMATION DISCLOSURE STATEMENT

In accordance with 37 C.F.R. §§ 1.97-1.99, the Applicants, through and by counsel, submit the following information which may be of interest to the Examiner in charge of the above-referenced application for patent.

Since the Applicants are submitting this information before the Office mailed a first action on the merits of the application, the Applicants respectfully assert that no fees are due at this time. However, the Applicants authorize the Office to charge any fees required *for this submission only* to deposit account no. 04-1577 to Dowell & Dowell, P.C.

Should the Examiner have any questions regarding this Information Disclosure Statement or the references cited therein, the Applicants invite the Examiner to contact the undersigned attorney of record at the telephone number provided below.

Respectfully submitted,

DOWELL & DOWELL, P. C.

/Jorie L. Stroup/
Jorie L. Stroup
Reg. No.: 57532
Date: October 3, 2013

DOWELL & DOWELL, P. C.
103 Oronoco Street, Suite 220
Alexandria, VA 22314
U.S.A.

Telephone: 703-739-9888
Facsimile: 703-739-9889
Email: dowell@dowellpc.com

Customer No.: 00293

Electronic Acknowledgement Receipt

EFS ID:	17026990
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Ralph A. Dowell
Filer Authorized By:	
Attorney Docket Number:	18154
Receipt Date:	04-OCT-2013
Filing Date:	08-MAY-2012
Time Stamp:	09:51:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	18154ids5form08a.pdf	612173 635539dc9fce9741b2bfe63557551dbe54329574	no	4

Warnings:	
Information:	

2	Transmittal Letter	18154ids5trans.pdf	45204 9ee87af5c8196af0698b03453e64139deea0f77a	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	657377

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN et al.
Art Unit	2821
Examiner Name	n/a
Attorney Docket Number	18154

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100164403		2010-07-01	Liu	
	2	20080025028		2008-01-31	Gloisten et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN et al.
Art Unit	2821
Examiner Name	n/a
Attorney Docket Number	18154

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	United States Patent and Trademark Office. Non-Final Office Action dated January 23, 2013.	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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Application Number	13466509
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First Named Inventor	TIKKANEN et al.
Art Unit	2821
Examiner Name	n/a
Attorney Docket Number	18154

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jorie L. Stroup/	Date (YYYY-MM-DD)	2013-04-05
Name/Print	Jorie L. Stroup	Registration Number	57,532

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	TIKKANEN et al.
Appl. No.	:	13/466,509
Filed	:	May 8, 2012
Title	:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Grp./A.U.	:	2821
Examiner	:	n/a

Docket No.: 18154

Honorable Commissioner of Patents
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

In accordance with 37 C.F.R. §§ 1.97-1.99, the Applicants submit the following information which may be of interest to the Examiner in charge of the above-referenced application for patent. As required, the Applicants file herewith a copy of one (1) non-patent literature reference listed on the attached form PTO/SB/08a.

Since the Applicants are submitting this information before the Office mailed a first action on the merits of the application, the Applicants respectfully assert that no fees are due at this time. However, the Applicants authorize the Office to charge any fees required for this submission to deposit account no. 04-1577 to Dowell & Dowell, P.C.

Should the Examiner have any questions regarding this Information Disclosure Statement or the references cited therein, the Applicants invite the Examiner to contact the undersigned attorney of record at the telephone number provided below.

Respectfully submitted,

DOWELL & DOWELL, P. C.

/Jorie L. Stroup /
Jorie L. Stroup
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First Named Inventor/Applicant Name:	David TIKKANEN
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	18154ids2form08a.pdf	612169 8ccf4683e0aaf8838504cf86b99b3980ddf51394	no	4

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Application Number	13466509
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First Named Inventor	David TIKKANEN
Art Unit	2821
Examiner Name	
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	1	20020047642		2002-04-25	ROHM CO., LTD.	Figs. 6, 7
	2	20080018261		2008-01-24	Kastner	Fig. 20; Para. 102
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	1	2009039112	WO		2009-03-26	EXCLARA, INC.	Figs. 1, 10	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	13466509
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Examiner Name	
Attorney Docket Number	PAT 67545AW-2

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Signature	/Jeffrey W. Wong/	Date (YYYY-MM-DD)	2012-10-02
Name/Print	Jeffrey W. Wong	Registration Number	46414

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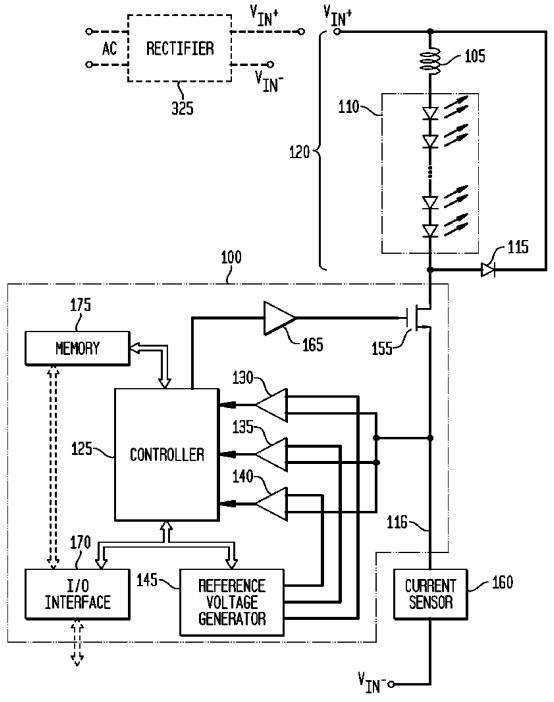
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(54) Title: DIGITAL DRIVER APPARATUS, METHOD AND SYSTEM FOR SOLID STATE LIGHTING

FIG. 1



(57) Abstract: An apparatus, method and system are provided for controlling the solid state lighting, such as LEDs An exemplary apparatus comprises a switch for switching electrical current through the LEDs, a current sensor, a first comparator adapted to determine a switch current first predetermined threshold, a second comparator determining the switch current reached an average level, controller adapted to turn the switch into on/off states, determine a first on time period as a duration between either second predetermined threshold detection or the turning the switch into the on state, and the detection of the predetermined average current level, determine a second on time period as a duration between predetermined average current level and first predetermined threshold detection, determine an on time switch penod as proportional to first and second on time periods Additionally, utilize a difference between first and second on time periods to generate an error signal.

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DIGITAL DRIVER APPARATUS, METHOD AND SYSTEM FOR SOLID STATE LIGHTING

FIELD OF THE INVENTION

The present invention in general is related to supplying and controlling power to solid state lighting devices, and more particularly, to digitally controlling the current of solid state lighting devices such as light emitting diodes utilized in lighting and other applications.

BACKGROUND OF THE INVENTION

Arrays of light emitting diodes ("LEDs") are utilized for a wide variety of applications, including for general lighting and multicolored lighting. Because emitted light intensity is proportional to the average current through an LED (or through a plurality of LEDs connected in series), adjusting the average current through the LED(s) is one typical method of regulating the intensity or the color of the illumination source. Solid state lighting, such as LEDs, are typically coupled to a converter as a power source.

A step-down (Buck) converter can be controlled either in discontinuous conduction mode (DCM) or continuous conduction mode (CCM). Typically DCM is suitable only for low power processing, while CCM mode is utilized for higher power conversion, such as for high brightness LEDs.

In the prior art, a technique referred to as "current programming mode" ("CPM") is utilized in an attempt to simplify compensator designs for the Buck converter, *see, e.g.*, U.S. Patent Nos. 6,034,517; 4,975,820; 4,672,518; 4,674,020; and 4,717,994. Prior art circuits for this CPM mode typically regulate the inductor current in CCM mode around a set point within the Buck converter. This set point is further manipulated by an outer compensating loop. For a Buck converter implemented with CPM mode, the outer compensating loop can be a single pole network.

A CPM implementation, however, cannot simply utilize a controller for a Buck converter, but must also be accompanied with a circuit implementing DCM. One challenge facing this CCM implementation is that the control system needs to transition between DCM and CCM modes in both directions. Many prior art control

systems will oscillate around these two modes, which causes LED current to fluctuate, and which may be visually apparent as flicker, for example. When the outer compensator bandwidth may be low, another problem with this CCM technique is that the LED current may also fluctuate, particularly when the input voltage to the Buck converter contains a high ripple percentage.

Most prior art LED control systems also utilize a "high side sensing" technique, in which the output current of a Buck converter is sensed by a sensing resistor in series with the inductor (see, e.g., U.S. Patent Nos. 6,853,174; 6,166,528; and 5,600,234). With high side sensing, output current can be regulated accurately, and high side sensing can also be utilized with CPM techniques. In order to overcome the various stability problems and other disadvantages mentioned above, the prior art has utilized various controllers to implement hysteretic (or so called "bang-bang") control to regulate this inductor current.

The high side sensing technique works well when the controller integrated circuit ("IC") can tolerate the Buck converter input voltage range. This is typically not the case for an LED driver, however, which involves input voltages which are much higher than what a controller IC is capable of tolerating or specified to tolerate and, accordingly, such a high side sensing technique cannot be utilized with typical controller ICs.

Various techniques for "low side sensing" are also found in the prior art, in which the sense resistor is in between the main converter switching element (MOSFET) and ground, *see, e.g.*, U.S. Patent Nos. 6,580,258 and 5,912,552. The low side sensing technique is usually associated with a control method called "constant off time" (U.S. Patent Nos. 6,580,258 and 5,912,552). Detailed analysis of this constant off time method shows that while it may be suitable for controlling Buck converter output voltage, it exhibits a very large error if it is used for controlling output current, due to converter component and environmental variations (*e.g.*, manufacturing variations, component aging or life span, and environmental conditions such as temperature).

A need remains, therefore, for a control method, apparatus and system, using low side sensing and suitable for IC implementation, that can regulate output current accurately while eliminating those drawbacks caused by existing techniques.

Such an apparatus, method and system should provide a simpler controller compared to CPM techniques, and further provide excellent accuracy and not exhibiting the problems associated with prior art techniques such as CPM technique. Such an apparatus, system and method should also control the intensity (brightness) of light emissions for solid state devices such as LEDs, while simultaneously providing for substantial stability of perceived color emission and control over wavelength shifting, over both a range of intensities and a range of LED junction temperatures. Such an apparatus, system and method should be capable of being implemented with few components, and without requiring extensive feedback systems.

SUMMARY OF THE INVENTION

The exemplary embodiments of the present invention provide numerous advantages for providing power to solid state lighting, such as light emitting diodes. The exemplary embodiments allow for energizing one or more LEDs, using digital control and low side sensing, enabling low voltage IC implementations. The exemplary apparatus and system embodiments may be implemented with either fixed or variable frequency switching, and may be implemented with either AC or DC power sources. As a digital implementation, the exemplary embodiments may also be implemented at a reduced cost. The exemplary embodiments also provide for precise current control, within any selected tolerance levels. In addition, the exemplary embodiments also eliminate the required RC filtering of the prior art.

Further advantages of the exemplary embodiments further provide for controlling the intensity of light emissions for solid state devices such as LEDs, while simultaneously providing for substantial stability of perceived color emission, over both a range of intensities and also over a range of LED junction temperatures. The exemplary embodiments provide digital control, without requiring external compensation. The exemplary embodiments do not utilize significant resistive impedances in the current path to the LEDs, resulting in appreciably lower power losses and increased efficiency. The exemplary current regulator embodiments also utilize comparatively fewer components, providing reduced cost and size, while simultaneously increasing efficiency and enabling longer battery life when used in portable devices, for example.

An exemplary embodiment provides a method of controlling solid state lighting, with the solid state lighting coupled to a switch providing an electrical current path, and the solid state lighting having an electrical current. The exemplary method comprises: turning the switch into an on state; detecting when the electrical current has reached a predetermined average current level; detecting when the electrical current has reached a first predetermined current threshold; determining a first on time period as a duration between detection of a second predetermined current level or turning the switch into the on state and the detection of the predetermined average current level; determining a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; and determining an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period. When the on time period has elapsed, the exemplary also provides for turning the switch into an off state. The exemplary method may also provide for detecting when the electrical current has reached the second predetermined current threshold.

The exemplary embodiments may operate in a fixed or variable frequency switching mode. For the fixed frequency switching, subsequent to turning the switch into the off state, when a fixed time period has elapsed from having turned the switch into the on state, the exemplary method again turns the switch into an on state and repeats the detection and determination steps. For this exemplary embodiment, the method also provides for generating an error signal as a difference between the second on time period and the first on time period, and adjusting the on time period proportionally to the error signal.

For variable frequency switching, when a current off time period has elapsed, the exemplary method provides for determining the current off time period of the switch as a function of the first on time period and the second on time period, and more particularly, determining the current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period. In an exemplary embodiment, the current off time period of the switch may be determined as:

$T_{OFF}(K+1) \approx \frac{2 \bullet T_{ON2}(K) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period. In another exemplary embodiment, the current off time period of the switch may be determined as:

$T_{OFF}(K+1) \approx \frac{(T_{ON1}(K)_A + T_{ON2}(K)) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON1}(K)_A$ is a previous first on time period determined using the detection of the second predetermined current level, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period. In another exemplary embodiment, the current off time period of the switch may be determined as a function of a current first on time period, a previous second on time period, and a previous off time period, or as a function of a current first on time period, a previous first on time period, a previous second on time period, and a previous off time period.

In another exemplary embodiment, the method includes adjusting the current off time period to provide that the first on time period is substantially equal to the second on time period. In addition, the exemplary method also provides for decreasing the current off time period proportionally to a driving gate rising edge time period, or decreasing the on time period proportionally to a driving gate falling edge time period and a comparator falling edge time period. In another variation, the exemplary method may include adjusting the second on time period proportionally to a driving gate falling edge time period, or decreasing the second on time period proportionally to a driving gate falling edge time period and a comparator falling edge time period.

The exemplary method also provides for determining a blanking time interval following turning the switch into the on state. During the blanking time interval, the exemplary method provides for ignoring the detection of the second predetermined current threshold, the detection of the predetermined average current level, or the detection of the first predetermined current threshold. The blanking time interval may be determined as proportional to a gate rising edge time period and a

transient current time period, or as proportional to a gate rising edge time period and detection of the predetermined average current level, for example.

In another exemplary embodiment, the exemplary method includes adjusting a brightness level of the solid state lighting by using at least two different and opposing electrical biasing techniques. In addition, the method of adjusting a brightness level of the solid state lighting may include using a hysteresis of at least two electrical current amplitude levels and at least two electrical current duty cycle ratios.

In an exemplary embodiment, the solid state lighting comprises at least one light emitting diode which has a comparatively high voltage node and a comparatively low voltage node, and wherein the detection of the second predetermined current threshold, the detection of the predetermined average current level, and the detection of the first predetermined current threshold occur at the comparatively low voltage node.

In another exemplary embodiment, the solid state lighting comprises a plurality of arrays of a plurality of series-connected light emitting diodes, and each array of the plurality of arrays further coupled to a corresponding switch providing an electrical current path. The exemplary method may also include separately determining a corresponding first on time period, a corresponding second on time period, and a corresponding on time period as substantially proportional to the sum of the corresponding first on time period and the corresponding second on time period for each array of the plurality of arrays; when the corresponding on time period has elapsed, separately turning the corresponding switch into an off state; and separately determining a corresponding off time period for each array of the plurality of arrays. In addition, the exemplary method may also include interleaving the corresponding on time periods of the corresponding switches of the plurality of arrays, such as by successively switching electrical current to each array of the plurality of arrays for the corresponding on time period.

Another exemplary embodiment provides an apparatus for controlling solid state lighting, with the apparatus comprising: a switch couplable to the solid state lighting; a first comparator adapted to determine when a switch electrical current has reached a first predetermined current threshold; a second comparator adapted to determine when the switch electrical current has reached a predetermined average

current level; and a controller coupled to the first comparator and to the second comparator. In an exemplary embodiment, the controller is adapted to turn the switch into an on state and an off state, to determine a first on time period as a duration between either a detection of a second predetermined current threshold or the turning the switch into the on state, and the detection of the predetermined average current level; to determine a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; and to determine an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period. The controller is further adapted to perform the methodology discussed above.

In an exemplary embodiment, the apparatus also includes a gate driver circuit coupled between the controller and the switch, and wherein the controller is adapted to turn the switch on and to turn the switch off by generating a corresponding signal to the gate driver circuit. The exemplary apparatus may also include a third comparator adapted to determine when the electrical current has reached the second predetermined current threshold; a reference voltage generator adapted to provide reference voltages respectively corresponding to the first and second predetermined current thresholds and to the predetermined average current level; an input-output interface coupled to the controller and adapted to receive an input control signal; and a current sensor coupled to the first and second comparators and to the switch. An exemplary current sensor is embodied as a resistive circuit element.

When the solid state lighting comprises a plurality of arrays of a plurality of series-connected light emitting diodes, with each array of the plurality of arrays is further coupled to a corresponding switch, the controller is further adapted to turn each corresponding switch into an on state and an off state; to separately determine a corresponding first on time period, a corresponding second on time period, and a corresponding on time period as substantially proportional to the sum of the corresponding first on time period and the corresponding second on time period for each array of the plurality of arrays; when the corresponding on time period has elapsed, to separately turn the corresponding switch into an off state; to separately determine a corresponding off time period for each array of the plurality of arrays; and to interleave the corresponding on time periods of the corresponding switches of the

plurality of arrays, such as by successively turn into an on state each corresponding switch for each array of the plurality of arrays for the corresponding on time period.

The exemplary embodiments also provide a solid state lighting system, the system couplable to a power source, with the system comprising: a plurality of arrays of series-connected light emitting diodes; a plurality of switches, a corresponding switch of the plurality of switches coupled to each the array of the plurality of arrays of light emitting diodes; at least one corresponding first comparator adapted to determine when a corresponding switch electrical current has reached a corresponding first predetermined current threshold; at least one corresponding second comparator adapted to determine when the corresponding switch electrical current has reached a corresponding predetermined average current level; and at least one controller coupled to the corresponding first comparator and to the corresponding second comparator, the controller adapted to turn the corresponding switch into an on state and an off state, to determine a corresponding first on time period as a duration between either a detection of a corresponding second predetermined current threshold or the turning the corresponding switch into the on state, and the detection of the corresponding predetermined average current level; to determine a corresponding second on time period as a duration between the detection of the corresponding predetermined average current level and the detection of the corresponding first predetermined current threshold; and to determine a corresponding on time period of the corresponding switch as substantially proportional to a sum of the corresponding first on time period and the corresponding second on time period. The exemplary controller is also adapted to separately perform the methodology of the invention for each array, including the interleaving and the other features discussed above and below.

In addition, in the exemplary system, the exemplary apparatus may be coupled to a DC-DC power converter receiving a DC input voltage or coupled to AC-DC power converter receiving a rectified AC input voltage. When the power source provides a rectified AC input voltage, an electrical current through a corresponding switch is substantially zero when the rectified AC input voltage is below a selected or predetermined threshold. In addition, when the power source provides a rectified AC input voltage, the at least one controller is in an off state when the rectified AC input voltage is below a selected or predetermined threshold.

Another exemplary embodiment includes an apparatus for controlling solid state lighting, with the apparatus comprising: a switch couplable to the solid state lighting; a current sensor coupled to the switch; a first comparator adapted to determine when a switch electrical current has reached a first predetermined current threshold; a second comparator adapted to determine when the switch electrical current has reached a predetermined average current level; a third comparator adapted to determine when the switch electrical current has reached a second predetermined current threshold; a reference voltage generator coupled to the first, second and third comparators and adapted to provide reference voltages respectively corresponding to the first predetermined current threshold, the second predetermined current threshold; and to the predetermined average current level; an input-output interface adapted to receive an input control signal; and a controller coupled to the first, second and third comparators and to the input-output interface, the controller adapted to turn the switch into an on state and an off state, to determine a first on time period as a duration between either the detection of a second predetermined current threshold or the turning the switch into the on state, and the detection of the predetermined average current level; to determine a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; to determine an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period; to turn the switch into an off state when the on time period has elapsed; and to determine a current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, features and advantages of the present invention will be more readily appreciated upon reference to the following disclosure when considered in conjunction with the accompanying drawings, wherein like reference numerals are used to identify identical components in the various views, and wherein reference numerals

with alphabetic characters are utilized to identify additional types, instantiations or variations of a selected component embodiment in the various views, in which:

Figure (or "FIG.") 1 is a block and circuit diagram of an exemplary first system embodiment and first apparatus embodiment in accordance with the teachings of the present invention.

Figure (or "FIG.") 2, divided into FIGs. 2A and 2B, are graphical diagrams illustrating a first exemplary current waveform through the solid state lighting and through a switch, respectively, in accordance with the teachings of the present invention.

Figure (or "FIG.") 3 is a graphical diagram illustrating an exemplary current waveform of a solid state lighting current overshoot, in accordance with the teachings of the present invention.

Figure (or "FIG.") 4 is a graphical diagram illustrating an exemplary current waveform of a solid state lighting current undershoot, in accordance with the teachings of the present invention.

Figure (or "FIG.") 5 is a graphical diagram of an inrush current and a blanking time interval in accordance with the teachings of the present invention.

Figure (or "FIG.") 6 is a graphical diagram illustrating combined pulse width modulation ("PWM") and amplitude modulation for brightness adjustment in accordance with the teachings of the invention.

Figure (or "FIG.") 7 is a graphical diagram illustrating hysteresis between two amplitude levels and duty cycle ratios for brightness adjustment in accordance with the teachings of the invention.

Figure (or "FIG.") 8 is a block and circuit diagram of an exemplary second system embodiment and second apparatus embodiment in accordance with the teachings of the present invention.

Figure (or "FIG.") 9 is a graphical diagrams illustrating a second exemplary current waveform through the solid state lighting and a rectified AC current in accordance with the teachings of the present invention.

Figure (or "FIG.") 10 is a block and circuit diagram of an exemplary third system embodiment in accordance with the teachings of the present invention.

Figure (or "FIG.") 11 is a timing diagram illustrating exemplary multiphase switching of the exemplary third system embodiment in accordance with the teachings of the present invention.

Figure (or "FIG.") 12 is a flow diagram of an exemplary method embodiment in accordance with the teachings of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

While the present invention is susceptible of embodiment in many different forms, there are shown in the drawings and will be described herein in detail specific exemplary embodiments thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated. In this respect, before explaining at least one embodiment consistent with the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of components set forth above and below, illustrated in the drawings, or as described in the examples. Methods and apparatuses consistent with the present invention are capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract included below, are for the purposes of description and should not be regarded as limiting.

As mentioned above, exemplary embodiments of the present invention provide numerous advantages for providing power to solid state lighting, such as light emitting diodes. The exemplary embodiments allow for energizing one or more LEDs, using digital control and low side sensing, enabling low voltage IC implementations. The exemplary apparatus and system embodiments may be implemented with either fixed or variable frequency switching, and may be implemented with either AC or DC power sources. As a digital implementation, the exemplary embodiments may also be implemented at a reduced cost. The exemplary embodiments also provide for precise current control, within any selected tolerance levels. In addition, the exemplary embodiments also eliminate the required RC filtering of the prior art. Further advantages are discussed below.

Figure 1 is a block and circuit diagram of an exemplary first system 150 embodiment and first apparatus 100 embodiment in accordance with the teachings of the present invention, for a single channel of LEDs 110. As illustrated in Figure 1, the system 150 comprises an apparatus 100, a converter 120 with an array of LEDs 110 (as an exemplary type of solid state lighting), and a current sensor 160 (illustrated in Figure 8 as implemented using a resistor 160_A). The illustrated configuration for the converter 120 is a Buck converter, although many other configurations and types of converters may be utilized equivalently, requiring only the capability for "low side" (node 116) current sensing, *i.e.*, current sensor 160 is on the comparatively low side (*e.g.*, at node 116) of the power converter 120, as described in greater detail below. The converter 120 comprises an inductor 105 and a diode 115, with the inductor 105 having a series connection with the LEDs 110. The switch 155 may be considered part of the apparatus 100 or part of the converter 120. As known in the art, other components may also be included within the converter 120, and are also within the scope of the present invention.

The apparatus 100, also referred to as a "digital LED driver", comprises a controller 125, a plurality of comparators 130, 135, 140, and a reference voltage generator 145. The comparators 130, 135, 140 and reference voltage generator 145 may be implemented as known or becomes known in the electronic arts. Optionally, the apparatus 100 may also include an input-output ("I/O") interface 170, to receive (and/or transmit) various signals, such as on, off, brightness (dimming) information, or other control information (such as from a building control system), and may communicate using any protocol, as described below. The apparatus 100 also may include a memory 175, such as to store settings, values, and other parameters which may be used by the controller 125, and which also may have a connection to the I/O interface 170, for input or modification of such parameters. Various implementations of the controller 125 (and other controller 225 embodiments), the I/O interface 170, and the memory 175 are described in greater detail below. A switch 155, typically implemented as a field effect transistor ("FET") or any other type of transistor or switching device, may be considered to be part of either the apparatus 100, the converter 120, or the system 150, and is controlled by the controller 125, typically through an optional gate driver (buffer) 165. The current sensor 160 also may be

considered to be part of either the apparatus 100 or the system 150. Those of skill in the art will recognize that the current sensor 160 may be implemented in innumerable ways, in addition to the illustrated resistor (Figure 8), and any and all of which are considered equivalent and within the scope of the invention. Not separately illustrated in Figure 1 are the typical power (Vdd and/or V_{IN}), ground, and clock (oscillator) inputs and connections for the apparatus 100. In addition, either terminal illustrated as V_{IN}^- or V_{IN}^+ may also be a ground (GND) connection (*e.g.*, V_{IN}^+ and GND, or GND and V_{IN}^-). Also as illustrated, V_{IN}^+ and V_{IN}^- may be a DC voltage or a rectified AC (AC line voltage), using an optional rectifier 325. Exemplary current waveforms for an AC implementation are illustrated and discussed below with reference to Figure 9.

As mentioned above, the apparatus 100 implements "low-side" sensing, such that voltages are detected on the "low" side of LEDs 110, compared to prior art "high-side" sensing of inductor 105 (or LED 110) current. Accordingly, the apparatus 100 is not required to tolerate high voltages which would be necessary with high-side sensing. The apparatus 100 operates by detecting various LED 110 current levels when the switch 155 is on and conducting, and by the controller 125 calculating and predicting optimal switch 155 "on time" durations ("T_{ON}") (divided into first and second portions) and switch 155 "off time" durations ("T_{OFF}"). By controlling the on and off durations of the switch 155, the controller 125 thereby regulates the current through the LEDs 110, with current increasing during the on time, and decreasing during the off time (and flowing through diode 115, rather than the switch 155), as illustrated in Figure 2A. In addition, for these first system and apparatus embodiments, because the combined duration (arithmetic sum) of the on (T_{ON}) and off (T_{OFF}) times for the LEDs 110 is not constant, but is variable, the system 150 has a variable switching frequency (a constant switching frequency is discussed below with reference to Figure 8). The LED 110 current levels are detected as corresponding voltage levels across the current sensor 160 during the on time, and compared by the plurality of comparators 130, 135, 140, to corresponding reference voltages generated by reference voltage generator 145. When the switch 155 is off and not conducting, however, it should be noted that no current flow through or otherwise will be available to the current sensor 160 (switch 155 current falls to zero during T_{OFF}, as illustrated in Figure 2B), and as a consequence, the comparators 130, 135, 140, will not have corresponding

voltage input and will therefore have a low (binary zero) output. Described another way, during the off time of the switch 155, the comparators 130, 135, 140 are not providing any (valid) information concerning the LED 110 current levels.

In accordance with the present invention, the controller 125 will determine various "on" times of the switch 155 to provide a selected or predetermined average current level through the LEDs 110, which current is further less than a selected or predetermined first, high threshold level and greater than a selected or predetermined second, low threshold level, thereby regulating average current through the LEDs 110 with a predetermined current ripple level. A first comparator 130 is utilized to detect the first, high threshold ("HT") level, typically as a voltage across the current sensor 160, by comparing the voltage level across the current sensor 160 with a first reference voltage level provided by the reference voltage generator 145. A second comparator 135 is utilized to detect the second, low threshold ("LT") level, by comparing the voltage level across the current sensor 160 with a second reference voltage level provided by the reference voltage generator 145, and a third comparator 140 is utilized to detect the third, average level, by comparing the voltage level across the current sensor 160 with a third (*e.g.*, average ("AV")) reference voltage level provided by the reference voltage generator 145. Based upon those detected levels, the controller 125 will determine the accurate (and optimal) on time durations for the switch 155. Using those switch 155 on time durations, and a current "off" time duration (which at initial start up may be a default value), the controller 125 will calculate a next off time duration. Quite rapidly and within very few on and off cycles of the switch 155, the controller 125 will cause the on and off durations of the switch 155 to converge to accurate (and optimal) values, and further, to provide any corrections within very few clock cycles, such as due to potentially fluctuating input voltage levels (V_{IN}^{+} and/or V_{IN}^{-}).

Figure 2, divided into FIGs. 2A and 2B, are graphical diagrams illustrating a first exemplary current waveform through the solid state lighting (LEDs 110) (and being equal to the current through the inductor 105) and through the switch 155, respectively, in accordance with the teachings of the present invention. As illustrated in Figure 2A, during initial start up, the switch 155 is on ($T_{ON1}(1)$, interval 214), and the current through the LEDs 110 will increase (180). During this time

period, as the current increases and the voltage across the current sensor 160 increases, the voltage level across the current sensor 160 will be compared by the comparators 130, 135, 140. As the various threshold levels are reached, the comparators 130, 135, 140 will provide corresponding signals to the controller 125, and the controller 125, in turn, is adapted to determine the corresponding time intervals (durations) for the current to increase, for example, either from when the switch 155 has been turned on to the third, average current level (signal from the third comparator 140) ($T_{ON1}(K)$), or from the second, low threshold (signal from second comparator 135) to the third, average current level (also a signal from the third comparator 140) ($T_{ON1}(K)_A$), and then from the third, average current level to the first, high threshold level (T_{ON2}) (signal from the first comparator 130). Upon reaching the first, high threshold, the first comparator 130 will provide a corresponding signal to the controller 125, which will then turn off the switch 155, typically via the gate driver 165, and the current through the LEDs 110 will begin to decrease (181). During initial start up ($T_{ON1}(1)$), the $T_{ON1}(1)$ interval is not utilized (*e.g.*, insufficiently accurate, due to the start up time), and a default off time is implemented ($T_{OFF}(1)$), such that following the default interval, the switch 155 will be turned on again (187).

In accordance with the exemplary embodiments, the on time of the switch 155 is divided into two intervals, $T_{ON1}(K)$ and $T_{ON2}(K)$, indexed for each switching cycle "K" of the switch 155, with consecutive cycles referred to as "K" and "K+1", with $T_{ON1}(K)$ being the time interval commencing with turning on the switch 155 and ending with the LED 110 current reaching the third, average current level (I_{AV}), and with $T_{ON2}(K)$ being the time interval commencing with the current having reached the third, average current level (I_{AV}) and ending with the LED 110 current reaching the first, high threshold current level (I_{HT}). In addition, to accommodate various input (V_{IN}^{+}) and output (V_O) voltage levels, another T_{ON1} time interval is utilized, illustrated in Figure 2A as $T_{ON1}(K)_A$ (177) and $T_{ON1}(K+1)_A$ (198), which is the time interval commencing with the LED 110 current reaching the second, low threshold current level (I_{LT}) and ending with the LED 110 current reaching the third, average current level (I_{AV}). The $T_{ON1}(K)_A$ and $T_{ON1}(K+1)_A$ time periods are utilized for the non-linear rising of the inductor 105 current, illustrated as curves 183, 186 in Figure 2A. The alternative first on time, $T_{ON1}(K)_A$, from the second, low threshold (I_{LT}) to the

third, average current level (I_{AV}), also may be utilized generally when valid second, low threshold (I_{LT}) information is obtainable (depending upon whether the low threshold has already been reached when the blanking time interval has elapsed, as discussed below). Also in accordance with the exemplary embodiments, as the apparatus 100 has a few cycles of operation, the time at which the switch 155 is turned on will be at about the second, low threshold current level (I_{LT}).

When the switch 155 is turned on again (187), depending on the input (V_{IN}^{+}) and output (V_O) voltage levels, the increase in current through LEDs 110 may be comparatively linear (182, 185), typically for the input voltage V_{IN}^{+} being significantly greater than the output voltage V_O, or may be nonlinear (183, 186), typically for the input voltage V_{IN}^{+} being comparatively close in value to the output voltage V_O. The exemplary embodiments of the present invention provide current control for and regardless of either the linear or the nonlinear situation. As the current increases, based upon the input from the comparators 130, 135, 140, the controller 125 will determine the time intervals (durations) $T_{ON1}(K)$ and $T_{ON2}(K)$. When the first, high threshold has been reached, the controller 125 will again turn off the switch 155 (189, 199), and will calculate the next off duration for the switch 155 (to be utilized currently), such that the LED current level is generally kept above the second, low threshold (188), and does not have undershoot (or has insignificant undershoot) (as may have occurred previously (187) during initial start up, as illustrated).

The controller 125, generally, will determine a current off time of the switch 155 as a function of the on time and the previous off time. More specifically, the controller 125 will determine a current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period. Even more specifically, the controller 125 will determine a current off time period of the switch as a function of a current first on time period, a previous second on time period, and a previous off time period. In another alternative, and also more specifically, the controller 125 will determine a current off time period of the switch as a function of a current first on time period, a previous first on time period, a previous second on time period, and a previous off time period. In addition, current and previous should be understood in their relative sense, which are also pair-wise equivalent to the relative terms next and current (respectively, as a pair), so that any

reference or claim to current and previous should be understood to mean and include next and current, respectively.

During any given cycle, at the point of turning off the switch 155 (189, 199), the current values (or parameters) for $T_{ON1}(K+1)$, $T_{ON2}(K+1)$ and the previous values (or parameters) for $T_{ON1}(K)$, $T_{ON2}(K)$, and $T_{OFF}(K)$ are known. In accordance with the exemplary embodiments, the next off time ($T_{OFF}(K+1)$) which will be utilized in the current cycle (K+1) will be calculated or otherwise determined by the controller 125 using the previous off time ($T_{OFF}(K)$), and the various on times, such as the previous second on time $T_{ON2}(K)$ and the current first on time $T_{ON1}(K+1)$, or the previous second on time $T_{ON2}(K)$, the current first on time $T_{ON1}(K+1)$ and the previous first on time $T_{ON1}(K)_A$. More specifically, in accordance with the invention, the switch 155 off time ($T_{OFF}(K)$) is adjusted such that the first and second on times are generally about or substantially equal to each other, $T_{ON1}(K) \approx T_{ON2}(K)$, which then provides the desired current regulation, maintaining the average current level (I_{AV}), while generally maintaining the current below the first, high threshold (I_{HT}) and above the second, low threshold (I_{LT}), depending upon the allowed or tolerated current ripple level.

When V_{IN} is significantly higher than V_O, the inductor 105 current rise slope generally is substantially linear (182, 185). We may assume that the converter 120 input and output voltages V_{IN} and V_O do not vary between consecutive cycles. For a Buck converter, the current rising slope is defined by (Equation 1):

$$current\_rising\_slope = \frac{V_{IN} - V_o}{L},$$

such that the current rising slope does not vary appreciably between consecutive cycles. Since comparators 130, 135, 140 are comparing against fixed thresholds I_{HT}, I_{LT} and I_{AV}, T_{ON2} should remain the same across the consecutive cycles, *i.e.*, (Equation 2):

$$T_{ON2}(K+1) = T_{ON2}(K),$$

such that any calculation using a current second on time $T_{ON2}(K+1)$ is equivalent to and includes using a previous second on time period $T_{ON2}(K)$, and vice versa. By the time $T_{ON1}(K+1)$ elapses, the controller 125 knows $T_{OFF}(K)$, $T_{ON2}(K)$ and $T_{ON1}(K+1)$. Since $T_{OFF}(K)$, $T_{ON1}(K+1)$, and $T_{ON2}(K+1)$ (which equals $T_{ON2}(K)$ from Equation 2) share the same peak (I_{HT})and valley (I_{LT})currents, then (Equation 3)

$$\Delta I = \frac{V_o}{L} T_{OFF}(K) = \frac{V_{in} - V_o}{L} \{T_{ON1}(K+1) + T_{ON2}(K+1)\}$$
$$\approx \frac{V_{in} - V_o}{L} \{T_{ON1}(K+1) + T_{ON2}(K)\}$$

Because an average current of I_{AV} and equal halves (time intervals) for of peak (I_{HT})and valley (I_{LT}) currents are desired, then (Equation 4):

$$T_{ON1}(K+1) = T_{ON2}(K).$$

The desired T_{OFF} (K+1) can be formulated as (Equation 5):

$$\Delta I_{desired} = \frac{V_o}{L} T_{OFF}(K+1) = \frac{V_{IN} - V_o}{L} \{2 \bullet T_{ON2}(K)\}.$$

Dividing Equation 5 by Equation 3 (i.e., Equation 5 over Equation 3) to remove a dependence over V_{IN}, V_O and L, yields (Equation 6):

$$\frac{T_{OFF}(K+1)}{T_{OFF}(K)} = \frac{2 \bullet T_{ON2}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}.$$

Thus, for an exemplary embodiment, the next T_{OFF} (K+1) should be generated by the controller 125 as (Equation 7):

$$T_{OFF}(K+1) = \frac{2 \bullet T_{ON2}(K) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}.$$

Implementation of Equation 7 requires one multiply, one shift, one addition and one divide operation per converter 120 switching cycle. The performance of the apparatus 100, therefore, is about two switching cycles to converge to its target values or parameters for I_{AV}, I_{HT}, and I_{LT}. In addition, the requirement of one multiply and divide per converter 120 switching cycle can be relaxed if the converter 120 switching frequency is much higher than normal ripple found in V_{IN} and V_O. As mentioned above, however, when the current first on time $T_{ON1}(K+1)_A$ or previous first on time $T_{ON1}(K)_A$ are available (*i.e.*, may be measured after the blanking interval described below), these measurements may be utilized instead of the current first on time $T_{ON1}(K+1)$ or previous first on time $T_{ON1}(K)$.

When V_{IN} is not much higher than V_O, the rising slope of the inductor 105 current is no longer linear (183, 186 in Figure 2A). Typically, the initial slope during the $T_{ON1}(K)$ interval is steeper than the $T_{ON2}(K)$ interval. Because in this case Equation 7 may yield a much lower valley (I_{LT}) current than the desired average current I_{AV}, Equation 7 can be modified as (Equation 8):

$$T_{OFF}(K+1) = \frac{(T_{ON1}(K)_A + T_{ON2}(K)) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)} \quad .$$

As mentioned above, $T_{ON1}(K)_A$ is the time interval from I_{LT} to I_{AV}, and may be determined along curves 183, 186 or the curves 182, 185. As discussed in greater detail below, however, because the controller 125 of various exemplary embodiments does not utilize any output of comparators 130, 135, 140 during a "blanking" interval following turning on the switch 155, it is possible that the output of the second comparator 135 (I_{LT}) may be already high when the blanking interval has elapsed and, in which case, Equation 7 is utilized to calculate T_{OFF} (K+1) as well, rather than Equation 8.

Referring again to Figure 1, the thresholds (peak (I_{HT}), valley (I_{LT}) and average (I_{AV}) currents used by comparators 130, 135, 140 are set (predetermined) within the apparatus 100, such as by inputting values using the I/O interface 170, and storing those values as parameters or values in memory 175. For example, for an allowable or selectable 20% ripple in LED 110 current regulation, peak (I_{HT}), average (I_{AV}) and valley (I_{LT}) currents can be set to be apart by 10% intervals. Typical values for peak (I_{HT}), average (I_{AV}) and valley (I_{LT}) currents are represented by corresponding voltages across the current sensor 160, *e.g.*, at around 0.3 Volts (and can be lower when using an IC). The current sensor 160 is selected based upon the desired application; for example, when implemented as a resistor, a value is selected to pass a desired average current.

For even more fine-grained current regulation, the exemplary embodiments of the invention also account for rise and fall delays of the various switching elements, such as the rising and falling time delays of the switch 155, the gate driver 165, and the comparators 130, 135, 140, with any propagation delays included within any such rising and falling time delays. Figure 3 is a graphical diagram illustrating an exemplary current waveform of a solid state lighting current overshoot, in accordance with the teachings of the present invention, illustrating in greater detail section 215 from Figure 2. Figure 4 is a graphical diagram illustrating an exemplary current waveform of a solid state lighting current undershoot, in accordance with the teachings of the present invention, illustrating in greater detail section 210 from Figure 2.

Referring to Figure 3, when the LED 110 current reaches the first, high threshold (I_{HT}) at time t_1, there is a rise time associated with the first (peak) comparator 130 (interval 201), such that the controller 125 does not receive the corresponding information until time t_2. At time t_2, the controller 125 will turn off the gate driver 165 to turn off the switch 155, resulting in a fall time associated with the gate driver 165 and the switch 155 (interval 202), such that the switch 155 has stopped conducting at time t_3. As the current through the LEDs 110 (and switch 155) decreases, there is another fall time associated with the first (peak) comparator 130 (interval 203), such that the controller 125 does not receive the corresponding information until time t_4. Because of these rising and falling time delays, unless the delays are accounted for, there can be an overshoot of the LED 110 current, with the LED 110 current being higher than the selected first, high threshold. Accordingly, the controller 125 receives the corresponding comparator (130) rising and falling edge information at t_2 and t_4.

Similarly, referring to Figure 4, when the LED 110 current decreases to the second, low threshold (I_{LT}) during an off time period, no current is flowing through the switch 155 (Figure 2B), so no information is available to the controller 125. At time t_6, the end of the off time period, the controller 125 will turn on the gate driver 165 to turn on the switch 155, resulting in a rise time associated with the gate driver 165 and the switch 155 (interval 205), such that the switch 155 will start conducting at time t_7. As the current through the LEDs 110 (and switch 155) increases to the low threshold (t_8), there is a rise time associated with the second (valley) comparator 135 (interval 206), such that the controller 125 does not receive the corresponding information until time t_9. Because of these rising and falling time delays, unless the delays are accounted for, there can be an undershoot of the LED 110 current, with the LED 110 current being lower than the selected second, low threshold. Accordingly, the controller 125 receives the corresponding comparator (135) rising edge information at t_9.

The exemplary embodiments of the invention may be implemented to account the various delays associated with the rising and falling times of the first (peak) comparator 130, the gate driver 165 and the switch 155, and the second (valley) comparator 135. By making the rising and falling delay times equal (symmetrical) for each comparator 130, 135, then the time interval during which the controller 125

receives the corresponding comparator (130, 135) rising and falling edge information (*e.g.*, at t_2 and t_4) is equal to the actual overshoot time interval (of t_1 to t_3). Accordingly, the overshoot time may be measured from the first comparator 130 rising edge (t_2) (also coincident with the falling edge of the off command/signal to the gate driver 165) to the first (peak) comparator 130 falling edge (t_4), resulting in (Equation 9):

$$T_{overshoot} \approx T_{p\_gate\_drive\_fall} + T_{pk\_comp\_fall} .$$

Accordingly, for finer-grained control, the overshoot time is subtracted from T_{ON2} by the controller 125, such that the actual LED 110 current would barely reach the first, high threshold I_{HT}.

Because the second comparator 135 is not receiving comparable information during T_{OFF}, a different approach may be utilized, as an option, for determining an undershoot time interval or duration. Accordingly, by also making the first comparator 130 and second comparator 135 to be similar, such that each effectively having the same rising and falling time intervals as the other (symmetrical), then the undershoot time may be considered to be substantially equal or otherwise comparable to the overshoot time. Assuming such symmetry between comparators 130, 135, results in (Equation 10):

$$T_{undershoot} \approx T_{overshoot},$$

such that the interval from t_2 to t_4 in turn also would be equal to the undershoot time interval (of t_5 to t_7). In this instance, the undershoot time is subtracted from T_{OFF} by the controller 125, such that the actual LED 110 current would barely decrease to the second, low threshold I_{LT}. In both overshoot and undershoot circumstances, the measurements of these intervals may be completed during the initial system 150 start up, and treated as constants during subsequent switching cycles or, alternatively, the overshoot and undershoot time intervals may be calibrated whenever the corresponding first (peak) comparator 130 has valid information. In addition, because the undershoot and overshoot time periods may be symmetrical, when the gate driver 165 and switch 155 have symmetrical rise and fall times, and when the various comparators have symmetrical rise and fall times, then the measurement of one (overshoot) also may be used for the other (undershoot).

In another variation, when the second comparator 135 does not provide valid information during an on time interval (*e.g.*, the second comparator 135 has already indicated that the low threshold of current has been reached when the blanking time has elapsed), then the relevant undershoot time may be considered to be only the rise time of the gate driver 165 and switch 155 which, given the symmetrical rise and fall times, would be equal to the fall time of the gate driver 165 and switch 155. This may be determined as described below, or as another alternative, the overshoot time (which also includes first comparator 130 rise or fall time) may be utilized as a sufficiently accurate estimation.

In addition, in exemplary embodiments, depending upon selected tolerance levels, the undershoot compensation may be omitted, as lower current levels are not harmful to the LEDs 110, and if the undershoot is not large, may not be visually apparent. Alternatively, the first, high threshold I_{HT} and the second, low threshold I_{LT} may also be adjusted in advance, to provide tighter regulation, such as spacing them apart by 5% of 7.5% intervals, rather than 10% intervals, for example.

Both of the overshoot and undershoot controls, however, generally should be implemented such that both the first (peak) comparator 130 and the second (valley) comparator 135 periodically trip, to avoid the LED 110 current from deviating down or up without notice. Accordingly, in accordance with the exemplary embodiments, the controller 125 will periodically allow the LED 110 current to rise and fall sufficiently to trip the first (peak) comparator 130 and the second (valley) comparator 135, respectively.

Conversely, if the specification for LED 110 current ripple allow current overshoot (*e.g.*, allowing the LED 110 current envelope to follow V_{IN} ripple), then the overshoot and undershoot may be made symmetrical as well, such as by increasing the off time T_{OFF} by the undershoot (or symmetrical overshoot) interval. By doing so, the LED 110 average current would remain constant.

Figure 5 is a graphical diagram of an inrush current through the switch 155 when it is turned on and a "blanking" time interval in accordance with the teachings of the present invention. In the prior art, such an inrush (transient) current would be filtered using an additional capacitor and resistor (RC filter) in parallel with the current sensor 160; in the exemplary embodiments, the use of such an RC filter is

not required, and a blanking time interval is utilized instead, as mentioned above and as described below. Initially the controller 125 issues a command to the gate driver 165 (and thereby switch 155) to turn on, at time t_{10}. After the gate driver 165 and switch 155 rise time (interval 211) (combined as "Tp_gate_drive_rise" time), the switch 155 current exhibits a transient spike, referred to as an "inrush", starting at time t_{11}, typically caused by its terminal capacitance and the reverse recovery of diode 115, which lasts for interval 212 (through time t_{12}). This inrush current through the switch 155 may be higher than the average current (I_{AV}) and potentially even higher than the first, high threshold (I_{HT}), causing their respective comparators 140, 130 to trip (and provide corresponding logic high signals to the controller 125). In accordance with the exemplary embodiments, the controller 125 disregards this information by establishing or setting a "blanking" time interval (216) ("Tblank"), during which the outputs of the comparators 130, 135, and 140 are ignored. The blanking time interval commences when the controller 125 generates the command to turn on the gate driver 165 (and switch 155) (t_{10}), and extends until the transient inrush current has settled (t_{13}), resulting in (Equation 10): $T_{blank} > T_{P\_gate\_drive\_rise} + T_{inrush}$.

The transient, inrush time interval (212) is generally a function of switch 155 terminal capacitance, diode 115 reverse recovery charge, and the sense resistance value (when current sensor 160 is implemented as a resistor). If the inrush current is higher than the average current (I_{AV}), it is possible for the controller 125 to determine the inrush time and adjust the blanking time appropriately.

Ideally, Equation 4 provides that T_{ON1} should be equal to T_{ON2}. The controller 125, however, as mentioned above, should turn on the gate driver 165 and switch 155 earlier by an amount equal to their combined rise time (Tp_gate_drive_rise time). In a system where the gate driver 165 is designed such that its rise time is close to the overshoot time (*e.g.*, the gate driver 165 and switch 155 have symmetrical rising and falling times and comparator delay time is not significant), then the overshoot time can be utilized to decrease T_{OFF}.

Yet another method of determine the rise time of the gate driver 165 and switch 155 (Tp_gate_drive_rise) is through the third, average current (I_{AV}) comparator 140. Although the moment when the switch 155 inrush current trips the third, average current (I_{AV}) comparator 140 should not be used as an indicator of the actual inductor

105 average current, it can be used to indicate the time when the switch 155 actually starts to conduct. Accordingly, the rise time of the gate driver 165 and switch 155 and the rise time of the third, average current (I_{AV}) comparator 140 ("Tav_comp_rise ") (Tp_gate_drive_rise + Tav_comp_rise) can be measured from the time the controller 125 issues the turn on command until the third, average current (I_{AV}) comparator 140 trips. Then the third, average current (I_{AV}) comparator 140 rise time (Tav_comp_rise) is subtracted from the measurement in order to obtain the rise time of the gate driver 165 and switch 155 (Tp_gate_drive_rise). In an exemplary embodiment, the third, average current (I_{AV}) comparator 140 rise time (Tav_comp_rise) is a known design parameter or is significantly smaller than the rise and fall times of the gate driver 165 and switch 155 (Tp_gate_drive_rise and Tp_gate_drive_fall).

The rise times of the various comparators 130, 135 and 140 may also affect the measurements of T_{ON1} and T_{ON2}. As mentioned above, T_{ON1} is the interval from the time the current reaches the low threshold current level (I_{LT}), as determined by the second (I_{LT}) comparator 135 (or from the time when the switch 155 actually conducts) to the time the current reaches the average current level (I_{AV}), as determined by the third, average current (I_{AV}) comparator 140. T_{ON2} is the time interval from the average current level to the first, high (peak) current level, namely, as determined by the third, average current (I_{AV}) comparator 140 and the first (I_{HT}) comparator 130, respectively. In the exemplary embodiments, therefore, the first (I_{HT}) comparator 130 and the third, average current (I_{AV}) comparator 140 are designed or implemented to have the same or substantially similar delay times (*i.e.*, $T_{av\_comp\_rise} = T_{pk\_comp\_rise}$). With the rise times of the first (I_{HT}) comparator 130 and the third, average current (I_{AV}) comparator 140 being substantially the same, then T_{ON2} can be measured by the interval from when the controller 125 receives the rising edge of the third, average current (I_{AV}) comparator 140 to when the controller 125 receives the rising edge of the first (I_{HT}) comparator 130. It should be noted, as mentioned above, that this measurement does not apply during the blanking time interval, or when the controller 125 does not receive a valid rising edge of the first (I_{HT}) comparator 130 (*e.g.*, due to overshoot compensation, in which case T_{ON2} may be adjusted occasionally in order for the first (I_{HT}) comparator 130 to trip and provide information at these various intervals).

As indicated above, T_{ON1} may be measured from the interval beginning with the controller 125 receiving the rising edge of the second (I_{LT}) comparator 135 (when available (*i.e.* when the rising edge did not occur during the blanking interval)) until the controller 125 receives the rising edge of the third, average current (I_{AV}) comparator 140, or beginning with the controller 125 generating the turn on command for the gate driver 165 and switch 155) until the controller 125 receives the rising edge of the third, average current (I_{AV}) comparator 140 (T_{ON1} measured). For the former case, given the symmetry of the comparators, no additional compensation is needed for determining T_{ON1} measured. In the latter case however, when the rising edge of the second (I_{LT}) comparator 135 does not provide valid information (during the blanking interval, or due to undershoot compensation), then for this measurement, the rise time of the gate driver 165 and switch 155 should then be subtracted, to provide the actual value of T_{ON1} ($T_{ON1} \approx T_{ON1}$ measured - Tav_comp_rise). T_{ON1} may also be measured using the transient current spike (inrush current), if the inrush current is sufficiently high to trip the third, average current (I_{AV}) comparator 140, indicating a start of the conduction by the switch 155. T_{ON1} is then the interval between the controller 125 receiving the first rising edge of the third, average current (I_{AV}) comparator 140 due to the inrush current and receiving the second rising edge of the third, average current (I_{AV}) comparator 140 (after the transient has settled). Knowing both T_{ON1} and T_{ON2}, the controller 125 may then determine T_{OFF}.

In the event that during initial start up, the third, average current (I_{AV}) comparator 140 stays high after the transient current spike (inrush current) has settled, indicating that the current is already too high, there is no need to measure T_{ON1} and T_{ON2}. Rather, TOFF is extended, to allow current to decrease, with valid measurements for T_{ON1} and T_{ON2} obtainable in the next cycle.

Figure 6 is a graphical diagram illustrating combined pulse width modulation ("PWM") and amplitude modulation for brightness adjustment in accordance with the teachings of the invention. The exemplary embodiments implement brightness control (dimming) using a combination of at least two different electrical biasing techniques across the LEDs 110, such as PWM and amplitude modulation (or constant current regulation ("CCR"). A first electrical biasing technique, by itself, will tend to produce a first wavelength shift (higher or lower) in

response to a change in intensity, such as in response to a change in duty cycle for PWM, while a second electrical biasing technique, by itself, will tend to produce a second, opposite or opposing wavelength shift (lower or higher, respectively) in response to the change in intensity, such as in response to a change in amplitude for analog regulation or CCR. In accordance with the exemplary embodiments, any resulting wavelength shift is minimized or maintained within a selected tolerance level by utilizing at least two different and opposing electrical biasing techniques (such that the opposing wavelength shifts effectively "cancel" each other). Additional discussion of that methodology is in one or more related patent applications. To decrease brightness, for PWM, the duty cycle is decreased (*e.g.*, from D1 to D2), and for amplitude modulation (CCR), the amplitude of the LED current is decreased (*e.g.*, from ILED1 to ILED2), as illustrated in Figure 6. In accordance with the exemplary embodiments, the controller 125 implements dimming by using both PWM and amplitude modulation, either alternating them in successive modulation intervals or combining them during the same modulation interval, with the latter illustrated in Figure 6. This inventive combination of at least two different electrical biasing techniques having opposing effects on wavelength emission allows for both regulating the intensity of the emitted light while controlling the wavelength emission shift, from either or both the LED response to intensity variation (dimming technique) and due to p-n junction temperatures changes, and also to produce dynamic lighting and color effects.

Figure 7 is a graphical diagram illustrating hysteresis between two amplitude levels (ILED1, ILED2) and duty cycle ratios (D1L, D2L, D1H, D2H) for brightness adjustment in accordance with the teachings of the invention. In order to prevent jitter, a hysteresis is implemented as illustrated in Figure 7. The operating points (ILED1, D1L) have the same brightness (color) to (ILED2, D2L), and the same brightness applies to (ILED1, D1H) and (ILED2, D2H). When D1 comes from high brightness down to D1L, ILED1 is changed to ILED2 and D2L is used instead. When D2 comes up from low brightness to D2H, ILED2 is switched to ILED1 and D1H is used.

Figure 8 is a block and circuit diagram of an exemplary second system 250 embodiment and second apparatus 200 embodiment, for fixed frequency switching

operation, in accordance with the teachings of the present invention. The second system 250 and second apparatus 200 differ from the first system 150 and first apparatus 100 insofar as: (1) the combined duration (arithmetic sum) of the on (T_{ON}) and off (T_{OFF}) times for the LEDs 110 is constant, not variable, such that the second system 250 has a fixed or constant switching frequency (rather than the variable switching frequency previously discussed); and (2) the controller 225 is adapted to provide current control when the commencement or initiation of the on time of the switch 155 is at a fixed, regular frequency. In addition, as an illustrated alternative, the controller 225 is coupled directly to the switch 155, rather than via a gate driver (165). It should be understood, however, that the second system 250 and second apparatus 200 may also include such a gate driver circuit 165, such as a buffer.

For the second system 250 and second apparatus 200, the controller 225 includes an error generator 260, a compensator 255, and a control block 251 for determining the respective on (T_{ON}) and off (T_{OFF}) durations for the switch 155. In this embodiment, the controller 225 also provides that T_{ON1} is substantially equal to T_{ON2}, with the error generator 260 generating an error signal substantially equal or proportional to the difference between T_{ON1} and T_{ON2} (error = T_{ON2} - T_{ON1}, error $\approx$ T_{ON2} - T_{ON1}, or error $\approx c \cdot (T_{ON2} - T_{ON1})$, where "c" is a constant of proportionality). The error signal is provided to the compensator 255, which then adjusts the on time (T_{ON}) of the switch 155, which is then correspondingly switched on and off by the control block 251. It should be noted, because the switch 155 is switched on at a fixed frequency, adjusting the on time (T_{ON}) of the switch 155 automatically changes the off time (T_{OFF}) of the switch 155 (*e.g.*, increasing the on time T_{ON} decreases the off time T_{OFF}, and vice versa).

Figure 9 is a graphical diagrams illustrating a second exemplary current waveform through the solid state lighting and a rectified AC current in accordance with the teachings of the present invention. Such a rectified AC current 301 (or voltage) may be provided by a rectifier 325 to provide a voltage input V_{IN} (illustrated as V_{IN}^{+} and V_{IN}^{-}) having a DC average value, from an AC line voltage (AC mains), for example, and may be utilized with either the first or second system 150, 250 and first or second apparatus 100, 200, and also may be utilized with the third system 350 discussed below. When the rectified AC current 301 is below a selected (or

predetermined) threshold, illustrated as intervals 303, there is generally no switch 155 current, and the apparatus 100, 200 will typically be off during these AC zero crossing intervals. As illustrated, the switch 155 is turned on, above the selected (or predetermined) threshold, the LED 110 current 302 will initially track the rectified AC current 301, increasing to the second, low threshold (I_{LT}), reaching the average current level (I_{AV}) and then the first, high threshold (I_{HT}), followed by turning the switch 155 off for its calculated duration, and followed by successive on and off cycles, as described above, using the measurements and calculations described above for T_{ON1}, T_{ON2}, and T_{OFF}, or using the error signal (*e.g.*, error $\approx T_{ON2} - T_{ON1}$) described above, for either variable or fixed frequency embodiments. Such an apparatus and system can be built directly into an Edison socket, and further, can provide power factor correction ("PFC"). In order to achieve PFC operation, the controller 125 or compensator 255 is comparatively slow with respect to a V_{IN} ripple frequency of 120Hz (or 100Hz). For example and without limitation, for each half of the AC cycle, the T_{ON} determined and outputted by the compensator 255 can be regarded as a constant, and is adjusted during successive half-cycles.

It should be noted that the first system 150, first apparatus 100, the second system 250 and second apparatus 200, and their versions including an AC rectifier 325, may be scaled or extended to multiple channels of LEDs 110. In one such implementation, the first or second apparatus 100, 200 is instantiated in its entirety for each separate channel of LEDs 110.

In another such implementation, discussed below with reference to Figure 10, the comparators 130, 135, 140 are instantiated separately for each separate or independent channel of LEDs 110, such that the LED 110 current through each channel is separately monitored. In this scaled embodiment, the controller 125, 225 then has multiple outputs, one to each to each gate driver 165 (which in turn is coupled to a corresponding switch 155 for each separate or independent channel of LEDs 110). The controller 125, 225 separately computes the various on (T_{ON1} and T_{ON2}) durations for the switch 155, and for apparatus 100, the controller 125 also computes the off (T_{OFF}) duration, for each separate (or independent) channel of LEDs 110, and separately controls each gate driver 165 to each switch 155 for each separate channel of

LEDs 110 to provide the current regulation through each such channel of LEDs 110 as discussed above and as discussed below.

Figure 10 is a block and circuit diagram of an exemplary third system 350 embodiment, for multichannel operation, in accordance with the teachings of the present invention. As mentioned above, the various first and second apparatus 100, 200 may be extended to control current through a plurality of separate arrays 310 (also referred to equivalently as channels or strings) of LEDs 110, illustrated as array 310_1 having LEDs 110_1, array 310_2 having LEDs 110_2, through array 310_n having LEDs 110_n. Each such array or channel 310 includes at least one LED 110 or a plurality of LEDs 110 connected in series. In contrast with the prior art, the plurality of LEDs 110 of each array are not required to be identical or from the same manufacturing bin; instead, because of the separate control and regulation provided by the exemplary embodiments, there may be significant variation among the LEDs 110, for a considerable cost savings.

With the separate current control for each LED array 310, the regulated current can be matched to each separate LED array 310. Accordingly, various LED arrays 310 are not subject to excessive current levels, that would be caused in the prior art systems from some LED arrays having a higher impedance and drawing less current than expected. As a consequence, the exemplary third system 350 enables increased durability, improved system lifetime, decreased heat generated (also enabling a corresponding decrease in the size of heat sinks for the LEDs 110), a decrease in the number of LEDs 110 required for the same optical output, and overall increased system efficiency and efficacy.

As illustrated for the third system 350, each array 310 has a corresponding switch 155, illustrated as switch 155_1, switch 155_2, through switch 155_n, which are controlled by respective gate driver circuits (buffers) 165 (illustrated collectively, for ease of discussion), under the control of at least one controller 125, 225. The comparators 130, 135, 140 are instantiated separately for each separate or independent array or channel 310 of LEDs 110, such that the LED 110 current through each array (channel) 310 (via corresponding current sensors 160_1, 160_2, through 160_n) is separately monitored and separately controlled, as described above for the first and second systems 100, 200. At least one reference voltage generator 145 provides the

corresponding reference voltages (corresponding to the first (high) threshold, average, and second (low) threshold) for each current through each separate array 310. It should be noted that the various average, first and second threshold currents may be either the same or different across the various arrays 310, such that any selected array 310 may have its own set average and threshold current levels, separate from the average and threshold currents of the other arrays 310.

In this scaled, third system 350 embodiment, the controller 125, 225 then has multiple outputs, one to each to each gate driver 165, to turn on or off a corresponding switch 155 for each separate array 310 of LEDs 110. The controller 125, 225 separately determines the various on (T_{ON1} and T_{ON2}) durations for each corresponding switch 155_1, switch 155_2, through switch 155_n, and for variable frequency operation, the controller 125 also computes the off (T_{OFF}) duration, for each separate (or independent) array 310 of LEDs 110. The controller 125, 225 separately controls each gate driver 165 to each switch 155_1, switch 155_2, through switch 155_n, for each separate array 310 of LEDs 110, to provide separate current regulation through each separate channel of LEDs 110 in accordance with the exemplary embodiments of the invention.

Accordingly, for each separate array 310 of LEDs 110, for variable frequency switching, the controller 125 will determine T_{ON1} and T_{ON2}, and a corresponding T_{OFF}, as previously described above for the first system 150 and first apparatus 100, to provide regulated current control, for each array 310, and for fixed frequency switching, the controller 225 will determine T_{ON1} and T_{ON2}, as previously described above for the second system 250 and second apparatus 200, to provide regulated current control, for each array 310.

While the exemplary third system 350 provides separate control to each LED array 310, such control may be independent, controlling each LED array 310 completely independently of all the other LED arrays 310, or such control may include any type of coordinated, joint or dependent regulation, for any selected lighting or color effect, as may be necessary or desirable for any selected application. In addition, such independent or dependent regulation may be implemented for any type of LEDs 110, such as separate or independent control of red, blue, and green LEDs 110, or coordinated control of such red, blue, and green LEDs 110, such as to produce various

lighting effects having a selected hue, for example. Also for example, lighting effects such as output intensity, color output, color temperature, etc. may be regulated independently or in a coordinated manner for each LED array 310. Importantly, the exemplary third system 350 is capable of providing completely separate and independent current regulation of each LED array 310, with any such independence selectively implemented or not, for example, by the end user of the exemplary third system 350. Also importantly, the exemplary third system 350 is capable of providing any type of coordinated current regulation of each LED array 310, with any such coordination selectively implemented or not, for example, by the end user of the exemplary third system 350.

As an example of one form of coordinated control, in the exemplary third system 350, interleaving of switch 155 on (T_{ON}) durations may be implemented, providing a multiphase control, such that only selected arrays 310 are switched on and are conducting current during a given time interval. Figure 11 is a timing diagram illustrating exemplary multiphase switching of the exemplary third system embodiment, for "n" arrays 310 of LEDs 110, in accordance with the teachings of the present invention. As illustrated, each T_{ON} "pulse" 370 represents the on duration (T_{ON}) of a switch 155 of an array 310; while illustrated as a square wave, it may have any waveform, and merely represents a signal from the controller 125, 225 to turn on (and keep on for the selected on time duration) the corresponding switch 155 (via a corresponding gate driver 165). Also as illustrated, the timing of each such T_{ON} pulse 370 differs across the "n" arrays, with T_{ON} pulses 370_1, 370_{n-3}, and 370_{n-2} occurring during time interval t_A for LED arrays 310_1, 310_{n-3}, and 310_{n-2}, respectively; T_{ON} pulses 370_1, 370_2, 370_{n-2} and 370_{n-1} occurring during time interval t_B for LED arrays 310_1, 310_2, 310_{n-2} and 310_{n-1}, respectively; T_{ON} pulses 370_2, 370_3, 370_{n-1} and 370_n occurring during time interval t_C for LED arrays 310_2, 310_3, 310_{n-1} and 310_n, respectively; and so on. The various on durations may be selected to be separate (*e.g.*, T_{ON} pulses 370_1 and 370_4) or to overlap (*e.g.*, T_{ON} pulses 370_1 and 370_2), as may be necessary or desirable.

Because of this interleaving, multiphase control, not all LED arrays 310 are receiving current at the same time. This enables a much smoother AC input current, which minimizes any requirement on input electromagnetic interference (EMI)

filter size, further enabling a reduction in the input filter capacitor size, and reduced component costs. It is also expected to work well with a thyristor-type dimming.

It should be noted that the controllers 125, 225 may be implemented the same, and configured or otherwise programmed for operation as part of any of the systems 150, 250, and 350.

Figure 12 is a flow diagram of an exemplary method embodiment, in accordance with the teachings of the present invention, for controlling the energizing of solid state lighting, such as LEDs 110, and provides a useful summary. As discussed above, the solid state lighting is coupled to a switch (155) providing an electrical current path (*e.g.*, through current sensor 160), and with the solid state lighting having an electrical current. The method begins, start step 400, with turning the switch 155 into an on state, step 405. The method then detects when the electrical current has reached a predetermined average current level, step 410, and detects when the electrical current has reached a first predetermined (*e.g.*, high) current threshold, step 415. When available (*i.e.*, not during the blanking interval), and prior to detecting the average current level, step 410 may also include detecting when the electrical current has reached a second predetermined (*e.g.*, low) current threshold. The method then determines a first on time period (T_{ON1}) as a duration between the detection of the second predetermined (*e.g.*, low) current threshold (or turning the switch into the on state) and the detection of the predetermined average current level, step 420, and determines a second on time period (T_{ON2}) as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold, step 425. An on time period (T_{ON}) of the switch is then determined as substantially equal or proportional to the sum of the first on time period and the second on time period ($T_{ON} \approx T_{ON1} + T_{ON2}$), step 430. When the on time period has elapsed, the switch is turned off, step 435. For a first embodiment, the exemplary method also determines a current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period (Equations 7 and 8), step 440. When the method continues, step 445, then following expiration of the off time period, step 450, the method returns to step 405 to turn the switch on, and the method iterates. When the method does not continue in step 445, the method may end, return step 455.

Not separately illustrated, the method may also include: adjusting the current off time period to provide that the first on time period is substantially equal to the second on time period (($T_{ON1} \approx T_{ON2}$); or decreasing the current off time period proportionally to a driving gate rising edge time period. In addition, the determination of the current off time period of the switch may be a further function, more specifically, of previous first and second on times and one or more current first on times.

The exemplary method may also provide for determining a blanking time interval following turning the switch into the on state, and ignoring the detection of the second predetermined current threshold, the detection of the predetermined average current level or the detection of the first predetermined current threshold during the blanking time interval. The blanking time interval may be determined as proportional to a gate rising edge time period and a transient current time period, or as proportional to a gate rising edge time period and detection of the predetermined average current level.

The exemplary method may also provide for adjusting a brightness level of the solid state lighting by using at least two electrical biasing techniques, and for example, adjusting a brightness level of the solid state lighting by using a hysteresis of at least two electrical current amplitude levels and at least two electrical current duty cycle ratios.

The method may also provide for current overshoot protection, by adjusting the second on time period proportionally to a driving gate falling edge time period, and more particularly, such as by decreasing the second on time period proportionally to a driving gate falling edge time period and a comparator falling edge time period.

The method may also provide for current undershoot protection by adjusting the first on time period proportionally to a driving gate rising edge time period, such as by increasing the first on time period proportionally to a driving gate rising edge time period. Such undershoot protection may be provided equivalently by decreasing the current off time period proportionally to a driving gate rising edge time period, such as by decreasing the current off time period proportionally to a driving gate rising edge time period.

In another exemplary embodiment, the method may include generating an error signal as a difference between the second on time period and the first on time period, and then adjusting the on time period proportionally to the error signal.

Referring to Figures 1, 8 and 10, as mentioned above, the I/O interface 170 is utilized for input/output communication, providing appropriate connection to a relevant channel, network or bus; for example, and the interface 170 may provide additional functionality, such as impedance matching, drivers and other functions for a wireline interface, may provide demodulation and analog to digital conversion for a wireless interface, and may provide a physical interface for the memory 175 and controller 125, 225 with other devices. In general, the interface 170 is used to receive and transmit data, depending upon the selected embodiment, such as to receive intensity level selection data, temperature data, and to provide or transmit control signals for current regulation (for controlling an LED driver), and other pertinent information. For example and without limitation, the interface 170 may implement communication protocols such as DMX 512, DALI, I^2C, SPI, etc.

Also as mentioned above, a controller 125, 225 (or, equivalently, a "processor") may be any type of controller or processor, and may be embodied as one or more controllers 125, 225, adapted to perform the functionality discussed herein. As the term controller or processor is used herein, a controller 125, 225 may include use of a single integrated circuit ("IC"), or may include use of a plurality of integrated circuits or other components connected, arranged or grouped together, such as controllers, microprocessors, digital signal processors ("DSPs"), parallel processors, multiple core processors, custom ICs, application specific integrated circuits ("ASICs"), field programmable gate arrays ("FPGAs"), adaptive computing ICs, associated memory (such as RAM, DRAM and ROM), and other ICs and components. As a consequence, as used herein, the term controller (or processor) should be understood to equivalently mean and include a single IC, or arrangement of custom ICs, ASICs, processors, microprocessors, controllers, FPGAs, adaptive computing ICs, or some other grouping of integrated circuits which perform the functions discussed below, with associated memory, such as microprocessor memory or additional RAM, DRAM, SDRAM, SRAM, MRAM, ROM, FLASH, EPROM or E^2PROM. A controller (or processor) (such as controller 125, 225), with its associated memory, may be adapted or

configured (via programming, FPGA interconnection, or hard-wiring) to perform the methodology of the invention, as discussed above and below. For example, the methodology may be programmed and stored, in a controller 125, 225 with its associated memory (and/or memory 175) and other equivalent components, as a set of program instructions or other code (or equivalent configuration or other program) for subsequent execution when the processor is operative (*i.e.,* powered on and functioning). Equivalently, when the controller 125, 225 may implemented in whole or part as FPGAs, custom ICs and/or ASICs, the FPGAs, custom ICs or ASICs also may be designed, configured and/or hard-wired to implement the methodology of the invention. For example, the controller 125, 225 may be implemented as an arrangement of controllers, microprocessors, DSPs and/or ASICs, collectively referred to as a "controller", which are respectively programmed, designed, adapted or configured to implement the methodology of the invention, in conjunction with a memory 175.

The memory 175, which may include a data repository (or database), may be embodied in any number of forms, including within any computer or other machine-readable data storage medium, memory device or other storage or communication device for storage or communication of information, currently known or which becomes available in the future, including, but not limited to, a memory integrated circuit ("IC"), or memory portion of an integrated circuit (such as the resident memory within a controller 125, 225 or processor IC), whether volatile or non-volatile, whether removable or non-removable, including without limitation RAM, FLASH, DRAM, SDRAM, SRAM, MRAM, FeRAM, ROM, EPROM or E^2PROM, or any other form of memory device, such as a magnetic hard drive, an optical drive, a magnetic disk or tape drive, a hard disk drive, other machine-readable storage or memory media such as a floppy disk, a CDROM, a CD-RW, digital versatile disk (DVD) or other optical memory, or any other type of memory, storage medium, or data storage apparatus or circuit, which is known or which becomes known, depending upon the selected embodiment. In addition, such computer readable media includes any form of communication media which embodies computer readable instructions, data structures, program modules or other data in a data signal or modulated signal, such as an electromagnetic or optical carrier wave or other transport mechanism, including any

information delivery media, which may encode data or other information in a signal, wired or wirelessly, including electromagnetic, optical, acoustic, RF or infrared signals, and so on. The memory 175 may be adapted to store various look up tables, parameters, coefficients, other information and data, programs or instructions (of the software of the present invention), and other types of tables such as database tables.

As indicated above, the controller 125, 225 is programmed, using software and data structures of the invention, for example, to perform the methodology of the present invention. As a consequence, the system and method of the present invention may be embodied as software which provides such programming or other instructions, such as a set of instructions and/or metadata embodied within a computer readable medium, discussed above. In addition, metadata may also be utilized to define the various data structures of a look up table or a database. Such software may be in the form of source or object code, by way of example and without limitation. Source code further may be compiled into some form of instructions or object code (including assembly language instructions or configuration information). The software, source code or metadata of the present invention may be embodied as any type of code, such as C, C++, SystemC, LISA, XML, Java, Brew, SQL and its variations (*e.g.*, SQL 99 or proprietary versions of SQL), DB2, Oracle, or any other type of programming language which performs the functionality discussed herein, including various hardware definition or hardware modeling languages (*e.g.,* Verilog, VHDL, RTL) and resulting database files (*e.g.,* GDSII). As a consequence, a "construct", "program construct", "software construct" or "software", as used equivalently herein, means and refers to any programming language, of any kind, with any syntax or signatures, which provides or can be interpreted to provide the associated functionality or methodology specified (when instantiated or loaded into a processor or computer and executed, including the controller 125, 225, for example).

The software, metadata, or other source code of the present invention and any resulting bit file (object code, database, or look up table) may be embodied within any tangible storage medium, such as any of the computer or other machine-readable data storage media, as computer-readable instructions, data structures, program modules or other data, such as discussed above with respect to the memory 175, *e.g.*, a floppy disk, a CDROM, a CD-RW, a DVD, a magnetic hard drive, an

optical drive, or any other type of data storage apparatus or medium, as mentioned above.

Numerous advantages of the present invention for providing power to solid state lighting, such as light emitting diodes, are readily apparent. The exemplary embodiments allow for energizing one or more LEDs, using digital control and low side sensing, enabling low voltage IC implementations. The exemplary apparatus and system embodiments may be implemented with either fixed or variable frequency switching, and may be implemented with either AC or DC power sources. As a digital implementation, the exemplary embodiments may also be implemented at a reduced cost. The exemplary embodiments also provide for precise current control, within any selected tolerance levels. In addition, the exemplary embodiments also eliminate the required RC filtering of the prior art.

For changes in brightness levels, a combination of forward biasing techniques are implemented, which allow for both regulating the intensity of the emitted light while controlling the wavelength emission shift, from either or both the LED response to intensity variation (dimming technique) and due to p-n junction temperatures changes. In addition, the exemplary embodiments of the invention also provide for varying intensity while simultaneously reducing the EMI produced by prior art lighting systems, especially because current steps in the pulse modulation are dramatically reduced or eliminated completely. The exemplary LED controllers are also backwards-compatible with legacy LED control systems, frees the legacy host computer for other tasks, and allows such host computers to be utilized for other types of system regulation. The exemplary current regulator embodiments provide digital control, without requiring external compensation. The exemplary current regulator embodiments also utilize comparatively fewer components, providing reduced cost and size, while simultaneously providing increased efficiency and enabling longer battery life when used in portable devices.

Although the invention has been described with respect to specific embodiments thereof, these embodiments are merely illustrative and not restrictive of the invention. In the description herein, numerous specific details are provided, such as examples of electronic components, electronic and structural connections, materials, and structural variations, to provide a thorough understanding of embodiments of the

present invention. One skilled in the relevant art will recognize, however, that an embodiment of the invention can be practiced without one or more of the specific details, or with other apparatus, systems, assemblies, components, materials, parts, etc. In other instances, well-known structures, materials, or operations are not specifically shown or described in detail to avoid obscuring aspects of embodiments of the present invention. In addition, the various Figures are not drawn to scale and should not be regarded as limiting.

Reference throughout this specification to "one embodiment", "an embodiment", or a specific "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention and not necessarily in all embodiments, and further, are not necessarily referring to the same embodiment. Furthermore, the particular features, structures, or characteristics of any specific embodiment of the present invention may be combined in any suitable manner and in any suitable combination with one or more other embodiments, including the use of selected features without corresponding use of other features. In addition, many modifications may be made to adapt a particular application, situation or material to the essential scope and spirit of the present invention. It is to be understood that other variations and modifications of the embodiments of the present invention described and illustrated herein are possible in light of the teachings herein and are to be considered part of the spirit and scope of the present invention.

It will also be appreciated that one or more of the elements depicted in the Figures can also be implemented in a more separate or integrated manner, or even removed or rendered inoperable in certain cases, as may be useful in accordance with a particular application. Integrally formed combinations of components are also within the scope of the invention, particularly for embodiments in which a separation or combination of discrete components is unclear or indiscernible. In addition, use of the term "coupled" herein, including in its various forms such as "coupling" or "couplable", means and includes any direct or indirect electrical, structural or magnetic coupling, connection or attachment, or adaptation or capability for such a direct or indirect electrical, structural or magnetic coupling, connection or attachment, including

integrally formed components and components which are coupled via or through another component.

As used herein for purposes of the present invention, the term "LED" and its plural form "LEDs" should be understood to include any electroluminescent diode or other type of carrier injection- or junction-based system which is capable of generating radiation in response to an electrical signal, including without limitation, various semiconductor- or carbon-based structures which emit light in response to a current or voltage, light emitting polymers, organic LEDs, and so on, including within the visible spectrum, or other spectra such as ultraviolet or infrared, of any bandwidth, or of any color or color temperature.

Furthermore, any signal arrows in the drawings/Figures should be considered only exemplary, and not limiting, unless otherwise specifically noted. Combinations of components of steps will also be considered within the scope of the present invention, particularly where the ability to separate or combine is unclear or foreseeable. The disjunctive term "or", as used herein and throughout the claims that follow, is generally intended to mean "and/or", having both conjunctive and disjunctive meanings (and is not confined to an "exclusive or" meaning), unless otherwise indicated. As used in the description herein and throughout the claims that follow, "a", "an", and "the" include plural references unless the context clearly dictates otherwise. Also as used in the description herein and throughout the claims that follow, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

The foregoing description of illustrated embodiments of the present invention, including what is described in the summary or in the abstract, is not intended to be exhaustive or to limit the invention to the precise forms disclosed herein. From the foregoing, it will be observed that numerous variations, modifications and substitutions are intended and may be effected without departing from the spirit and scope of the novel concept of the invention. It is to be understood that no limitation with respect to the specific methods and apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

It is claimed:

1. A method of controlling solid state lighting, the solid state lighting coupled to a switch providing an electrical current path, and the solid state lighting having an electrical current, the method comprising:

turning the switch into an on state;

detecting when the electrical current has reached a predetermined average current level;

detecting when the electrical current has reached a first predetermined current threshold;

determining a first on time period as a duration between detection of a second predetermined current level or turning the switch into the on state and the detection of the predetermined average current level;

determining a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; and

determining an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period.

2. The method of claim 1, further comprising:

when the on time period has elapsed, turning the switch into an off state.

3. The method of claim 2, further comprising:

subsequent to turning the switch into the off state, when a fixed time period has elapsed from having turned the switch into the on state, again turning the switch into the on state and repeating the detection and determination steps.

4. The method of claim 3, further comprising:

generating an error signal as a difference between the second on time period and the first on time period.

5. The method of claim 5, further comprising:

adjusting the on time period proportionally to the error signal.

6. The method of claim 2, further comprising:

when a current off time period has elapsed, turning the switch into the on state and repeating the detection and determination steps.

7. The method of claim 6, further comprising:

determining the current off time period of the switch as a function of the first on time period and the second on time period.

8. The method of claim 6, further comprising:

determining the current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period.

9. The method of claim 6, further comprising:

determining the current off time period of the switch as:

$T_{OFF}(K+1) \approx \frac{2 \bullet T_{ON2}(K) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period.

10. The method of claim 6, further comprising:

determining the current off time period of the switch as:

$T_{OFF}(K+1) \approx \frac{(T_{ON1}(K)_A + T_{ON2}(K)) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON1}(K)_A$ is a previous first on time period determined using the detection of the second predetermined current level, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period.

11. The method of claim 6, further comprising:

determining the current off time period of the switch as a function of a current first on time period, a previous second on time period, and a previous off time period.

12. The method of claim 6, further comprising:

determining the current off time period of the switch as a function of a current first on time period, a previous first on time period, a previous second on time period, and a previous off time period.

13. The method of claim 6, further comprising:

adjusting the current off time period to provide that the first on time period is substantially equal to the second on time period.

14. The method of claim 6, further comprising:

decreasing the current off time period proportionally to a driving gate rising edge time period.

15. The method of claim 1, further comprising:

decreasing the on time period proportionally to a driving gate falling edge time period and a comparator falling edge time period.

16. The method of claim 1, further comprising:

determining a blanking time interval following turning the switch into the on state.

17. The method of claim 16, further comprising:

ignoring the detection of the second predetermined current threshold, the detection of the predetermined average current level, or the detection of the first predetermined current threshold during the blanking time interval.

18. The method of claim 16, further comprising:

determining the blanking time interval as proportional to a gate rising edge time period and a transient current time period.

19. The method of claim 16, further comprising:

determining the blanking time interval as proportional to a gate rising edge time period and detection of the predetermined average current level.

20. The method of claim 1, further comprising:

adjusting a brightness level of the solid state lighting by using at least two different and opposing electrical biasing techniques.

21. The method of claim 1, further comprising:

adjusting a brightness level of the solid state lighting by using a hysteresis of at least two electrical current amplitude levels and at least two electrical current duty cycle ratios.

22. The method of claim 1, further comprising:

adjusting the second on time period proportionally to a driving gate falling edge time period.

23. The method of claim 1, further comprising:

decreasing the second on time period proportionally to a driving gate falling edge time period and a comparator falling edge time period.

24. The method of claim 1, further comprising:

detecting when the electrical current has reached the second predetermined current threshold.

25. The method of claim 1, wherein the solid state lighting comprises at least one light emitting diode.

26. The method of claim 25, wherein the at least one light emitting diode is coupled to a power converter, and wherein the electrical current detections occur at a comparatively low side of the power converter.

27. The method of claim 1, wherein the solid state lighting comprises a plurality of arrays of a plurality of series-connected light emitting diodes, and each array of the plurality of arrays further coupled to a corresponding switch providing an electrical current path.

28. The method of claim 27, further comprising:

separately determining a corresponding first on time period, a corresponding second on time period, and a corresponding on time period as substantially proportional to the sum of the corresponding first on time period and the corresponding second on time period for each array of the plurality of arrays.

29. The method of claim 28, further comprising:

when the corresponding on time period has elapsed, separately turning the corresponding switch into the off state.

30. The method of claim 29, further comprising:

separately determining a corresponding off time period for each array of the plurality of arrays.

31. The method of claim 29, further comprising:

interleaving the corresponding on time periods of the corresponding switches of the plurality of arrays.

32. The method of claim 27, further comprising:

successively switching electrical current to each array of the plurality of arrays for the corresponding on time period.

33. An apparatus for controlling solid state lighting, the apparatus comprising:

a switch couplable to the solid state lighting;

a first comparator adapted to determine when a switch electrical current has reached a first predetermined current threshold;

a second comparator adapted to determine when the switch electrical current has reached a predetermined average current level; and

a controller coupled to the first comparator and to the second comparator, the controller adapted to turn the switch into an on state and an off state, to determine a first on time period as a duration between either a detection of a second predetermined current threshold or the turning the switch into the on state, and the detection of the predetermined average current level; to determine a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; and to determine an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period.

34. The apparatus of claim 33, wherein the controller is further adapted, when the on time period has elapsed, to turn the switch into an off state.

35. The apparatus of claim 34, wherein the controller is further adapted, subsequent to turning the switch into the off state and when a fixed time period has elapsed from having turned the switch into the on state, to turn the switch into the on state.

36. The apparatus of claim 35, wherein the controller is further adapted to generate an error signal as a difference between the second on time period and the first on time period.

37. The apparatus of claim 36, wherein the controller is further adapted to adjust the on time period proportionally to the error signal.

38. The apparatus of claim 34, wherein the controller is further adapted to determine a current off time period of the switch as a function of the first on time period and the second on time period.

39. The apparatus of claim 34, wherein the controller is further adapted to determine a current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period.

40. The apparatus of claim 34, wherein the controller is further adapted to determine a current off time period of the switch as:

$T_{OFF}(K+1) \approx \frac{2 \bullet T_{ON2}(K) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period.

41. The apparatus of claim 34, wherein the controller is further adapted to determine a current off time period of the switch as a function of a current first on time period, a previous second on time period, and a previous off time period.

42. The apparatus of claim 34, wherein the controller is further adapted to determine a current off time period of the switch as a function of a current first on time period, a previous first on time period, a previous second on time period, and a previous off time period.

43. The apparatus of claim 34, wherein the controller is further adapted to adjust a current off time period to provide that the first on time period is substantially equal to the second on time period.

44. The apparatus of claim 33, further comprising:

a gate driver circuit coupled between the controller and the switch, and wherein the controller is adapted to turn the switch on and to turn the switch off by generating a corresponding signal to the gate driver circuit.

45. The apparatus of claim 44, wherein the controller is further adapted to decrease a current off time period proportionally to a rising edge time period of the gate driver circuit.

46. The apparatus of claim 44, wherein the controller is further adapted to decrease the on time period proportionally to a falling edge time period of the gate driver circuit and a falling edge time period of the first comparator.

47. The apparatus of claim 44, wherein the controller is further adapted to adjust the second on time period proportionally to a falling edge time period of the gate driver circuit.

48. The apparatus of claim 44, wherein the controller is further adapted to decrease the second on time period proportionally to a falling edge time period of the gate driver circuit and a falling edge time period of the first comparator.

49. The apparatus of claim 44, wherein the controller is further adapted to determine a blanking time interval following turning the switch into the on state.

50. The apparatus of claim 49, further comprising:

a third comparator adapted to determine when the electrical current has reached the second predetermined current threshold.

51. The apparatus of claim 50, further comprising:

a current sensor coupled to the first, second and third comparators and to the switch.

52. The apparatus of claim 51, wherein the current sensor is embodied as a resistive circuit element.

53. The apparatus of claim 50, wherein the controller is further adapted to determine a current off time period of the switch as:

$$T_{OFF}(K+1) \approx \frac{(T_{ON1}(K)_A + T_{ON2}(K)) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$$, in which $T_{OFF}(K+1)$ is the current off time period, $T_{ON1}(K)_A$ is a previous first on time period determined using the detection of the second predetermined current level, $T_{ON2}(K)$ is a previous second on time period, $T_{OFF}(K)$ is a previous off time period, and $T_{ON1}(K+1)$ is a current first on time period.

54. The apparatus of claim 50, wherein the controller is further adapted to ignore the detection of the second predetermined current threshold, the detection of the predetermined average current level, or the detection of the first predetermined current threshold during the blanking time interval.

55. The apparatus of claim 50, wherein the controller is further adapted to determine the blanking time interval as proportional to a rising edge time period of the gate driver circuit and a transient current time period.

56. The apparatus of claim 50, wherein the controller is further adapted to determine the blanking time interval as proportional to a rising edge time period of the gate driver circuit and detection of the predetermined average current level.

57. The apparatus of claim 33, wherein the controller is further adapted to adjust a brightness level of the solid state lighting by generating control signals to a driver circuit for using at least two different and opposing electrical biasing techniques.

58. The apparatus of claim 33, wherein the controller is further adapted to adjust a brightness level of the solid state lighting by generating control signals to a driver circuit to use a hysteresis of at least two electrical current amplitude levels and at least two electrical current duty cycle ratios.

59. The apparatus of claim 33, wherein the solid state lighting comprises at least one light emitting diode.

60. The apparatus of claim 59, wherein the at least one light emitting diode is coupled to a power converter, and wherein the first and second comparators are coupled to a current sensor at a comparatively low side of the power converter.

61. The apparatus of claim 33, wherein the solid state lighting comprises a plurality of arrays of a plurality of series-connected light emitting diodes, each array of the plurality of arrays is further coupled to a corresponding switch, and wherein the controller is further adapted to turn each corresponding switch into an on state and an off state.

62. The apparatus of claim 61, wherein the controller is further adapted to separately determine a corresponding first on time period, a corresponding second on time period, and a corresponding on time period as substantially proportional to the sum of the corresponding first on time period and the corresponding second on time period for each array of the plurality of arrays.

63. The apparatus of claim 62, wherein the controller is further adapted, when the corresponding on time period has elapsed, to separately turn the corresponding switch into an off state.

64. The apparatus of claim 62, wherein the controller is further adapted to separately determine a corresponding off time period for each array of the plurality of arrays.

65. The apparatus of claim 62, wherein the controller is further adapted to interleave the corresponding on time periods of the corresponding switches of the plurality of arrays.

66. The apparatus of claim 62, wherein the controller is further adapted to successively turn into an on state each corresponding switch for each array of the plurality of arrays for the corresponding on time period.

67. The apparatus of claim 33, further comprising:

a reference voltage generator coupled to the first and second comparators and adapted to provide reference voltages respectively corresponding to the first predetermined current threshold and to the predetermined average current level.

68. The apparatus of claim 33, further comprising:

an input-output interface coupled to the controller and adapted to receive an input control signal.

69. The apparatus of claim 33, wherein the apparatus is coupled to a DC-DC power converter receiving a DC input voltage or coupled to AC-DC power converter receiving a rectified AC input voltage.

70. A solid state lighting system, the system couplable to a power source, the system comprising:

a plurality of arrays of series-connected light emitting diodes;

a plurality of switches, a corresponding switch of the plurality of switches coupled to each the array of the plurality of arrays of light emitting diodes;

at least one corresponding first comparator adapted to determine when a corresponding switch electrical current has reached a corresponding first predetermined current threshold;

at least one corresponding second comparator adapted to determine when the corresponding switch electrical current has reached a corresponding predetermined average current level; and

at least one controller coupled to the corresponding first comparator and to the corresponding second comparator, the controller adapted to turn the corresponding switch into an on state and an off state, to determine a corresponding first on time period as a duration between either a detection of a corresponding second predetermined current threshold or the turning the corresponding switch into the on state, and the detection of the corresponding predetermined average current level; to determine a corresponding second on time period as a duration between the detection of the corresponding predetermined average current level and the detection of the corresponding first predetermined current threshold; and to determine a corresponding on time period of the corresponding switch as substantially proportional to a sum of the corresponding first on time period and the corresponding second on time period.

71. The system of claim 70, wherein the at least one controller is further adapted, when the corresponding on time period has elapsed, to turn the corresponding switch into an off state.

72. The system of claim 70, wherein the at least one controller is further adapted, subsequent to turning the corresponding switch into the off state and when a fixed time period has elapsed from having turned the corresponding switch into the on state, to turn the corresponding switch into the on state.

73. The system of claim 72, wherein the at least one controller is further adapted to generate a corresponding error signal as a difference between the corresponding second on time period and the corresponding first on time period.

74. The system of claim 73, wherein the at least one controller is further adapted to adjust the corresponding on time period proportionally to the corresponding error signal.

75. The system of claim 70, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as a function of the corresponding first on time period and the corresponding second on time period.

76. The system of claim 70, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as a function of the corresponding first on time period, the corresponding second on time period, and a corresponding previous off time period.

77. The system of claim 70, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as:

$T_{OFF}(K+1) \approx \frac{2 \bullet T_{ON2}(K) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$, in which $T_{OFF}(K+1)$ is the corresponding current off time period, $T_{ON2}(K)$ is a corresponding previous second on time period, $T_{OFF}(K)$ is a corresponding previous off time period, and $T_{ON1}(K+1)$ is a corresponding current first on time period.

78. The system of claim 70, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as a function of a corresponding current first on time period, a corresponding previous second on time period, and a corresponding previous off time period.

79. The system of claim 70, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as a function of a corresponding current first on time period, a corresponding previous first on time period, a corresponding previous second on time period, and a corresponding previous off time period.

80. The system of claim 70, wherein the at least one controller is further adapted to adjust a corresponding current off time period to provide that the corresponding first on time period is substantially equal to the corresponding second on time period.

81. The system of claim 70, further comprising:

at least one corresponding gate driver circuit coupled between the at least one controller and the corresponding switch, and wherein the at least one controller is adapted to turn the corresponding switch on and to turn the corresponding switch off by generating a corresponding signal to the corresponding gate driver circuit.

82. The system of claim 81, wherein the at least one controller is further adapted to decrease a corresponding current off time period proportionally to a rising edge time period of the at least one corresponding gate driver circuit.

83. The system of claim 81, wherein the at least one controller is further adapted to decrease the corresponding on time period proportionally to a falling edge time period of the at least one corresponding gate driver circuit and a falling edge time period of the at least one first comparator.

84. The system of claim 81, wherein the at least one controller is further adapted to adjust the corresponding second on time period proportionally to a falling edge time period of the at least one corresponding gate driver circuit.

85. The system of claim 81, wherein the at least one controller is further adapted to decrease the corresponding second on time period proportionally to a falling edge time period of the at least one corresponding gate driver circuit and a falling edge time period of the at least one first comparator.

86. The system of claim 81, wherein the at least one controller is further adapted to determine a corresponding blanking time interval following turning the corresponding switch into the on state.

87. The system of claim 86, further comprising:

at least one corresponding third comparator adapted to determine when the corresponding electrical current has reached the corresponding second predetermined current threshold.

88. The system of claim 87, wherein the at least one controller is further adapted to determine a corresponding current off time period of the corresponding switch as:

$$T_{OFF}(K+1) \approx \frac{(T_{ON1}(K)_A + T_{ON2}(K)) \bullet T_{OFF}(K)}{T_{ON1}(K+1) + T_{ON2}(K)}$$, in which $T_{OFF}(K+1)$ is the corresponding current off time period, $T_{ON1}(K)_A$ is a corresponding previous first on time period determined using the detection of the second predetermined current level, $T_{ON2}(K)$ is a corresponding previous second on time period, $T_{OFF}(K)$ is a corresponding previous off time period, and $T_{ON1}(K+1)$ is a corresponding current first on time period.

89. The system of claim 87, wherein the at least one controller is further adapted to ignore the detection of the corresponding second predetermined current threshold, the detection of the corresponding predetermined average current level, or the detection of the corresponding first predetermined current threshold during the corresponding blanking time interval.

90. The system of claim 87, wherein the at least one controller is further adapted to determine the corresponding blanking time interval as proportional to a rising edge time period of the at least one corresponding gate driver circuit and a corresponding transient current time period.

91. The system of claim 87, wherein the at least one controller is further adapted to determine the corresponding blanking time interval as proportional to a rising edge time period of the at least one corresponding gate driver circuit and detection of the corresponding predetermined average current level.

92. The system of claim 70, wherein the at least one controller is further adapted to adjust a brightness level of at least one array of the plurality of arrays of light emitting diodes by generating control signals to a driver circuit for the at least one array for using at least two different and opposing electrical biasing techniques.

93. The system of claim 70, wherein the at least one controller is further adapted to adjust a brightness level of at least one array of the plurality of arrays of light emitting diodes by generating control signals to a driver circuit for the at least one array to use a hysteresis of at least two electrical current amplitude levels and at least two electrical current duty cycle ratios.

94. The system of claim 70, wherein each corresponding array of the plurality of arrays of light emitting diodes has a comparatively high voltage node and a comparatively low voltage node, and wherein the at least one first and second comparators are coupled via the corresponding switch to the comparatively low voltage node.

95. The system of claim 70, wherein the at least one controller is further adapted to interleave the corresponding on time periods of the corresponding switches of the plurality of arrays.

96. The system of claim 70, wherein the at least one controller is further adapted to successively turn into an on state each corresponding switch for each array of the plurality of arrays for the corresponding on time period.

97. The system of claim 70, further comprising:

at least one reference voltage generator coupled to the at least one corresponding first and second comparators and adapted to provide corresponding reference voltages respectively for the corresponding first predetermined current threshold and the corresponding predetermined average current level.

98. The system of claim 70, further comprising:

an input-output interface coupled to the at least one controller and adapted to receive an input control signal.

99. The system of claim 70, further comprising:

at least one rectifier couplable to the power source.

100. The system of claim 70, wherein the power source provides a DC input voltage or a rectified AC input voltage.

101. The system of claim 70, wherein when the power source provides a rectified AC input voltage, an electrical current through a corresponding switch is substantially zero when the rectified AC input voltage is below a selected or predetermined threshold.

102. The system of claim 70, wherein when the power source provides a rectified AC input voltage, the at least one controller is in an off state when the rectified AC input voltage is below a selected or predetermined threshold.

103. An apparatus for controlling solid state lighting, the apparatus comprising:

a switch couplable to the solid state lighting;

a current sensor coupled to the switch;

a first comparator adapted to determine when a switch electrical current has reached a first predetermined current threshold;

a second comparator adapted to determine when the switch electrical current has reached a predetermined average current level;

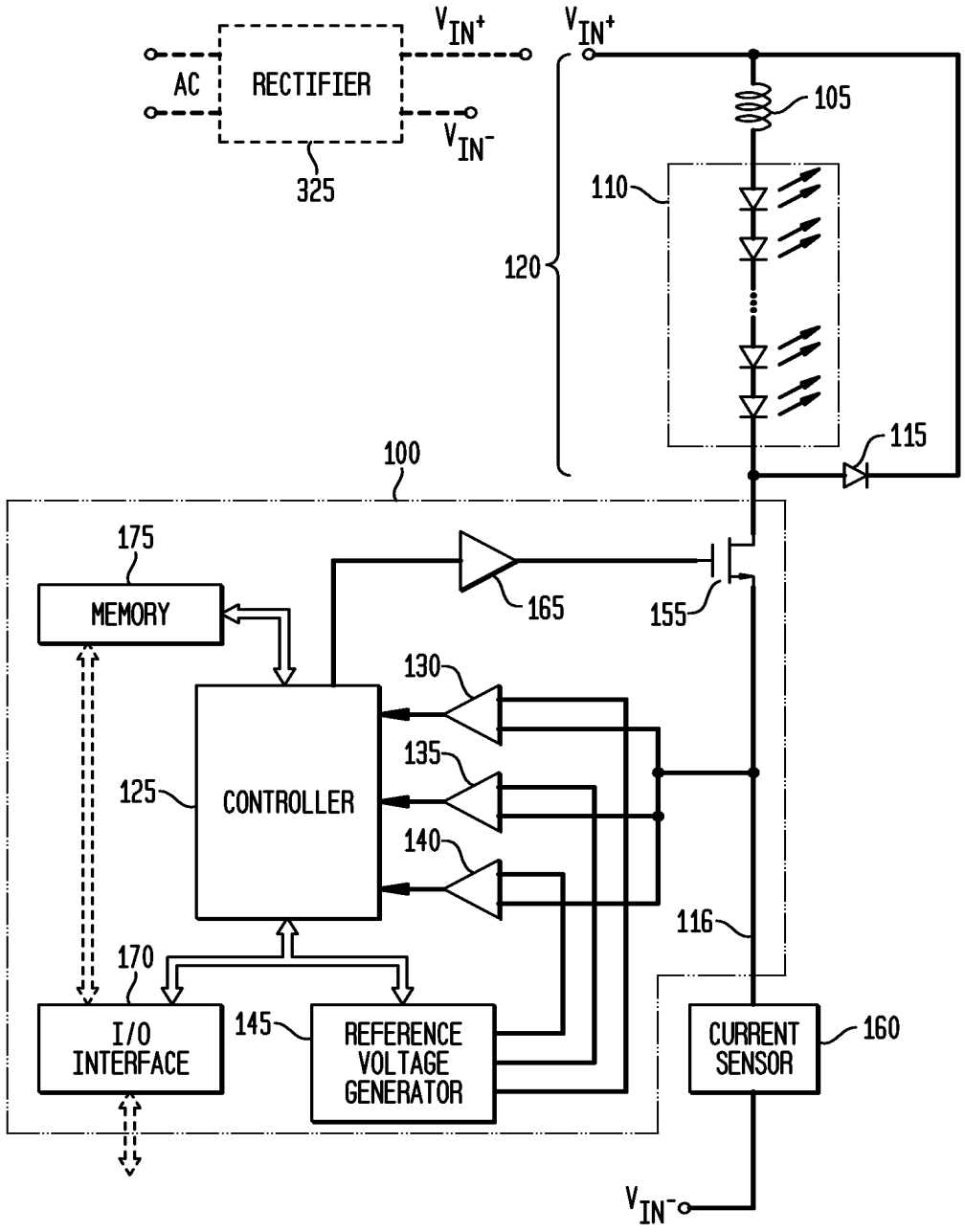
a third comparator adapted to determine when the switch electrical current has reached a second predetermined current threshold;

a reference voltage generator coupled to the first, second and third comparators and adapted to provide reference voltages respectively corresponding to the first predetermined current threshold, the second predetermined current threshold; and to the predetermined average current level;

an input-output interface adapted to receive an input control signal; and

a controller coupled to the first, second and third comparators and to the input-output interface, the controller adapted to turn the switch into an on state and an off state, to determine a first on time period as a duration between either the detection of a second predetermined current threshold or the turning the switch into the on state, and the detection of the predetermined average current level; to determine a second on time period as a duration between the detection of the predetermined average current level and the detection of the first predetermined current threshold; to determine an on time period of the switch as substantially proportional to a sum of the first on time period and the second on time period; to turn the switch into an off state when the on time period has elapsed; and to determine a current off time period of the switch as a function of the first on time period, the second on time period, and a previous off time period.

FIG. 1


150
AC
RECTIFIER
V_{IN}^+
V_{IN}^-
325
V_{IN}^+
105
110
120
115
100
175
MEMORY
165
155
130
135
125
CONTROLLER
140
116
170
I/O INTERFACE
145
REFERENCE VOLTAGE GENERATOR
CURRENT SENSOR
160
V_{IN}^-

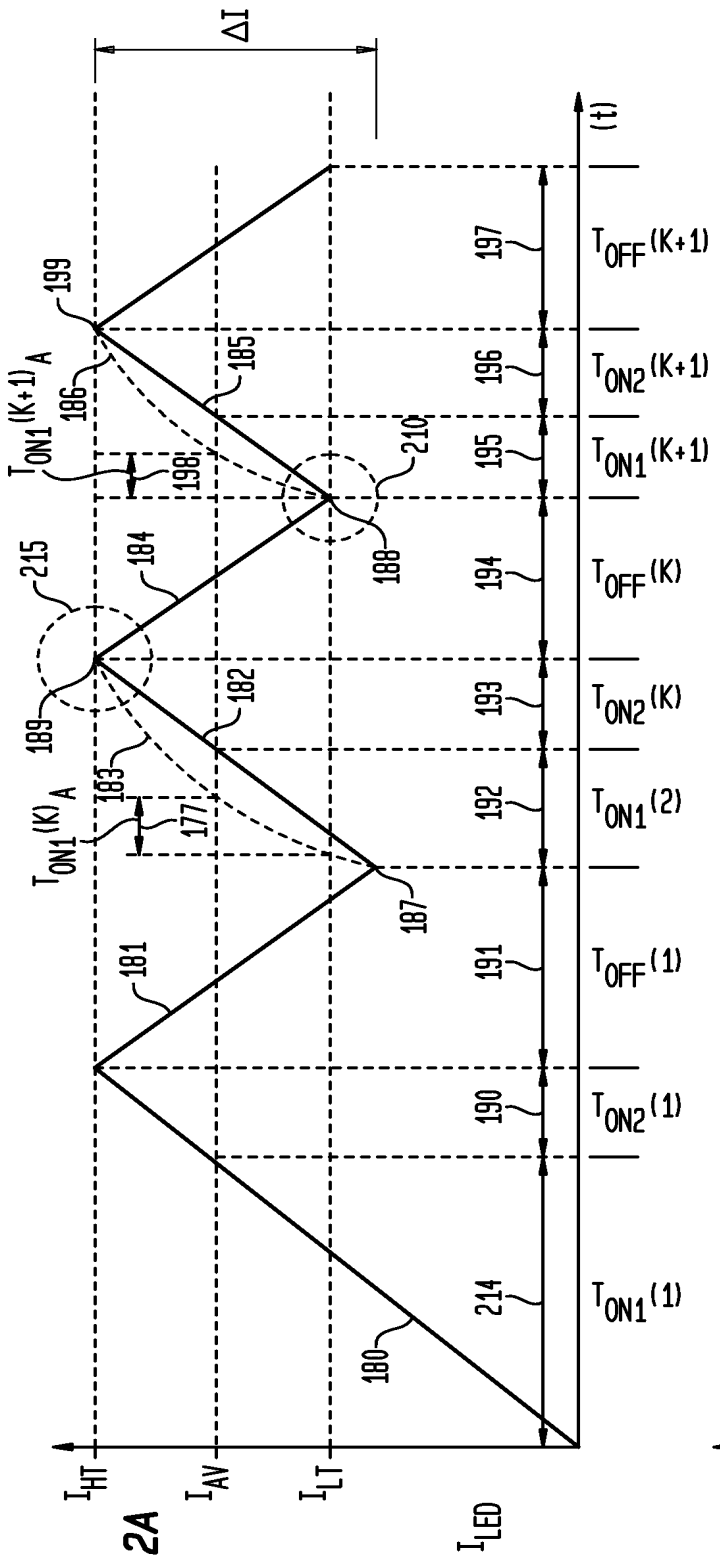

ΔI
(t)
$T_{OFF}(K+1)$
$T_{ON2}(K+1)$
$T_{ON1}(K+1)$
$T_{OFF}(K)$
$T_{ON2}(K)$
$T_{ON1}(2)$
$T_{OFF}(1)$
$T_{ON2}(1)$
$T_{ON1}(1)$
$T_{ON1}(K+1)_A$
$T_{ON1}(K)_A$
197
196
195
194
193
192
191
190
214
199
186
185
198
210
188
215
184
189
182
183
177
187
181
180
I_{HT}
I_{AV}
I_{LT}
I_{LED}

FIG. 2A

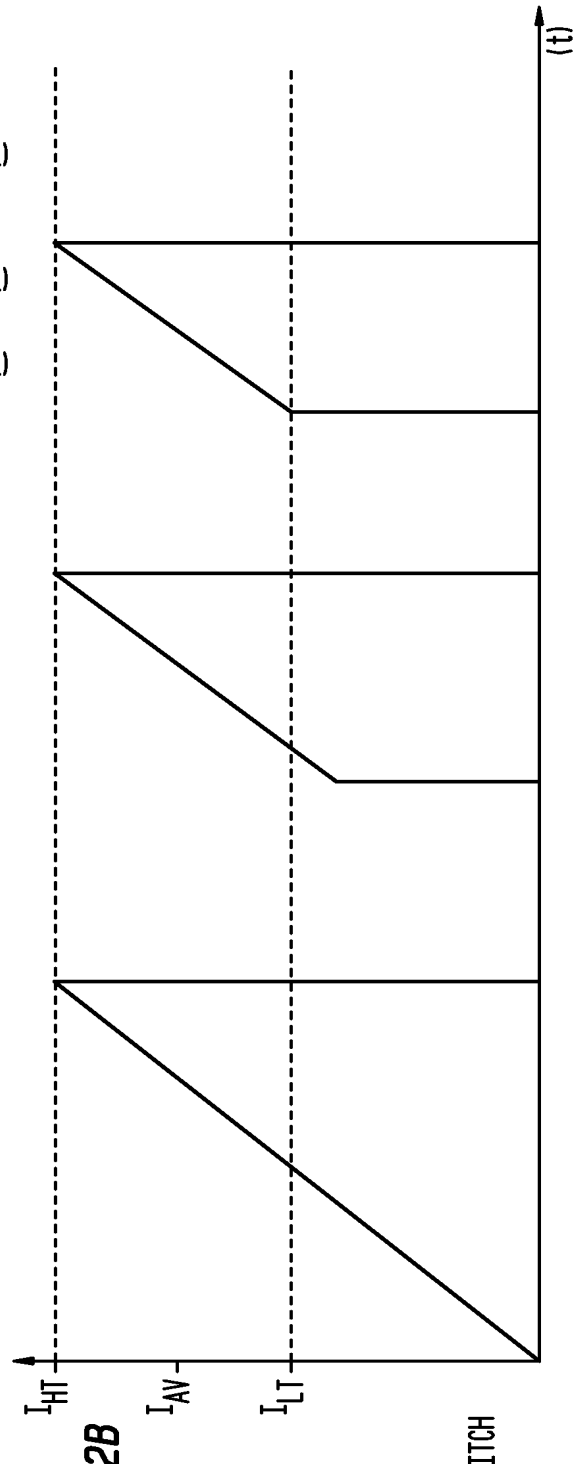

(t)
I_{HT}
I_{AV}
I_{LT}
I_{SWITCH}

FIG. 2B

FIG. 3

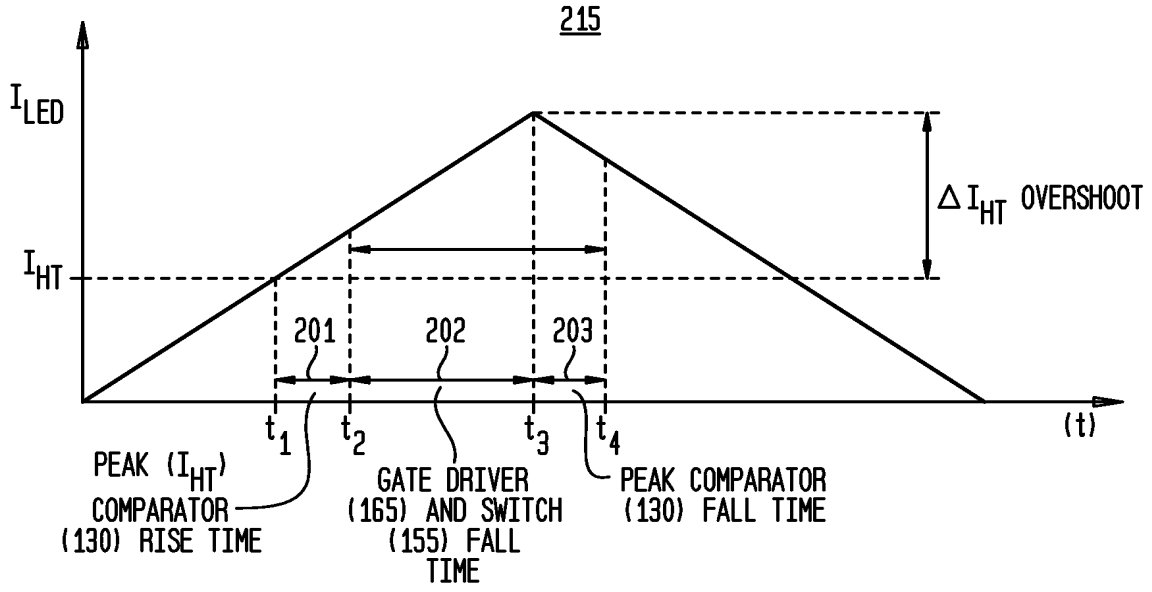

215
I_{LED}
I_{HT}
ΔI_{HT} OVERSHOOT
201
202
203
t_1
t_2
t_3
t_4
(t)
PEAK (I_{HT}) COMPARATOR (130) RISE TIME
GATE DRIVER (165) AND SWITCH (155) FALL TIME
PEAK COMPARATOR (130) FALL TIME

FIG. 4

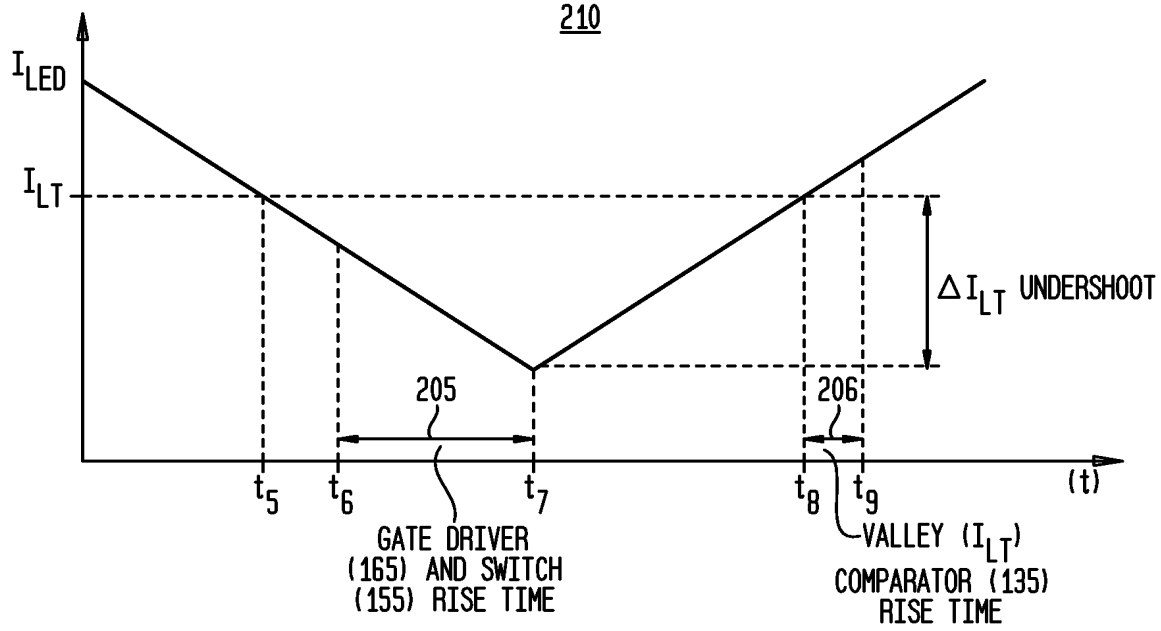

210
I_{LED}
I_{LT}
ΔI_{LT} UNDERSHOOT
205
206
t_5
t_6
t_7
t_8
t_9
(t)
GATE DRIVER (165) AND SWITCH (155) RISE TIME
VALLEY (I_{LT}) COMPARATOR (135) RISE TIME

FIG. 5

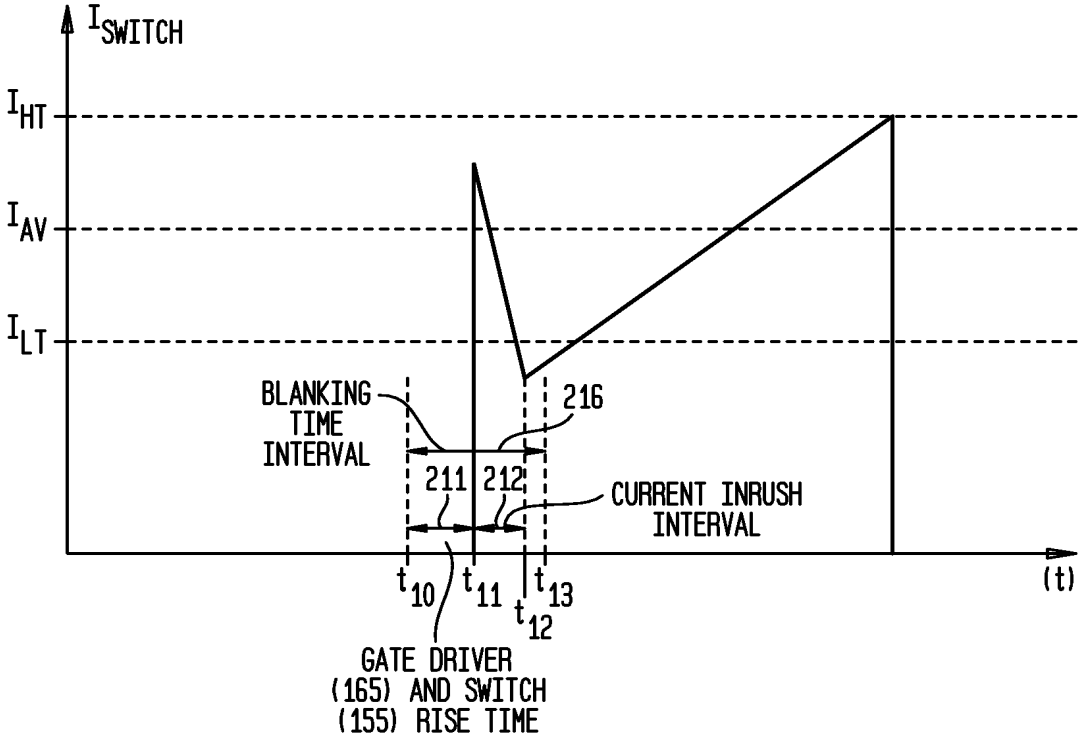

I SWITCH
I HT
I AV
I LT
BLANKING TIME INTERVAL
216
211
212
CURRENT INRUSH INTERVAL
t 10
t 11
t 12
t 13
(t)
GATE DRIVER (165) AND SWITCH (155) RISE TIME

FIG. 6

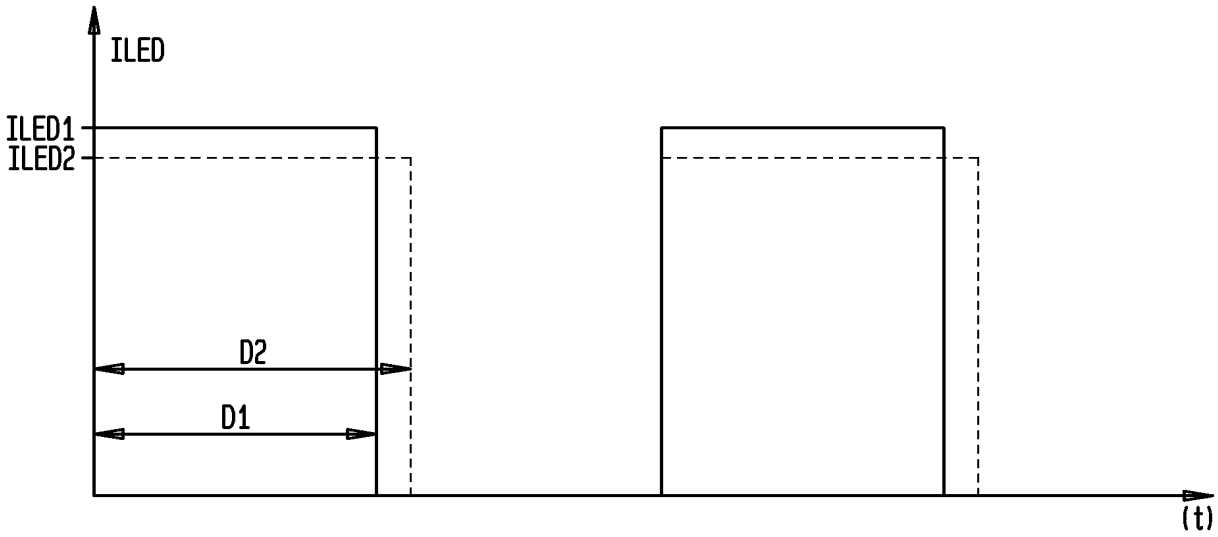

ILED
ILED1
ILED2
D2
D1
(t)

FIG. 7

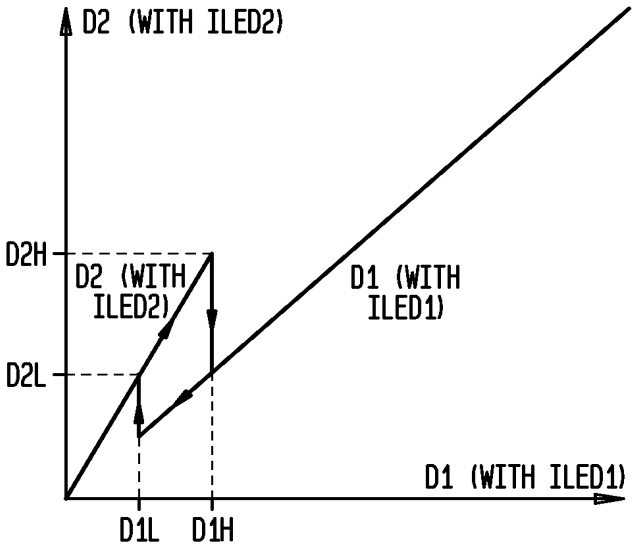

D2 (WITH ILED2)
D2H
D2 (WITH ILED2)
D1 (WITH ILED1)
D2L
D1 (WITH ILED1)
D1L
D1H

FIG. 8

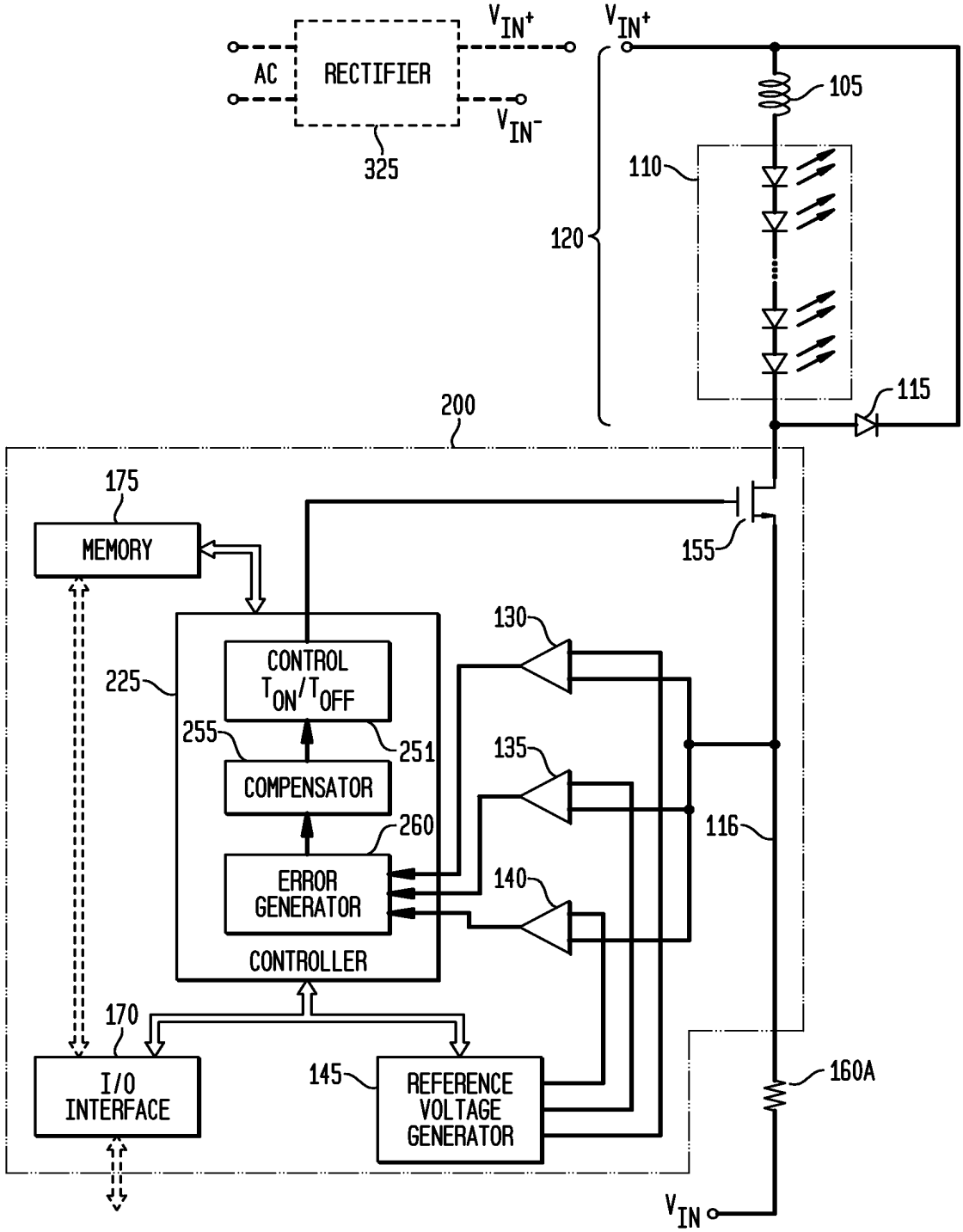

250
AC
RECTIFIER
V_{IN}^+
V_{IN}^-
325
V_{IN}^+
105
110
120
115
200
175
MEMORY
155
130
CONTROL
T_{ON}/T_{OFF}
225
255
251
135
COMPENSATOR
260
116
ERROR
GENERATOR
140
CONTROLLER
170
I/O
INTERFACE
145
REFERENCE
VOLTAGE
GENERATOR
160A
V_{IN}

FIG. 9

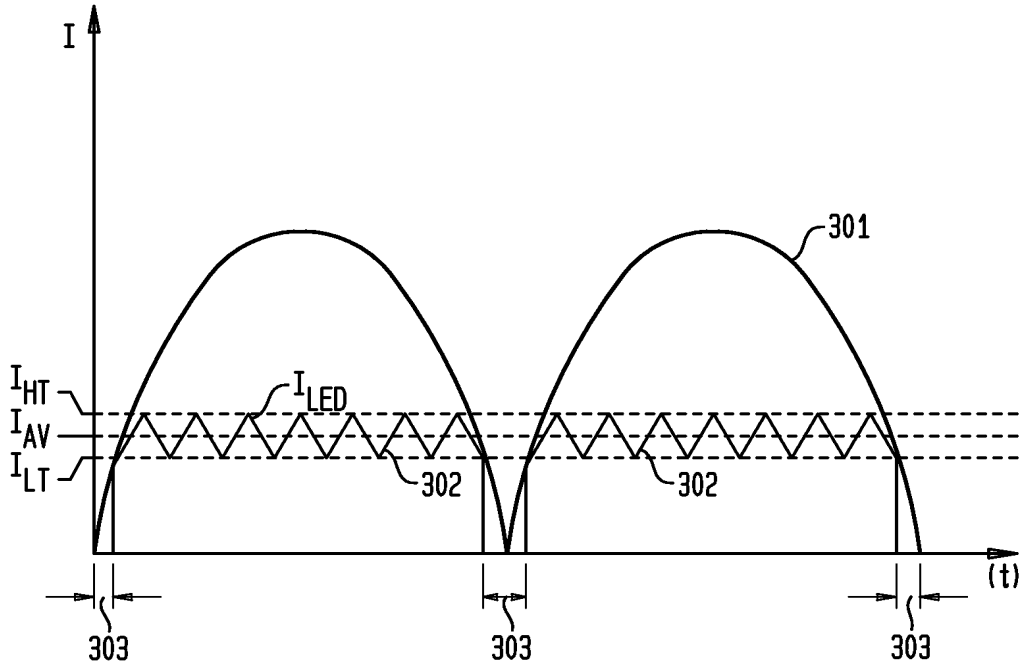


FIG. 10

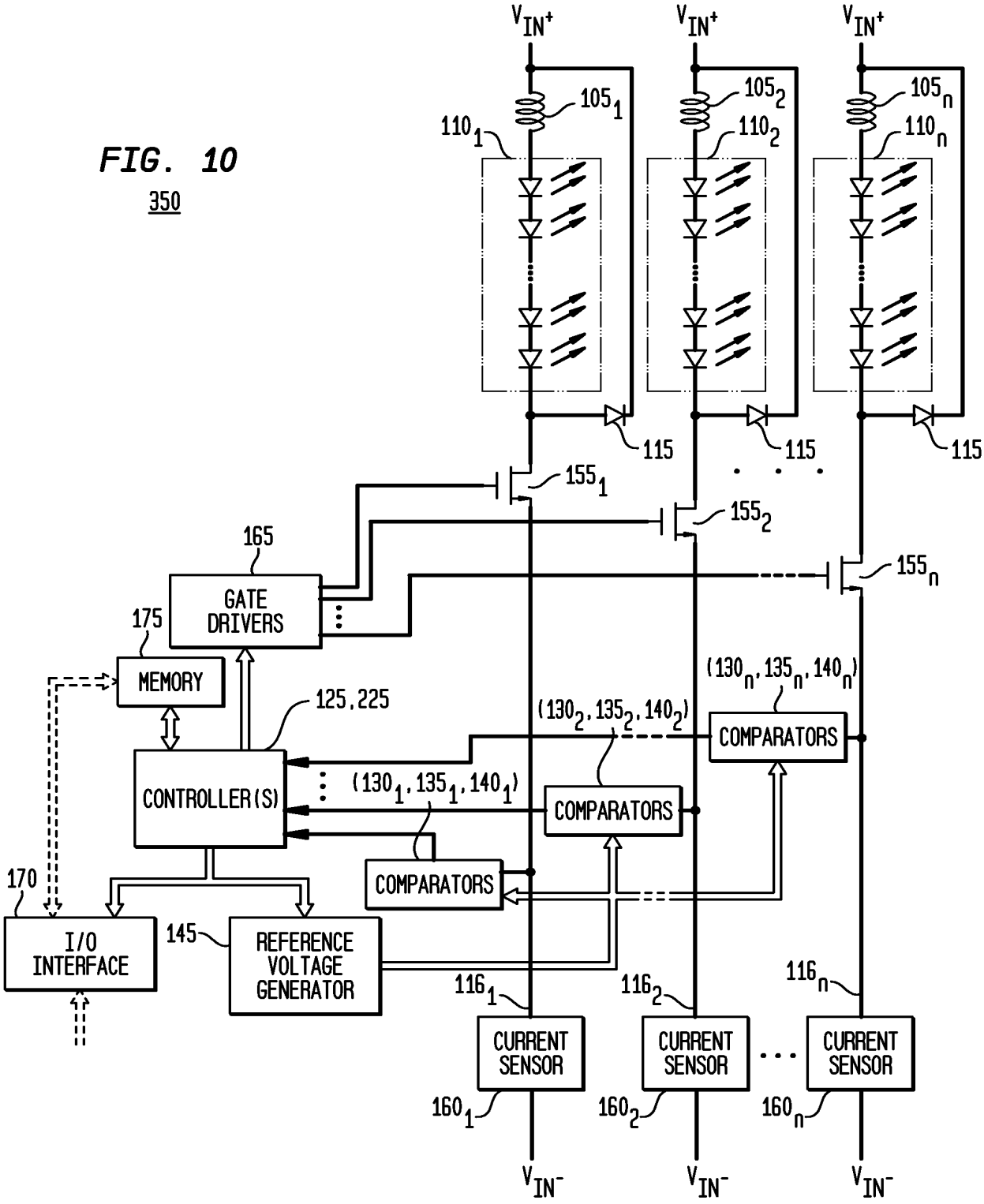

350
V_{IN}^+
105_1
110_1
105_2
110_2
105_n
110_n
115
155_1
155_2
155_n
165
GATE DRIVERS
175
MEMORY
125,225
CONTROLLER(S)
$(130_1, 135_1, 140_1)$
$(130_2, 135_2, 140_2)$
$(130_n, 135_n, 140_n)$
COMPARATORS
170
I/O INTERFACE
145
REFERENCE VOLTAGE GENERATOR
116_1
116_2
116_n
CURRENT SENSOR
160_1
160_2
160_n
V_{IN}^-

FIG. 11

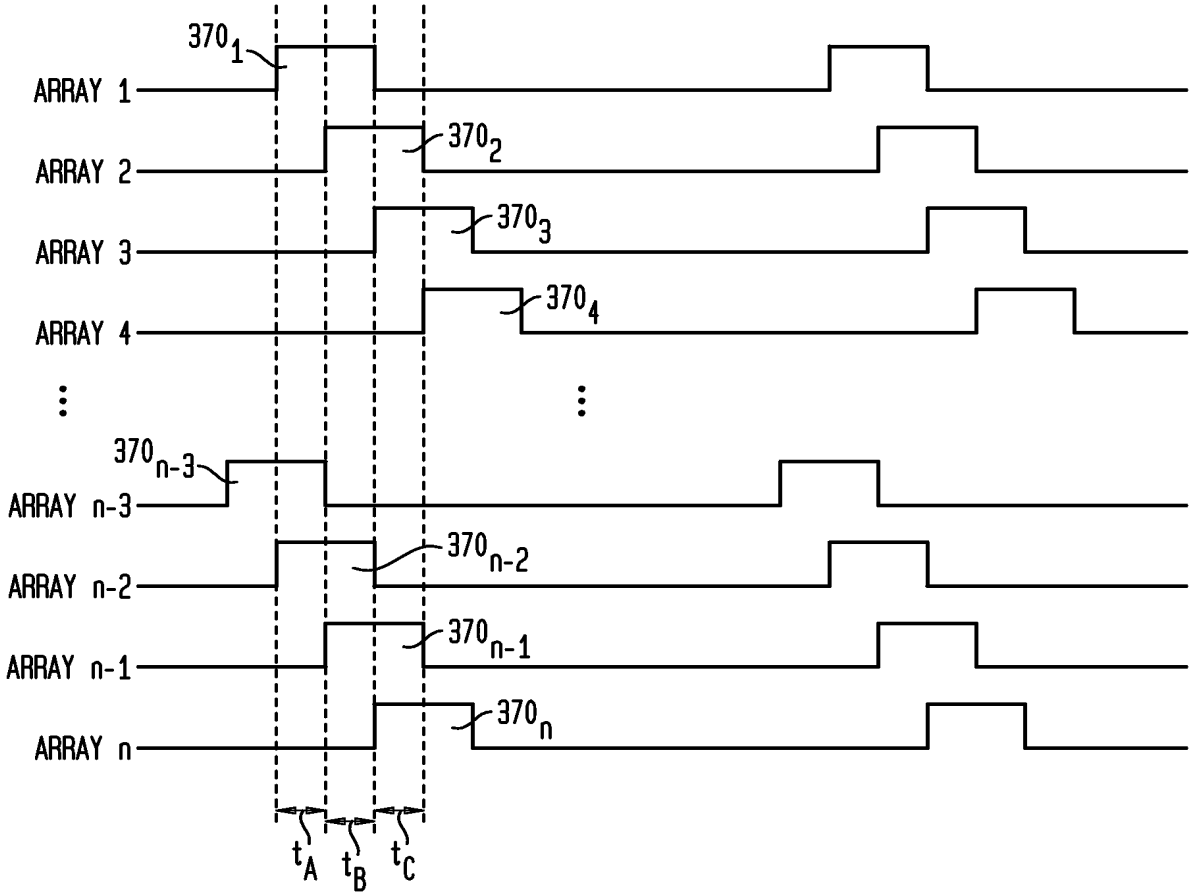
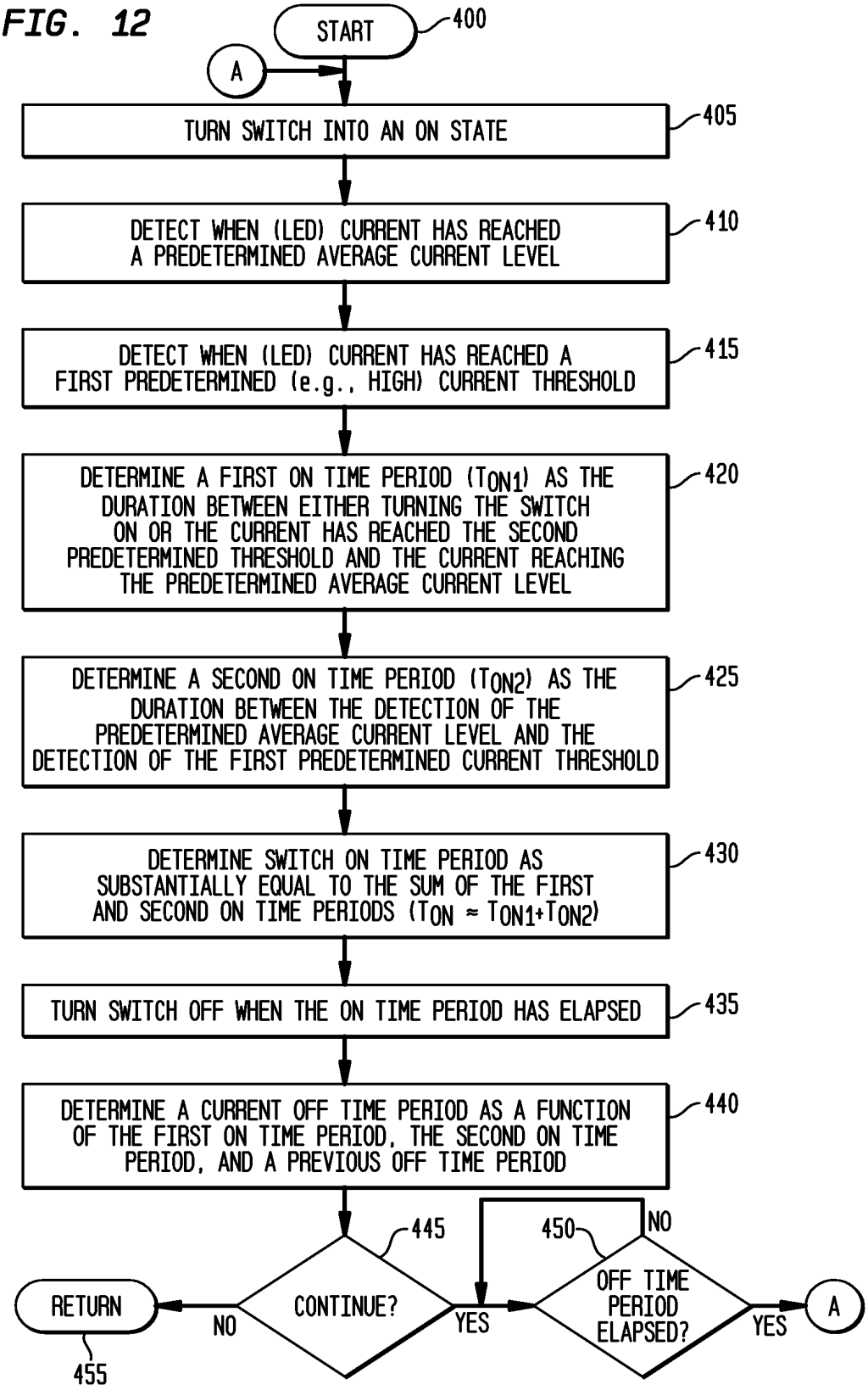

370 1
ARRAY 1
370 2
ARRAY 2
370 3
ARRAY 3
370 4
ARRAY 4
370 n-3
ARRAY n-3
370 n-2
ARRAY n-2
370 n-1
ARRAY n-1
370 n
ARRAY n
t A
t B
t C

FIG. 12


START
400
A
TURN SWITCH INTO AN ON STATE
405
DETECT WHEN (LED) CURRENT HAS REACHED A PREDETERMINED AVERAGE CURRENT LEVEL
410
DETECT WHEN (LED) CURRENT HAS REACHED A FIRST PREDETERMINED (e.g., HIGH) CURRENT THRESHOLD
415
DETERMINE A FIRST ON TIME PERIOD (T_{ON1}) AS THE DURATION BETWEEN EITHER TURNING THE SWITCH ON OR THE CURRENT HAS REACHED THE SECOND PREDETERMINED THRESHOLD AND THE CURRENT REACHING THE PREDETERMINED AVERAGE CURRENT LEVEL
420
DETERMINE A SECOND ON TIME PERIOD (T_{ON2}) AS THE DURATION BETWEEN THE DETECTION OF THE PREDETERMINED AVERAGE CURRENT LEVEL AND THE DETECTION OF THE FIRST PREDETERMINED CURRENT THRESHOLD
425
DETERMINE SWITCH ON TIME PERIOD AS SUBSTANTIALLY EQUAL TO THE SUM OF THE FIRST AND SECOND ON TIME PERIODS ($T_{ON} \approx T_{ON1}+T_{ON2}$)
430
TURN SWITCH OFF WHEN THE ON TIME PERIOD HAS ELAPSED
435
DETERMINE A CURRENT OFF TIME PERIOD AS A FUNCTION OF THE FIRST ON TIME PERIOD, THE SECOND ON TIME PERIOD, AND A PREVIOUS OFF TIME PERIOD
440
445
CONTINUE?
NO
RETURN
455
YES
450
OFF TIME PERIOD ELAPSED?
NO
YES
A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/76552

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G05F 1/00 (2008.04)
USPC - 315/291
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC: 315/291

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 368/189, 315/291,149,150,156,159

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO WEST (PGPB, USPT, EPAB, JPAB); Google Scholar;
Search Terms Used: predetermined, current level, light control, controlling, LED, array, detect, current, period, time, phase, duration, interval, on time, circuit.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0024213 A1 (Shteynberg et al.) 1 February 2007 Especially (para [0007]-[0009],[0012],[0013],[0017]-[0019],[0047]-[0049],[0052],[0053],[0057]-[0059], [0065],[0066], [0072],[0075], para [0081] - Fig. 14, Fig. 2)	1-103
A	US 2007/0194210 A1 (Lee et al.) 23 August 2007	1-103
A	US 7081722 B1 (Huynh et al.) 25 July 2006	1-103
A	US 6731079 B2 (Anderson et al.) 4 May 2004 (04.05.2004)	1-103

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 November 2008 (05.11.2008)	19 NOV 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Electronic Acknowledgement Receipt

EFS ID:	13893202
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Jeffrey Wong/Tara Charbonneau
Filer Authorized By:	Jeffrey Wong
Attorney Docket Number:	18154
Receipt Date:	02-OCT-2012
Filing Date:	08-MAY-2012
Time Stamp:	15:57:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	PAT_67545AW-2_IDS.PDF	612658 e4b98e83d15fa7213efddbae2c9941d29b1a949d	no	4

Warnings:	
Information:	

2	Non Patent Literature	PAT_67545AW-2_NPL_1.pdf	522150 ed66fe6d169dbf8a7b0356f11320536c3e06f167	no	3
Warnings:					
Information:					
3	Foreign Reference	WO2009039112.pdf	3122535 6f012efcdc88fdc607f362f1f2f8decf6649ae89	no	70
Warnings:					
Information:					
			Total Files Size (in bytes):	4257343	

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	2821
Examiner Name	
Attorney Docket Number	PAT 67545AW-2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8197079		2012-06-12	RUUD ET AL	

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13466509
	Filing Date	2012-05-08
	First Named Inventor	TIKKANEN, David
	Art Unit	2821
	Examiner Name	
	Attorney Docket Number	PAT 67545AW-2

	1		☐

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Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13466509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Art Unit	2821
Examiner Name	
Attorney Docket Number	PAT 67545AW-2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey W. Wong/	Date (YYYY-MM-DD)	2012-08-31
Name/Print	Jeffrey W. Wong	Registration Number	46414

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	13634103
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	293
Filer:	Jeffrey Wong/Stacy Duke
Filer Authorized By:	Jeffrey Wong
Attorney Docket Number:	18154
Receipt Date:	31-AUG-2012
Filing Date:	08-MAY-2012
Time Stamp:	09:56:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	PAT-67545AW-2-IDS-form.PDF	760283 a690978b05c3b4c9fb19ac5ac6135cc2eab29261	no	4

Warnings:	
Information:	

Total Files Size (in bytes):	760283

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	18154

CONFIRMATION NO. 8469

293
DOWELL & DOWELL P.C.
103 Oronoco St.
Suite 220
Alexandria, VA 22314

POA ACCEPTANCE LETTER

OC00000055848571

Date Mailed: 08/13/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/03/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/kgebremichael/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/466,509
Filing Date	2012-05-08
First Named Inventor	TIKKANEN, David
Title	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID...
Art Unit	2821
Examiner Name	
Attorney Docket Number	

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

00293

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Assignee of Record

Signature		Date	July 31/2012
Name	David TIKKANEN	Telephone	1-519-744-5677
Title and Company	Vice President, LUMASTREAM CANADA ULC		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt

EFS ID:	13412704
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	26123
Filer:	Ralph A. Dowell/Jorie Wilson
Filer Authorized By:	Ralph A. Dowell
Attorney Docket Number:	PAT 67545AW-2
Receipt Date:	03-AUG-2012
Filing Date:	08-MAY-2012
Time Stamp:	13:04:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	18154poatrans.pdf	13391 feaaf722be005678d400efcf527cf99d4e9ed0b2	no	1

Warnings:	
Information:	

2	Assignee showing of ownership per 37 CFR 3.73(b).	18154Statement373b.pdf	307752 00badc49e6bd7f50a677d0a978871774a3192b29	no	1
Warnings:					
Information:					
3	Power of Attorney	18154POA.pdf	411829 90adf3c0d87df15a8a706a42233a07e388fa738d	no	1
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
			Total Files Size (in bytes):	732972	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : David TIKKANEN
Appl. No. : 13/466,509
Filed : May 8, 2012

Title : CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

Grp./A.U. :
Examiner :
Docket No.: 18154

Honorable Commissioner of Patents
Alexandria, VA 22313-1450

POWER OF ATTORNEY AND
REVOCATION OF PREVIOUS POWER

Sir:

Submitted herewith is a Power of Attorney and Statement Under 37 C.F.R. § 3.73(b), referencing a previously recorded assignment. Please associate this application with Customer Number **00293**.

In the event any additional information is required, please contact the undersigned agent of record at the telephone number shown below.

Respectfully submitted,

DOWELL & DOWELL, P. C.

Date: August 3, 2012

/Jorie L. Wilson/
Jorie L. Wilson
Reg. No.: 57,532

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PTO/SB/96 (07-09)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: LUMASTREAM CANADA ULC

Application No./Patent No.: 13/466,509 Filed/Issue Date: 2012-05-08

Titled: CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

LUMASTREAM CANADA ULC , a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in (The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 028705, Frame 0467, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.



Signature

July 31/2012

Date

David TIKKANEN

Printed or Typed Name

Vice President, LUMASTREAM CANADA ULC

Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/466,509

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	18 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/466,509	05/08/2012	2821	1380	PAT 67545AW-2	18	2

CONFIRMATION NO. 8469

UPDATED FILING RECEIPT

26123
BORDEN LADNER GERVAIS LLP
Anne Kinsman
WORLD EXCHANGE PLAZA
100 QUEEN STREET SUITE 1100
OTTAWA, ON K1P 1J9
CANADA

OC000000055680955

Date Mailed: 08/01/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

David TIKKANEN, Waterloo, CANADA;
Christopher Douglas Booth, Saint Petersburg, FL;

Assignment For Published Patent Application

LUMASTREAM CANADA ULC, Calgary, CANADA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 13/059,336 03/22/2011 *
which is a 371 of PCT/CA2009/001295 09/17/2009
which claims benefit of 61/097,963 09/18/2008
(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 05/21/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/466,509**

Projected Publication Date: 11/08/2012

Non-Publication Request: No

Early Publication Request: No

Title

CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

Preliminary Class

315

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2821
Examiner:	
Attorney Ref.:	PAT 67545AW-2

July 24, 2012

MAIL STOP AMENDMENT
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, Virginia 22314-1450
U.S.A.

Dear Sir:

PRELIMINARY AMENDMENT

Please amend the above-identified application as follows:

Amendments to the Specification begin on page **2** of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page **3** of this paper.

Remarks/Arguments begin on page **6** of this paper.

Amendments to the Specification

Please replace paragraph **[0103]** with the following amended paragraph:

[0103] The break out module 51 regroups ~~or separates~~ the feed in channels with a different grouping of feed out channels or separates the feed in channels into individual feed out channels. It may also provide visual means for an installer to easily organize and keep track of the grouping and arrangement of channels during installation.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Cancelled)

2. (New) Apparatus for controlling a set of light fixture loads in a light emitting diode (LED) low voltage distribution system comprising:

an LED driver/dimmer including a power circuit having at least one power limit and a set of output current drivers connected to the at least one power limit in the power circuit; and

a break-out module connected to an output of the LED driver/dimmer;

wherein the LED driver/dimmer is located remotely from the set of light fixture loads.

3. (New) The apparatus of Claim 2 wherein the set of output current drivers are connected to the break-out module via cabling.

4. (New) The apparatus of Claim 3 further comprising:

a set of series connect modules, each of the set of series connect modules associated with one of the set of light fixture loads and connected to an output of the break-out module.

5. (New) The apparatus of Claim 3 wherein the power cabling includes a set of input channels.

6. (New) The apparatus of Claim 5 wherein the break-out module changes the number of output channels from the number of input channels.

7. (New) The apparatus of Claim 5 wherein the break-out module splits the set of input channels into individual output channels.

8. (New) The apparatus of Claim 6 wherein the break-out module connects to multiple light fixture loads via cabling.

9. (New) The apparatus of Claim 7 wherein the break-out module connects to multiple light fixture loads via cabling.

10. (New) The apparatus of Claim 3 wherein the break-out module comprises:

at least one printed circuit board (PCB) having power connectors.

11. (New) The apparatus of Claim 10 wherein the at least one PCB assist in regrouping the set of input channels into a different grouping of output channels.

12. (New) The apparatus of Claim 10 wherein the at least one PCB assist in splitting the set of input channels into individual output channels.

13. (New) The apparatus of Claim 10 wherein the power connectors include apparatus to enable quick connection and release with the cabling.

14. (New) The apparatus of Claim 4 wherein at least one of the set of series connect modules comprises:

at least one printed circuit board (PCB) assembly for connecting an output from the break-out module.

15. (New) The apparatus of Claim 4 wherein the break-out module and the set of series connect modules are integrated together.

16. (New) The apparatus of Claim 2 wherein the LED driver/dimmer and the break-out module are integrated together.

17. (New) The apparatus of Claim 2 wherein the LED driver/dimmer further comprises a communication interface for receiving data from an external transmitter.

18. (New) The apparatus of Claim 2 wherein the at least one current driver comprises a buck topology power stage with hysteretic control.

19. (New) A method of controlling a set of light fixture loads in a LED low voltage distribution system comprising:

receiving light control information;

limiting power for powering the set of light fixture loads;

converting limited power to multiple constant current outputs based on light control information; and

splitting or regrouping constant current outputs.

REMARKS/ARGUMENTS

Claims 2 to 19 remain in the current application. Claim 1 has been cancelled. Claims 2 to 19 have been added.

The specification and claims have been amended to more clearly define the invention. No new matter has been added as a result of these amendments.

For the above reasons, it is respectfully submitted that the application is now in condition for allowance, which is requested. If there are any outstanding issues, the Examiner is invited to contact the undersigned to discuss this matter further.

The Commissioner is hereby authorized to charge any additional fees, and credit any over payments, to Deposit Account No. 501593, in the name of Borden Ladner Gervais LLP.

Respectfully submitted,
TIKKANEN, David et al.

By: /Jorie L. Wilson/

Jorie L. Wilson
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Dowell & Dowell, P.C.
103 Oronoco Street
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USA 22314
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E-mail: dowell@dowellpc.com

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	TIKKANEN, David; BOOTH, Christopher, Douglas
Serial No.:	13/466,509
Filed:	September 17, 2009
Title:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
Group:	2821
Examiner:	
Attorney Ref.:	PAT 67545AW-2

July 24, 2012

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USA

RESPONSE TO NOTICE TO FILE MISSING PARTS

In response to the Notice to File Missing Parts dated May 24, 2012, for which a response is due by **July 24, 2012**, Applicant submits an executed Declaration and replacement Figures 12 to 19 in compliance with 37 CFR 1.84 and 37 CFR 1.121(d). Figure 15 has also been amended to correct the reference numeral corresponding to the break out module. No new matter has been added.

The Commissioner is hereby authorized to charge any additional fees, and credit any over payments to Deposit Account No. 501593, in the name of Borden Ladner Gervais LLP.

Respectfully submitted,
TIKKANEN, David et al.

By: /Jorie L. Wilson/
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E-mail: dowell@dowellpc.com

Electronic Acknowledgement Receipt

EFS ID:	13324614
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Customer Number:	26123
Filer:	Ralph A. Dowell/Jorie Wilson
Filer Authorized By:	Ralph A. Dowell
Attorney Docket Number:	PAT 67545AW-2
Receipt Date:	24-JUL-2012
Filing Date:	08-MAY-2012
Time Stamp:	14:09:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	PAT67545AW_2Declaration.pdf	514903 b25d2421c1dfc140716758712af63a1ea7a617c8	no	6

Warnings:	
Information:	

2	Drawings-only black and white line drawings	PAT67545AW_2Drawings.pdf	240245 3a4f077a7324b1324c3a68c4bd84ee8c90d0ad9f	no	10
Warnings:					
Information:					
3	Preliminary Amendment	PAT67545AW_2PreliminaryAmendmentII.pdf	34473 1aad9ce7fba95b558294c8d63621ef372d8c33a3	no	6
Warnings:					
Information:					
4	Applicant Response to Pre-Exam Formalities Notice	PAT67545AW_2ResponseII.pdf	17071 9b6028a985f66c2b643198904ff9cdd33da1d87a	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	806692		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted With Initial Filing OR ☑ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)

Attorney Docket Number	PAT 67545AW-2
First Named Inventor	TIKKANEN, David
COMPLETE IF KNOWN	
Application Number	13/466,509
Filing Date	2012-05-08
Art Unit	2821
Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☑ was filed on (MM/DD/YYYY) 05/08/2012 as United States Application Number or PCT International Application Number 13/466,509 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

☐ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☑ The address associated with Customer Number: 26123	OR	☐ Correspondence address below

Name		
Address		
City	State	Zip
Country	Telephone	Email

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: *Patent Application Files*. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: *Deposit Accounts and Electronic Funds Transfer Profiles*.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any]): David	Family Name or Surname: TIKKANEN
Inventor's Signature: *David Tikkanen*	Date: July 23/2012

Residence: City	State	Country	Citizenship
Waterloo	ON	CA	CA

Mailing Address: 194 Silverwood Place

City	State	Zip	Country
Waterloo	ON	N2T 2R9	CA

☑ Additional inventors or a legal representative are being named on the 1 supplemental sheet(s) PTO/SB/02A or 02LR attached hereto

PTO/SB/02A (07-07)
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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Christopher Douglas		BOOTH	
Inventor's Signature			Date 7-14-2012
Saint Petersburg Residence: City	FL State	US Country	US Citizenship
2445 3rd Avenue North Mailing Address			
Saint Petersburg City	FL State	33713 Zip	US Country

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature			Date
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature			Date
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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DECLARATION – Supplemental Priority Data Sheet

Foreign applications:

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
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This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

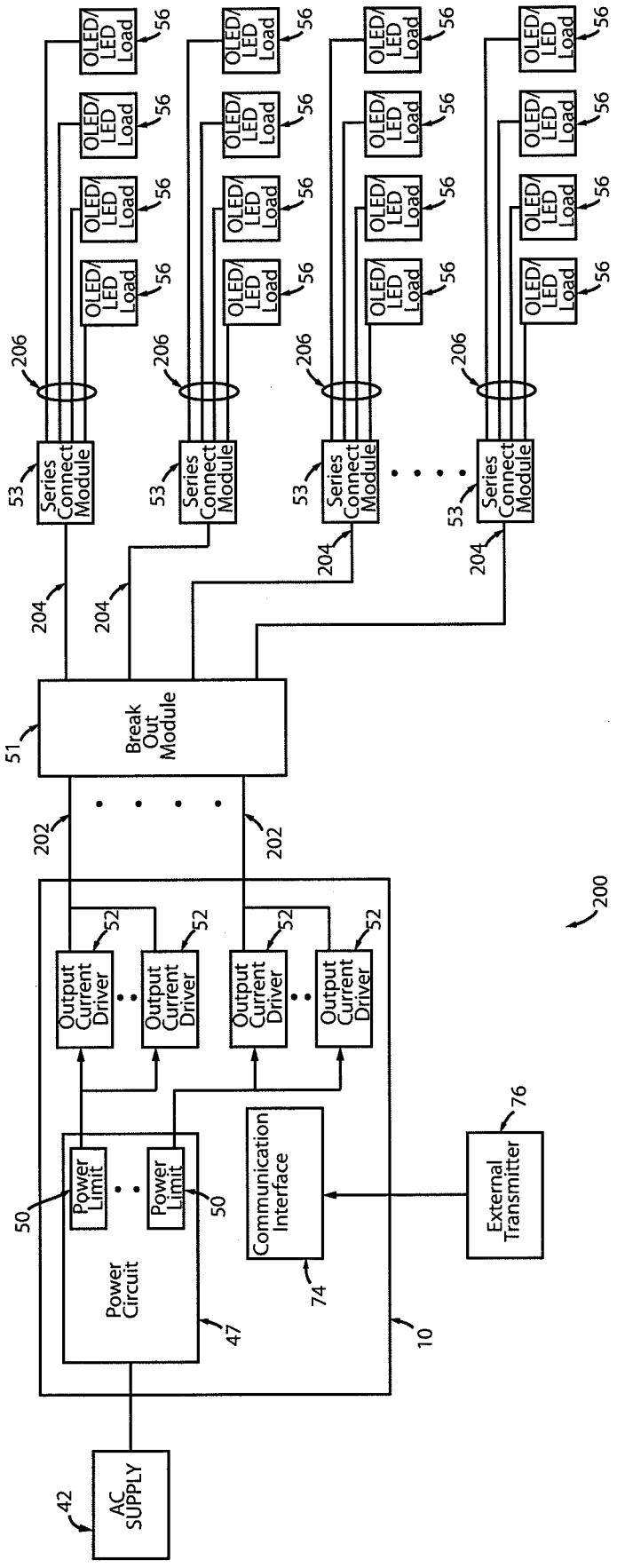

OLED/ LED Load
56
206
Series Connect Module
53
204
Break Out Module
51
202
Output Current Driver
52
Power Limit
50
Power Circuit
47
Communication Interface
74
External Transmitter
76
10
AC SUPPLY
42
200

FIGURE 12

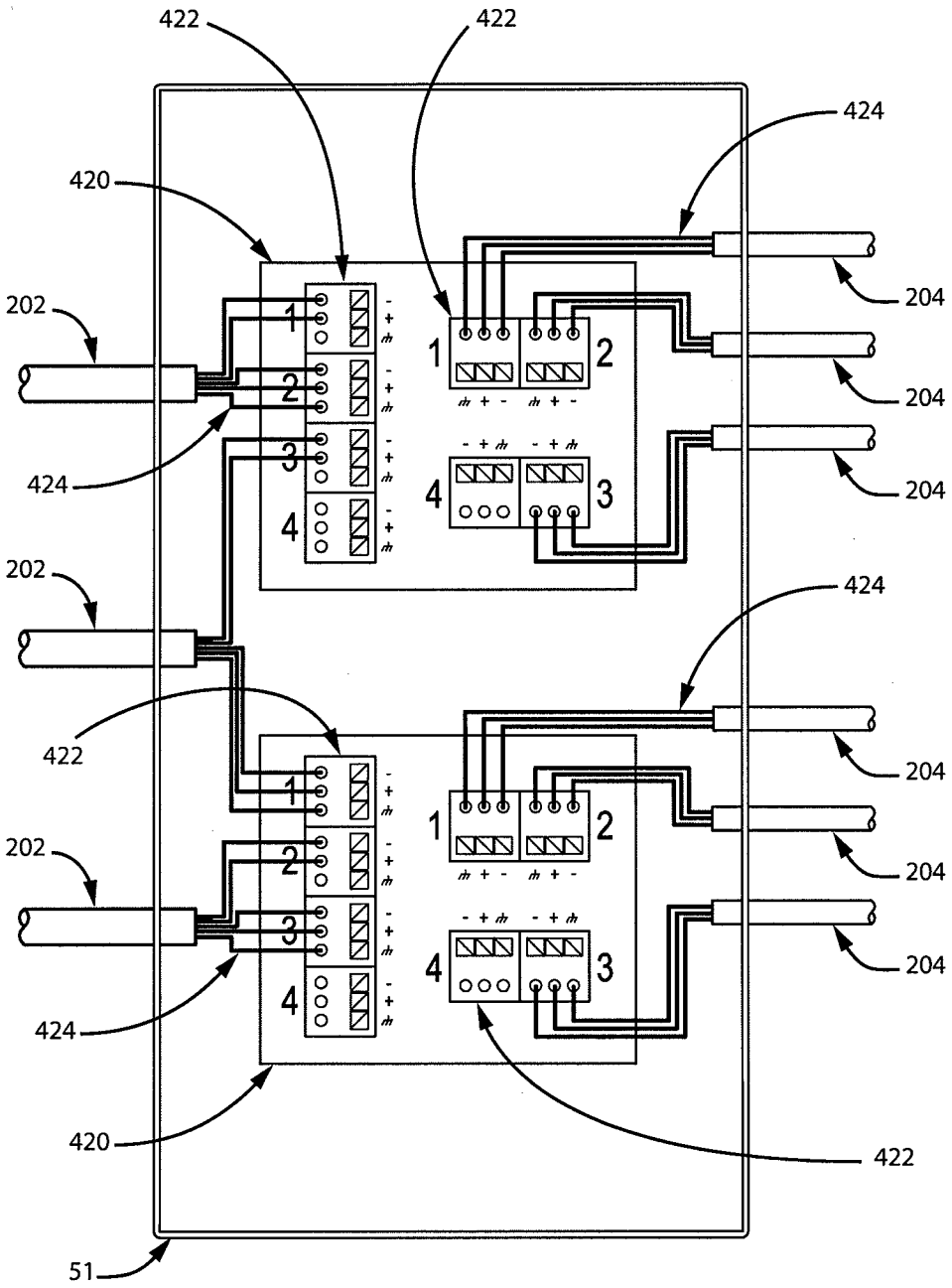

422
422
424
420
202
204
204
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422
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424
420
422
51

FIGURE 13a

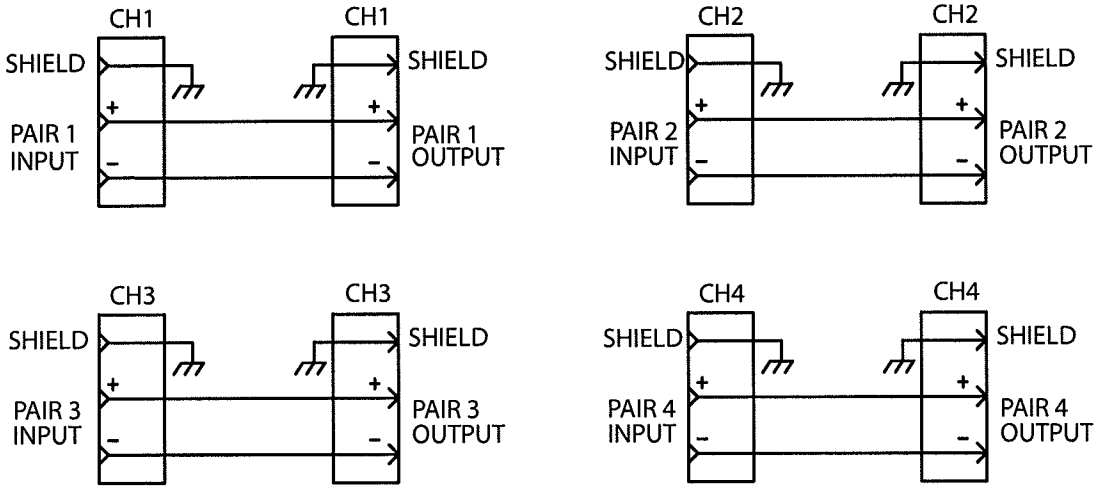


FIGURE 13b

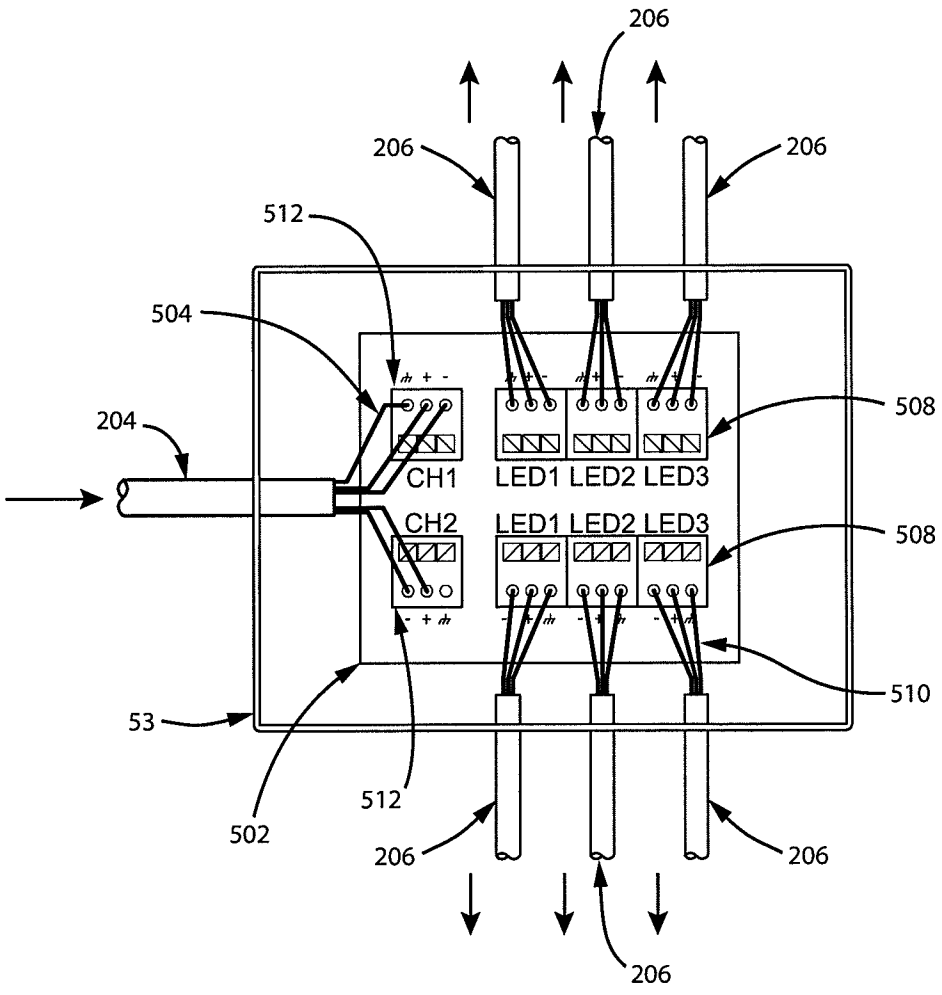


FIGURE 14a

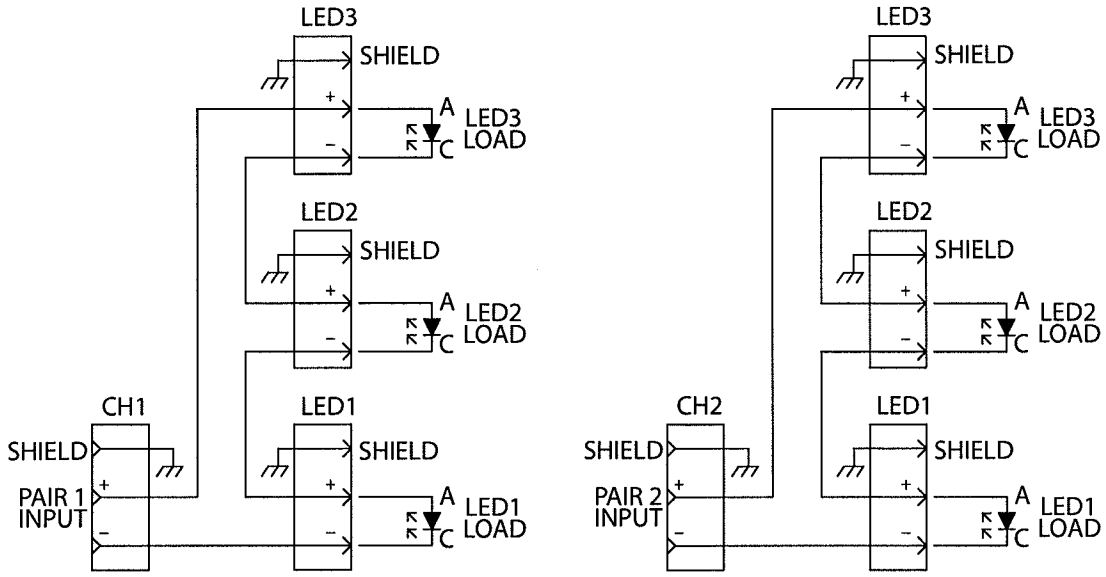

LED3
SHIELD
A
C
LED3
LOAD
LED2
SHIELD
A
C
LED2
LOAD
LED1
SHIELD
A
C
LED1
LOAD
CH1
SHIELD
PAIR 1
INPUT
+
-
LED3
SHIELD
A
C
LED3
LOAD
LED2
SHIELD
A
C
LED2
LOAD
LED1
SHIELD
A
C
LED1
LOAD
CH2
SHIELD
PAIR 2
INPUT
+
-

FIGURE 14b

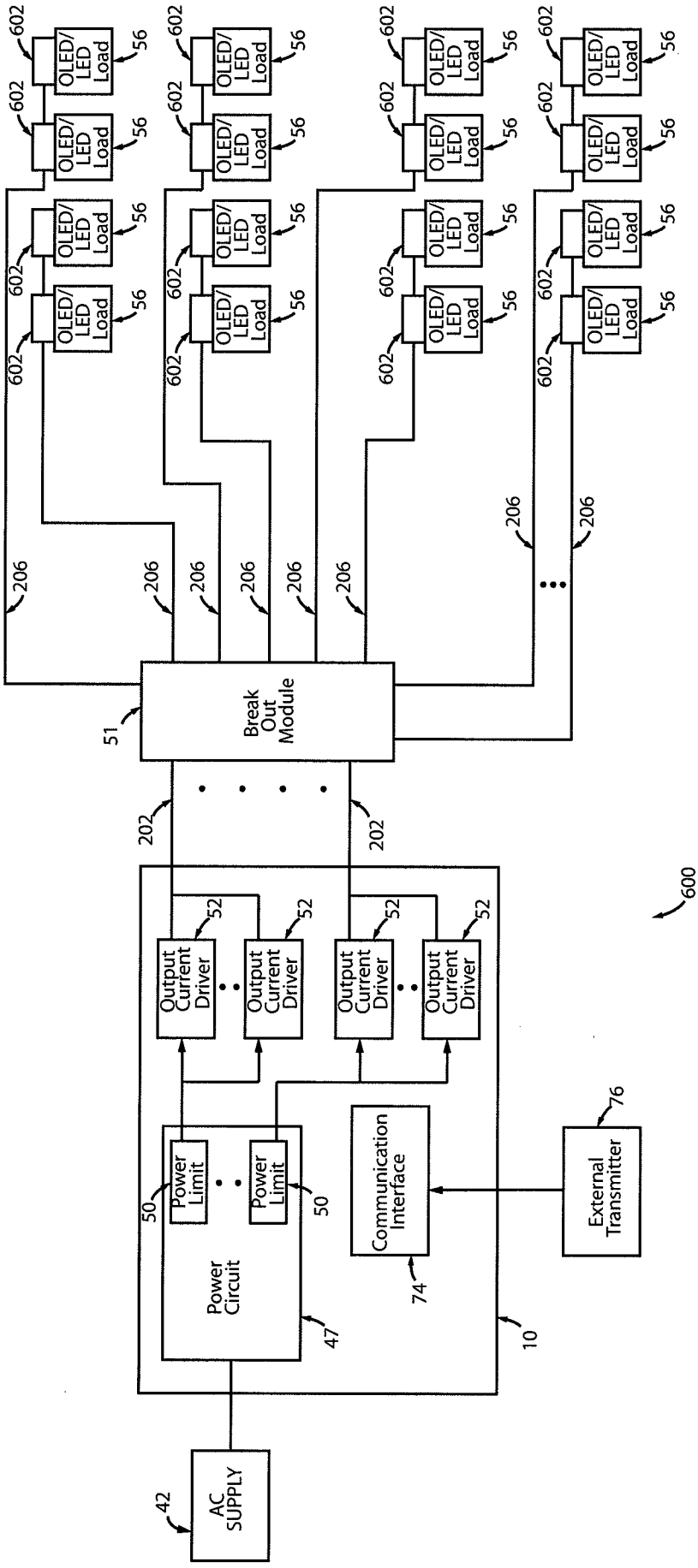

600
AC SUPPLY
42
Power Circuit
47
Power Limit
50
Communication Interface
74
External Transmitter
76
Output Current Driver
52
Break Out Module
51
202
206
OLED/ LED Load
56
602
10

FIGURE 15

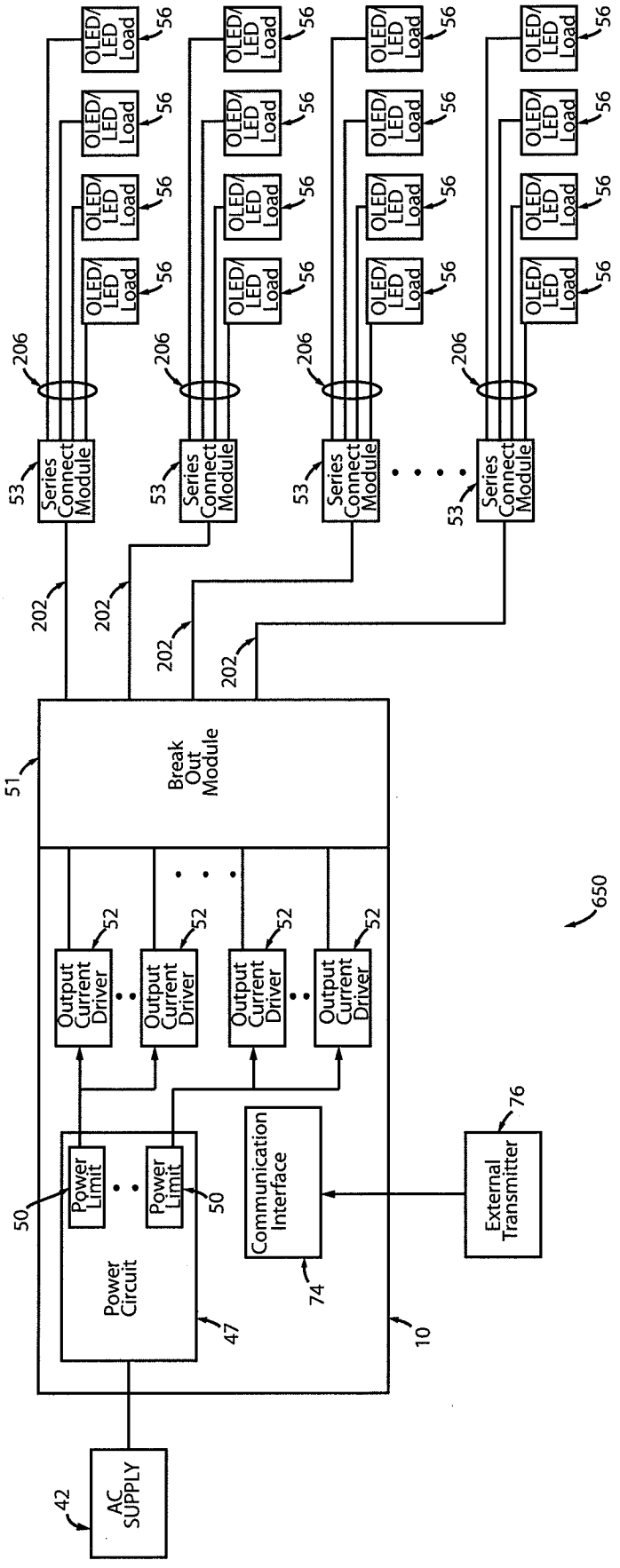

OLED/ LED Load
56
206
Series Connect Module
53
202
Break Out Module
51
Output Current Driver
52
Power Limit
50
Power Circuit
47
Communication Interface
74
External Transmitter
76
AC SUPPLY
42
10
650

FIGURE 16

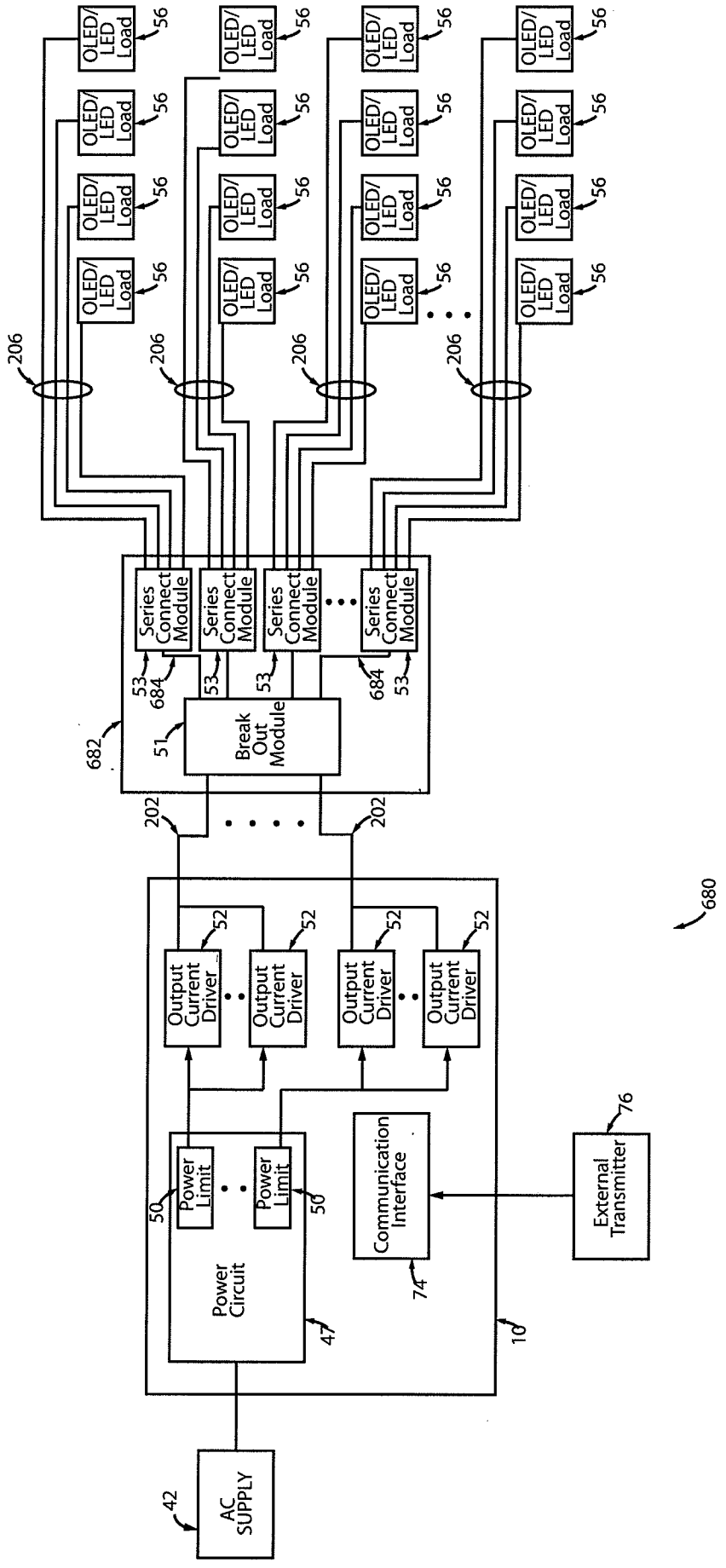

OLED/ LED Load
56
206
Series Connect Module
53
684
682
Break Out Module
51
202
Output Current Driver
52
Power Limit
50
Power Circuit
47
10
Communication Interface
74
External Transmitter
76
AC SUPPLY
42
680

FIGURE 17

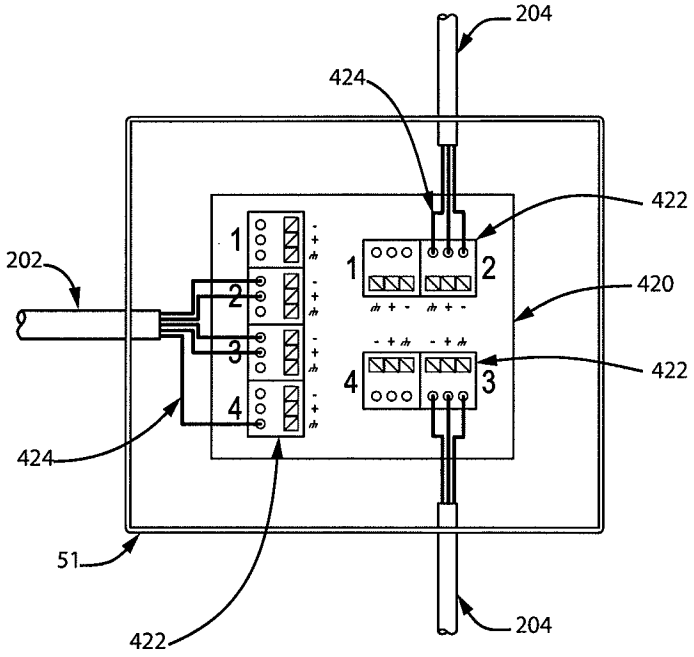


FIGURE 18a

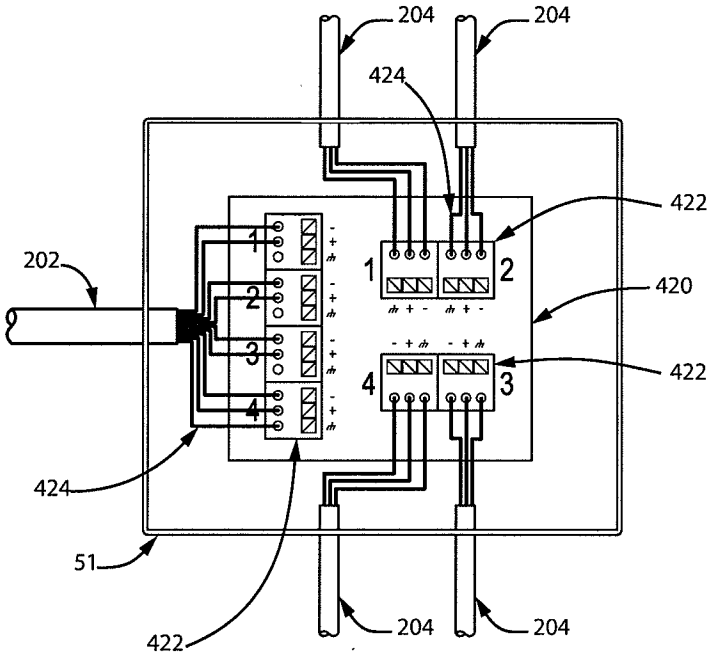


FIGURE 18b

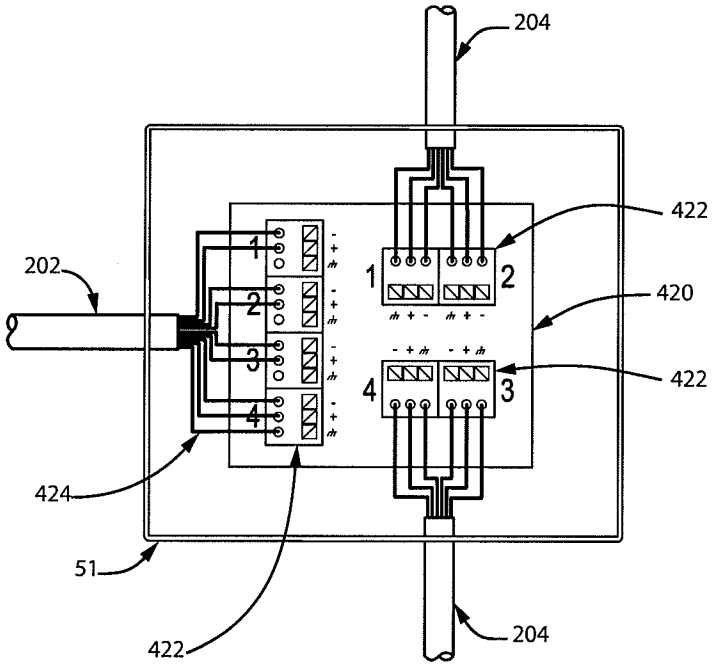


FIGURE 18c

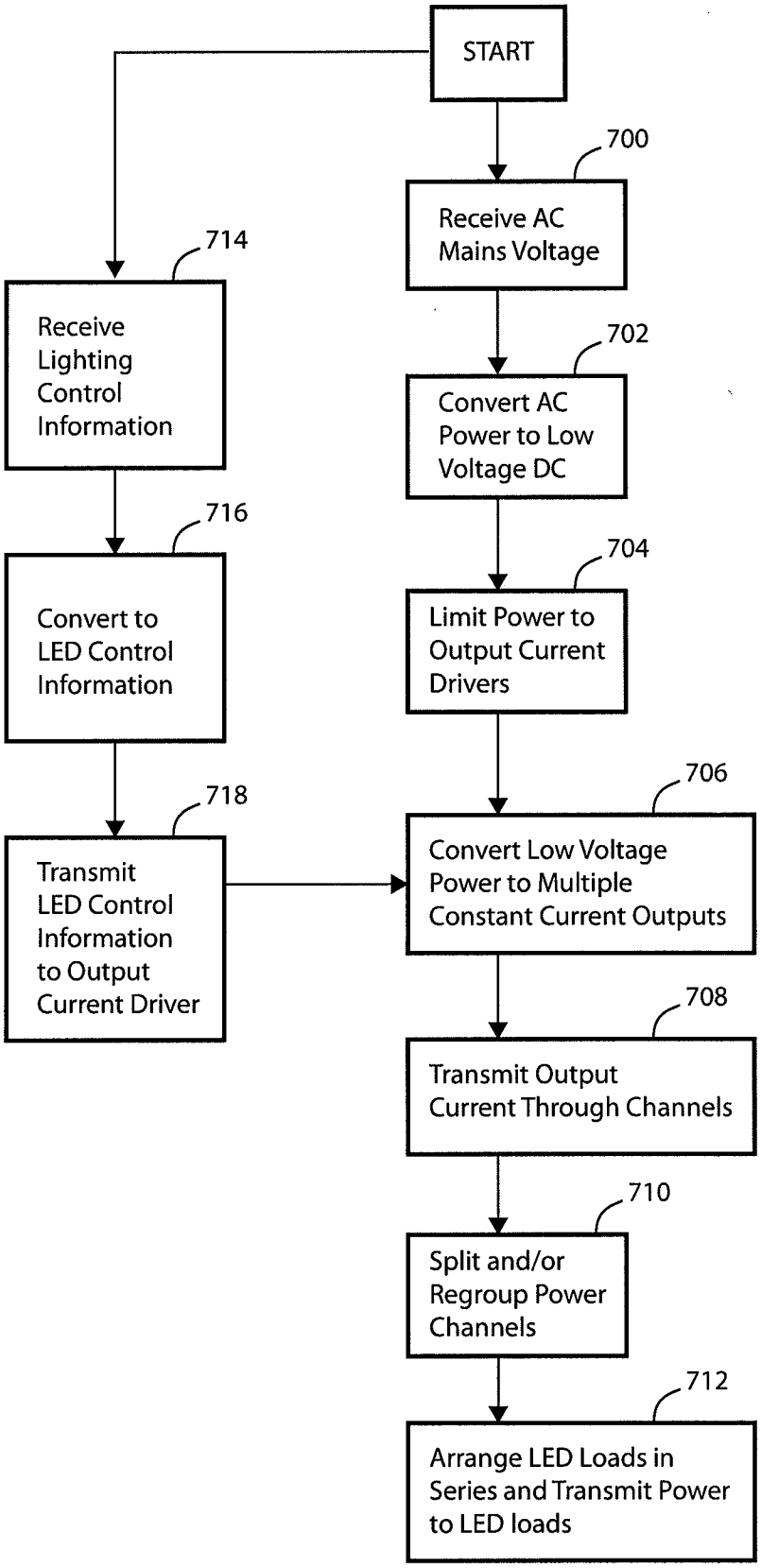

START
700
Receive AC Mains Voltage
702
Convert AC Power to Low Voltage DC
704
Limit Power to Output Current Drivers
706
Convert Low Voltage Power to Multiple Constant Current Outputs
708
Transmit Output Current Through Channels
710
Split and/or Regroup Power Channels
712
Arrange LED Loads in Series and Transmit Power to LED loads
714
Receive Lighting Control Information
716
Convert to LED Control Information
718
Transmit LED Control Information to Output Current Driver

FIGURE 19

PTO/SB/06 (07-06)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/466,509	Filing Date 05/08/2012	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	07/24/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $60=	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/ADRIENE SELLMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/466,509

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	1 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/466,509	05/08/2012	David TIKKANEN	PAT 67545AW-2

CONFIRMATION NO. 8469

FORMALITIES LETTER

26123
BORDEN LADNER GERVAIS LLP
Anne Kinsman
WORLD EXCHANGE PLAZA
100 QUEEN STREET SUITE 1100
OTTAWA, ON K1P 1J9
CANADA

OC00000054422732

Date Mailed: 05/24/2012

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The application is informal since it does not comply with the regulations for the reason(s) indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings must be reasonably free from erasures and must be free from alterations, overwriting, interlineations, folds, and copy marks. See Figure(s) 12 - 19.
  - The drawings submitted to the Office are not electronically reproducible because portions of figures 13a, 14a, 18a-c are missing and/or blurry.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/cnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/466,509	05/08/2012	2821	1380	PAT 67545AW-2	1	1

CONFIRMATION NO. 8469

FILING RECEIPT

26123
BORDEN LADNER GERVAIS LLP
Anne Kinsman
WORLD EXCHANGE PLAZA
100 QUEEN STREET SUITE 1100
OTTAWA, ON K1P 1J9
CANADA



Date Mailed: 05/24/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

David TIKKANEN, Waterloo, CANADA;
Jason NEUDORF, Kitchener, CANADA;
Steven LYONS, Kitchener, CANADA;
Todd William SCOTT, Waterloo, CANADA;
Kyle Grahame HATHAWAY, Kitchener, CANADA;
David Wainesworth JANSEN, Waterloo, CANADA;

Assignment For Published Patent Application

LUMASTREAM CANADA ULC, Calgary, CANADA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 13/059,336 03/22/2011 *
which is a 371 of PCT/CA2009/001295 09/17/2009
which claims benefit of 61/097,963 09/18/2008
(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 05/21/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/466,509**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No
Title

CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

Preliminary Class

315

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	TIKKANEN, David
Art Unit	
Examiner Name	
Attorney Docket Number	PAT 67545AW-2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050289279		2005-12-29	FAILS ET AL.	
	2	20050218838		2005-10-06	LYS	
	3	20080018261		2008-01-24	KASTNER	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2008052293	WO		2008-05-08	QUICK ET AL.		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	
	Examiner Name	
	Attorney Docket Number	PAT 67545AW-2

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	ERICSSON AB, Power Supplies Goes Digital White Paper, October 2006	☐
	2	SKANDA; MICROCHIP TECHNOLOGY INC., Power Factor Correction in Power Conversion Applications using the dsPIC® DSC", AN1106, June 2007	☐
	3	TRAXON TECHNOLOGIES, LED Engine XB 3W-108 Technical Specifications and User Manual Version 1.1, 2007	☐
	4	PENWELL CORPORATION, Dialight Lumidrives Launches Colurdriver XP for High-Power LEDs, LEDs MAGAZINE, downloaded from http://www.ledsmagazine.com/press/15469, 2007-09-25	☐
	5	Colourdriver XP data sheet, 2008-07-30	☐
	6	US-TECH ONLINE, Dialight: New High Power LED Driver, downloaded from http://www.us-tech.com, October 2007	☐
	7	IST LTD., iDrive™ 1000 The Intelligent 210W LED Driver User Manual, v. 1.7, 2008-06-20	☐
	8	ROAL ELECTRONICS, S.P.A, Programmable RGB LED Driver 200 Watts Model RHPS180 Product Details, Rev. 2, 2007-10	☐
	9	INTERNATIONAL SEARCHING AUTHORITY (CA), International Search Report and Written Opinion for International Patent Application No. PCT/CA2009/001295, 2010-01-13	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	
	Examiner Name	
	Attorney Docket Number	PAT 67545AW-2

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	TIKKANEN, David
	Art Unit	
	Examiner Name	
	Attorney Docket Number	PAT 67545AW-2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey W. Wong/	Date (YYYY-MM-DD)	2012-05-08
Name/Print	Jeffrey W. Wong	Registration Number	46414

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PAT67545W-90	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below
International application No. **PCT/CA2009/001295**	International filing date *(day/month/year)* 17 September 2009 (17-09-2009)	(Earliest)Priority date *(day/month/year)* 18 September 2008 (18-09-2008)
Applicant E CRAFTSMEN CORPORATION ET AL		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 7 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

      [X] the international application in the language in which it was filed

      [ ] a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I

2. [ ] **Certain claims were found unsearchable** (see Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant

   [ ] the text has been established by this Authority to read as follows :

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant

   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 3

      [X] as suggested by the applicant

      [ ] as selected by this Authority, because the applicant failed to suggest a figure

      [ ] as selected by this Authority, because this figure better characterizes the invention

   b. [ ] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2009/001295

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***H05B 37/02*** (2006.01) , ***H05B 33/08*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05B (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Epoque, IEEE Xplore, Canadian Patent Database. Terms used: driver, dimmer, led, first, main primary, second*, auxiliary, controller, microcontroller, microprocessor, and others.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/0018261 (Kastner) 24 January 2008 (24-01-2008) figure 20; paragraph 102	1, 4-13, 15, 18-20
A	WO 2008/052293 (Quick et al.) 8 May 2008 (08-05-2008) figures 10-11	1, 4, 5
A	US 2005/0218838 (Lys) 6 October 2005 (06-10-2005) figure 22A	1, 6, 13, 18, 19

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 January 2010 (12-01-2010)	13 January 2010 (13-01-2010)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Andrew O'Malley (819) 953-5481

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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
BORDEN LADNER GERVAIS LLP
World Exchange Plaza
1100 - 100 Queen Street
OTTAWA, Ontario
Canada, K1P 1J9

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	13 January 2010 (13-01-2010)
Applicant's or agent's file reference PAT67545W-90	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CA2009/001295	17 September 2009 (17-09-2009)	18 September 2008 (18-09-2008)

International Patent Classification (IPC) or both national classification and IPC
IPC: ***H05B 37/02*** (2006.01), ***H05B 33/08*** (2006.01)

Applicant
E CRAFTSMEN CORPORATION ET AL

1. This opinion contains indications relating to the following items :

[X]	Box No. I	Basis of the opinion
[ ]	Box No. II	Priority
[ ]	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
[ ]	Box No. IV	Lack of unity of invention
[X]	Box No. V	Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
[ ]	Box No. VI	Certain documents cited
[ ]	Box No. VII	Certain defects in the international application
[X]	Box No. VIII	Certain observations on the international application

2. **FURTHER ACTION**
If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/CA	Date of completion of this opinion	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	12 January 2010 (12-01-2010)	Andrew O'Malley (819) 953-5481

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CA2009/001295

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   [X] the international application in the language in which it was filed

   [ ] a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

      [ ] on paper

      [ ] in electronic form

   b. (time)

      [ ] the international application as filed.

      [ ] together with the international application in electronic form

      [ ] subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments :

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CA2009/001295

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	2, 14, 16, 17	YES
	Claims	1, 3-13, 15, 18-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following document(s) cited in the International Search Report:

D1: US 2008/0018261 (Kastner) 24 January 2008 (24-01-2008)

Article 33(2) PCT – Novelty

Since the subject matter defined by claims 1 through 20 is not disclosed by any single piece of the available prior art, these claims meet the requirements of **Article 33(2) PCT**.

Article 33(3) PCT – Inventive step

Regarding claims 1 and 15, D1 discloses an LED driver/dimmer (figure 20) for controlling a set of lighting loads (figure 20D), comprising:
- a power circuit (figures 20A-B);
- a primary digital controller for controlling the power circuit (figure 20B: U1);
- a set of output current drivers, each of the set of output current drivers connected to one set of the light loads for controlling the associated load (figure 20D: Q2-Q4);
- a secondary digital controller for controlling the set of output current drivers (figure 20C: U4);
- wherein the secondary controlling transmits LED control information to control the outputs of the output current drivers (figure 20C: U4 via PWM); and
- wherein the secondary digital controller provides feedback control information to the primary digital controller (figures 20B-C: VFB; paragraph 102).

Although the feedback signal of D1 is sent between the secondary and first controllers as an analog signal, as opposed the digital signal defined by claim 1, the use of an analog versus a digital signal for transmitting feedback information between two digital controllers is considered a routine design choice for those skilled in the art of digital lighting controllers. Accordingly, claim 1 is found to lack an inventive step in view of D1.

The prior art fails to teach or suggest the specific power circuit as contemplated by claims 2, 14, 16, and 17, and these claims thus appear to include an inventive step.

Regarding claim 3, the prior art fails to teach or suggest individual ICSP ports associated with each of the output current drivers for dynamic control thereof, and this claim thus includes an inventive step in view of the available prior art.

Claims 4 and 5 are not considered to include an inventive step in view of D1 and state of the art on the claim date, since providing an ICSP port for a digital controller is well known in the embedded controller arts.

Claims 6 and 7 fail to include an inventive step in view of D1 which further discloses a communication interface for receiving external data via an isolation barrier (figure 20C: DIMMING INPUT; paragraph 0105).

Continued on Supplemental Sheet . . .

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made :

Claims

Claims 18 and 19 do not comply with **Article 6 PCT** since means to map the output current drivers to DMX512 addresses or various dimming zones for 0-10 Vdc control are not supported by the description.

Claim 20 and is unclear and thus fails to comply with **Article 6 PCT**. Specifically, the term PDC has not been defined within the scope of the claim and lacks antecedent basis.

Description

The description does not comply with **Rule 11.13(l) PCT** since reference character 80 does not appear in figure 3 (see page 6, line 17). The applies similarly to reference characters 22 and P1-P10 (see page 11).

On page 6, line 10, reference character 66 should be replaced with 61 for consistency with figure 3.

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of: **Box No. V**

The housing and heatsinking details defined by claims 8 to 12 are not considered to include inventive steps in view of D1 and the state of the art on the claim date.

The communication protocols defined by claim 13 would be known design choices to those skilled in the lighting control arts, and this claim thereby fails to include an inventive step in view of D1 and the state of the art on the claim date. Claims 18 and 19 similarly lack inventive steps.

Claim 20 also lacks an inventive step in view of D1 which further discloses isolated communication bus between the digital feedback control and the primary digital controller (figure 20C: OPT1).

Claims 1, 3 to 13, 15, and 18 to 20 thereby fail to comply with **Article 33(2) PCT**, while claims 2, 14, 16, and 17 do.

Article 33(4) PCT – Industrial applicability

Since the subject matter defined by claims 1 to 20 is directed to well established lighting control arts, these claims satisfy **Article 33(4) PCT**.

CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. Patent Application No. 13/059,336 filed February 16, 2011, which claims the benefit of U.S. Provisional Application No. 61/097,063 September 18, 2008, both of which are incorporated herein by reference.

BACKGROUND OF THE DISCLOSURE

[0002] With the rapid increase in light emitting diode (LED) efficacies for high powered LEDs, the latest technologies have exceeded incandescent and halogen sources and are now starting to compete with fluorescent, mercury vapour, metal halide and sodium lighting. In addition to better energy usage, LEDs also have considerable advantages over traditional light sources such as long life, better durability and improved color generating abilities. The advancement of LED technology by various manufacturers has produced high power LEDs with various recommended drive currents such as 350 mA, 500mA, 700mA, 1000mA, and 1400mA or higher.

[0003] In recent years, controllable power sources for Solid State Lighting (SSL) applications have entered the market with integrated features. In addition, digital controllers within power sources have enabled the development of configurable options to provide a wider flexibility of solutions for Solid State Lighting applications. The ability to dim the light output of LEDs is also important to reduce energy consumption.

[0004] However, lighting companies are faced with considerable challenges in adopting SSL technology due to their unfamiliarity and lack of expertise in the driving and dimming requirements for LEDs.

[0005] Therefore, there is provided a novel LED Driver/dimmer for solid state lighting applications.

SUMMARY OF THE DISCLOSURE

[0006] With the wide variety of communication interface options and LED drive currents available for numerous architectural and entertainment Solid State Lighting applications, the configurable LED Driver/dimmer of the current disclosure includes at least one of the

following advantages: configurable output current options that maximize the available power in the “front end” PFC and isolated power conversion converter stage; multiple drive current options for the multiple LED drive current options for various LEDs; elimination of a cooling fan which can present issues with audible noise and flexibility in where the power source is located, relatively low standby power consumption during “black out” lighting conditions, where “black out” refers to no load operation on the output of the dimmer/driver; multiple communication interface options; the ability to map output current sources/channels to different DMX512A addresses and the ability to configure multiple groups of output current sources/channels such that each group is controlled by one 0 - 10 Vdc analog signal.

[0007] Some embodiments of the present disclosure are directed to a highly efficient enclosed, configurable power source, controllable by various external communication interfaces and a method for driving and dimming LEDs or OLEDs in lighting fixtures such as used for architectural or entertainment lighting applications. Such applications can include, but are not limited to, theater, convention centers, cruise ships, architectural building features, amusement parks, museums, and hospitality lighting in restaurants and bars.

[0008] In one aspect of the present disclosure, there is provided a configurable light emitting diode (LED) driver/dimmer for controlling a set of light fixture loads comprising: a power circuit; a primary digital controller for controlling the power circuit; a set of output current drivers, each of the set of output current drivers connected to one of the set of light fixture loads for controlling the associated light fixture load; a secondary digital controller for controlling the set of output current drivers; wherein the secondary controller transmits LED control information to control outputs of the set of output current drivers; and wherein the secondary digital controller provides digital feedback control information to the primary digital controller.

[0009] In another aspect of the present disclosure, there is provided a configurable power source that provides a plurality of output channels, such as 6, 8, 9, or 12, to color change or dim OLED or LED loads. In color changing applications, the number of available channels is a multiple of three or four to accommodate either red/green/blue LED loads or red/green/blue/amber or white LED loads. The number of output channels and available output power is increased or maximized based on the LED current requirements. The output channels are programmable by means of in circuit serial programming (ICSP) ports and

calibrated by a secondary digital controller to the required output current and other parameters such as dimming frequency range.

[0010] In another embodiment, the dimming of multiple monochromatic color or white LED loads (output channels) utilizing a single 0 - 10 Vdc analog control signal, or the control of groups of LED loads (output channels) with an associated 0 - 10 Vdc analog control signal for each group is contemplated.

[0011] In another aspect of the present disclosure, the output channels are digitally controlled current sources configurable for various peak currents to power and control a variety of LEDs. The LED average current is encoded within the three variables of on-time, off-time, and period whereby no three variables are held constant. Depending on the output drive currents of the LED loads, the number of available output channels is maximized based on the maximum output power available from the power factor and isolated DC/DC converter stages.

[0012] In another aspect of the present disclosure, the configurable power source is housed in a rectangular enclosure with a monolithic aluminum extrusion and a U shaped aluminum chassis and metal end plates. Various electrical components are thermally coupled to the heatsink to increase or maximize heat transfer to the outside surface of the enclosure.

[0013] In another aspect of the present disclosure, the power source includes a digital controller to decrease power consumption of a relay coil as part of an inrush current limit circuit to reduce power consumption and improve efficiency.

[0014] In another aspect of the present disclosure, the power source utilizes an independent efficient auxiliary power source and one or more digital controllers to provide power to the communication interface. A digital controller disables various electrical circuits during black out lighting conditions to reduce no load power consumption and improve efficiency.

BRIEF DESCRIPTION OF DRAWINGS

[0015] Embodiments of the present disclosure will now be described, by way of example only, with reference to the attached Figures, wherein:

[0016] Figure 1 is a perspective view of a configurable LED Driver/dimmer;

[0017] Figures 2a and 2b are cross-sectional views of the configurable LED Driver/dimmer;

[0018] Figure 2c is a schematic view of an internal layout of the LED Driver/dimmer;

[0019] Figure 3 is a schematic block diagram of the configurable LED Driver/dimmer;

[0020] Figure 4 is a schematic diagram of a prior art inrush current limit circuit;

[0021] Figure 5 is a schematic diagram of an embodiment of a novel inrush current limit circuit for use with the configurable LED Driver/dimmer;

[0022] Figure 6 is a schematic diagram of an embodiment of an output current driver;

[0023] Figure 7 is a schematic diagram of another embodiment of the output current driver;

[0024] Figure 8 is a schematic block diagram of another embodiment of the configurable LED Driver/dimmer;

[0025] Figure 9 is a schematic diagram of a prior art multistage power source;

[0026] Figure 10 is a schematic diagram of an embodiment of a novel multistage power source;

[0027] Figure 11 is a schematic diagram of a communication interface for use with the configurable LED Driver/dimmer;

[0028] Figure 12 is a block diagram of an embodiment of a configurable LED Driver/Dimmer implemented in a low voltage DC distribution LED lighting system;

[0029] Figure 13a is a diagram of one implementation of a break out module;

[0030] Figure 13b is a schematic diagram of one implementation of a break out module;

[0031] Figure 14a is a diagram of an embodiment of a series connect module;

[0032] Figure 14b is a schematic diagram of a series connect module;

[0033] Figure 15 is a block diagram of an embodiment of a configurable LED Driver/dimmer implemented in a low voltage DC distribution LED lighting system;

[0034] Figure 16 is a block diagram of an embodiment of a configurable LED Driver/dimmer implemented in a low voltage DC distribution LED lighting system;

[0035] Figure 17 is a block diagram of an embodiment of a configurable LED Driver/dimmer implemented in a low voltage DC distribution LED lighting system;

[0036] Figures 18a, 18b, and 18c are diagrams of embodiments of a break out module; and

[0037] Figure 19 is a flowchart of a method of providing low voltage power to a set of LED loads.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0038] In general, the present disclosure is directed at a method and apparatus for providing a configurable LED Driver/dimmer. In the current description, the Driver/dimmer will be referred to as a dimmer, however, it will be understood that the configurable apparatus can function as either a driver, a dimmer or both. In the preferred embodiment, the dimmer is used for Solid State Lighting (SSL) applications.

[0039] Turning to Figure 1, a perspective view of an LED dimmer is shown. The LED dimmer 10 includes a body portion 12, or housing, which includes a monolithic aluminum heatsink 14 and a U-shaped chassis 16. Cross-sectional views of the dimmer 10 are provided in Figures 2a and 2b.

[0040] The dimmer 10 further includes a front plate 18 which includes a plurality of ports 20 along with a set of conductor cables 22. The front plate 18 is fastened to the body portion 12 via a set of fasteners 24, such as screws. In this embodiment, as conductor cables are used to provide output power to LED/OLED loads, the space requirement for the front plate 18 is reduced with respect to other known connection means such as terminal blocks.

[0041] Turning to Figures 2a and 2b, a pair of cross-sectional views of the LED dimmer are provided. Figure 2c is a schematic view of one embodiment of an internal layout of the dimmer 10. The cross-sectional views for Figures 2a and 2b are taken along lines A-A and B-B of Figure 2c respectively.

[0042] As shown, the heatsink 14 includes a receptacle portion 26 for receiving the ends of the chassis 16. In order to increase, or optimize, the heat dissipation capability of the configurable dimmer 10 at full output power, the extruded aluminum heatsink 14 includes fins 28 to increase the surface area for heat dissipation. The heatsink 14 also has a mounting platform 30 for receiving power components, or semiconductors 32, such as a bridge rectifier, MOSFETs, and/or diodes to efficiently transfer heat to the outside surface of the heatsink 14. These components will be discussed in more detail below with respect to Figure 3. A power factor inductor and main isolation transformer pair 34 are thermally coupled to the chassis 16 by a thermally conductive, electrically isolated material 36 to further improve heat dissipation of these components. A circuit board 38 is also mounted to the heatsink 14.

[0043] Turning to Figure 3, a block diagram of another embodiment of the LED dimmer is shown. The LED dimmer 10 includes an inrush current limit 40, or inrush current limit circuit,

which receives power from an AC power source or supply 42, located external to the dimmer 10. The inrush circuit 40 is connected to a Power Factor Correction (PFC) Boost 44 which, in turn, is connected to a DC/DC Converter 46, or power conversion stage. The converter 46 is connected to an Output Voltage bus 48 which is connected to a power limiter 50. The inrush circuit 40, the PFC boost 44, the DC/DC converter 46, the Output Voltage bus 48 and the power limit 50 can be seen as a power circuit 47. Although only one power limit 50 is shown, it will be understood that there could be multiple power limits. The power limiter 50 is connected to a set of output current drivers 52, whereby each of the output current drivers 52 has an associated in-circuit serial programming (ICSP) port 54. The output of the output current drivers 52 is connected to individual Organic Light-Emitting Diodes (OLED)/Light-Emitting Diodes (LED) loads 56, further referred to as LED loads.

[0044] Along with the above-identified components and circuitry, the dimmer 10 further includes a primary digital controller 58 which is connected to an auxiliary power source 60 and an ICSP Port 62. The primary digital controller 58 is further connected, via an isolated communication bus 61 to a secondary digital controller 64, which receives power from the auxiliary power source 60. An ICSP port 68 is also connected to the secondary digital controller 64.

[0045] The auxiliary power source 60 is also used to power an interface component 70 which includes an optional address selector 72 and a communication interface 74. The communication interface 74 receives inputs from an external transmitter 76 and communicates via an isolated serial communication bus 78 with the secondary digital controller 64. A set of isolation barriers 80 and 81 are located within the dimmer 10, each barrier separating various components of the dimmer 10 from each other.

[0046] As will be understood, not all of the components or connections of the LED dimmer 10 required for operation are shown as they will be understood by one skilled in the art. For instance, the dimmer 10 can also include an EMI filter and a bridge rectifier. With respect to connections, it will be understood that the primary digital controller 58 can also be connected to the PFC boost 44, the inrush current limit 40 and the DC/DC controller 46 while the secondary digital controller 64 can be connected to the output voltage bus 48, the power limit 50 and the output current drivers 52.

[0047] In operation, the PFC Boost 44 and DC/DC Converter 46 are controlled by the primary side digital controller 58 while the secondary digital controller 64 monitors the output

voltage bus 48 and provides digital feedback control information via isolated communication bus 61 to regulate the output voltage bus 48. Secondary digital controller 64 also translates dimming and/or color mixing information from the external transmitter 76 into LED control information for the output current drivers 52. The primary 58 and secondary 64 digital controllers and output current drivers 52 have an associated programming port for further configuring the LED dimmer 10.

[0048] Turning to Figure 4, a prior art inrush current limit is shown. In order to limit inrush current limit during initial start up of the power source, one approach is to utilize a negative temperature coefficient thermistor (NTC) in parallel with a relay contact. During initial turn on of the power source, the NTC thermistor limits the inrush current. When the PFC boost stage bulk capacitor is charged, and before the PFC stage is enabled by the primary controller, the primary controller closes the relay contact to bypass the NTC thermistor. This is accomplished by applying a DC voltage via a switch across the coil in the relay.

[0049] A limitation of this approach is the power consumption of the relay coil when a continuous DC voltage is applied. This power consumption becomes significant in terms of Energy Star requirements during no load or standby operation such as when a “black out” or minimum light intensity state is received by the communication interface.

[0050] Turning to Figure 5, an embodiment of an improved inrush current limit 40 is shown. An EMI filter 82 is connected between the power supply and the current limit 40 and is connected directly to the PFC boost 44 and via the current limit 40. The current limit 40 includes a thermistor 84, a relay 86 and a switch 59. The relay contact 86 is connected in parallel with the thermistor 84. A typical relay coil requires greater energy to close the contacts than is required with the currently described limiter 40 to maintain the contacts in a closed position since less holding force is required. After the relay contacts have been closed by applying a voltage of 12 Vdc, modulation of the relay coil voltage can be initiated by the primary controller 58 to effectively reduce the average voltage across the coil to approximately 5 volts versus a DC voltage of 12V, reducing power consumption. It should be noted that the pulse duty cycle and frequency can also be changed to improve or optimize performance.

[0051] In one embodiment, the primary controller 58 pulses the DC voltage across the relay coil via the switch 59 to reduce power consumption.

[0052] In one embodiment, for the PFC boost 44, as shown in Figure 3, the PFC Boost 44 utilizes a boost topology with an input AC voltage mains range of 103 Vac to 300 Vac from the AC supply 42. Energy stored in an inductor within the PFC boost 44 is transferred and stored in the bulk capacitor on a cycle by cycle switching basis at a loosely regulated 430V DC over the input range. The energy is controlled in a manner that forces AC input current to be sinusoidal and in phase with the AC line voltage. By drawing current in phase with the input mains voltage 42, the amount of harmonic currents of the fundamental AC mains frequency being introduced into the power line is reduced.

[0053] For the DC/DC convertor 46 and the output voltage bus 48, the preferred embodiment for the DC/DC converter 46 is derived from the isolated buck converter topology and comprises a galvanically isolated full bridge converter employing a primary side phase modulation technique with a secondary side current doubler rectifier circuit.

[0054] The full bridge converter parasitic circuit elements in conjunction with primary magnetization current and reflected inductor ripple current cause resonant edge switching transitions on the MOSFET switch thus forcing zero voltage across the MOSFET switching device before turn on. The result is higher efficiency due to the elimination of Coss (drain to source MOSFET Capacitance) switching losses, reduction of gate charge across the Miller capacitance and minimized power loss during switching transitions when voltage and current are changing simultaneously.

[0055] Since the output of the DC/DC converter is a tightly regulated DC bus 48, the set of power limit circuits 50 are coupled to either one or more current drivers 52 to limit the power output of each of the output current drivers. 52 The power limit circuits 50 each include a current sensor that is monitored by the secondary controller 64. In the event of a single component failure within the output current driver module, the power limit circuits 50 limit the energy to the loads in accordance with the UL standard 1310 Class 2. Supplementary protection to the power limit circuits can also include one or more fuses.

[0056] For the primary digital controller 44, the controller 44 provides digital feedback control for the PFC Boost 44 and DC/DC Converter 46. The digital feedback method for the PFC Boost 44 utilizes average current mode control with duty cycle feed forward for the inner current loop and voltage mode control for the outer control loop. The DC/DC Converter 46 utilizes voltage mode control for the digital control loop.

[0057] The primary digital controller 44 also controls the inrush current limit circuit 40, provides primary current limit protection, and over voltage protection for the output of the PFC Boost 44. The primary digital controller 44 also disables the PFC Boost 44 and the DC/DC Converter 46 during black out or no load conditions to reduce power dissipation.

[0058] With respect to the output current drivers 52, configuring the required number of outputs and required output current is accomplished by populating the appropriate sections of a single printed circuit board with the appropriate electrical components and programming the output current driver via the in-circuit serial programming (ICSP) ports 54.

[0059] Turning to Figure 6, which is an embodiment of an output current driver, the output current driver 52 comprises a load controller 90, a current source 92, and current sense 94. Although only one current driver 52 is shown, it will be understood that multiple are present as reflected in Figure 3.

[0060] The output current driver may utilize either the dimming/color mixing techniques for LEDs described in detail in US Patent Publication No. 2007/0103086, or the techniques described in detail in International Publication WO2011/140660 which is hereby incorporated by reference,

[0061] The secondary controller 64 receives dimming or color mixing information in the form of a serial data stream from the external transmitter 76 via the communication interface 74 and then translates the data stream into LED control information. The LED control information is transmitted to the load controller 90 in the form of instructions to generate a digital signal 98 and an analog signal 100.

[0062] The load controller 90 further comprises a signal generator 102 which transmits the digital signal 98 and the analog signal 100 to the current source 92. The digital control signal 98 and the analog signal 100 are preferably generated via a digital control algorithm and 1 Bit algorithm, respectively.

[0063] The current source 92 preferably includes ancillary circuitry for operation and comprises a buck topology power stage with hysteretic control. The current sense 94 provides a digital feedback loop for each current source 92. In the preferred embodiment, the current source 92 is a buck circuit topology however other embodiments can include topologies such as boost, buck-boost, or single ended primary inductor converter (SEPIC).

[0064] Output 104 of the current driver 52 provides a current pulse via current source 92 to the LED Load 56 whereby on times, off times, and period are not held constant.

[0065] Each output current driver 52, has an associated in-circuit serial programming (ICSP) port 54. The ICSP port 54 provides access to the load controller 90 such that firmware updates are possible to permit the configuration of the output current drivers 52. The ICSP port(s) 54 for the output current driver(s) 52 can be located on the printed circuit board assembly of the apparatus or they can be located on the outside of the enclosure.

[0066] The configuration options include, but are not limited to, such parameters as the adjustment of the frequency range of the dimming current pulse for the range of light intensity output or the set point adjustment of the peak on time output current.

[0067] For example, it might be necessary to increase the frequency range of the dimming current pulse in video recording applications where the dimming current pulse frequency can be programmed for a 2000Hz to 2500Hz range. This would negate a visible beat frequency effect that would other wise be noticeable on recorded video. There can be other applications where the adjustment of the dimming current frequency range is required to reduce EMI effects.

[0068] The default peak output current set point is programmed via the ICSP port 54 which provides flexibility in the number of possible LEDs types that can be driven and is typically dependent on the recommended operating current specified by the manufacturer such as 350mA, 700mA, etc. The set point current is preferably programmed to within 4% of the manufacturer's specification. The peak output current set point can then be precisely calibrated to within typically 1% via the secondary controller 64 during factory calibration.

[0069] An alternate embodiment of an output current driver 52 is shown in Figure 7. In this embodiment, the output current driver 52 comprises a load controller 110 including a signal generator 112. A current source 114 and a current sense 116 are located within an apparatus 118, such as a light fixture. The light fixture 118 also includes the LED load 56. After receiving the LED control information from the secondary controller 64, the signal generator 112 provides a data signal to the light fixture 118 to operate the LED load 56 via the current source 114 and the current sense 116. This is also schematically shown in Figure 8.

[0070] Figure 8 is a schematic diagram of an alternate embodiment of a configurable LED dimmer 10. As shown, individual current sources 114 and current senses 116 are mounted in the light fixture containing the LED load 56, and power and data signals are provided to each output current source 114 by the multi conductor cable 22. In this embodiment, the

current sources 114 are configured to regulate to a predetermined peak current. The load controller 64 transmits the data signal containing the output current information encoded within the three variables of on time, off time, and period whereby no three variables are held constant.

[0071] Turning to Figure 9, a known application of internal auxiliary power requirements in a multistage power source is shown and illustrates how auxiliary power is provided to the various blocks of a multistage power source. P1, P2…P10 represents the various power and voltage transfer requirements for each functional block. For simplicity, the various voltage regulator and filter circuits required for each of the power outputs have been omitted.

[0072] In operation, the bridge rectifier converts the AC mains voltage P1 to a rectified voltage P2. A portion of power P6 from the output of the bridge rectifier P2 is supplied to the start up circuit. The start up circuit is comprised of a power transistor or MOSFET and is intended to provide power P8 to the PFC analog controller for only a short duration of a few seconds. Power P8 to the PFC analog controller will allow the PFC Boost stage to begin switching, providing power P10 to the DC/DC controller, and power P3 to the DC/DC converter power stage. Since the start up circuit dissipates an excessive amount of power, it is turned off by the voltage component of P7 supplied by the PFC boost stage. The P7 power is permitted to 'flow through' the start up circuit to continue to supply power P8 to the PFC analog controller.

[0073] The output of the DC/DC Analog Converter provides power P4 to the multi output voltage bus, power P9 to the Communication Interface, and the Output Current Drivers by means of P5.

[0074] In this implementation, the PFC and DC/DC Controllers are typically analog controllers. It should be noted that in this implementation, in order for the communication interface to continually receive dimming information from an external transmitter, the DC/DC Converter stage must remain turned on. Similarly, in order for the DC/DC converter stage to provide power P4, the PFC Boost stage must remain on.

[0075] In a 'black out' state, the communication interface may receive a "0" intensity value out of 255 intensity levels for all of its output current drivers via the external transmitter such as a DMX512A or RDM controller interface, or it may receive an analog voltage of between 0 to 1V via a controller compliant to ESTA E1.3-2001 or IEC60929 as one of many

communication interface options. In this 'black out' state, the DC/DC Converter and PFC Boost Stage continue to dissipate an excessive amount of power.

[0076] Figure 10 is directed at an embodiment of an improved internal auxiliary power distribution in a multistage power source for providing auxiliary power to the various blocks of a multistage power source. For simplicity, the various voltage regulator and filter circuits required for each of the power outputs have been omitted. The transfer of power from AC mains to the Output Current Drivers (52) is unchanged. This embodiment shows an improved implementation of an independent auxiliary power source providing power to the primary digital controller 58, the secondary digital controller 64, and the communication interface 74. The auxiliary power source 60 comprises an efficient isolated flyback topology with a wide input voltage range and pulse skipping capability to minimize its power dissipation at light loads or no load conditions. In other words power can be provided to the primary digital controller 58, the secondary digital controller 64, and the communication interface 74 via an auxiliary flyback converter.

[0077] A 'black out' state received from the external transmitter 76 to the communication interface 74 is communicated to the secondary digital controller 64 and then the primary digital controller 58 via the isolated communication bus 66. The primary digital controller 58 then disables the PFC Boost Stage 44 and DC/DC Converter Stage 46 reducing overall power dissipation of the configurable power source.

[0078] It should be noted that even when the PFC Boost 44 is disabled, power can continue to be supplied to the auxiliary power source 60 since rectified voltage from a bridge rectifier 120 can continue to peak charge the PFC boost 44 through an internal capacitor via the boost diode.

[0079] The auxiliary power source 60 continues to provide power to the primary digital controller 58, secondary digital controller 64, and communication interface 74 in order to be able to 'listen' for or sense a change in light intensity state that may be communicated by the external transmitter 76.

[0080] Alternate embodiments can include additional ancillary circuits that can be powered by the independent auxiliary power source that can be disabled by a controller to reduce over all power dissipation in black out or no load conditions.

[0081] With respect to the communication interface 74, the communication interface 74 comprises a removable and interchangeable module with each module adapted for different

control options such as DMX512A, RDM, 0 - 10 Vdc and Zigbee. Operation of the communication interface with such control options will be understood by one skilled in the art.

[0082] The communication interface module receives lighting control information via the external transmitter 76 and converts the various protocols into a serial data stream. It then transmits this data by means of a Universal Asynchronous Receiver Transmitter (UART) to the secondary digital controller 64 via the isolated serial communication bus 78. The isolated serial communication bus 78 is comprised of a isolation barrier 82 to "float" the communication interface and prevent ground loops.

[0083] Turning to Figure 11, an embodiment of the communication interface is shown. In this embodiment, an analog interface module adapted for 0 - 10 Vdc IEC60929 or ESTA E1.3-2001 dimming methods as the communication interface 74 is shown. The analog interface module can be adapted to receive one or more analog control voltages from one or more associated external transmitters 76. The external transmitter 76 is preferably an electronic resistor or potentiometer that sinks current from the current source located on the analog interface module and outputs a variable 0 - 10 Vdc control voltage proportional to the required light intensity.

[0084] Individual external transmitters 76 supply signals to various controls 122 within the communication interface 74. Each control 122 is representative of an area or group of LED loads 56. Within each control 122 is a current source 124, a voltage sensor 126 and a differential amplifier 128. The differential amplifier 128 senses a voltage across the voltage sensor 126 and converts this into a correlated voltage (Vm,V1,V2…Vn) supplied to a controller 130. The controller 130 converts this analog voltage into a serial data stream for transmission to the secondary digital controller 64 via the isolated serial communication bus 78.

[0085] The communication interface 74 can be configured to have one 0 – 10 Vdc control voltage simultaneously control via the secondary digital controller 64, all output current drivers 52 and LED loads 56. This application is beneficial in monochromatic color or white lighting applications since only one control signal and associated wiring is required to control multiple light loads.

[0086] Furthermore, the communication interface 74 can be adapted to have one or more 0 - 10 Vdc signal voltages control an associated group of one or more output current drivers

in zonal dimming applications. An optional master 0 - 10 Vdc signal voltage could be able to simultaneously control all of the individual groups of output current drivers.

[0087] In applications not requiring the complexity of DMX512A, these analog control options are beneficial in red/green/blue or red/green/blue/amber color changing or monochromatic color or white light applications whereby the addressability and corresponding control of individual LED light loads is not required.

[0088] With respect to the secondary digital controller 64, the controller 64 monitors and transmits digital output voltage bus information (feedback loop) via the two way isolated serial communication bus 78, decodes the serial data from the communication interface 74, and transmits control information to the output current drivers 52. As a protection feature, the secondary controller 64 also monitors output currents from the power limit stages 50 supplied to the output current drivers 52

[0089] The secondary digital controller 64 includes the ICSP port 68 to program and calibrate the output voltage bus 48 to the required voltage. In DMX512A applications, the ICSP port 68 also allows for the mapping of each of the output channels to a wide variety of addresses. Similarly, in 0 - 10 Vdc analog control applications, the secondary digital controller ICSP port allows for the mapping of output channels into groups for each associated 0 - 10Vdc control signal.

[0090] This mapping capability is particularly useful in addressable-networked lighting systems using a DMX512A control protocol where different lighting zones are required to respond to different illumination information. For example, in a 12 channel output configuration, the first 6 channels could be mapped to the DMX base address of the power source (ie DMX01) and the last 6 channels could be mapped to DMX address +1 (i.e. DMX02).

[0091] This mapping capability is also useful in zone dimming applications using 0 - 10 Vdc analog controls as the communication interface. For example, a 12 channel output LED dimmer configuration can have 7 output channels grouped for a first associated 0 - 10 Vdc signal, the next 3 channels can be grouped to a second associated 0 - 10 Vdc control signal, and the last 2 channels can be grouped to a third associated control signal.

[0092] Turning to Figure 12, a block diagram of an embodiment of a configurable LED dimmer implemented in a low voltage DC distribution LED lighting system is shown. For reference, a low voltage DC distribution system is defined as a system where all power from

the Configurable LED dimmer provided to the LED loads meets Class 2 requirements as defined in UL1310 Class 2 Power Units and NEC (National Electrical Code) Article 725 for Class 2 Power Limited Circuits.

[0093] The low voltage DC distribution LED lighting system 200 includes a LED dimmer 10, which receives power from an AC supply 42, and is connected to at least one breakout module 51 which in turn is connected to a set of series connect modules 53 by means of communications cabling 204. Similarly, the series connect modules are connected to individual Organic Light Emitting Diodes (OLED)/Light Emitting Diodes (LED) loads 56, or LED loads, via communications cabling 206.

[0094] Referring to the LED dimmer 10, an example of which was previously described with respect to Figure 3, the power circuit 47 comprises a DC to DC converter 46 and a power limit or power limit function 50. The DC to DC power converter may be an isolated full bridge converter or an isolated half bridge LLC resonant converter. Although only one power limit is shown, there may be multiple power limits whereby each power limit is connected to a set of output current drivers 52 to limit the power output supplied to the set of output current drivers.

[0095] The power limit 50 may be a fuse, a resettable fuse or an electronic circuit that includes a current sense. The power limit may also include any ancillary circuits or components that limit power to the output current drivers or shut off the LED dimmer 10 or both

[0096] The power limit circuit 50 limits the amount of power supplied to a set of output current drivers under normal operation of each. Similarly, in the event of a single component failure within any output current driver 52 within the set, the power limit 50 may also limit the power to the set of current drivers 52. In one embodiment, the power is limited to less than 100 watts in accordance with UL standard 1310, Class 2 Power Units. The set of output current drivers 52 includes a quantity of output drivers such that the total output power of the set of output drivers does not exceed 100 watts under normal operating conditions.

[0097] Each set of output current drivers 52 is connected to the breakout module 51 by means of communications cabling 202.

[0098] With respect to the communication interface 74, the communication interface 74 comprises a removable and interchangeable module with each module adapted for different control options such as DMX512A, RDM (Remote Device Management), 0-10 Vdc analog

control, Zigbee, and DALI (Digital Addressable Lighting Interface). DALI requirements are defined in standards IEC 62386-101; System General Requirements, IEC 62386-102; General Requirements-Control Gear, and IEC 62386-207; Particular Requirements for Control Gear-LED Modules. The communication interface module receives lighting control information via the external transmitter 76 and converts the information regardless of the various protocols into a serial data stream for use by the dimmer 10.

[0099] As shown in Fig 12, the output current drivers or the set of output current drivers 52 are connected via the cabling 202, 204, 206, directly or indirectly, to breakout modules 51, and series connect modules 53 to the LED loads 56, and such connectivity may be referred to as individual channels or a set of channels respectively. In one embodiment, the cabling, communications cabling has an overall insulation sheath and may be shielded or unshielded. It is available in either insulated multi-conductor or insulated twisted pair stranded wiring and the wire gauge is typically 18 AWG. Alternate cabling options may also include 20AWG or 22AWG and type PLTC (power limited tray cable), CL2 (Class 2) or CL3 (Class 3) as permitted in Article 725 of the NEC.

[00100] The LED dimmer 10, via the output current drivers 52, connects into at least one breakout module 51 via the cabling 202 as a set of output channels. The breakout module 51 then splits the set of channels into individual channels or into a predetermined number of channels depending on the required configuration of the lighting system.

[00101] For example, a connection from the LED dimmer 10 may have four (4) individual cables 202 connected to the breakout module 51, each cable further comprising six (6) conductors or three (3) twisted pairs for connection (positive and negative) of 3 channels per cable. This represents a feed in of 12 channels in 4 groups of 3 into the breakout module 51. The breakout module 51 regroups the channels into groups of 2 for connection to the series connect module 53 using communications cabling 204 with 4 conductors or 2 twisted pairs of conductors. This may be seen as the output of the breakout module 51 and represents a feed out of 12 channels with 6 groups of 2 channels. In other embodiments, there are a number of other feed in cable and feed out cable combinations possible for the break out module 51.

[00102] The series connect modules 53 connect multiple LED loads 56, in series for every channel. In one embodiment, the series connect module 53 receives a four (4) conductor cable 204 feed in (representing 2 channels) and then electrically connects, via cabling 206,

at least 2 LED loads 56 in series for each channel. The cabling 204 is typically a 4 conductor or 2 twisted pair configuration.

[0100] A number of different LED load 56 configurations are possible. Typically, the LED loads 56 are part of a light fixture and comprise one or more LED arrays or a group of individual LEDs. The LEDs are typically mounted on a suitable heat sink and installed in various types of housings. Such housings or configurations may include recessed cans with an associated electrical junction box, pendants, rail systems or track systems. A rail fixture includes fixed location LED sources mounted on a linear rail and a track system includes moveable LED light sources mounted on a track system. In one embodiment, the LED loads 56 may have a lumen output of up to 1200 lumens. It is of course possible to have loads with a higher or lower lumen output.

[0101] The LED dimmer 10 may be remotely mounted from the LED loads and in some cases may be up to 200 feet from the LED loads. Alternate distances between the LED dimmer and the LED load are also possible and dependent on the forward voltage drops in the LED loads and the voltage drops dependent on the wire gauge of the communications cabling.

[0102] Figure 13a is a diagram of one implementation of the break out module 51. The break out module 51 comprises two printed circuit board (PCB) assemblies 420 with modular power connectors 422 arranged as terminal blocks to provide an electrical connection between the feed in channels and the feed out channels which are seen as cabling 204.

[0103] The break out module 51 regroups or separates the feed in channels with a different grouping of feed out channels. It may also provide visual means for an installer to easily organize and keep track of the grouping and arrangement of channels during installation.

[0104] In this embodiment, the feed in includes 6 channels of 3 cables 202 with each cable providing 2 channels. The feed out comprises 6 channels of 6 cables 204 with each cable providing one channel. The cabling includes an optional shield wire 424 for connection to the system ground. Other implementations are contemplated.

[0105] The power connectors 422 preferably include apparatuses to enable a method of quickly inserting or releasing the cabling by means of a tool or push button on the connector(s). The connectors 422 may be either cage clamp or push wire type connectors.

[0106] Figure 13b shows a schematic representation of the break out module 51 of Figure 13a.

[0107] With reference to Figure 14a, a diagram of an embodiment of a series connect module 53 is shown. The series connect module 53 contains at least one PCB assembly 502 with feed in modular power connectors 512 for electrical connection of the feed in cable seen as cabling 204. The feed in cable 204 comprises 4 conductors or 2 pairs representing 2 channels (CH1 and CH2) with an optional shield connection 504. The feed out modular connectors 508 are connected in series on the PCB assembly 502 in order to connect the LED loads 56 in series via feed out cables 206 as shown schematically in Figure 14b. The feed out cables 206 may be comprised of one pair of two conductors and an optional shield connection 510 to the system ground.

[0108] The power connectors 508, 512, preferably include apparatuses to enable a method of quickly inserting or releasing the cabling by means of a tool or push button on the connector. The connectors may be either cage clamp or push wire type connectors.

[0109] It is understood that many other embodiments are possible for the series connect module 53 whereby there may be multiple feed in cables where each feed in cable may comprise any number of channels. The series connection of LED loads 56 may also include any number greater than two.

[0110] Turning to Figure 15, a block diagram of another embodiment of a configurable dimmer implemented in a low voltage DC distribution LED lighting system is shown. In this embodiment, the series connect module is excluded from the low voltage DC distribution LED lighting system 600. The series connect means is completed within an electrical junction box 602 associated with each LED load 56. As before, the system 600 includes a dimmer 10 connected to a break out module 51 via cabling 202 and 204. The typical number of LED loads connected in series is two, and wire nuts are used to make the electrical series connections between the LED loads 56 and the cable 206.

[0111] With reference to Figure 16, a block diagram of an alternate embodiment of a configurable dimmer implemented in a low voltage DC distribution LED lighting system is shown. This embodiment shows the break out module 51 as an integral part of the LED dimmer 10 within the system 650.

[0112] Turning to Figure 17, a block diagram of a further embodiment of a configurable dimmer implemented in a low voltage DC distribution LED lighting system is shown. In this

embodiment of the system 680, the break out module 51 and the series connect modules 53 are integrated into a single enclosure or module 682. The electrical connection 684 between the break out module 51 and the series connect modules 53 may be accomplished by means such as cabling, hook up wire, or PCB (printed circuit board) copper tracks.

[0113] Turning to Figures 18a, 18b, and 18c, alternate embodiments of the break out module are shown. All configurations include modular power connectors 422 arranged as terminal blocks and mounted on a PCB 420 to provide an electrical connection between the feed in channels and the feed out channels. The connectors include apparatus to allow for a quick means to insert or release the wiring by means of a tool or push button on the connector.

[0114] In Figure 18a one feed in cable 202, comprises conductors for 2 channels and an optional shield wire connection 424. The feed out includes 2 cables 204 each with 2 conductors for one channel and an optional shield wire connection 424.

[0115] In Figure 18b, one feed in cable 202, comprises conductors for 4 channels and an optional shield wire connection. The feed out includes 4 cables 204, each with 2 conductors representing one channel and an optional shield wire connection 424.

[0116] In Figure 18c, one feed in cable 202, comprises conductors for 4 channels and an optional shield wire connection. The feed out includes 2 cables 204, each with 4 conductors representing two channels and an optional shield wire connection 424.

[0117] Turning to Figure 19, a method of providing low voltage power to a set of LED loads is shown. In operation, an AC voltage 700 is applied to the power circuit of the LED dimmer and converted to low voltage DC 702. The low voltage DC bus is then power limited 704 by at least one power limit circuit or like components to less than 100 watts in accordance with UL1310 Class 2 characteristics.

[0118] The low voltage DC power is the converted to multiple constant current outputs 706 via the power limit such as by means of the output current drivers which generate a constant peak current for each output channel.

[0119] The power is then transmitted in the form of low voltage and pulsed current on each channel 708 to the breakout module via the cabling connecting the dimmer and the breakout module. The breakout module splits or regroups, or both, the power channels 710 and transmits the power to the series connect modules. The series connect module provides power for each channel to multiple LED loads connected in series 712 by means of cabling.

[0120] Figure 19 also shows a method for control of the LED dimmer. Lighting control information such as dimming intensity levels in the form of various protocols is transmitted by an external transmitter into the communication interface 714 of the LED dimmer. The various protocols are converted to a data stream, preferably serial, and transmitted to the secondary digital controller which in turn translates the data stream into LED control information 716.

[0121] The LED control information, which in one embodiment is in the form of a digital and analog signal, is transmitted to the controllers of the associated output current drivers 718.

[0122] The output current drivers generate power as pulsed current at low voltages based on the dimming intensity levels received as lighting control information for each channel of the low voltage lighting system.

[0123] Embodiments of the disclosure can be represented as a software product stored in a machine-readable medium (also referred to as a computer-readable medium, a processor-readable medium, or a computer usable medium having a computer-readable program code embodied therein). The machine-readable medium can be any suitable tangible medium, including magnetic, optical, or electrical storage medium including a diskette, compact disk read only memory (CD-ROM), memory device (volatile or non-volatile), or similar storage mechanism. The machine-readable medium can contain various sets of instructions, code sequences, configuration information, or other data, which, when executed, cause a processor to perform steps in a method according to an embodiment of the disclosure. Those of ordinary skill in the art will appreciate that other instructions and operations necessary to implement the described disclosure can also be stored on the machine-readable medium. Software running from the machine-readable medium can interface with circuitry to perform the described tasks.

[0124] The above-described embodiments of the disclosure are intended to be examples only. Alterations, modifications and variations can be effected to the particular embodiments by those of skill in the art without departing from the scope of the disclosure, which is defined solely by the claims appended hereto.

What is claimed is:

1. A configurable light emitting diode (LED) dimmer for controlling a set of light fixture loads comprising:

a power circuit;

a primary digital controller for controlling the power circuit;

a set of output current drivers, each of the set of output current drivers connected to one of the set of light fixture loads for controlling the associated light fixture load;

a secondary digital controller for controlling the set of output current drivers;

wherein the secondary controller transmits LED control information to control outputs of the set of output current drivers; and

wherein the secondary digital controller provides digital feedback control information to the primary digital controller.

ABSTRACT

The disclosure is directed at a configurable light emitting diode (LED) dimmer for controlling a set of light fixture loads comprising: a power circuit; a primary digital controller for controlling the power circuit; a set of output current drivers, each of the set of output current drivers connected to one of the set of light fixture loads for controlling the associated light fixture load; a secondary digital controller for controlling the set of output current drivers; wherein the secondary controller transmits LED control information to control outputs of the set of output current drivers; and wherein the secondary digital controller provides digital feedback control information to the primary digital controller.

PTO/SB/14 (11-08)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	PAT 67545AW-2
	Application Number	
Title of Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
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☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

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Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

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	Application Number	
Title of Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	PAT 67545AW-2
	Application Number	
Title of Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS	

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All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

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Title of the Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS		
Attorney Docket Number	PAT 67545AW-2	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	20	**Suggested Figure for Publication (if any)**	3

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	PAT 67545AW-2
	Application Number	
Title of Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS	

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This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation in part of	13059336	2011-02-16
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
13059336	a 371 of international	PCT/CA2009/001295	2009-09-17
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/CA2009/001295	non provisional of	61097963	2008-09-18

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This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

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Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			◉ Yes ○ No

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Assignee Information:

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Assignee 1 Remove

If the Assignee is an Organization check here. ☒			
Organization Name	LUMASTREAM CANADA ULC		
Mailing Address Information:			
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Country [i] CA		Postal Code	T2P 4H2
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	PAT 67545AW-2
	Application Number	
Title of Invention	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS	

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Signature	/Jeffrey W. Wong/			Date (YYYY-MM-DD)	2012-05-08
First Name	Jeffrey W.	Last Name	Wong	Registration Number	46414

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Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
Filer:	Jeffrey Wong/Christopher Kreider
Attorney Docket Number:	PAT 67545AW-2

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	1051	1	130	130
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1380**

Electronic Acknowledgement Receipt

EFS ID:	12728912
Application Number:	13466509
International Application Number:	
Confirmation Number:	8469
Title of Invention:	CONFIGURABLE LED DRIVER/DIMMER FOR SOLID STATE LIGHTING APPLICATIONS
First Named Inventor/Applicant Name:	David TIKKANEN
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Filer Authorized By:	Jeffrey Wong
Attorney Docket Number:	PAT 67545AW-2
Receipt Date:	08-MAY-2012
Filing Date:	
Time Stamp:	15:06:09
Application Type:	Utility under 35 USC 111(a)

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings-only black and white line drawings	pat-67545aw-2-drawings.pdf	765733 710da24d339bc6b11ac93d5c69530f8767f0fd65	no	20
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	pat-67545aw-2-ids.pdf	847595 690efc797f924e35e050d74f586370a6498b810e	no	5
Warnings:					
Information:					
3	Non Patent Literature	npl-Colourdriver.PDF	448516 c74034a90fb0bb124f9af491b19fefd5aa307f99	no	2
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Information:					
4	Non Patent Literature	npl-Ericsson.PDF	639361 939c3714399146 43b859c6dd22287f08d1b7cb1c	no	16
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Information:					
13		pat-67545aw-2-spec.pdf	109599 ced3dd22bda8bd9e930f5c434e137d18b54f13b4	yes	22

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	20
Claims	21	21
Abstract	22	22

Warnings:					
Information:					
14	Application Data Sheet	pat-67545aw-2-ads.pdf	1325683 4e83c3e7df3fe8ad6aea216c065394d8af76f02d	no	6
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Information:					
15	Fee Worksheet (SB06)	fee-info.pdf	36749 f0ef20e40a36f84b9fa3c35fb2545e4f85bf2747	no	2
Warnings:					

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New International Application Filed with the USPTO as a Receiving Office

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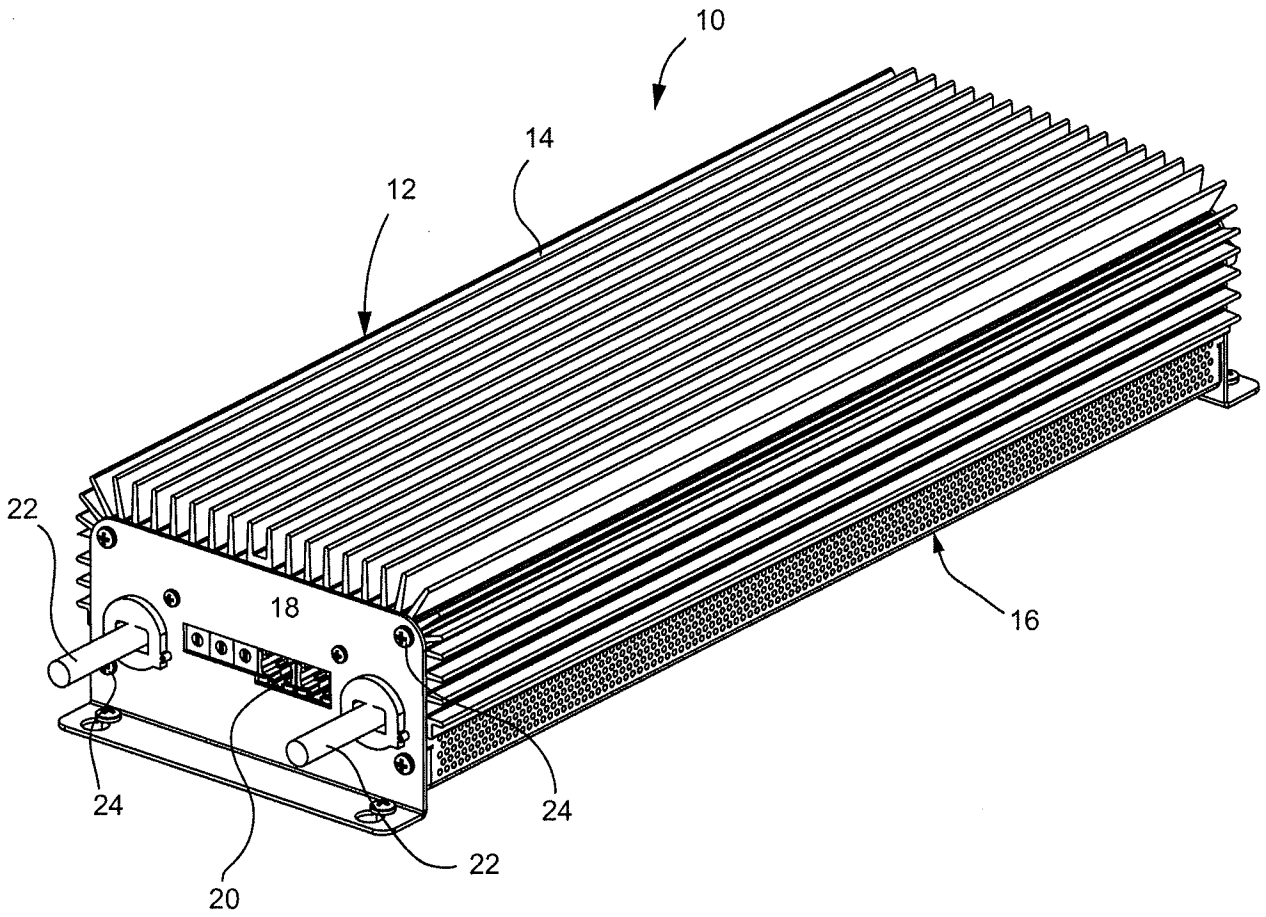


FIGURE 1

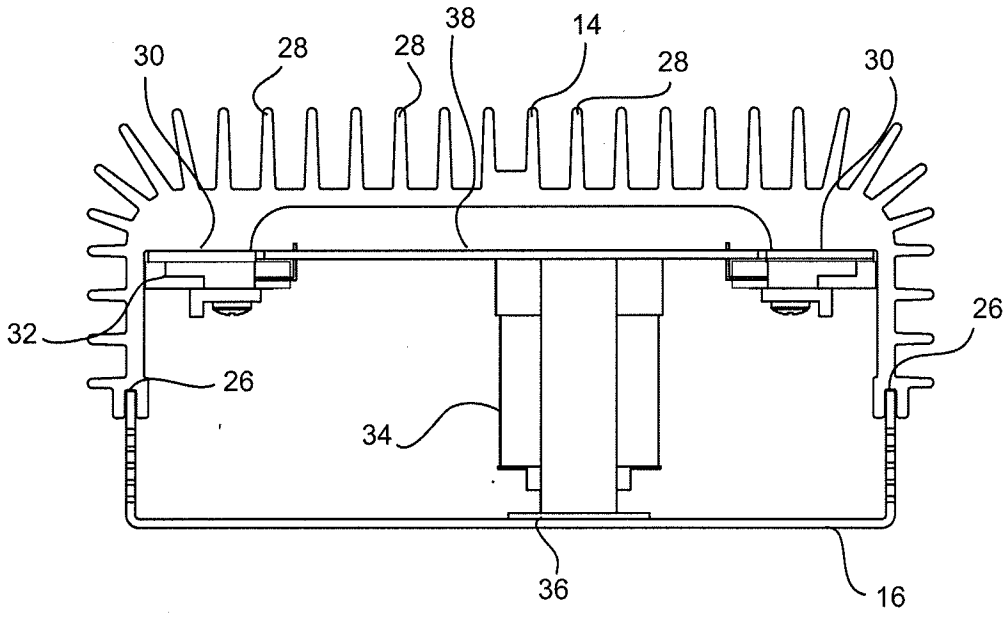


FIGURE 2a

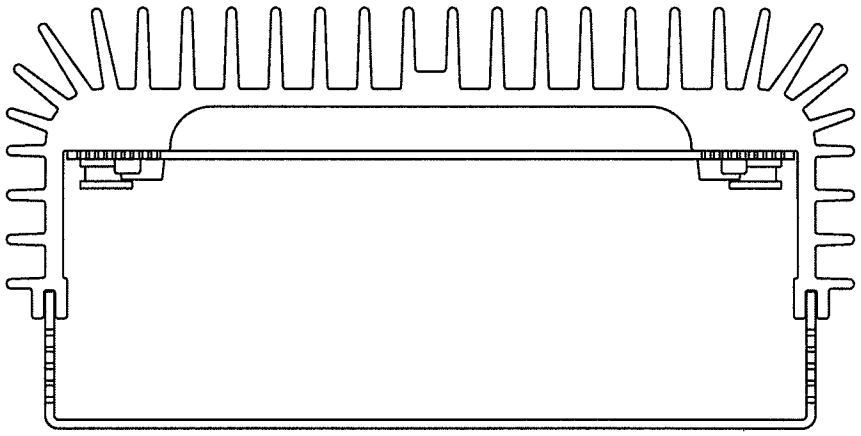


FIGURE 2b

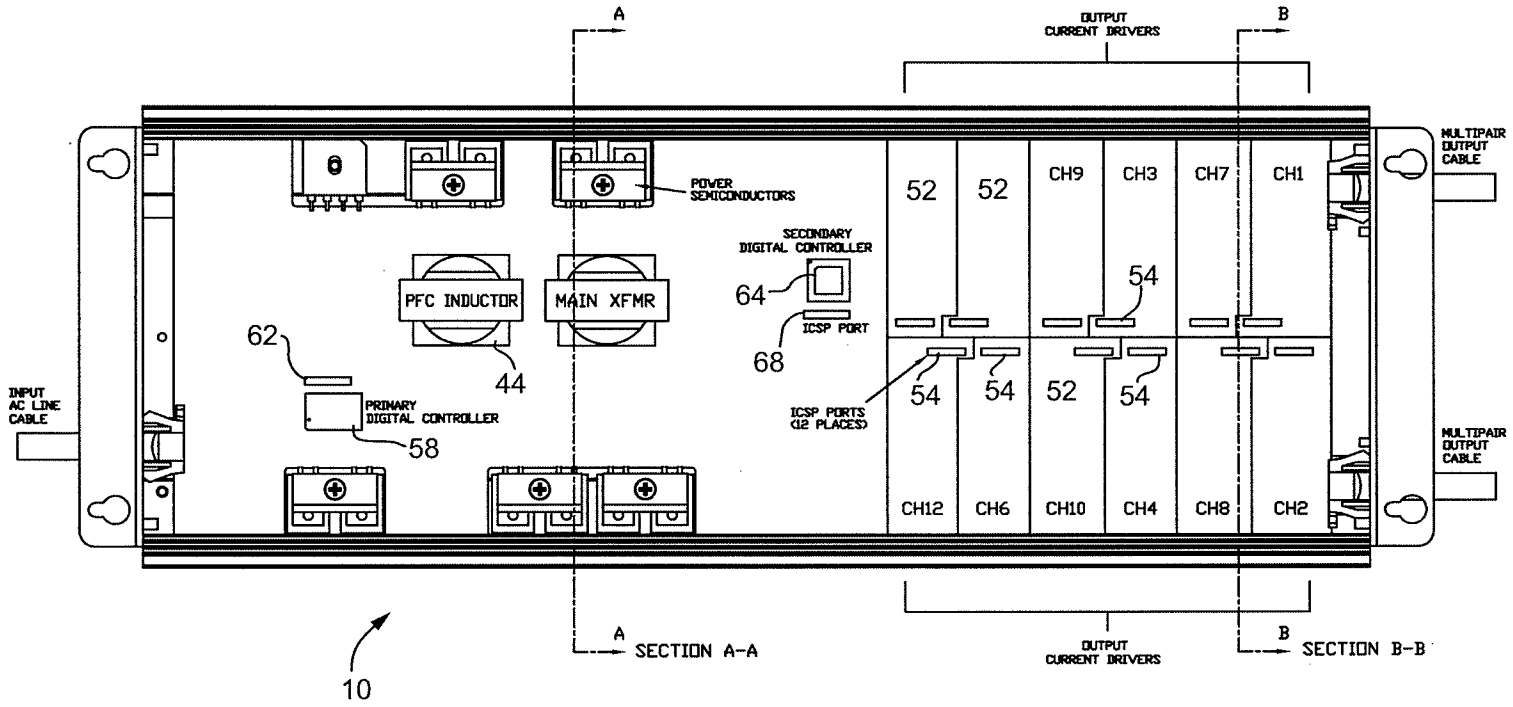

A
OUTPUT
CURRENT DRIVERS
B
MULTIPAIR
OUTPUT
CABLE
POWER
SEMICONDUCTORS
SECONDARY
DIGITAL CONTROLLER
52
52
CH9
CH3
CH7
CH1
54
PFC INDUCTOR
MAIN XFMR
64
ICSP PORT
62
68
44
INPUT
AC LINE
CABLE
PRIMARY
DIGITAL CONTROLLER
ICSP PORTS
(12 PLACES)
54
54
52
54
58
MULTIPAIR
OUTPUT
CABLE
CH12
CH6
CH10
CH4
CH8
CH2
A
SECTION A-A
OUTPUT
CURRENT DRIVERS
B
SECTION B-B
10

FIGURE 2c

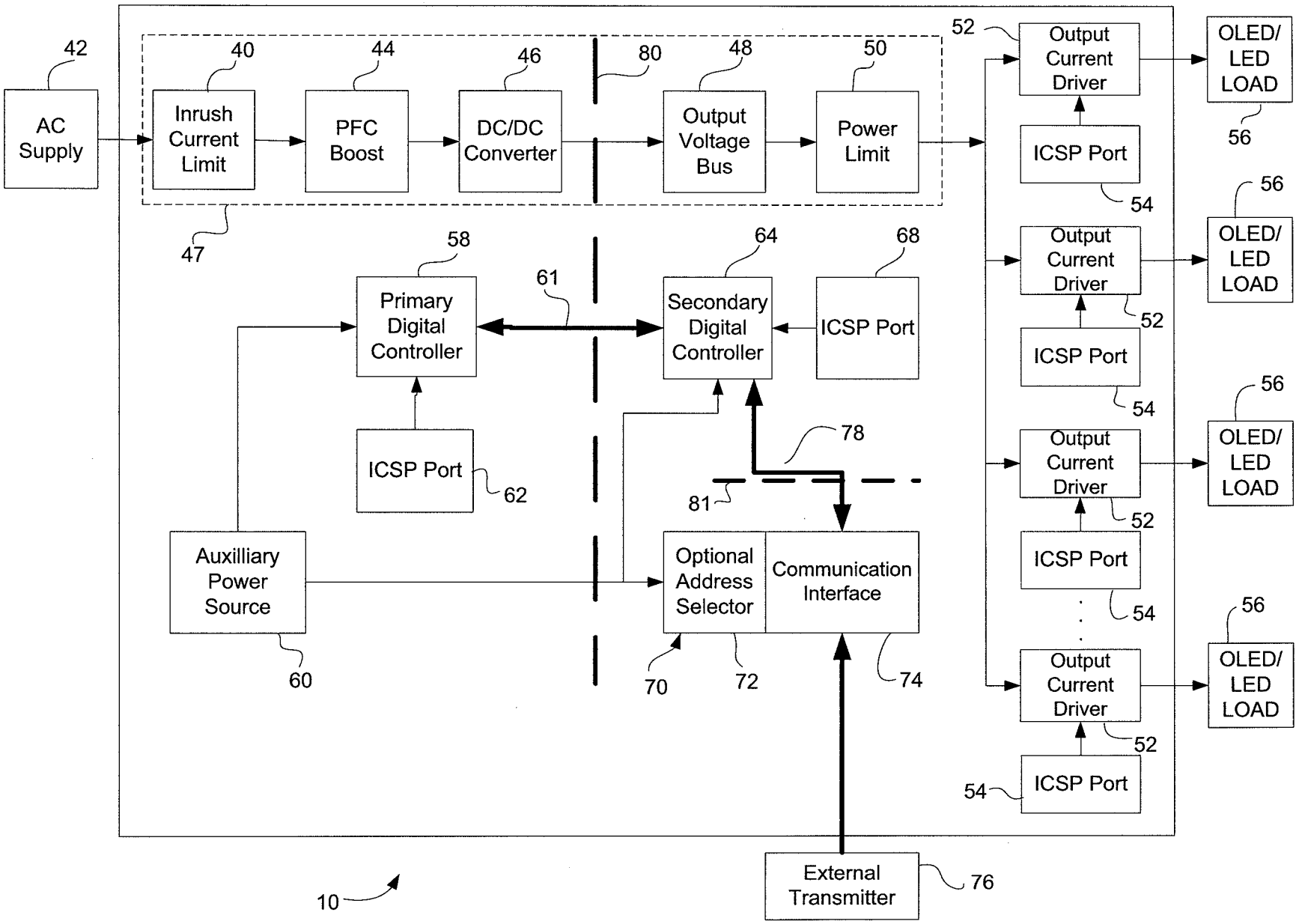

42
AC Supply
40
Inrush Current Limit
44
PFC Boost
46
DC/DC Converter
80
48
Output Voltage Bus
50
Power Limit
47
52
Output Current Driver
OLED/ LED LOAD
56
ICSP Port
54
58
Primary Digital Controller
61
64
Secondary Digital Controller
68
ICSP Port
ICSP Port
62
78
81
Auxilliary Power Source
60
Optional Address Selector
70
72
Communication Interface
74
External Transmitter
76
10

FIGURE 3

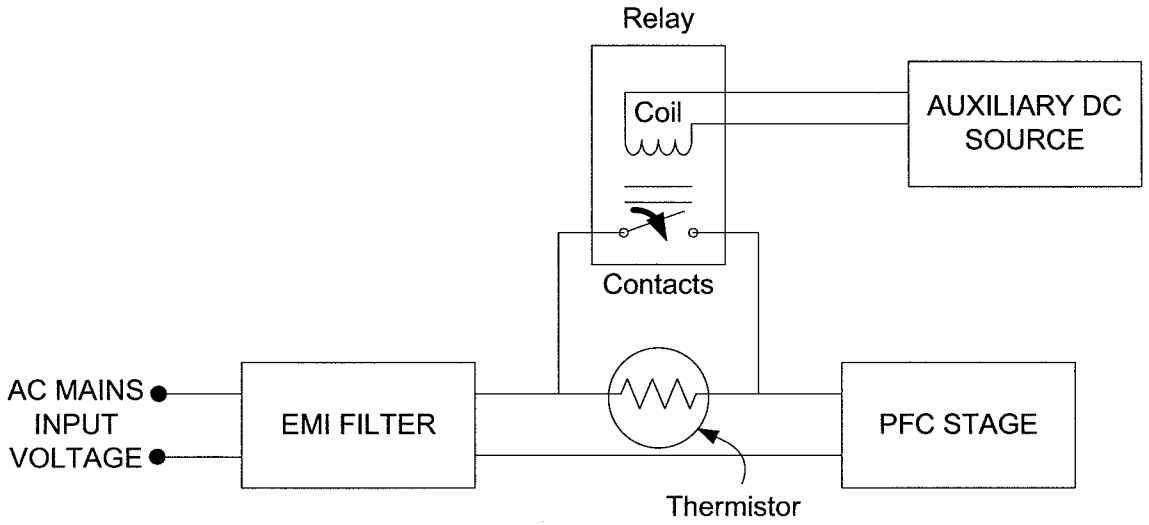


FIGURE 4 (PRIOR ART)

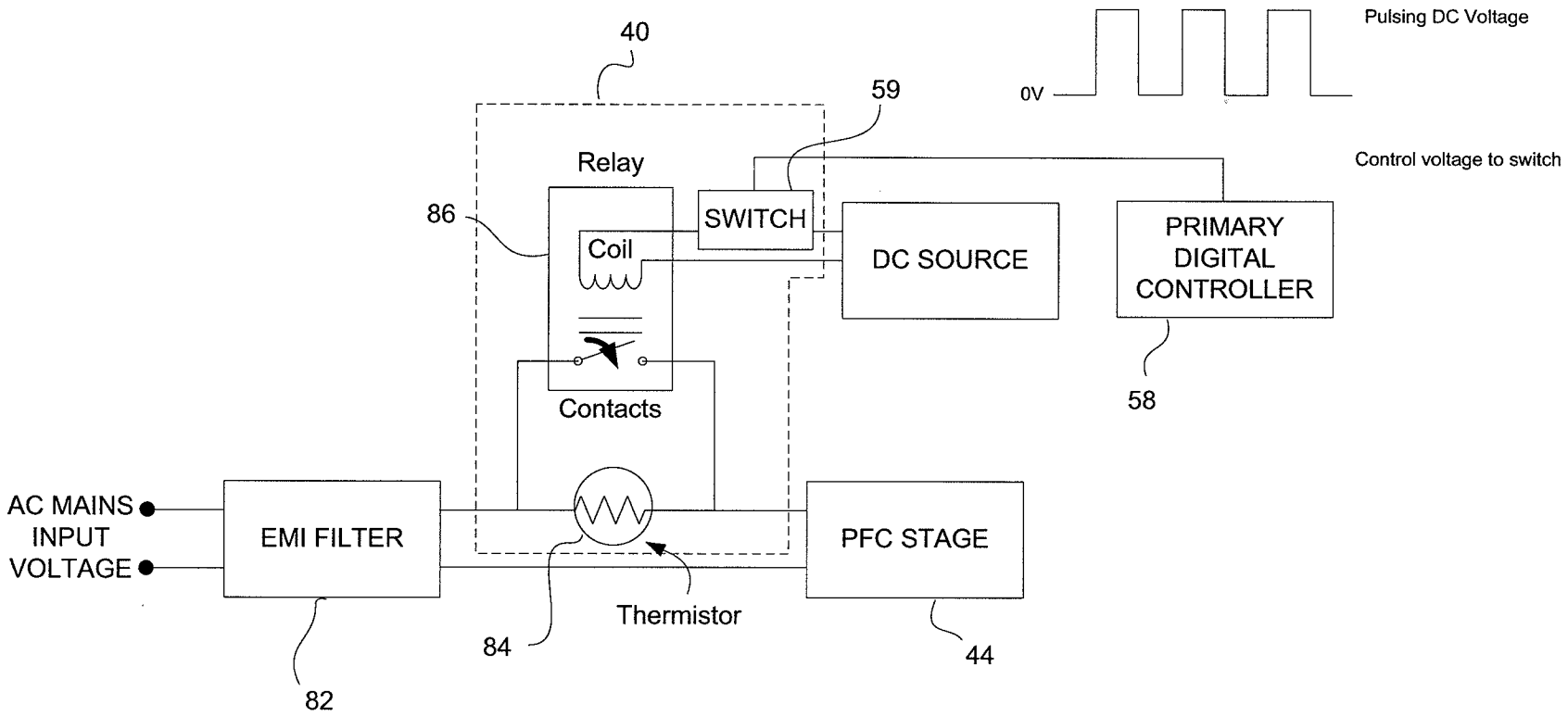

40
59
Pulsing DC Voltage
0V
Relay
Control voltage to switch
86
SWITCH
Coil
DC SOURCE
PRIMARY
DIGITAL
CONTROLLER
Contacts
58
AC MAINS
INPUT
VOLTAGE
EMI FILTER
PFC STAGE
Thermistor
84
44
82

FIGURE 5

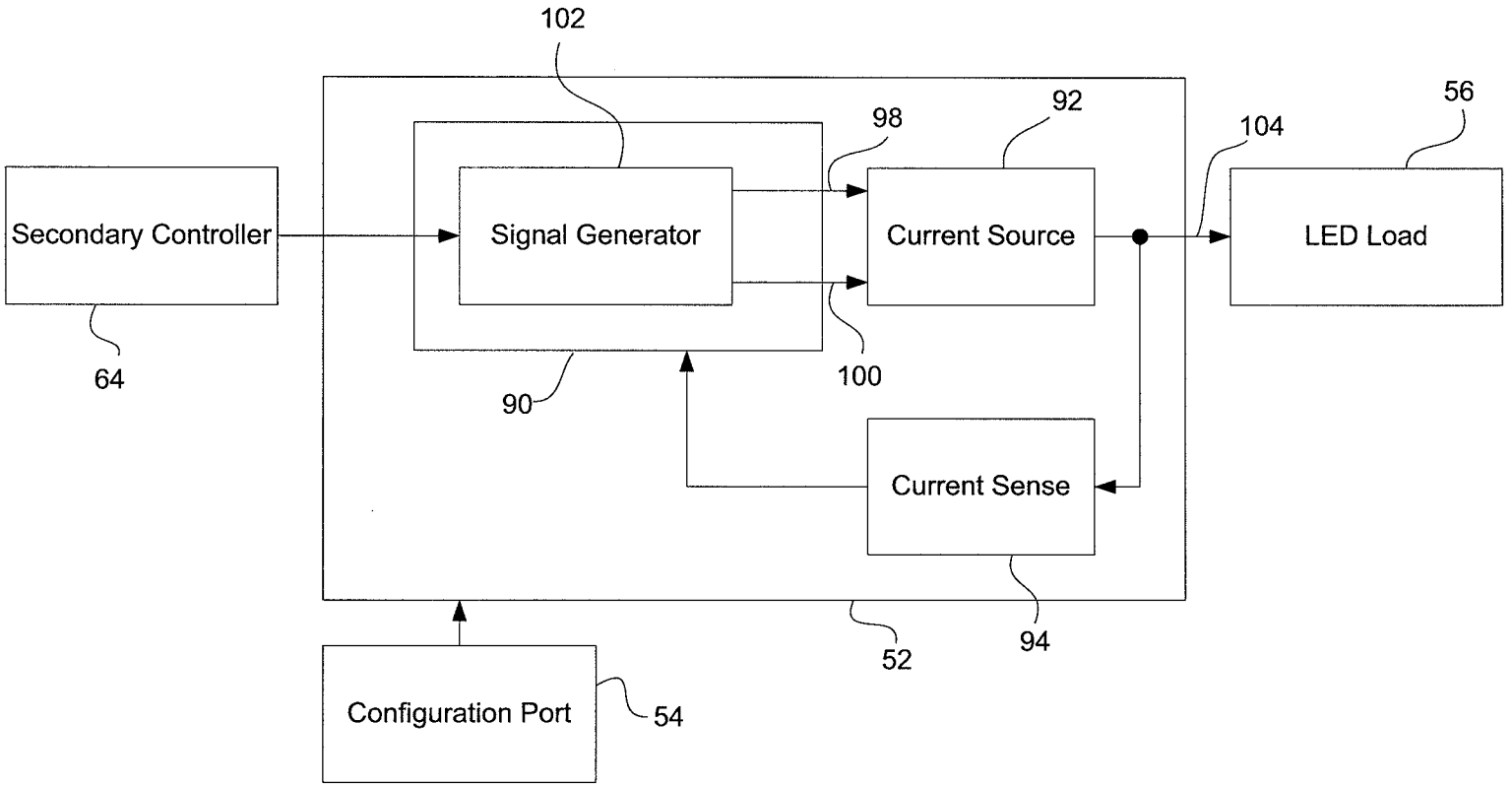

102
98
92
56
104
Secondary Controller
Signal Generator
Current Source
LED Load
64
90
100
Current Sense
94
52
Configuration Port
54

FIGURE 6

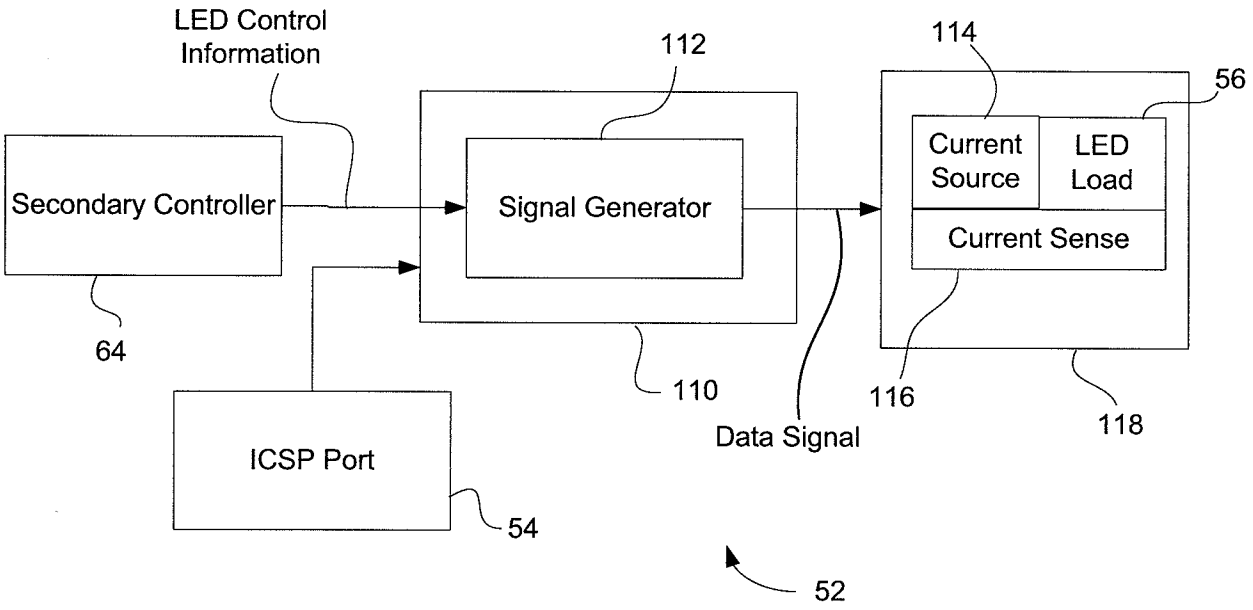

LED Control Information
112
114
56
Secondary Controller
Signal Generator
Current Source
LED Load
Current Sense
64
110
116
118
Data Signal
ICSP Port
54
52

FIGURE 7

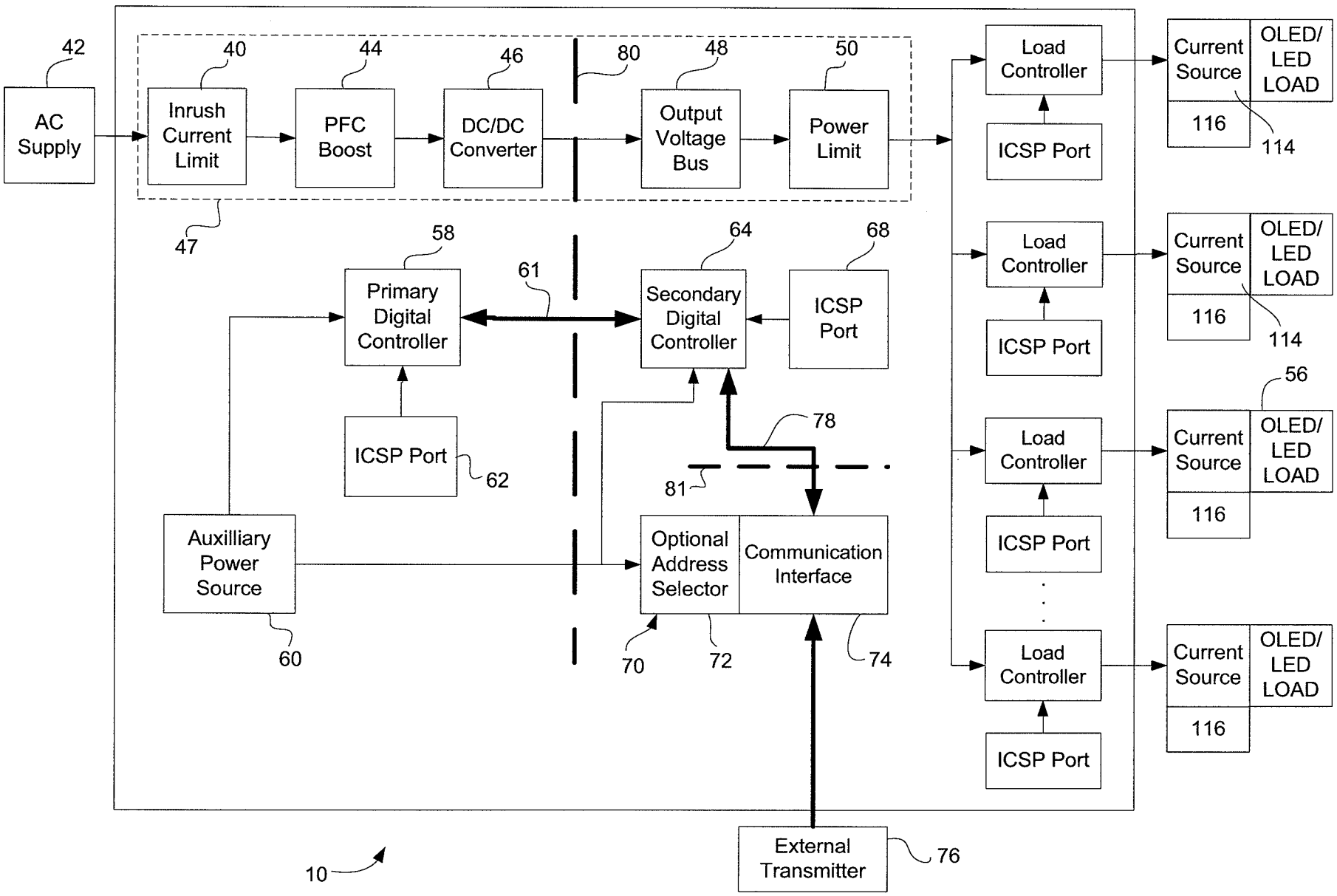

42
AC Supply
40
Inrush Current Limit
44
PFC Boost
46
DC/DC Converter
80
48
Output Voltage Bus
50
Power Limit
47
58
Primary Digital Controller
61
64
Secondary Digital Controller
68
ICSP Port
ICSP Port
62
78
81
Auxilliary Power Source
60
Optional Address Selector
70
72
Communication Interface
74
External Transmitter
76
10
Load Controller
ICSP Port
Current Source
116
OLED/ LED LOAD
114
56

FIGURE 8

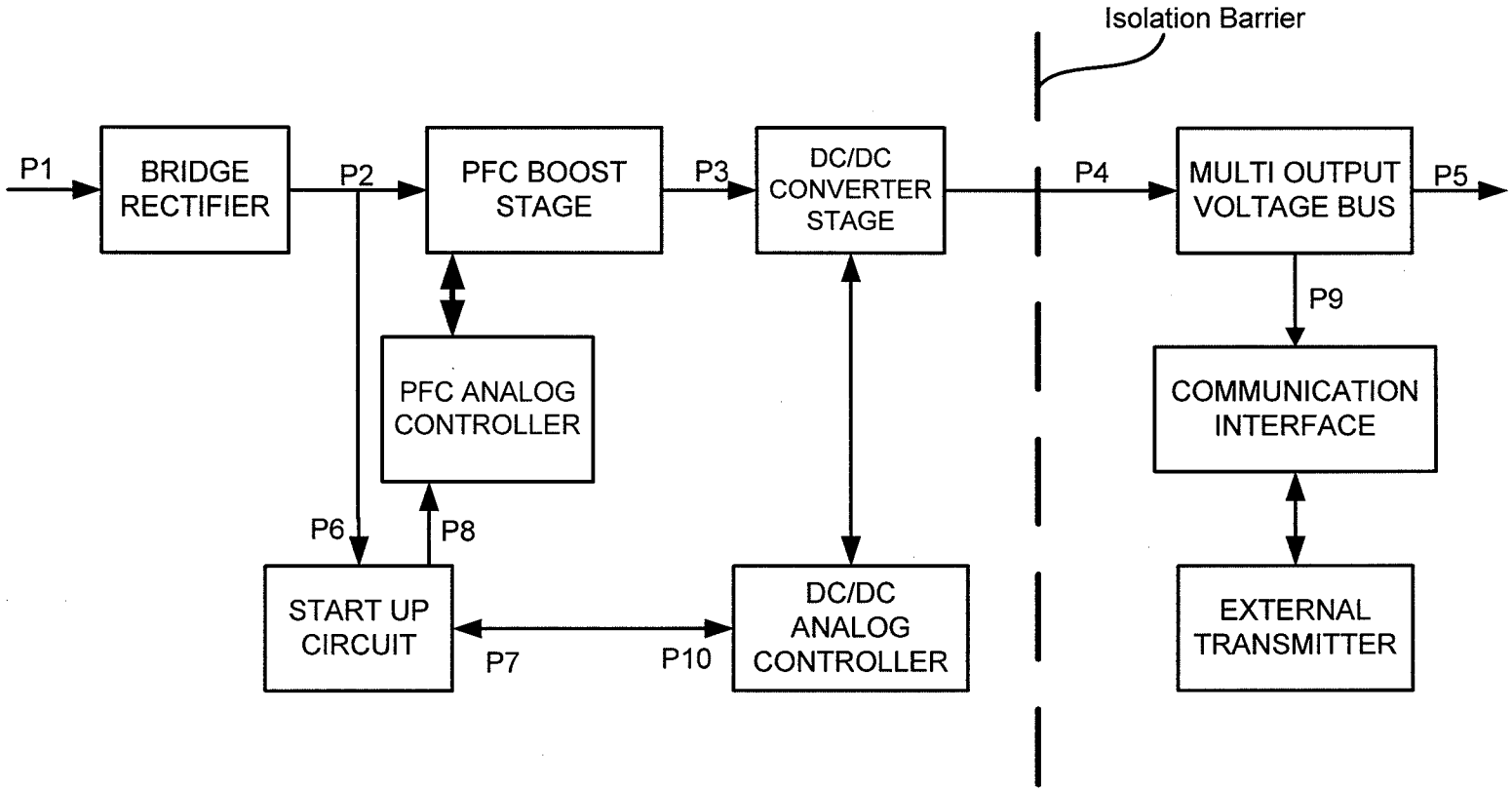


FIGURE 9 (PRIOR ART)

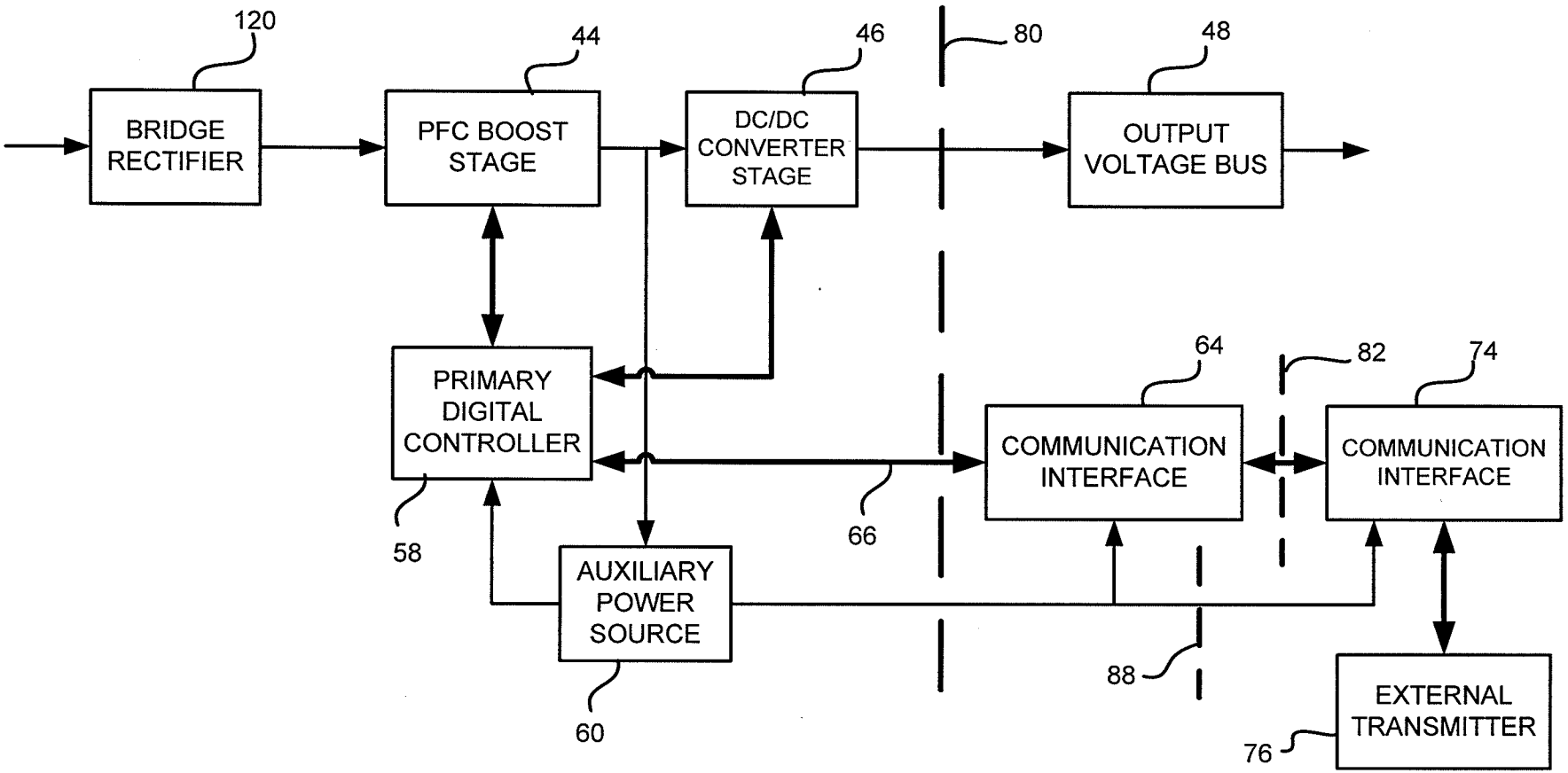

120
BRIDGE RECTIFIER
44
PFC BOOST STAGE
46
DC/DC CONVERTER STAGE
80
48
OUTPUT VOLTAGE BUS
PRIMARY DIGITAL CONTROLLER
58
AUXILIARY POWER SOURCE
60
66
64
COMMUNICATION INTERFACE
82
74
COMMUNICATION INTERFACE
88
EXTERNAL TRANSMITTER
76

FIGURE 10

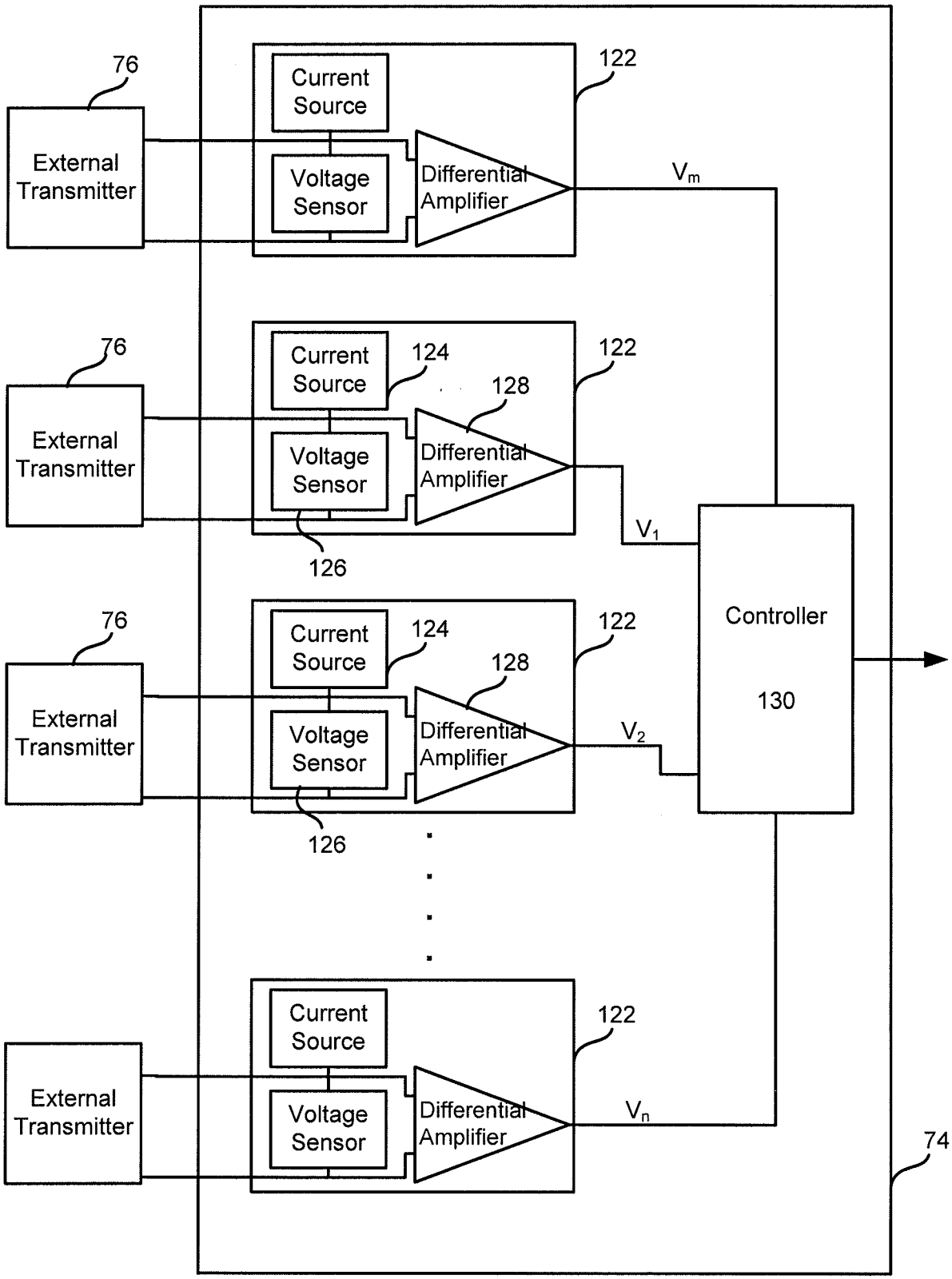

76
External Transmitter
Current Source
Voltage Sensor
Differential Amplifier
122
V_m
76
External Transmitter
Current Source
124
128
Voltage Sensor
Differential Amplifier
122
126
V_1
76
External Transmitter
Current Source
124
128
Voltage Sensor
Differential Amplifier
122
126
V_2
Controller
130
76
External Transmitter
Current Source
Voltage Sensor
Differential Amplifier
122
V_n
74

FIGURE 11

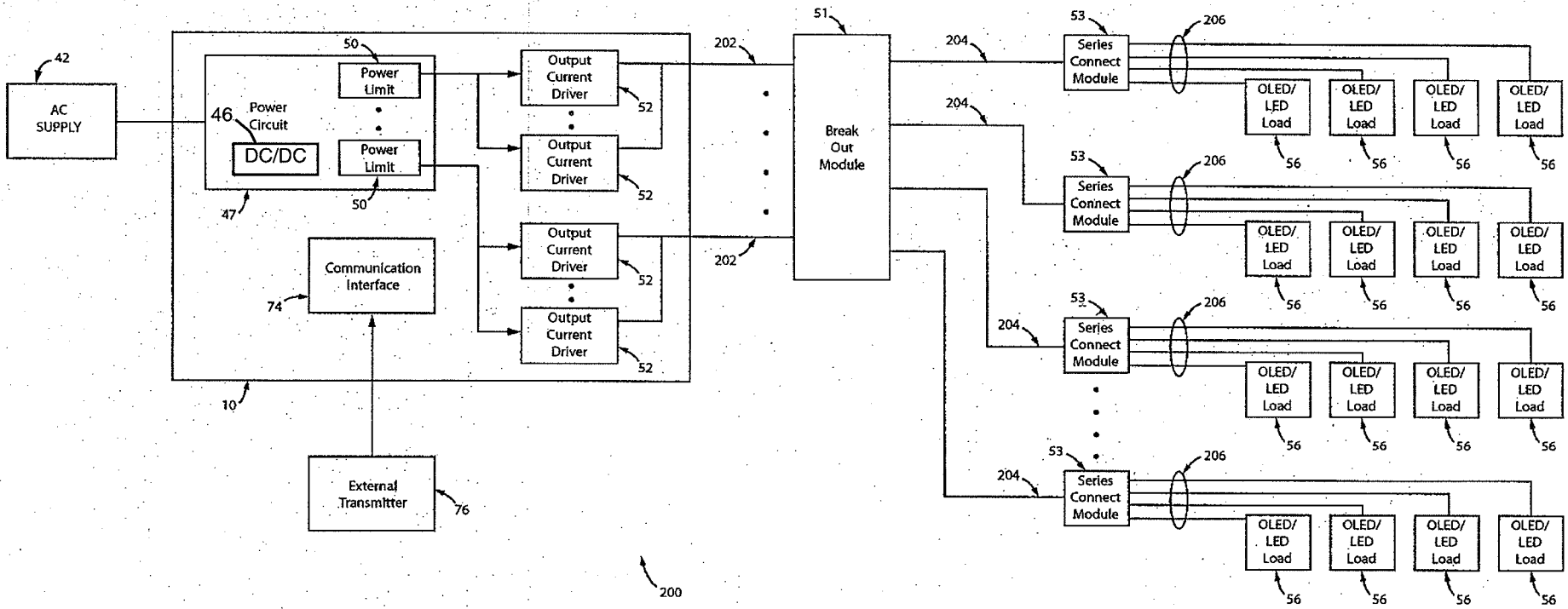

42
AC SUPPLY
46
Power Circuit
DC/DC
47
50
Power Limit
Power Limit
50
Output Current Driver
Output Current Driver
Output Current Driver
Output Current Driver
52
52
52
52
Communication Interface
74
10
External Transmitter
76
200
202
202
51
Break Out Module
204
204
204
204
53
Series Connect Module
Series Connect Module
Series Connect Module
Series Connect Module
206
OLED/ LED Load
56

Figure 12:

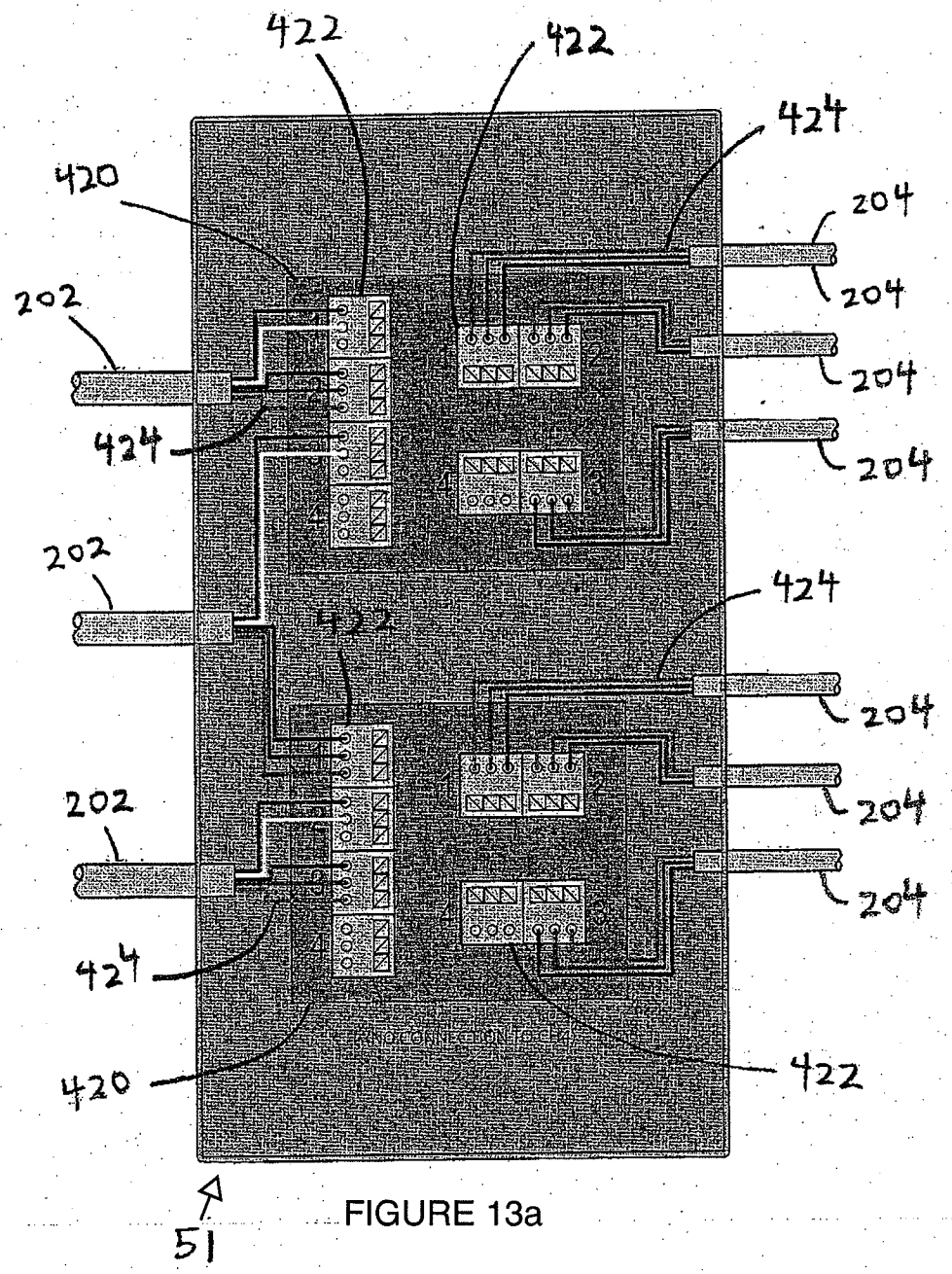


FIGURE 13a

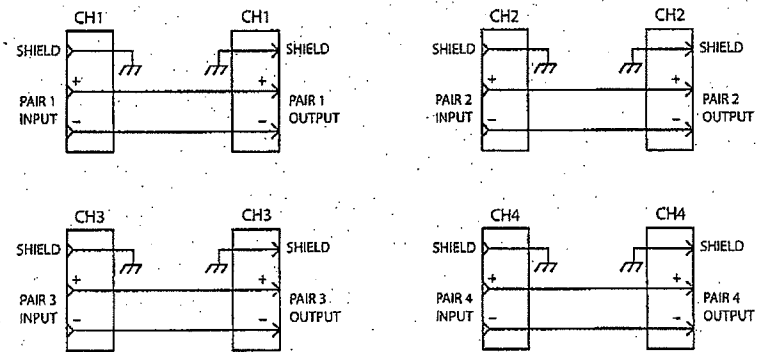


FIGURE 13b

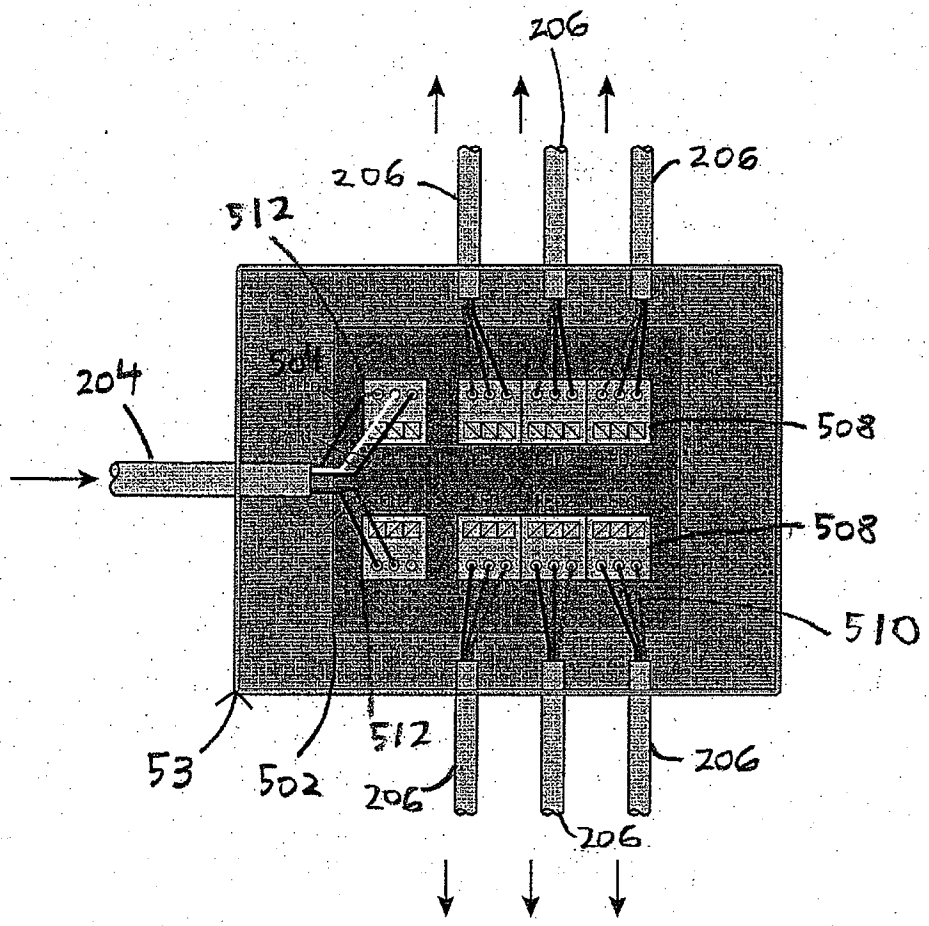


FIGURE 14a

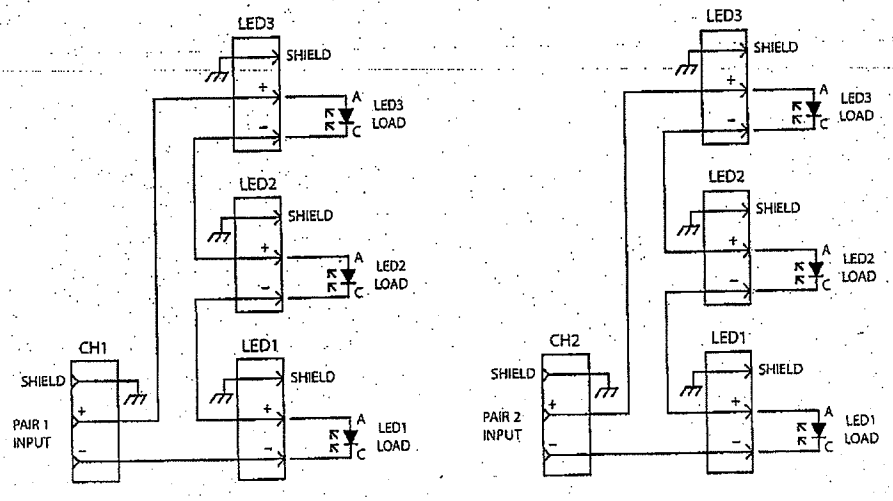


FIGURE 14b

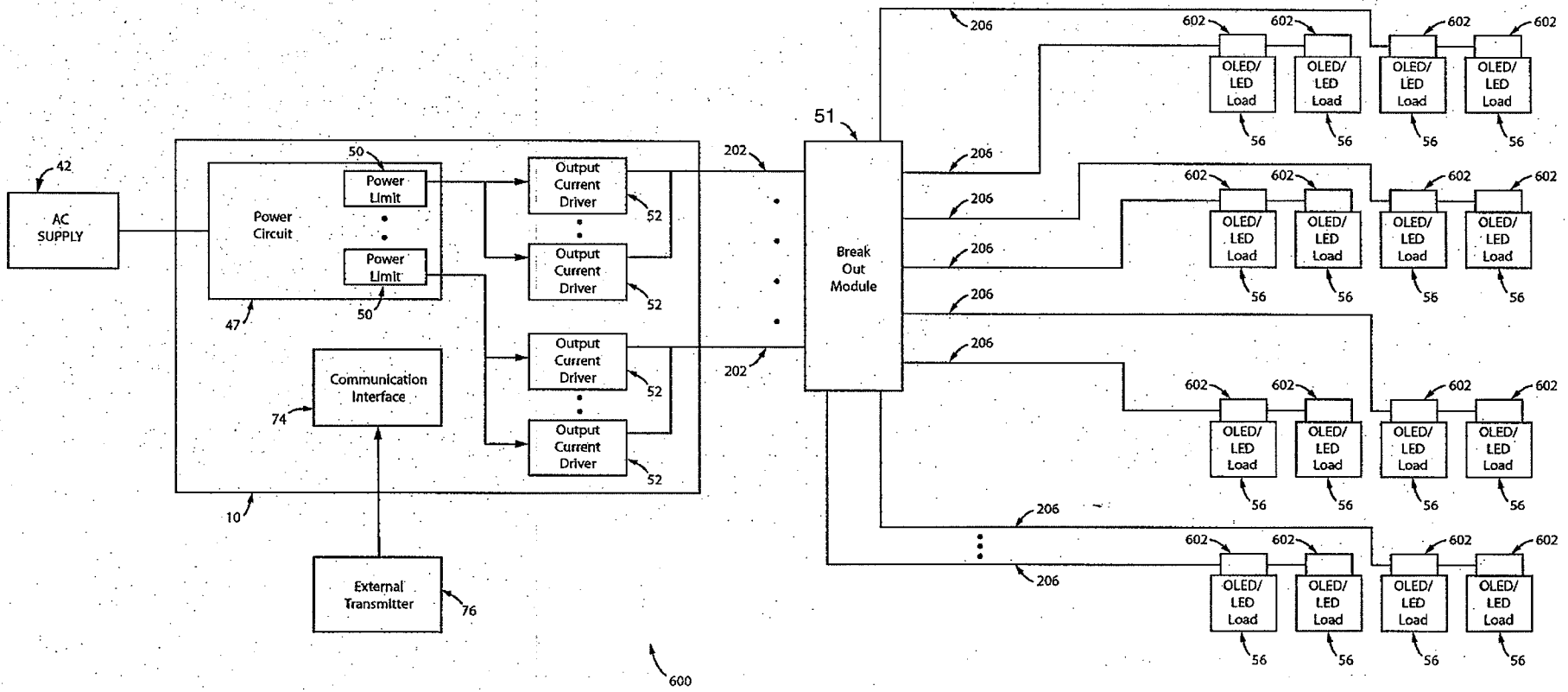

42
AC SUPPLY
Power Circuit
50
Power Limit
Power Limit
47
50
Output Current Driver
Output Current Driver
Output Current Driver
Output Current Driver
52
52
52
52
Communication Interface
74
10
External Transmitter
76
600
202
202
51
Break Out Module
206
206
206
206
206
206
206
602
OLED/ LED Load
56

Figure 15:

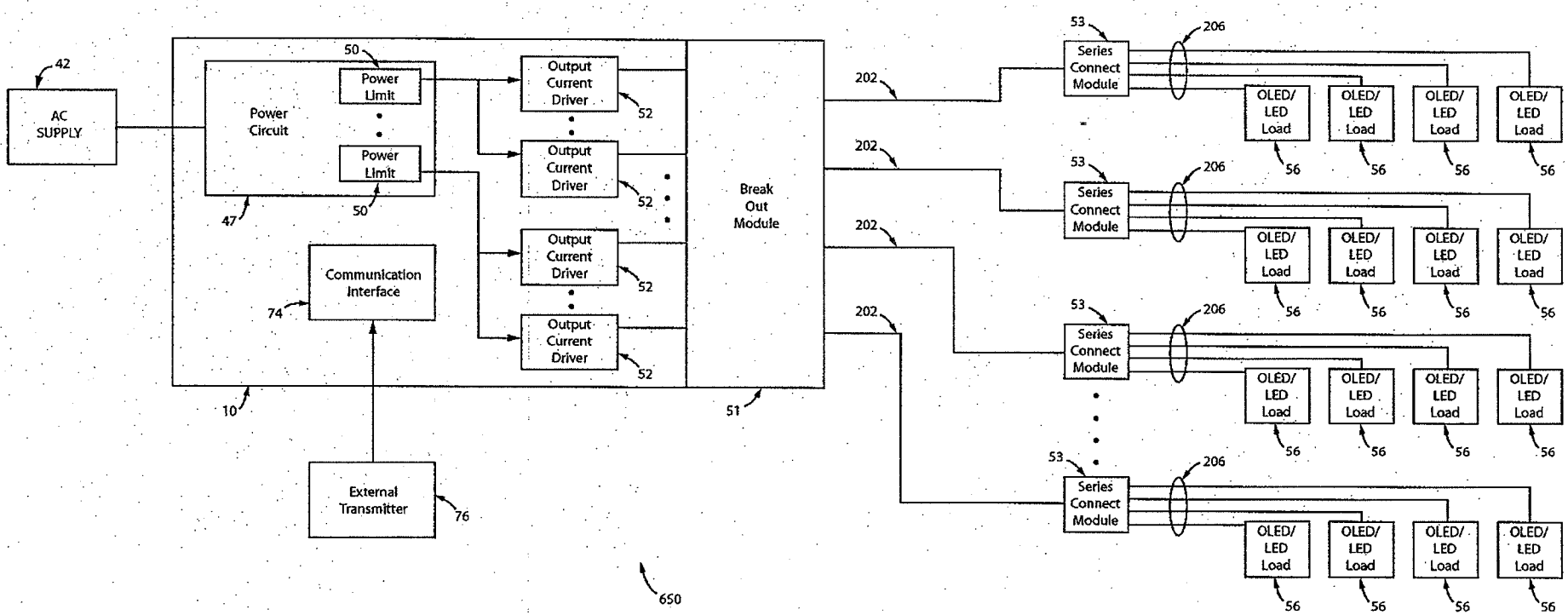
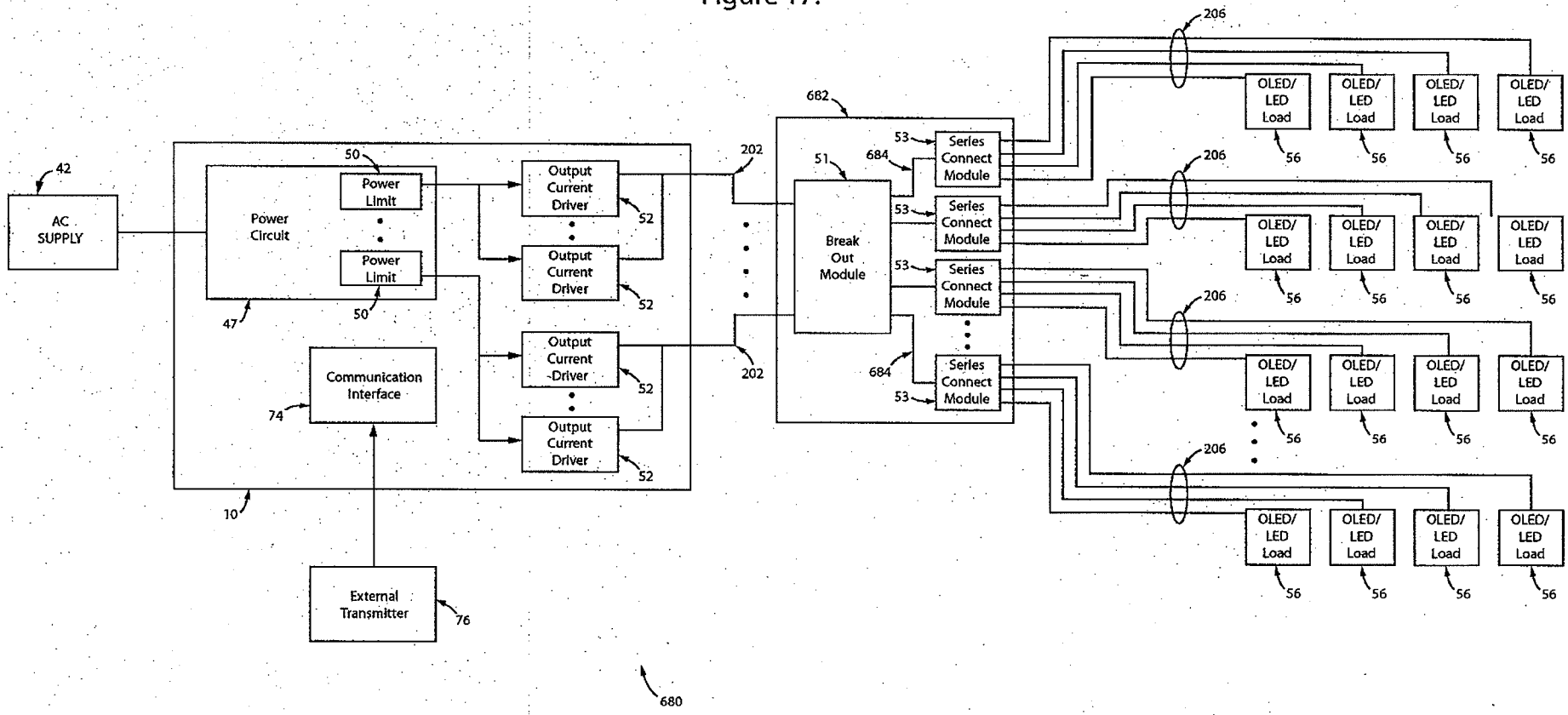

42
AC SUPPLY
Power Circuit
50
Power Limit
Power Limit
50
47
Communication Interface
74
External Transmitter
76
10
Output Current Driver
Output Current Driver
Output Current Driver
Output Current Driver
52
52
52
52
Break Out Module
51
650
202
202
202
202
53
Series Connect Module
206
OLED/ LED Load
56

Figure 16:

Figure 17:


42
AC SUPPLY
Power Circuit
50
Power Limit
Power Limit
50
47
Communication Interface
74
External Transmitter
76
10
Output Current Driver
Output Current Driver
Output Current Driver
Output Current Driver
52
52
52
52
202
202
682
51
Break Out Module
684
684
53
53
53
53
Series Connect Module
Series Connect Module
Series Connect Module
Series Connect Module
206
206
206
206
OLED/ LED Load
56
680

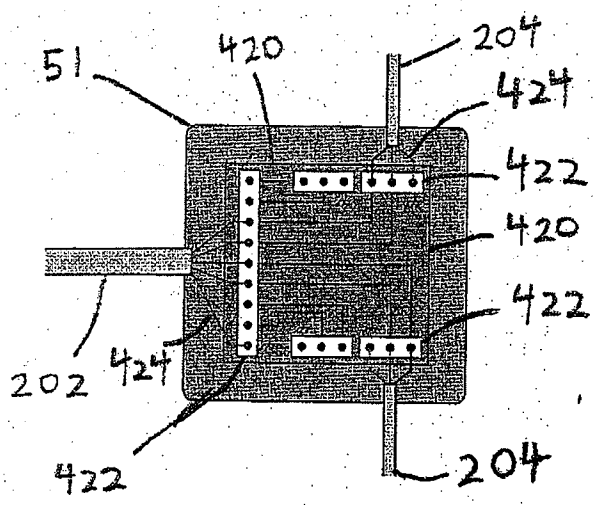


FIGURE 18a

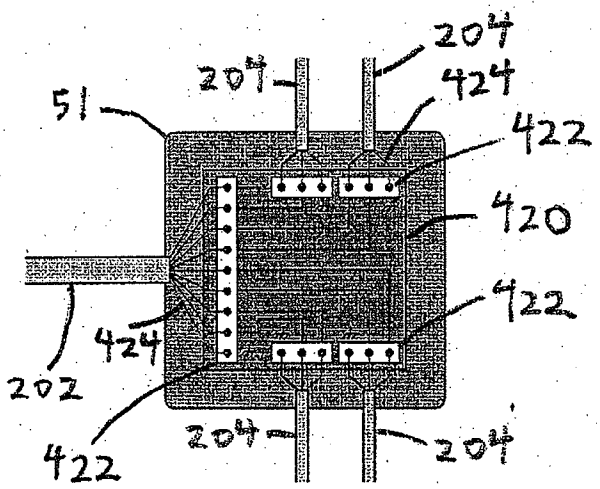


FIGURE 18b

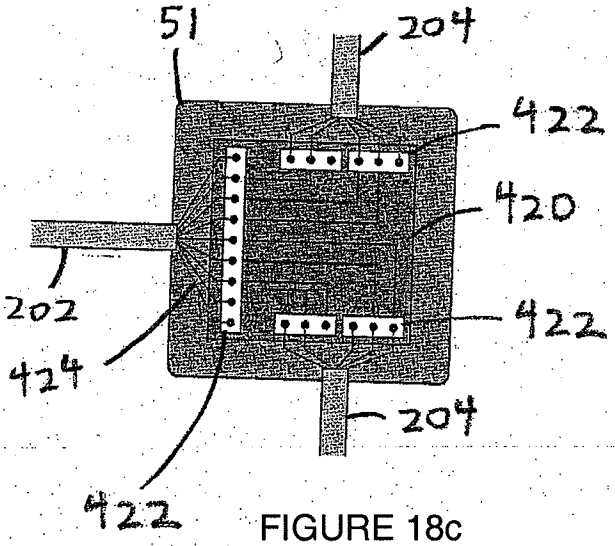


FIGURE 18c

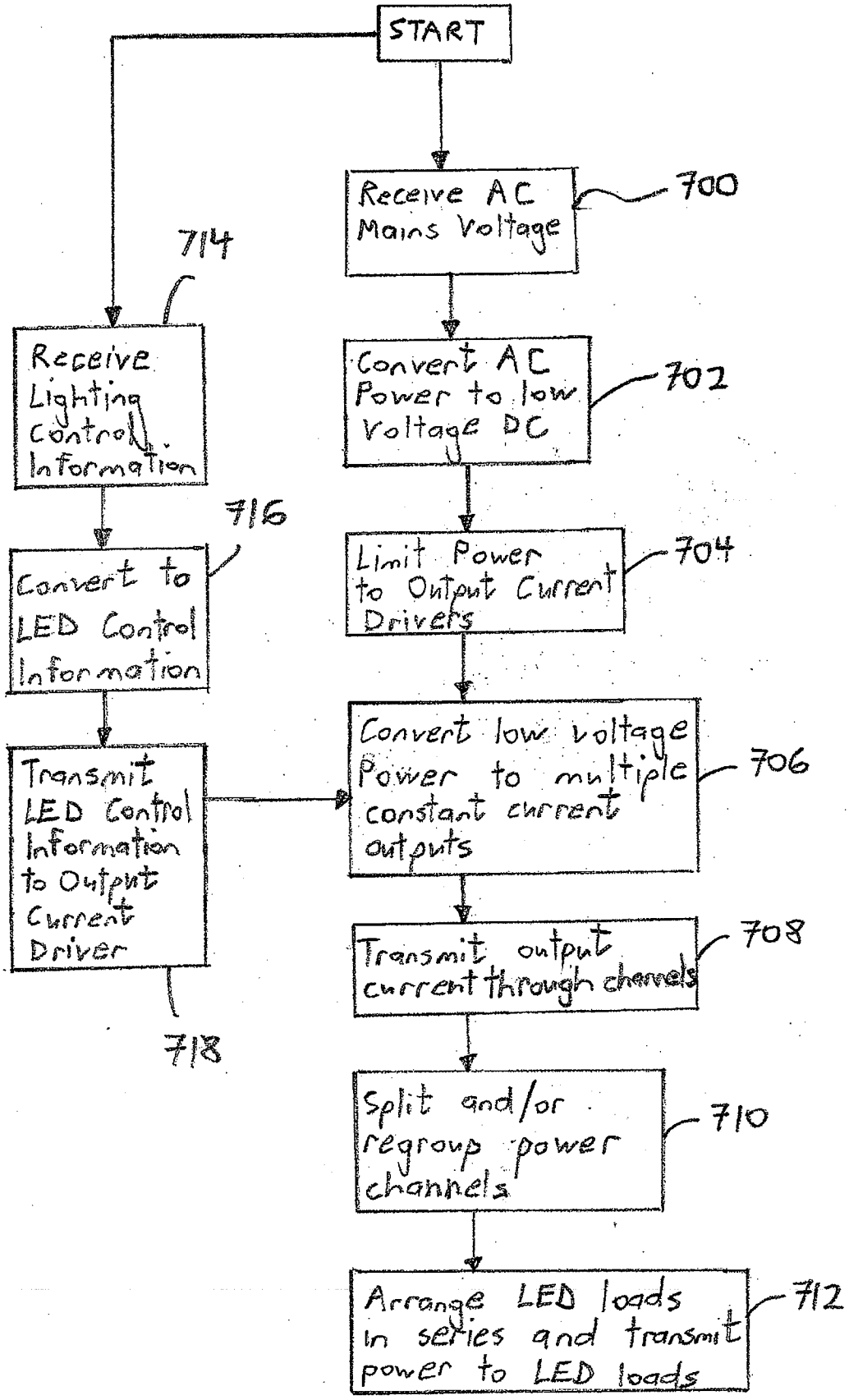

START
Receive AC Mains Voltage
700
Convert AC Power to low voltage DC
702
Limit Power to Output Current Drivers
704
Convert low voltage Power to multiple constant current outputs
706
Transmit output current through channels
708
Split and/or regroup power channels
710
Arrange LED loads in series and transmit power to LED loads
712
714
Receive Lighting Control Information
716
Convert to LED Control Information
Transmit LED Control Information to Output Current Driver
718

Fig 19