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CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,  
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MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,  
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(54) Title: SYSTEMS AND METHODS FOR DRIVING LIGHT EMITTING DIODES

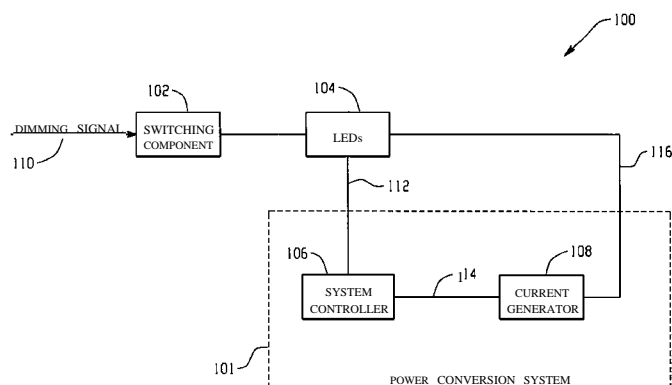


Fig. J

(57) Abstract: System and methods are provided for driving one or more light emitting diodes (LEDs) to reduce audible noise. An example system includes a switching component, a system controller, and a current generator. The switching component is configured to receive a dimming signal with a predetermined dimming frequency and configured to switch on or off the one or more LEDs in response to the dimming signal, the predetermined dimming frequency being outside a frequency band of the audible noise. The system controller is configured to receive a feedback signal related to a LED current that flows through the one or more LEDs and configured to generate a drive signal. Additionally, the current generator is configured to receive the drive signal, to generate a charging current to store energy during a charging period and to generate the LED current during a discharging period.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2012/022310

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. H05B33/08  
ADD.

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EPO-Internal , WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/251854 A1 (MATSUDA TOMOAKI [JP] ET AL) 16 December 2004 (2004-12-16) paragraph [0009] - paragraph [0054] ; figures 1-4 -----	1-11,19
Y	US 2010/148681 A1 (KUO CHING-CHUAN [TW] ET AL) 17 June 2010 (2010-06-17) the whole document -----	1-11,19
Y	US 2009/134817 A1 (JURNGWI RTH PAUL [CA] ET AL) 28 May 2009 (2009-05-28) paragraphs [0005], [0006], [0058], [0062] -----	1-11,19



Further documents are listed in the continuation of Box C.



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

24 August 2012

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20/11/2012

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US20 12/0223 10

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

see annex

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11, 19

System for driving LEDs to reduce audible noise comprising a current generator configured to generate a charging current to store energy during a charging period and generate an LED current during a discharging period.

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2. claims: 12-18, 20

System for driving strings of LEDs comprising a feedback signal detection circuit that controls dimming of respective strings of LEDs based upon their respective feedback signals.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

**PCT/US2012/0223 10**

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			EP 1967049 <b>AI</b>	10-09-2008
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			Wo 200707 1033 <b>AI</b>	28-06-2007
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