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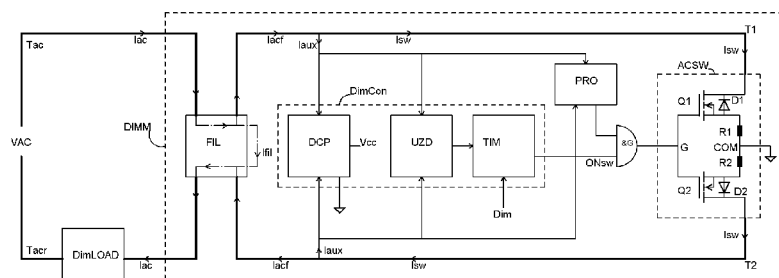
**(54) Title:** PHASE CUT DIMMING CONTROL AND PROTECTION

Fig. 2

(57) **Abstract:** A phase cut dimmer, coupled between an AC power source and a load, to control the amount of power delivered from the power source to the load, comprising: a dimmer switch to turn on and off the current from the power source to the load; the dimmer switch being an AC switch formed of a first MOSFET and a second MOSFET connected in anti-series; the two source electrodes of the MOSFETs being connected together to form a common source terminal and the two gate electrodes of the MOSFETs being connected together to form a switch control terminal; a line filter bypassing very low current at the line frequency; a rectifier to convert the AC voltage from the power source to pulsating DC voltage which is coupled to the dimmer switch; a very low power unipolar zero detector extracting a zero marker signal from the pulsating DC voltage; the unipolar zero detector comprising a voltage-controlled bleeder impedance, a comparator, a pulse generator, wherein the voltage-controlled bleeder impedance is coupled to the pulsating DC voltage whereby the bleeder impedance is controlled proportional to the instantaneous value of the voltage; the pulsating DC voltage is compared to a reference close to zero level by the comparator, triggering the pulse generator to generate the zero marker signal when the voltage is lower than the reference; a very low power adjustable timer to control the dimmer switch in synchronization with the zero marker signal.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2015/055681

**A. CLASSIFICATION OF SUBJECT MATTER**

H05B 33/08(2006.01)i

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, h02m

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)

WPI,EPODOC,CNPAT,CNKI,phase,cut,dimmer,dimming,two,wire,low,power,zero,LED, trailing,edge,fiter,MOSFET,timer

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                   | Relevant to claim No.     |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| X         | CN 103931276 A (LUTRON ELECTRONICS CO., INC.) 16 July 2014 (2014-07-16)<br>abstract, paragraphs [0052]-[0065], [0067], [0086]-[0088], [0108], [0117], figures 1-3, 6 | 1, 3, 4, 8-10, 16, 20, 23 |
| A         | CN 202353859 U (SHENZHEN HILS TECHNOLOGY CO., LTD.) 25 July 2012 (2012-07-25)<br>the whole document                                                                  | 1-25                      |
| A         | CN 202617436 U (ZHENG, RONGBIN) 19 December 2012 (2012-12-19)<br>the whole document                                                                                  | 1-25                      |
| A         | US 2012119669 A1 (MELANSON, JOHN L. ET AL.) 17 May 2012 (2012-05-17)<br>the whole document                                                                           | 1-25                      |
| A         | CN 101404844 A (SHENZHEN CIVILIGHT SEMICONDUCTOR LIGHTING CO., LTD.)<br>08 April 2009 (2009-04-08)<br>the whole document                                             | 1-25                      |

☐ 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                                                                | “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                                              |
| “E” | earlier application or patent but published on or after the international filing date                                                                               | “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                                                                     |
| “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) | “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 |
| “O” | document referring to an oral disclosure, use, exhibition or other means                                                                                            | “&” | document member of the same patent family                                                                                                                                                                                                    |
| “P” | document published prior to the international filing date but later than the priority date claimed                                                                  |     |                                                                                                                                                                                                                                              |

Date of the actual completion of the international search

15 January 2016

Date of mailing of the international search report

27 January 2016

Name and mailing address of the ISA/CN

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**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:

- [1] Claim 1 and 20 directed to a phase cut dimmer and a method of power control from an AC power source to a load by phase cut dimming, while claim 10 directed to an AC switch.

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 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.:

**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.

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/IB2015/055681**

| Patent document<br>cited in search report |            |    | Publication date<br>(day/month/year) | Patent family member(s) |            |    | Publication date<br>(day/month/year) |
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