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(71) Applicant: **ELDOLAB HOLDING B.V.** [NL/NL]; 5125, Science Park Eindhoven, 5692 ED Son En Breugel (NL).

(72) Inventors: **SAES, Marc**; 5125, Science Park Eindhoven, 5692 ED Son En Breugel (NL). **LYDECKER, Stephen Haight**; 1388, Brentford Cove, Snellville, Georgia 30078 (US). **VERSTEEGDE, Tijs**; 16, Nieuwe Fellenoord, 5612 KC Eindhoven (NL).

(74) Agent: **DE WEERDT, R.E.M.L. (EP&C)**; Postbus 3241, 2280 GE Rijswijk (NL).

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(54) Title: THE INVENTION RELATES TO THE FIELD OF LIGHTING APPLICATIONS, IN PARTICULAR LED BASED LIGHTING APPLICATIONS

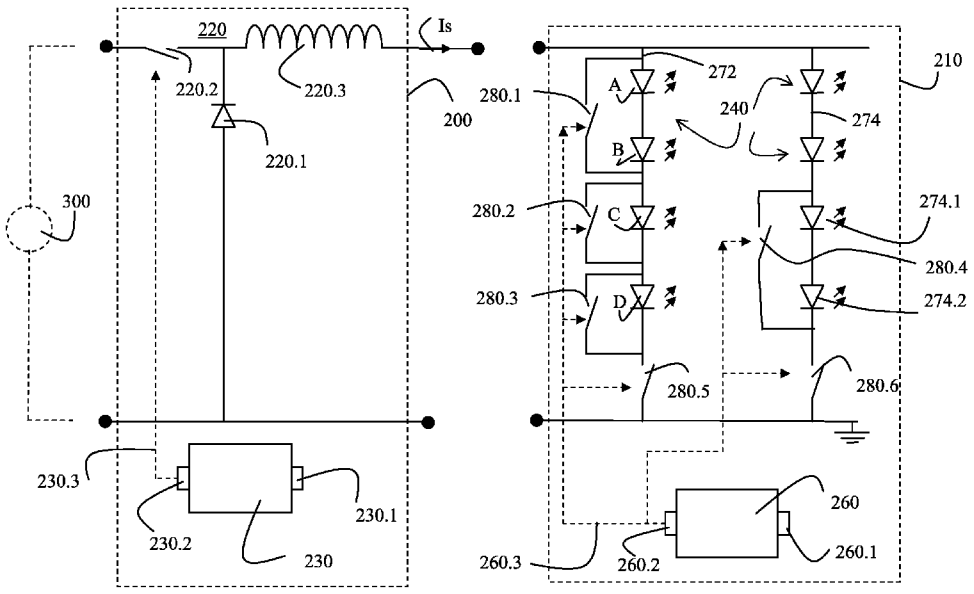

Figure 1

(57) Abstract: A modular system comprising a first component comprising an LED driver and a second component comprising a light engine is described. the LED driver comprising: a.a switched mode power converter configured to output a supply current; b.a first control unit configured to control a switch of the switched mode power converter, thereby controlling the supply current; the light engine comprising: c.an LED assembly configured to receive the supply current, the LED assembly comprising a plurality of LEDs and one or more switches arranged in series or in parallel with one or more LEDs of the plurality of LEDs, and d.a second control unit configured to control the one or more switches of the LED assembly, thereby controlling an LED current through the plurality of LEDs; wherein the first control unit is configured to control an amplitude of the supply current, the second control unit is configured to control a duty cycle of the LED current through the plurality of LEDs and wherein the first and second control unit are configured

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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to synchronize a switching operation of the switch of the switched mode power converter with a switching operation of the one or more switches of the light engine.

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2017/050255

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

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2014/333229 A1 (SAES MARC [NL] ET AL) 13 November 2014 (2014-11-13) paragraphs [0044], [0052] - [0057]; figure 2	17,19, 20,31-33 1-8, 10-16, 18, 21-23, 27-30, 34-36, 39-43, 46-52, 63-82

Y	US 2007/244366 A1 (MURATA MASANAO [JP]) 18 October 2007 (2007-10-18) paragraphs [0050] - [0051], [0067] - [0069], [0077] - [0082]; figures 5-8	63

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
30 November 2017	14/12/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Albertsson, Gustav

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2017/050255

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2008/116818 A1 (SHTEYNBERG ANATOLY [US] ET AL) 22 May 2008 (2008-05-22) paragraphs [0002], [0019], [0043] - [0072], [0077], [0080] - [0081]; figures 3-12	58,59, 61,62 1-8, 10-16, 18,28, 29, 41-43, 46-52, 63-82

X A	US 2006/022214 A1 (MORGAN FREDERICK M [US] ET AL) 2 February 2006 (2006-02-02) paragraphs [0176] - [0290]; figures 1-20	17,31, 58,61 1-16,32, 33,63-91

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X Y	US 2015/022112 A1 (NIETFELD DIETER [DE]) 22 January 2015 (2015-01-22) paragraphs [0023] - [0028], [0035] - [0040]; figures 1-4	58,61 21-23, 27, 34-36, 39,40

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Y	US 2013/106298 A1 (DATTA MICHAEL [US] ET AL) 2 May 2013 (2013-05-02) paragraphs [0031] - [0036], [0049]; figures 1-4	30

A	US 2015/123550 A1 (KUNST DAVID [US] ET AL) 7 May 2015 (2015-05-07) abstract; figures	1-91

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NL2017/050255

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.:

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: 1-20, 31-33, 63-91

A modular system comprising a first component comprising an LED driver, a second component comprising a light engine and a third component comprising an interface module,
the light engine comprising a plurality of LEDs or LED groups;
the interface module comprising:
- an input terminal for connecting to an output terminal of the LED driver;
- an output terminal for connecting to an input terminal of the light engine;
- a switch assembly comprising one or more switches for controlling a supply current of the LED driver, the supply current being received via the input terminal and provided to the light engine via the output terminal;
- a control unit having an input terminal for receiving a set point representing a desired illumination characteristic of the light engine, the control unit further having a processing unit for processing the set point and determining control signals for the switch assembly,
the LED driver comprising:
- a switched mode power converter configured to output the supply current;
- an LED driver control unit configured to control a switch of the switched mode power converter, thereby controlling the supply current;
wherein the control unit and the LED driver control unit are configured to co-operate and control the supply current and the supply of the supply current to the light engine in accordance with the desired illumination characteristic, and wherein the control unit and the LED driver control unit are configured to synchronize a switching operation of the switch of the switched mode power converter with a switching operation of the one or more switches of the switch assembly of the light engine.
This invention relates to a modular lighting system, having 3 main modules: a LED driver, a light engine and an interface module. In an alternative embodiment there are 2 main components: a LED driver and a light engine. This invention combines a modular design with coordination (synchronization) of switching action in the LED driver and in the interface module or light engine.
The problem to be solved can be described as: how to suppress current transients when switching LED current.

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2. claims: 21-30, 34-62

The modular system according to any of the claims 17 to 20, wherein the control unit is configured to determine a current modulation scheme and a duty cycle modulation scheme

for the LED driver and the light engine based on the set point.
This invention relates to the combination of a current modulation (AM) in the LED driver and a load modulation (PWM) of the light source, according to a setting (set point).
This invention solves the problem of how to provide a wide range of power levels in a LED lighting system.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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