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(88) Date of publication of the international search report:
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(54) Title: A METHOD AND APPARATUS FOR CONTROLLING A LOAD

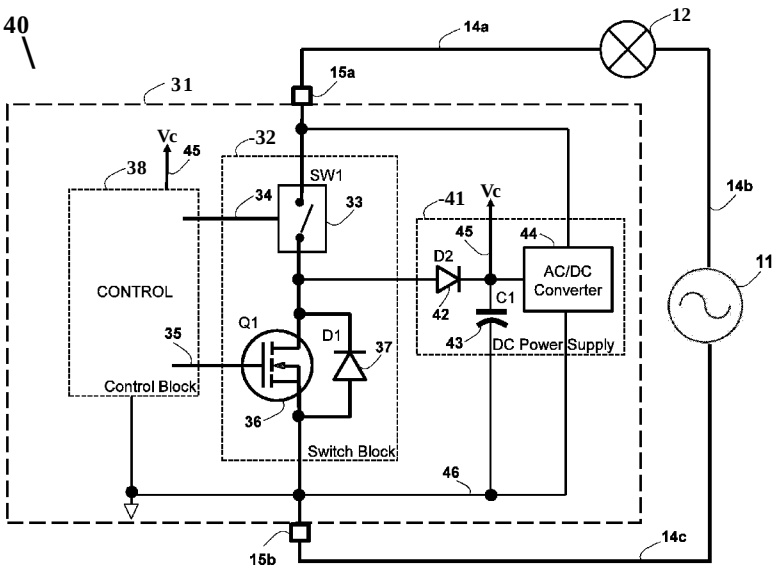


FIG. 4

(57) Abstract: A method and apparatus for switching AC power to a lamp (or other load) via a two terminal switch device. The switch device comprises a first electrically controlled switch, such as a triac or relay, and a second electrically controlled resistance or switch connected in series to the first switch. A diode is connected in parallel to the second switch. When the first switch is open, only a leakage current is flowing through the switch device, supplied to an AC/DC converter for producing a low DC voltage to the switch device logic and other low-voltage circuits and for charging a capacitor. When the first switch is closed, the second switch is controlled to be conductive for allowing powering the lamp from the AC power. During part of a positive half-cycle of the AC voltage, a closed loop regulates a DC voltage over the second switch terminals for providing a low DC voltage for charging a capacitor. At least during a negative half-cycle of the AC voltage, the low DC voltage is provided from the capacitor.

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# INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H05B 39/04, H05B 39/02 (2016.01)
CPC - Y02B20/42, H05B39/08, H05B37/0281
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)
IPC(8) - H05B 39/04, H05B 39/02 (2016.01 ); CPC - Y02B20/42, H05B39/08, H05B37/0281

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8) - H05B 39/04, H05B 39/02 (2016.01); CPC - Y02B20/42, H05B39/08, H05B37/0281 , H02M5/2573, H02M5/2576, H05B39/02, H05B39/04; USPC: 315/208, 315/297, 323/238, 323/325

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Electronic Database Searched: PatBase; Google Scholar/Patents
Search Terms Used: AC, DC, sensor, detector, first switch, second switch, state, relay, node, terminal, wireless, lighting, ballast, appliance, WiFi, Bluetooth, voltage, FET, MOSFET, transistor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y<br>---<br>A | US 6,867,558 B2 (Gaus, Jr. et al.) 15 March 2005 (15.03.2005), entire document, especially FIG. 3; col. 7, ln. 28-50;col. 7, ln. 51 to col. 9, ln. 34; col. 8, ln. 48-64 | 1-3, 8-9, 14-15, 28-36, 92-93, 104-105<br>---<br>4-7, 10-13, 16-27, 45-68<br>---<br>37-44, 69-91, 94-103 |
| Y | US 2011/0193495 A1 (Mishima et al.) 11 August 2011 (11.08.2011), para. [0041], [0044] | 4-7, 10-11 |
| Y<br>---<br>A | US 2011/0279053 A1 (Briggs) 17 November 2011 (17.11.2011), para. [0064], [0068] | 12-13<br>---<br>37-44, 69-78 |
| Y | US 2014/0167912 A1 (Snyder et al.) 19 June 2014 (19.06.2014), para. [0104], [0109], [0125], [0150], [0151] | 16-27 |
| Y | US 2012/0044350 A1 (Verfuerth) 23 February 2012 (23.02.2012), para. [0033], [0036], [0043], [0061] | 45-50 |
| Y | US 2002/0011923 A1 (Cunningham et al.) 31 January 2002 (31.01.2002), para. [0027], [0059], [0085], [0098]-[0099], [0159] | 51-68 |
| A | US 2014/0125230 A1 (Shteynberg et al.) 08 May 2014 (08.05.2014), para. [0160], FIG. 1 | 69-91 |

☐ 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
"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 |
|---|---|
| 01 March 2016 | 11 MAR 2016 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-8300 | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/210 (second sheet) (January 2015)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL 15/50946

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. Ill 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 extra 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 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.:
1-105

**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

International application No.

PCT/IL 15/50946

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

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1 . In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-105 drawn to a device connectable to an AC power source and a load, wherein the device comprises a first electrically controlled switching component and a second electrically controlled switching component, wherein a logic circuit controls the switching components from a first to a second state, thereby controlling how to pass the AC power signal.

Group II: Claims 106-161 drawn to a device connectable to an AC power source and a load, wherein the device comprises an electrically controlled switching component and a sensor coupled to sense the voltage.

Group III: Claims 162-180 drawn to a device connectable to an AC power source and a load, wherein the device comprises an electrically controlled switching component and a voltage detector coupled to sense the polarity or the magnitude of the voltage and a logic circuit.

Group IV: Claims 181-194 drawn to multiway AC power switching system in a building comprising an AC power source, an AC load, a first switch in a first single enclosure, a second switch in a second single enclosure.

The inventions listed as Groups I through IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Groups II-IV do not require a first electrically controlled switching component and a second electrically controlled switching component with connections to a first through eights terminals, as required by group I.

Groups I and 11 IV do not a sensor coupled to sense the voltage across the third and fourth terminals for producing a voltage to the fifth terminal in response to sensed voltage, as required by group II.

Groups I-II and IV do not require a voltage detector coupled to sense the polarity or the magnitude of the voltage across the third and fourth terminals; and a logic circuit coupled to output the control voltage at a fifth terminal and to the voltage detector, as required by group III.

Groups I-III do not require a multiway AC power switching system in a building comprising a first switch in a first single enclosure that is dimensioned and shaped to be installed in a light switch outlet cavity and a second switch in a second single enclosure that is dimensioned and shaped to be installed in a light switch outlet cavity, as required by group IV.

The following features are shared by the groups:

The only feature shared by Groups I through III that would otherwise unify the groups, is the a device having two terminals connectable in series to an AC power source and a load for switching an AC power signal from the AC power source to the load, the device comprising in a single enclosure:
a first terminal for connecting to the AC power source;
a second terminal for connecting to the load.
Group IV also shares the feature of an AC power source and an AC load, which will be addressed here as well.

Additionally, Groups II and III share the following features:
an electrically controlled switching component comprising a switch between third and fourth terminals that is controlled by a voltage at a fifth terminal, the third terminal coupled to the first terminal and the fourth terminal coupled to the second terminal so that the power signal is passed between the third and fourth terminals;
a sensor/detector to sense the voltage across the third and fourth terminals.

Additionally, Groups II and III share the following features:
a logic circuit coupled to the fifth terminal, wherein the logic circuit controls the state (open/closed) of the switch and is configured to stop the power signal.

Additionally, Groups I and IV share the following features:
a first switch and a second switch, wherein the switches are configured to change states (open/closed) and allow AC power to pass to the load.

—see extra sheet—

Continuation form previous page:

However, these shared technical feature does not represent a contribution over prior art, because the shared technical features are anticipated by US 6,867,558 B2, "Method and apparatus for networked lighting system control," published 15 March 2005 (15.03.2005), to Gaus, Jr. et al. (hereinafter Gaus).

Gaus teaches
a device having two terminals (addressable wall switch 48, FIG. 3) connectable in series (connected by terminal 26 to power source) to an AC power source (shown by neutral and hot lines 12 and 14) and a load (connected by terminal 24 to ballast 32/lamp 16) for switching an AC power signal from the AC power source to the load (col. 7, In. 28-50), the device comprising in a single enclosure (dashed line around wall switch 48 denotes a single enclosure for all components within the line):
a first terminal for connecting to the AC power source (terminal 26 to power source);
a second terminal for connecting to the load (terminal 24 to ballast 32/lamp 16);
an electrically controlled switching component (switch component 50, comprising two switches SW1 and SW2) comprising a switch between third and fourth terminals that is controlled by a voltage at a fifth terminal, the third terminal coupled to the first terminal and the fourth terminal coupled to the second terminal so that the power signal is passed between the third and fourth terminals (see FIG. 3, full operation of the switching component 50 is described in col. 7, In. 51 to col. 9, In. 34, see table 2 for the states of the switches);
a sensor/detector to sense the voltage across the third and fourth terminals (sensed voltage across the switches is notes as on-off sense signal line going to the PLC module 42);
a logic circuit (PLC module 42) coupled to the fifth terminal, wherein the logic circuit controls the state (open/closed) of the switch and is configured to stop the power signal (col. 8, In. 48-64, the triac 52 is controlled by the embedded processor in the PLC transceiver module 38 which in turn controls the switch 50); and
a first switch (SW1) and a second switch (SW2), wherein the switches are configured to change states (open/closed) and allow AC power to pass to the load (col. 8, In. 48-64, see also table 2 for the states of the switches).

As the technical feature was known in the art at the time of the invention, this cannot be considered a special technical feature that would otherwise unify the groups.

Groups I through IV therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.