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(54) **OPERATING DEVICE FOR LIGHTING MEANS**

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention is, generally, in the area of operating devices for lighting means, which are controllable by means of NFC communication.

BACKGROUND OF THE INVENTION

[0002] Near Field Communication, NFC, modules can be used for configuring LED drivers or other operating devices for lighting means. Usually, a control circuitry of the LED driver or operating device, such as a microcontroller, can be used in order to communicate with the NFC module.

[0003] It is known to use such NFC modules to translate a configuration signal for the LED driver into a pulse-width-modulated signal (e.g., representing an LED current) which can be fed to an integrated control circuit of the LED-driver without the need of further intelligence, such as an extra control circuitry or microcontroller.

[0004] Typically, such NFC modules convert a NFC signal into a PWM signal via an integrated circuitry on the NFC module, wherein the duty cycle of the PWM signal reflects the wirelessly received signal.

[0005] Moreover, it is known that a control circuitry for operating devices for lighting means can comprise a programming input pin, at which such analog DC voltage may be supplied in order to input a nominal value for the current through the lighting means, especially through an LED load.

[0006] Thus, using the NFC communication, the nominal current for LEDs may be programmed.

[0007] US 2020/0313727 A1 discloses a power regulation for lighting using NFC. A NFC transceiver is used to make the programming of the nominal set-point easier.

[0008] Moreover, in some situations, it may be required to perform an LED current selection. However, the previously mentioned solutions make use of NFC modules, which require the presence of a control circuitry such as a microcontroller. This increases the complexity of the NFC modules.

[0009] Further, many operating devices have a so-called "DC level feature", which allows to detect and distinguish between an AC and a DC supply voltage. It is, however, difficult to implement such a DC level feature in an operating device without making use of additional intelligence.

[0010] Thus, it is an objective to provide for an improved operating device for lighting means.

SUMMARY OF THE INVENTION

[0011] The object of the present invention is achieved by the solution provided in the enclosed independent claims 1 and 11.

[0012] Advantageous implementations of the present invention are further defined in the dependent claims.

[0013] According to a first aspect, the invention relates to an operating device for lighting means, comprising: output terminals supplying lighting means, such as e.g. a LED load, a control circuitry for controlling the electrical supply of the lighting means, a NFC module configured to receive NFC signals and output a pulse width modulation, PWM, signal with variable duty cycle, a conversion circuitry arranged for being supplied with the PWM signal and for outputting a DC voltage supplied to an input of the control circuitry. Moreover, the DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate and the conversion circuitry is configured to be supplied with an internal control signal to set at least two conversion rates.

[0014] This provides the advantage that, by making use of the above mentioned NFC module, there is no need for further intelligence within the operating device for lighting means, which is configurable by means of the NFC module. The control circuitry may be a microcontroller. The control signal may comprise an AC or DC voltage signal

[0015] According to the invention, the operating device comprises a detection circuitry configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the control signal for the conversion rate differently in case of the presence of a AC or DC signal, respectively.

[0016] In an implementation form of the first aspect, the control circuitry is configured to map the level of the supplied DC voltage into a nominal current for the LED load and to control the operation of the lighting means, e.g. by controlling a switch operation of at least one switch of a switched converter such that an actual current matches the nominal current.

[0017] In an implementation form of the first aspect, the conversion rate can be varied continuously or incrementally in steps by said control signal.

[0018] In an implementation form of the first aspect, the conversion circuitry comprises a R-C low pass filter configured to convert the PWM signal into the DC voltage.

[0019] According to the first aspect, the operating device comprises a detection circuitry configured to detect if a supply voltage of the operating device is an AC or DC voltage and to set the control signal for the conversion rate differently in case of the presence of an AC or DC signal, respectively.

[0020] This provides the advantage that the operating device has a DC level feature, i.e. it can detect whether a mains voltage is an AC or a DC voltage. In case of a detection of a DC signal, such as from a battery inside the operating device, the output current of the operating device for lighting means, e.g., LED driver, can be reduced, so that the battery lasts longer for example in case of an emergency situation.

[0021] In an implementation form of the first aspect, the detection circuitry comprises a voltage divider or a R-C low pass filter or a capacitor.

[0022] In an implementation form of the first aspect, the operating device comprises a limiting circuitry configured to limit the DC voltage in case the set control signal is a DC signal.

[0023] In an implementation form of the first aspect, the limiting circuitry comprises a Zener diode configured to clamp the DC signal.

[0024] In an implementation form of the first aspect, the limiting circuitry comprises a switch configured to switch if the control signal is a DC signal.

[0025] In particular, the switch is configured to switch on a connection between the detection circuitry and the limiting circuitry.

[0026] In an implementation form of the first aspect, the NFC module is configured to program a nominal current of the LED load.

[0027] According to a second aspect, the invention relates to a system comprising a NFC transmitting handheld device and an operating device according to the first aspect or any one of the implementation forms thereof.

[0028] According to a third aspect, the invention relates to a method for operating a device for lighting means, comprising: supplying lighting means, such as LED load, by output terminals; controlling the electrical supply of the lighting means; receiving NFC signals; outputting a pulse width modulation, PWM, signal with variable duty cycle; supplying a conversion circuitry with the PWM signal; outputting a DC voltage supplied to an input of a control circuitry, wherein the DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate, wherein the conversion circuitry is configured to be supplied with an internal control signal to set at least two conversion rates, wherein the operating device (400) comprises a detection circuitry (402) configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the control signal for the conversion rate differently in case of the presence of a AC or DC signal, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention will be explained in the followings together with the figures.

Fig. 1 shows a schematic representation of an operating device for lighting means according to an embodiment;

Fig. 2 shows a schematic representation of the NFC and NFC output signal processing part of an operating device for lighting means according to an embodiment;

Fig. 3 shows a schematic representation of the NFC and NFC output signal processing part of an operating device for lighting means according to an embodiment;

Fig. 4 shows a schematic representation of the NFC and NFC output signal processing part of an operating device for lighting means according to an embodiment;

Fig. 5 shows a schematic representation of the NFC and NFC output signal processing part of an operating device for lighting means according to an embodiment;

Fig. 6 shows a schematic representation of PWM signals and voltage signals in an operating device for lighting means according to an embodiment;

Fig. 7 shows a schematic representation of PWM signals and voltage signals in an operating device for lighting means according to an embodiment;

Fig. 8 shows a schematic representation of a AC/DC detection circuitry of an operating device for lighting means according to an embodiment;

Fig. 9 shows a schematic representation of a AC/DC detection circuitry of an operating device for lighting means according to an embodiment;

Fig. 10 shows a schematic representation of a AC/DC detection circuitry of an operating device for lighting means according to an embodiment;

Fig. 11 shows a schematic representation of a AC/DC detection circuitry of an operating device for lighting means according to an embodiment;

Fig. 12 shows a schematic representation of a AC/DC detection part an operating device for lighting means according to an embodiment; and

Fig. 13 shows a schematic representation of a method for operating a device for lighting means according to an embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Aspects of the present invention are described herein in the context of an operating device for lighting means.

[0031] The present invention is described more fully hereinafter with reference to the accompanying drawings, in which various aspects of the present invention are shown. This invention however may be embodied in many different forms and should not be construed as limited to the various aspects of the present invention presented through this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art. The various aspects of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus.

[0032] Various aspects of an operating device for lighting means will be presented. However, as those skilled in the art will readily appreciate, these aspects may be extended to aspects of operating devices for lighting means without departing from the invention.

[0033] The term "LED luminaire" shall mean a luminaire with a light source comprising one or more LEDs or OLEDs. LEDs are well-known in the art, and therefore, will only briefly be discussed to provide a complete description of the invention.

[0034] It is further understood that the aspect of the present invention might contain integrated circuits that are readily manufacturable using conventional semiconductor technologies, such as complementary metal-oxide semiconductor technology, short "CMOS". In addition, the aspects of the present invention may be implemented with other manufacturing processes for making optical as well as electrical devices. Reference will now be made in detail to implementations of the exemplary aspects as illustrated in the accompanying drawings. The same references signs will be used throughout the drawings and the following detailed descriptions to refer to the same or like parts.

[0035] Fig. 1 shows a schematic representation of an operating device 400 for lighting means 408 according to an embodiment.

[0036] The operating device 400 for lighting means 408 can be fed with an AC or DC voltage at the input terminals 401a and 401b. Moreover, the operating device 400 for lighting means 408 comprises: output terminals 407a, 407b supplying lighting means 408, such as e.g. a LED load, a control circuitry 404 for controlling an electrical supply of the lighting means 408; a NFC module 406 configured to receive NFC signals and output a pulse width modulation, PWM, signal with variable duty cycle; a conversion circuitry 405 arranged for being supplied with the PWM signal and for outputting a DC voltage supplied to an input of the control circuitry 404. The DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate, and the conversion circuitry 405 is configured to be supplied with an internal control signal to set at least two conversion rates.

[0037] The internal control signal can comprise an AC or DC voltage signal.

[0038] Furthermore, the operating device 400 can comprise a detection circuitry 402 configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the control signal for the conversion rate differently in case of the presence of a AC or DC signal, respectively.

[0039] Moreover, the operating device 400 can comprise a limiting circuitry 403 configured to limit the DC voltage in case the set control signal is a DC signal.

[0040] The NFC module 406 can be configured to translate a current configuration into a pulse-width-modulation (PWM) signal which, then, can be filtered and used as current selection information for a LED control integration circuit or control circuitry 404.

[0041] Advantageously, in case of a DC voltage at the input terminals 401a and 401b, the output current of the LED driver or operating device 400 can be reduced, so that, for example, a battery inside the LED driver or operating device 400 can last longer, for example, in emergency situations.

[0042] Fig. 2 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0043] Fig. 2 shows a NFC module 406 (antenna and processing circuitry) connected to a voltage divider 500 which is connected to a low pass R-C filter 501. In this embodiment, the R-C filter 501 forms the conversion circuitry 405. In particular, it can be shown that a dim voltage Vdim at the output of the R-C filter 501 can depend on the duty cycle of the PWM signal. Moreover, it can be shown that the pulse-width-modulation (PWM) of the input signal of the NFC module 406 correlates linearly with the set LED current. The frequency of the PWM signal can be in the range of 1 kHz - 30 kHz, while the PWM voltage levels can be in the range of 0 V - 2,8 V. Moreover, via the R-C low-pass filter 501 an analog signal can be obtained.

[0044] Furthermore, in Fig. 2, an AC/DC signal is provided as input to the limiting circuitry 403 and the voltage divider 500 comprising two resistors is connected to the NFC module 406 and the R-C filter 501. The module 502 of the operating device 400 can comprise the control circuitry 404 (not shown in Fig. 2).

[0045] In general, the operating device 400 can be adapted to operate in different configurations: either a high level of the PWM signal at the output of the NFC module 406 can be adapted depending on the supply signal (configuration options 1a and 1b), or a filtered analog signal at the output of the R-C low-pass filter 501 can be adapted (configuration option 2a and 2b) depending on the supply signal. Here, the supply signal may refer to the supply voltage of the operating device 400.

[0046] For example, according to configuration option 1a, the high level of the PWM signal at the output of the NFC module 406 is adapted via the voltage divider 500, which divides the voltage in case of a DC supply signal. In case of an AC supply signal, the voltage is not divided.

[0047] Fig. 3 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0048] Fig. 3 shows a circuitry similar to the one shown in Fig. 2. In particular, instead of a voltage divider 500, a Zener diode 600 is added to the circuitry, and an AC/DC voltage is given as input to the Zener diode 600.

[0049] In the case of configuration option 1b, the high level of the PWM signal at the output of the NFC module 406 is adapted via the Zener diode 600. In case of a DC voltage, the voltage is clamped by the Zener diode 600, while in case of an AC voltage, the voltage is not clamped.

[0050] Fig. 4 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0051] Fig. 4 shows a circuitry similar to the circuitry of Fig. 2, wherein the voltage divider 500 is added at the output of the R-C low pass filter 501, instead of at the output of the NFC module 406. In this way, according to configuration option 2a, the analog signal at the output of the R-C filter is adapted by the voltage divider 500. In case of a DC input voltage, the voltage is divided, while in case of an AC voltage, the voltage is not divided.

[0052] Fig. 5 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0053] In particular, Fig. 5 shows a circuitry similar to the one of Fig. 2, wherein a Zener diode 600 is added to the circuit at the output of the R-C low pass filter 501. In this case, according to configuration option 2b, the filtered analog signal at the output of the R-C low pass filter is adapted via the Zener diode 600. In case of an input DC voltage, the voltage is clamped, while in case of AC input voltage, the voltage is not clamped.

[0054] Fig. 6 shows a schematic representation of PWM signals and voltage signals in the operating device 400 for lighting means 408 according to an embodiment.

[0055] Fig. 6 shows the effect of the DC level feature of the operating device 400 in case of an AC supply signal.

[0056] In particular, the PWM NFC signal at the output of the NFC module 406 is shown in case of the configuration options 1a, 1b, 2a and 2b on the upper panel (case "PWM NFC chip out'').

[0057] Moreover, the PWM signal at the RC-filter input is shown on the middle panel for the configuration options 1a, 1b, 2a and 2b (case "PWM RC-filter in'').

[0058] Finally, a dimmed voltage Vdim or DC voltage, namely the voltage at the output of the R-C low-pass filter 501, is shown as a function of the duty-cycle of the PWM signal on the lower panel for the configuration options 1a, 1b, 2a and 2b (case "Vdim vs. duty-cycle'').

[0059] As it can be taken from Fig. 6, in case of the AC signal, the voltage Vdim or DC voltage does not change in any configuration option.

[0060] In some operating devices 400 for lighting means 408, the DC level or conversion rate can be set in the range of 0-100% dim level, while in other devices it can be fixed at, e.g., 70% of dim level.

[0061] Fig. 7 shows a schematic representation of PWM signals and voltage signals in the operating device 400 for lighting means 408 according to an embodiment.

[0062] Fig. 7 shows the effect of the DC level feature of the operating device 400 in case of a DC supply signal.

[0063] In particular, the PWM NFC signal at the output of the NFC module 406 is shown for all configuration options 1a, 1b, 2a and 2b on the upper panel (case "PWM NFC chip out'').

[0064] Moreover, the PWM signal at the input of the RC-filter 501 is shown on the middle panel for the all configuration options 1a, 1b, 2a and 2b (case "PWM RC-filter in''). As it can be taken from Fig. 7, in this case, the DC voltage level is lowered at the input of the PWM R-C filter 501 for the configuration options 1a and 1b.

[0065] Finally, the dimmed voltage Vdim or DC voltage, namely the voltage at the output of the R-C low-pass filter 501, is shown as a function of the duty-cycle of the PWM signal on the lower panel for the configuration options 1a, 1b, 2a and 2b (case "Vdim vs. duty-cycle"). In all the cases, the dimmed voltage or DC voltage as a function of the duty-cycle of the PWM signal reaches its highest value, namely the DC voltage level.

[0066] In particular, the voltage Vdim is influenced by connecting a voltage divider 500 or a Zener diode 600 by a switch if, e.g., a DC mains voltage is applied. Therefore, a circuit can be implemented in order to switch in case of a DC mains, as it will be described with reference to the following figures.

[0067] Fig. 8 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0068] In the embodiment shown in Fig. 8, the operating device 400 for lighting means 408 comprises the detection circuitry 402, the limiting circuitry 403 and a rectifying bridge 1105.

[0069] In particular, the detection circuitry 402 comprises two rectifying diodes 1101, a voltage divider 1100, a R-C filter 1102 and a capacitor 1103. The input voltage comes from the L and N wires, wherein the input voltage is rectified by the rectifying bridge 1105. Moreover, the limiting circuit 403 comprises a switch 1104.

[0070] In case of an AC voltage, with e.g. a frequency f=100 Hz, the time constant of the R-C filter is much longer than 10 ms and the switch 1104, e.g. FET, does not switch. This can also be seen in the plot of the threshold value th 1106 which is higher than the voltage value which allows for the switch 1104 to switch.

[0071] Fig. 9 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0072] Fig. 9 shows a circuitry which is analogous to the one shown in Fig. 8, besides that, in this case, the input voltage is a DC voltage, i.e. with a frequency f=0 Hz. In this case, the capacitor 1103 is charged according to the time constant of R-C low-pass filter and the switch 1104 FET switches. This can also be seen in the plot of the threshold value th 1106 which is lower than the voltage value which allows for the switch 1104 to switch.

[0073] Fig. 10 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0074] Fig. 10 shows a circuitry analogous to the one of Fig. 8 and Fig. 9, besides that the detection circuitry 402 does not comprise the rectifying diodes 1101. Moreover, in this embodiment, only the L wire is sensed. This provides the advantage that sensing only L is cheaper.

[0075] In case of an AC supply voltage, e.g. with a frequency f=50 Hz, the time constant of the R-C low-pass filter 1102 is much longer than 20 ms, and the switch 1104 FET does not switch. This can also be seen in the plot of the threshold value th 1106 which is higher than the voltage value which allows for the switch 1104 to switch.

[0076] Fig. 11 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0077] Fig. 11 shows a circuitry analogous to the one shown in Fig. 10. In the case of a DC voltage signal, i.e. with a frequency f=0 Hz, the capacitor 1103 is charged according to the time constant of the R-C low-pass filter 1102 and the switch 1104 FET switches. This can also be seen in the plot of the threshold value th 1106 which is lower than the voltage value which allows for the switch 1104 to switch.

[0078] Fig. 12 shows a schematic representation of the operating device 400 for lighting means 408 according to an embodiment.

[0079] In particular, Fig. 12 shows a selection of some of the elements which can be comprised in the operating device 400 for lighting means 408 according to an embodiment.

[0080] In particular, the operating device 400 in Fig. 12 comprises the detection circuitry 402, the limiting circuitry 403, the conversion circuitry 405, the NFC module 406 and a rectifying bridge 1105. The signal coming from the L and N wires is given as input to the detecting circuitry 402.

[0081] The detecting circuitry 402 can comprise two rectifying diodes 1101, a voltage divider 1100, a R-C low pass filter 1102 and a capacitor 1103.

[0082] Moreover, the limiting circuity 403 can comprise a switch 1104 and a Zener diode 600. The switch 600 is configured to switch if the input signal or control signal is a DC signal.

[0083] The NFC module 406 comprises an NFC antenna which transmits a signal to the unit 406a which, in turn, converts the received signal into a PWM signal. The PWM signal is given as input signal to the conversion circuitry 405. In this embodiment, the conversion circuitry 405 comprises the R-C low-pass filter 501. The output signal of the R-C filter 501 is given as input to the module 502 which comprises the control circuitry 404 (not shown in Fig. 12).

[0084] In particular, Fig. 12 shows an example of a limiting circuitry 403 for a DC level or conversion rate of 70%.

[0085] In this embodiment, the configuration option 2b of influencing the Vdim signal or DC voltage via the Zener 600 at the R-C low-pass filter 501 output and the configuration option 1a and 1b of detecting the DC voltage and switching via sensing L and N are used.

[0086] Therefore, by detecting the DC mains voltage with the detection circuit 402, the high level of the PWM signal output of the NFC module 406 is influenced in such a way, that the resulting analog signal at the output of the R-C low pass filter 501 is relating to a DC dim level relatively to the selected LED current or the current of the operating device 400 via the NFC module 406.

[0087] Fig. 13 shows a schematic representation of a method 1600 for operating a device 400 for lighting means 408 according to an embodiment.

[0088] The method 1600 comprises the steps of:

- supplying 1601 the lighting means 408 such as LED load, by output terminals 407a, 407b;
- controlling 1602 an electrical supply of the lighting means 408;
- receiving 1603 NFC signals;
- outputting 1604 a pulse width modulation, PWM, signal with variable duty cycle;
- supplying 1605 a conversion circuitry 405 with the PWM signal;

characterized by

- outputting 1606 a DC voltage supplied to an input of a control circuitry 404, wherein the DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate, wherein the conversion circuitry 405 is configured to be supplied with an internal control signal to set at least two conversion rates,
- wherein the operating device (400) comprises a detection circuitry (402) configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the control signal for the conversion rate differently in case of the presence of a AC or DC signal, respectively.

[0089] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only and not limitation.

[0090] The breadth and scope of the present invention should not be limited by any of the above-described embodiments. Rather, the scope of the invention should be defined in accordance with the following claims and their equivalence.

[0091] Although the invention has been illustrated and described with respect to one or more implementations, equivalent alternations and modifications will occur to those skilled in the art upon the reading of the understanding of the specification and the annexed drawings. In addition, while a particular feature of the invention may have been disclosed with respect to only of the several implementations, such features may be combined with one or more other features of the other implementations as may be desired and advantage for any given or particular application.

Claims

1. Operating device for lighting means (400), comprising:

   - output terminals (407a, 407b) supplying lighting means (408), such as e.g. a LED load,
   - a control circuitry (404) for controlling an electrical supply of the lighting means (408);
   - a NFC module (406) configured to receive NFC signals and output a pulse width modulation, PWM, signal with variable duty cycle;
   - a conversion circuitry (405) arranged for being supplied with the PWM signal and for outputting a DC voltage supplied to an input of the control circuitry (404),

   characterized in that the supplied DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate,
   the conversion circuitry (405) is configured to be supplied with an internal control signal to set at least two conversion rates,
   wherein the operating device (400) comprises a detection circuitry (402) configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the internal control signal for the conversion rate differently in case of presence of AC or DC voltage, respectively.

2. The operating device (400) of claim 1, wherein the control circuitry (404) is configured to map the level of the supplied DC voltage into a nominal current for the lighting means and to control the operation of the lighting means (408), e.g. by controlling a switch operation of at least one switch of a switched converter such that an actual current matches the nominal current.

3. The operating device (400) of claim 1 or 2, wherein the conversion rate can be varied continuously or incrementally in steps by said internal control signal.

4. The operating device (400) of any one of the preceding claims, wherein the conversion circuitry (405) comprises a R-C low pass filter (501) configured to convert the PWM signal into the supplied DC voltage.

5. The operating device (400) of any one of the preceding claims, wherein the detection circuitry (402) comprises a voltage divider (1100) or a R-C low pass filter (1102) or a capacitor (1103).

6. The operating device (400) of any one of the preceding claims, wherein the operating device (400) comprises a limiting circuitry (403) configured to limit the supplied DC voltage in case the set internal control signal is a DC signal.

7. The operating device (400) of claim 6, wherein the limiting circuitry (400) comprises a Zener diode (600) configured to clamp the supplied DC signal.

8. The operating device (400) of claim 6 or 7, wherein the limiting circuitry (403) comprises a switch (1104) configured to switch if the internal control signal is a DC signal.

9. The operating device (400) of any one of the preceding claims, wherein the NFC module (406) is configured to program a nominal current of the lighting means.

10. System comprising a NFC transmitting handheld device and an operating device (400) according to any of the preceding claims.

11. A method (1600) for operating an operating device (400) for lighting means (408), comprising

    - supplying (1601) the lighting means (408), such as LED load, by output terminals (407a, 407b);
    - controlling(1602) an electrical supply of the lighting means (408);
    - receiving (1603) NFC signals;
    - outputting (1604) a pulse width modulation, PWM, signal with variable duty cycle;
    - supplying (1605) a conversion circuitry (405) with the PWM signal;
    - outputting (1606) a DC voltage supplied to an input of a control circuitry (404),

    characterized in that the supplied

    DC voltage is a function of the duty cycle of the PWM signal according to a set conversion rate,
    wherein the conversion circuitry (405) is configured to be supplied with an internal control signal to set at least two conversion rates,
    wherein the operating device (400) comprises a detection circuitry (402) configured to detect if a supply voltage of the operating device is a AC or DC voltage and to set the internal control signal

for the conversion rate differently in case of presence of AC or DC voltage, respectively.

Patentansprüche

1. Betriebsvorrichtung für Leuchtmittel (400), umfassend:

    - Ausgangsanschlüsse (407a, 407b), die das Leuchtmittel (408) versorgen, wie z. B. eine LED-Last,
    - eine Steuerschaltlogik (404) zum Steuern einer Elektrizitätsversorgung des Leuchtmittels (408);
    - ein NFC-Modul (406), das konfiguriert ist, um NFC-Signale zu empfangen und ein Pulsweitenmodulationssignal, PWM-Signal, mit variablem Tastverhältnis auszugeben;
    - eine Umwandlungsschaltlogik (405), die eingerichtet ist, um mit dem PWM-Signal versorgt zu werden und um eine Gleichspannung auszugeben, die einem Eingang der Steuerschaltlogik (404) zugeführt wird,

    dadurch gekennzeichnet, dass die zugeführte Gleichspannung abhängig von dem Tastverhältnis des PWM-Signals gemäß einer eingestellten Umwandlungsrate ist,

    die Umwandlungsschaltlogik (405) konfiguriert ist, um mit einem internen Steuersignal versorgt zu werden, um mindestens zwei Umwandlungsraten einzustellen,
    wobei die Betriebsvorrichtung (400) eine Erkennungsschaltlogik (402) umfasst, die konfiguriert ist, um zu erkennen, ob eine Versorgungsspannung der Betriebsvorrichtung eine Wechsel- oder Gleichspannung ist, und um das interne Steuersignal für die Umwandlungsrate im Falle eines Vorhandenseins von Wechsel- beziehungsweise Gleichspannung unterschiedlich einzustellen.

2. Betriebsvorrichtung (400) nach Anspruch 1, wobei die Steuerschaltlogik (404) konfiguriert ist, um die Höhe der zugeführten Gleichspannung in einen Nennstrom für das Leuchtmittel umzusetzen und um den Betrieb des Leuchtmittels (408) zu steuern, z. B. durch derartiges Steuern eines Schaltbetriebs von mindestens einem Schalter eines geschalteten Wandlers, dass ein tatsächlicher Strom mit dem Nennstrom übereinstimmt.

3. Betriebsvorrichtung (400) nach Anspruch 1 oder 2, wobei die Umwandlungsrate durch das interne Steuersignal kontinuierlich oder inkrementell schrittweise variiert werden kann.

4. Betriebsvorrichtung (400) nach einem der vorstehenden Ansprüche, wobei die Umwandlungsschaltlogik (405) einen R-C-Tiefpassfilter (501) umfasst, der konfiguriert ist, um das PWM-Signal in die zugeführte Gleichspannung umzuwandeln.

5. Betriebsvorrichtung (400) nach einem der vorstehenden Ansprüche, wobei die Erkennungsschaltlogik (402) einen Spannungsteiler (1100) oder einen R-C-Tiefpassfilter (1102) oder einen Kondensator (1103) umfasst.

6. Betriebsvorrichtung (400) nach einem der vorstehenden Ansprüche, wobei die Betriebsvorrichtung (400) eine Begrenzungsschaltlogik (403) umfasst, die konfiguriert ist, um die zugeführte Gleichspannung zu begrenzen, falls das eingestellte interne Steuersignal ein Gleichstromsignal ist.

7. Betriebsvorrichtung (400) nach Anspruch 6, wobei die Begrenzungsschaltlogik (400) eine Zener-Diode (600) umfasst, die konfiguriert ist, um das zugeführte Gleichstromsignal zu halten.

8. Betriebsvorrichtung (400) nach Anspruch 6 oder 7, wobei die Begrenzungsschaltlogik (403) einen Schalter (1104) umfasst, der konfiguriert ist, um umzuschalten, wenn das interne Steuersignal ein Gleichstromsignal ist.

9. Betriebsvorrichtung (400) nach einem der vorstehenden Ansprüche, wobei das NFC-Modul (406) konfiguriert ist, um einen Nennstrom des Leuchtmittels zu programmieren.

10. System, umfassend eine tragbare NFC-Übertragungsvorrichtung und eine Betriebsvorrichtung (400) nach einem der vorstehenden Ansprüche.

11. Verfahren (1600) zum Betreiben einer Betriebsvorrichtung (400) für Leuchtmittel (408), umfassend

    - Versorgen (1601) des Leuchtmittels (408), wie die LED-Last, durch Ausgangsanschlüsse (407a, 407b);
    - Steuern (1602) einer Elektrizitätsversorgung des Leuchtmittels (408);
    - Empfangen (1603) von NFC-Signalen;
    - Ausgeben (1604) eines Pulsweitenmodulationssignals, PWM-Signal, mit variablem Tastverhältnis;
    - Versorgen (1605) einer Umwandlungsschaltlogik (405) mit dem PWM-Signal;
    - Ausgeben (1606) einer Gleichspannung, die einem Eingang einer Steuerschaltlogik (404) zugeführt wird, **dadurch gekennzeichnet, dass** die zugeführte Gleichspannung abhängig von dem Tastverhältnis des PWM-Signals ge-

mäß einer eingestellten Umwandlungsrate ist, wobei die Umwandlungsschaltlogik (405) konfiguriert ist, um mit einem internen Steuersignal versorgt zu werden, um mindestens zwei Umwandlungsraten einzustellen, wobei die Betriebsvorrichtung (400) eine Erkennungsschaltlogik (402) umfasst, die konfiguriert ist, um zu erkennen, ob eine Versorgungsspannung der Betriebsvorrichtung eine Wechsel- oder Gleichspannung ist, und um das interne Steuersignal für die Umwandlungsrate im Falle des Vorhandenseins von Wechselbeziehungsweise Gleichspannung unterschiedlich einzustellen.

Revendications

1. Dispositif de fonctionnement pour des moyens d'éclairage (400), comprenant :

- des bornes de sortie (407a, 407b) alimentant des moyens d'éclairage (408), tels que, par exemple, une charge DEL,
- un ensemble de circuits de commande (404) pour commander une alimentation électrique des moyens d'éclairage (408) ;
- un module CCP (406) configuré pour recevoir des signaux CCP et émettre un signal de modulation d'impulsions en largeur, PWM, à cycle de service variable ;
- un ensemble de circuits de conversion (405) agencé pour être alimenté avec le signal PWM et pour émettre une tension continue alimentée à une entrée de l'ensemble de circuits de commande (404), **caractérisé en ce que** la tension continue alimentée est une fonction du cycle de service du signal PWM en fonction d'un taux de conversion défini,

l'ensemble de circuits de conversion (405) est configuré pour être alimenté avec un signal de commande interne afin de définir au moins deux taux de conversion,
dans lequel le dispositif de fonctionnement (400) comprend un ensemble de circuits de détection (402) configuré pour détecter si une tension d'alimentation du dispositif de fonctionnement est une tension alternative ou continue et pour définir le signal de commande interne pour le taux de conversion différemment en cas de présence d'une tension alternative ou continue, respectivement.

2. Dispositif de fonctionnement (400) selon la revendication 1, dans lequel l'ensemble de circuits de commande (404) est configuré pour adapter le niveau de la tension continue alimentée en un courant nominal pour les moyens d'éclairage et pour commander le fonctionnement des moyens d'éclairage (408), par exemple en commandant le fonctionnement de commutateur d'au moins un commutateur d'un convertisseur commuté de sorte qu'un courant réel correspond au courant nominal.

3. Dispositif de fonctionnement (400) selon la revendication 1 ou 2, dans lequel le taux de conversion peut être modifié de façon continue ou incrémentale par étapes par ledit signal de commande interne.

4. Dispositif de fonctionnement (400) selon l'une quelconque des revendications précédentes, dans lequel l'ensemble de circuits de conversion (405) comprend un filtre passe-bas R-C (501) configuré pour convertir le signal PWM en tension continue alimentée.

5. Dispositif de fonctionnement (400) selon l'une quelconque des revendications précédentes, dans lequel l'ensemble de circuits de commande (402) comprend un diviseur de tension (1100) ou un filtre passe-bas R-C (1102) ou un condensateur (1103).

6. Dispositif de fonctionnement (400) selon l'une quelconque des revendications précédentes, dans lequel le dispositif de fonctionnement (400) comprend un ensemble de circuits de limitation (403) configuré pour limiter la tension continue alimentée dans le cas où le signal de commande interne défini est un signal continu.

7. Dispositif de fonctionnement (400) selon la revendication 6, dans lequel l'ensemble de circuits de limitation (400) comprend une diode Zener (600) configurée pour bloquer le signal continu alimenté.

8. Dispositif de fonctionnement (400) selon la revendication 6 ou 7, dans lequel l'ensemble de circuits de limitation (403) comprend un commutateur (1104) configuré pour commuter si le signal de commande interne est un signal continu.

9. Dispositif de fonctionnement (400) selon l'une quelconque des revendications précédentes, dans lequel le module CCP (406) est configuré pour programmer un courant nominal des moyens d'éclairage.

10. Système comprenant un dispositif portatif transmettant la CCP et un dispositif de fonctionnement (400) selon l'une quelconque des revendications précédentes.

11. Procédé (1600) permettant de faire fonctionner un dispositif de fonctionnement (400) pour des moyens d'éclairage (408), comprenant

- l'alimentation (1601) des moyens d'éclairage (408), tels qu'une charge DEL, par des bornes de sortie (407a, 407b) ;
- la commande (1602) d'une alimentation électrique des moyens d'éclairage (408) ;
- la réception (1603) de signaux CCP ;
- l'émission (1604) d'un signal de modulation d'impulsions en largeur, PWM, à cycle de service variable ;
- l'alimentation (1605) d'un ensemble de circuits de conversion (405) avec le signal PWM ;
- l'émission (1606) d'une tension continue alimentée à une entrée d'un ensemble de circuits de commande (404), **caractérisé en ce que** la tension continue alimentée est une fonction du cycle de service du signal PMW selon un taux de conversion défini, dans lequel l'ensemble de circuits de conversion (405) est configuré pour être alimenté avec un signal de commande interne afin de définir au moins deux taux de conversion, dans lequel le dispositif de fonctionnement (400) comprend un ensemble de circuits de détection (402) configuré pour détecter si une tension d'alimentation du dispositif de fonctionnement est une tension alternative ou continue et pour définir le signal de commande interne pour le taux de conversion différemment en cas de présence d'une tension alternative ou continue, respectivement.

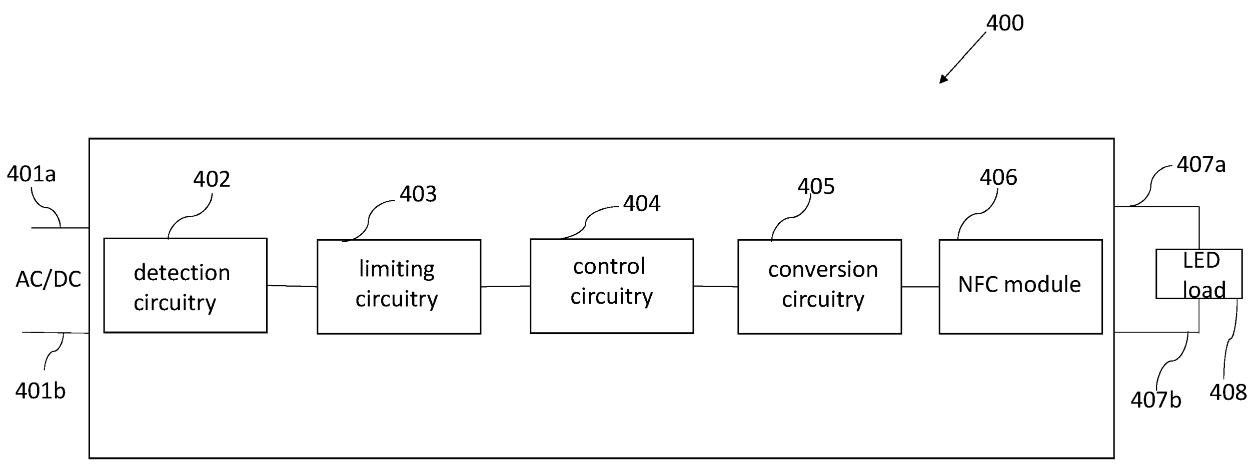
400
401a
402
403
404
405
406
407a
AC/DC
detection circuitry
limiting circuitry
control circuitry
conversion circuitry
NFC module
LED load
401b
407b
408

Fig. 1

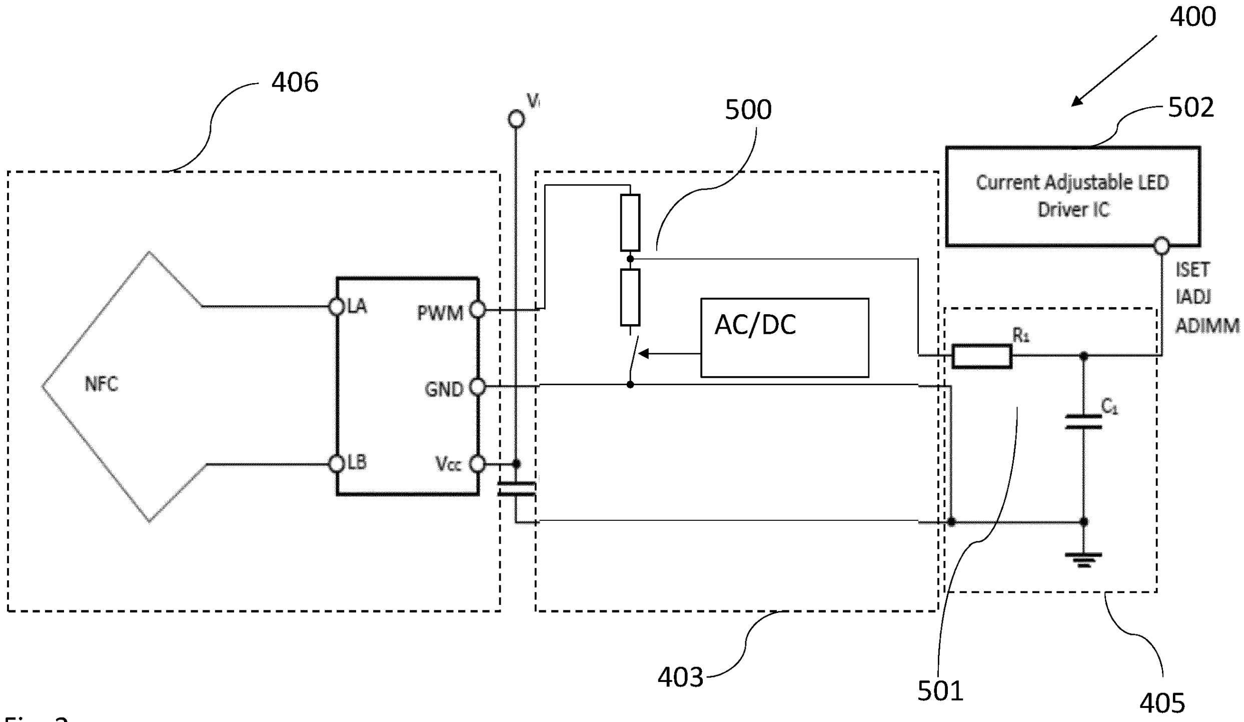
400
406
500
502
Current Adjustable LED Driver IC
ISET
IADJ
ADIMM
NFC
LA
LB
PWM
GND
Vcc
AC/DC
R1
C1
403
501
405

Fig. 2

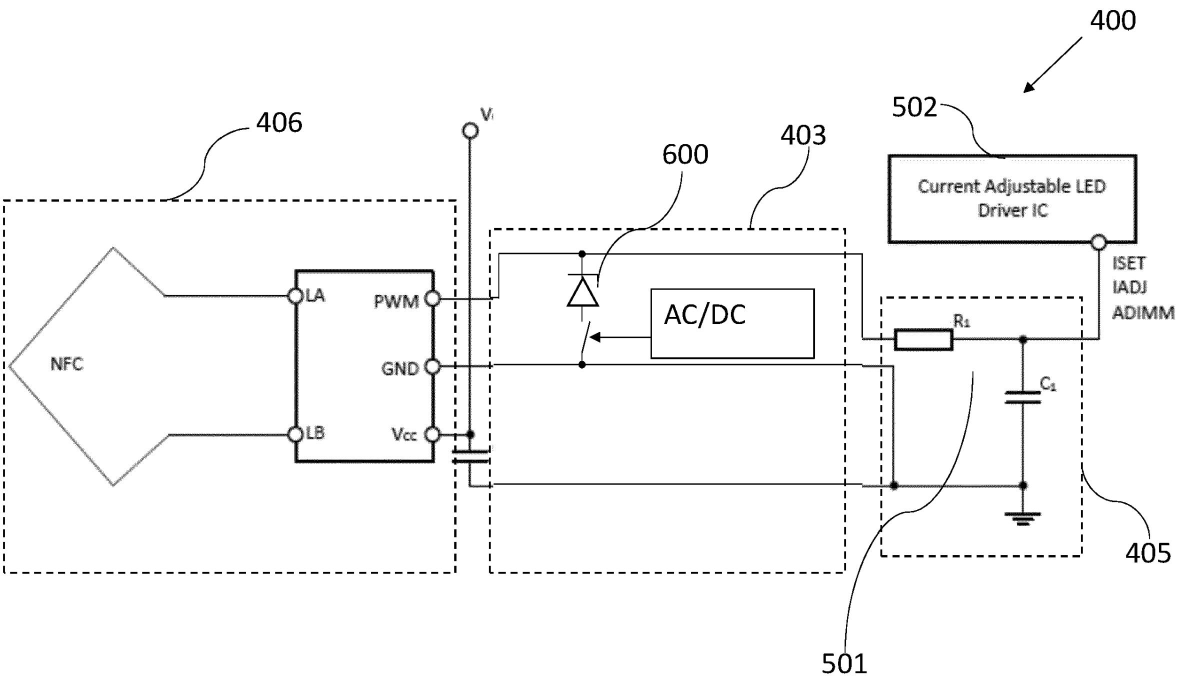
400
406
502
600
403
Current Adjustable LED Driver IC
NFC
LA
PWM
GND
LB
Vcc
AC/DC
R1
C1
ISET
IADJ
ADIMM
405
501

Fig. 3

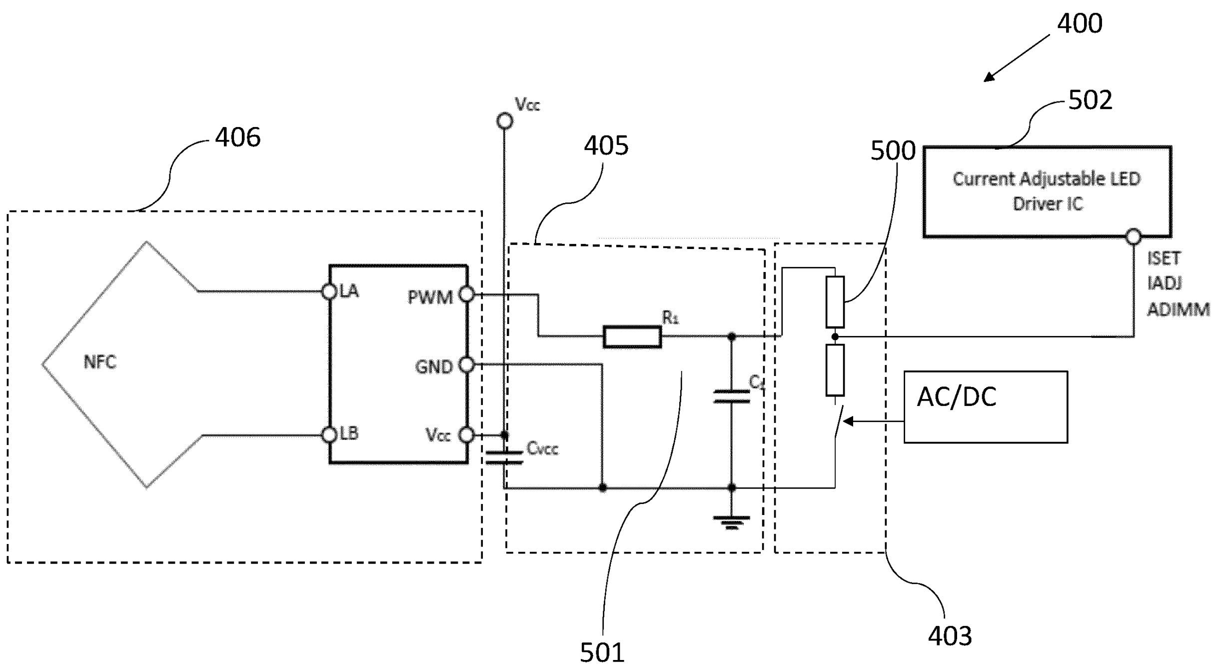
400
502
Current Adjustable LED Driver IC
406
405
500
Vcc
NFC
LA
LB
PWM
GND
Vcc
Cvcc
R1
C1
ISET
IADJ
ADIMM
AC/DC
501
403

Fig. 4

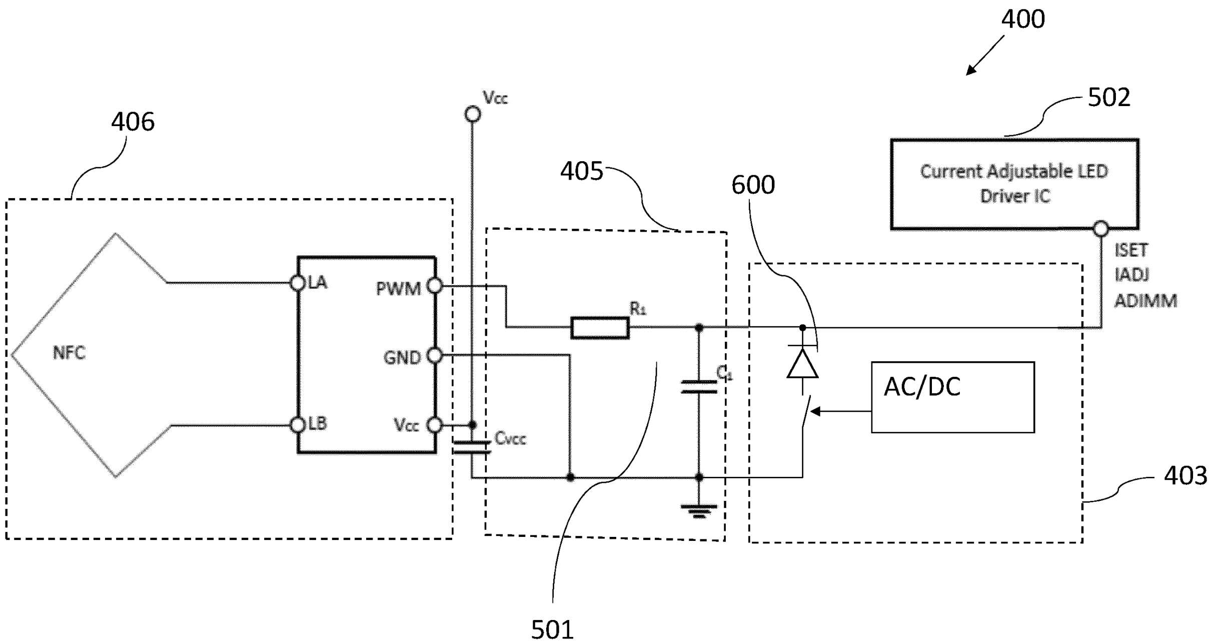
400
502
Current Adjustable LED Driver IC
ISET
IADJ
ADIMM
406
Vcc
405
600
NFC
LA
LB
PWM
GND
Vcc
Cvcc
R1
C1
AC/DC
403
501

Fig. 5

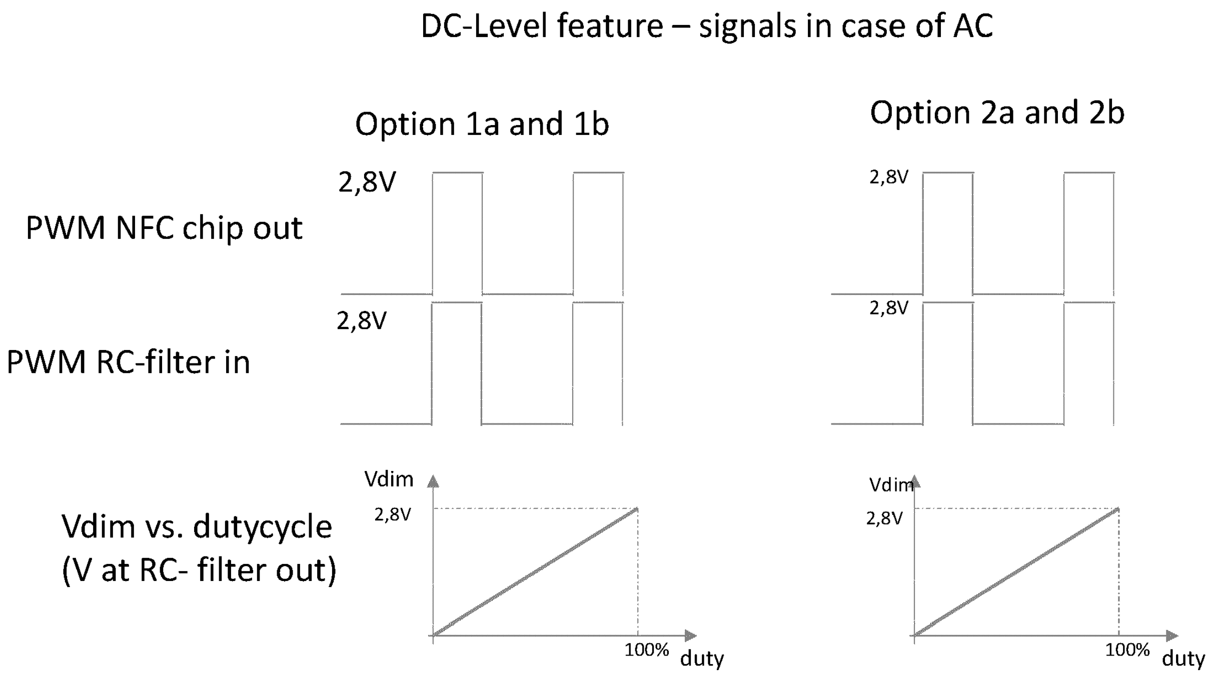
DC-Level feature – signals in case of AC
Option 1a and 1b
Option 2a and 2b
2,8V
PWM NFC chip out
2,8V
PWM RC-filter in
Vdim
2,8V
Vdim vs. dutycycle
(V at RC- filter out)
100%
duty

Fig. 6

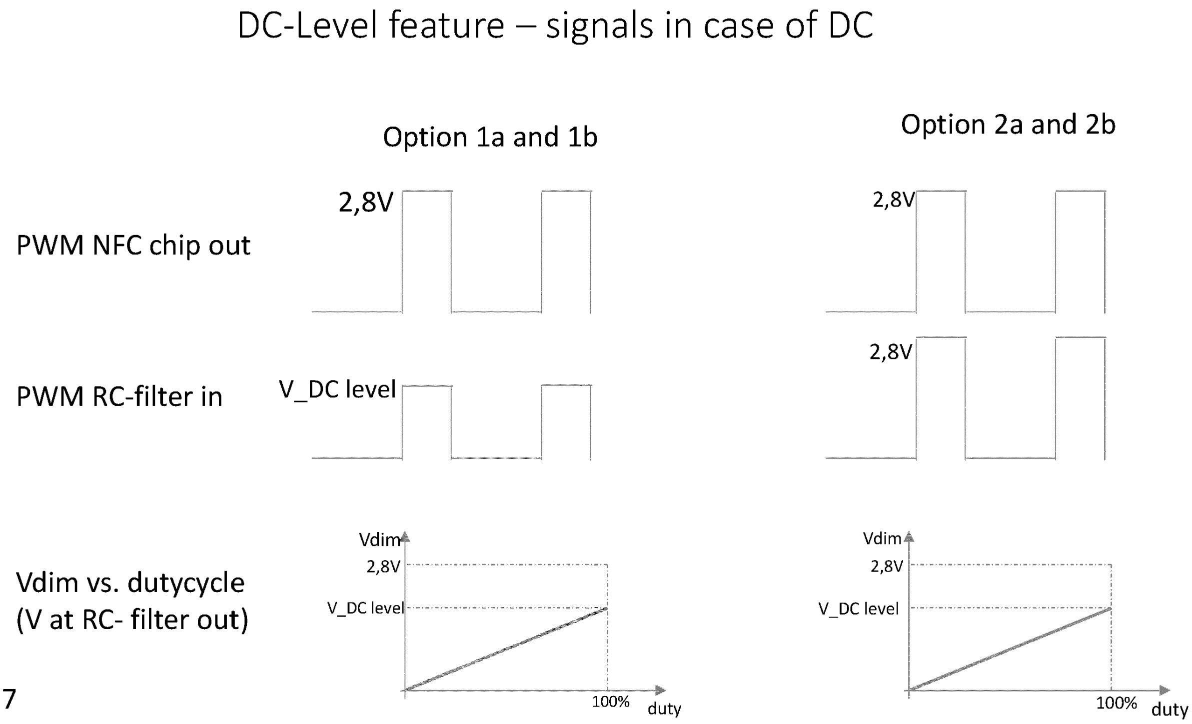
DC-Level feature – signals in case of DC
Option 1a and 1b
Option 2a and 2b
PWM NFC chip out
2,8V
2,8V
PWM RC-filter in
V_DC level
2,8V
Vdim vs. dutycycle
(V at RC- filter out)
Vdim
2,8V
V_DC level
100%
duty
Vdim
2,8V
V_DC level
100%
duty

Fig. 7

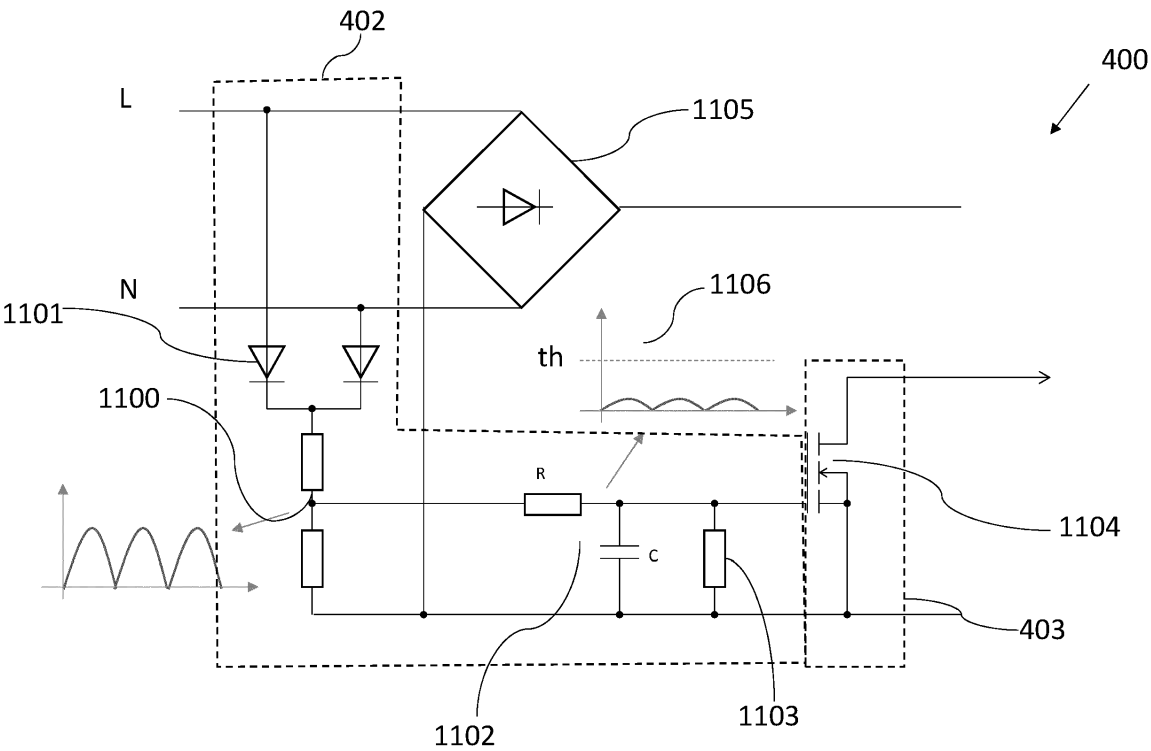

Fig. 8

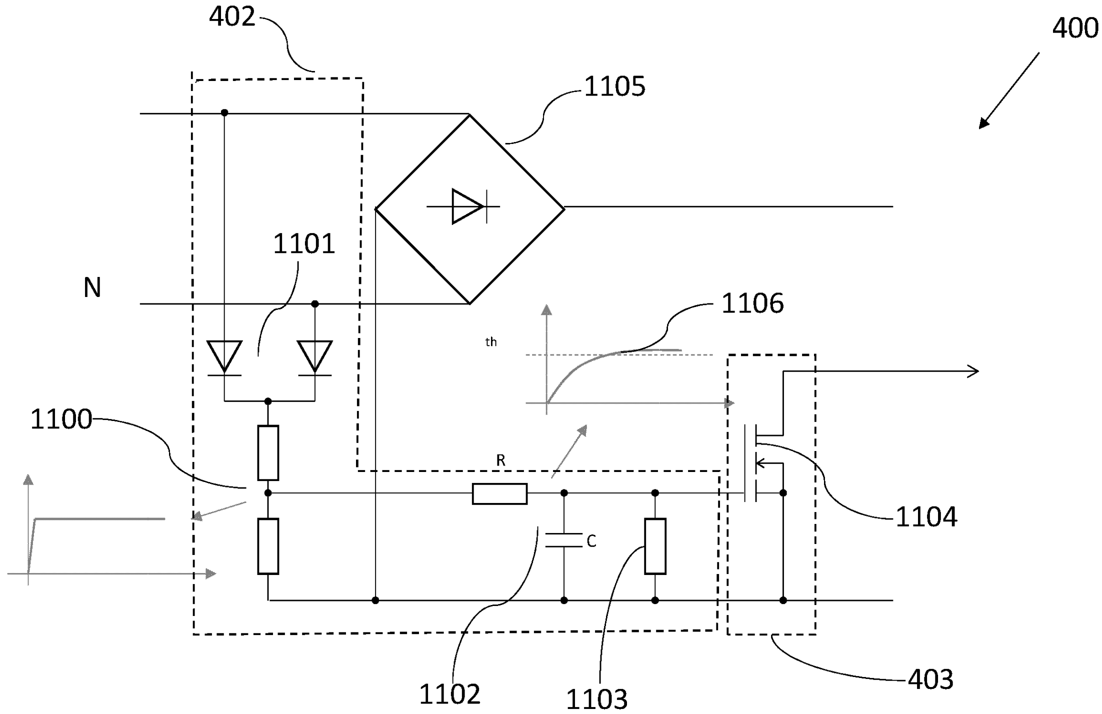

Fig. 9

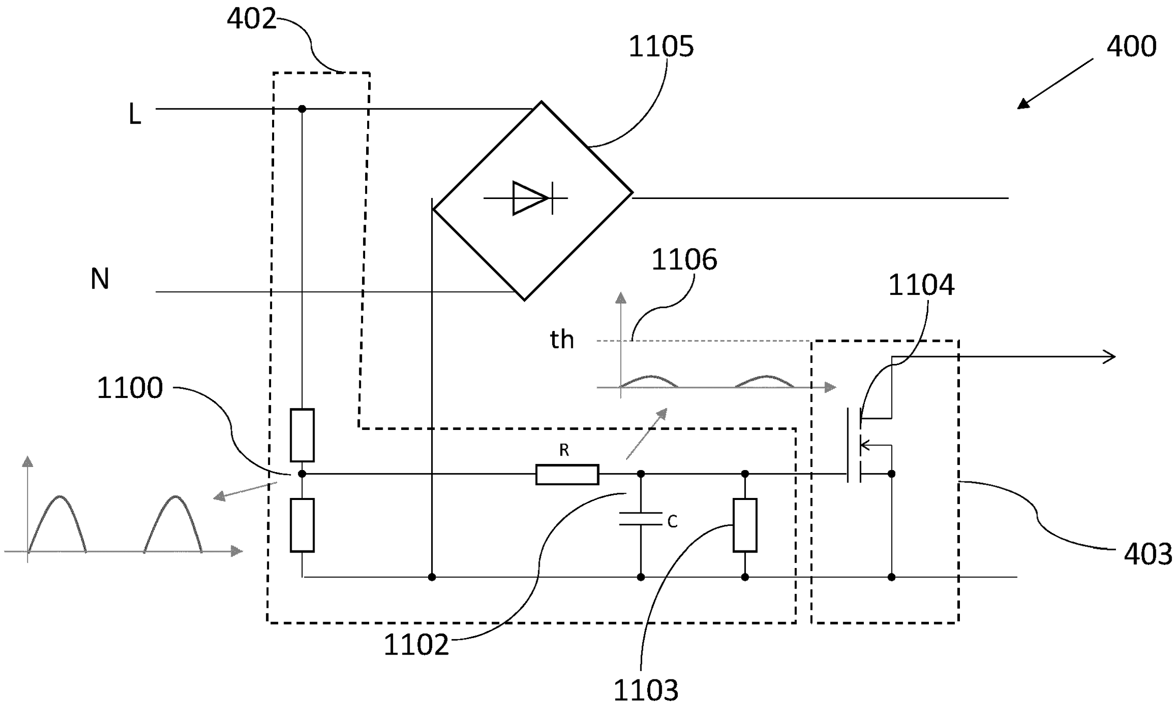

Fig. 10

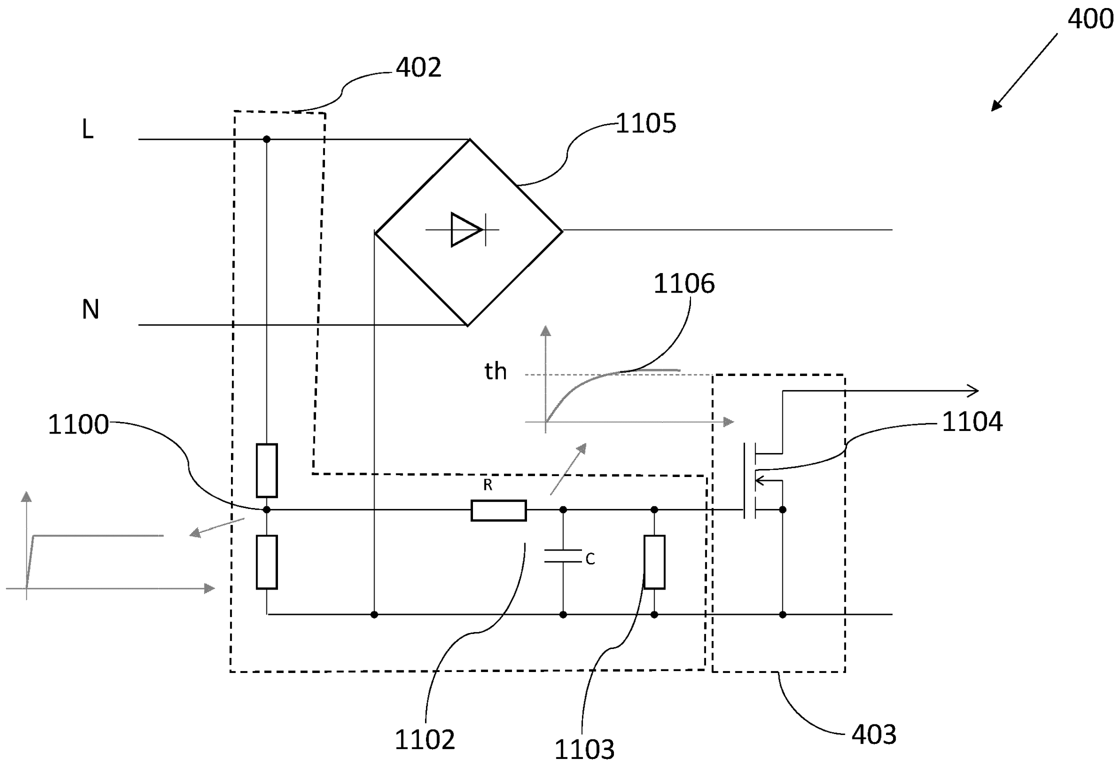

Fig. 11

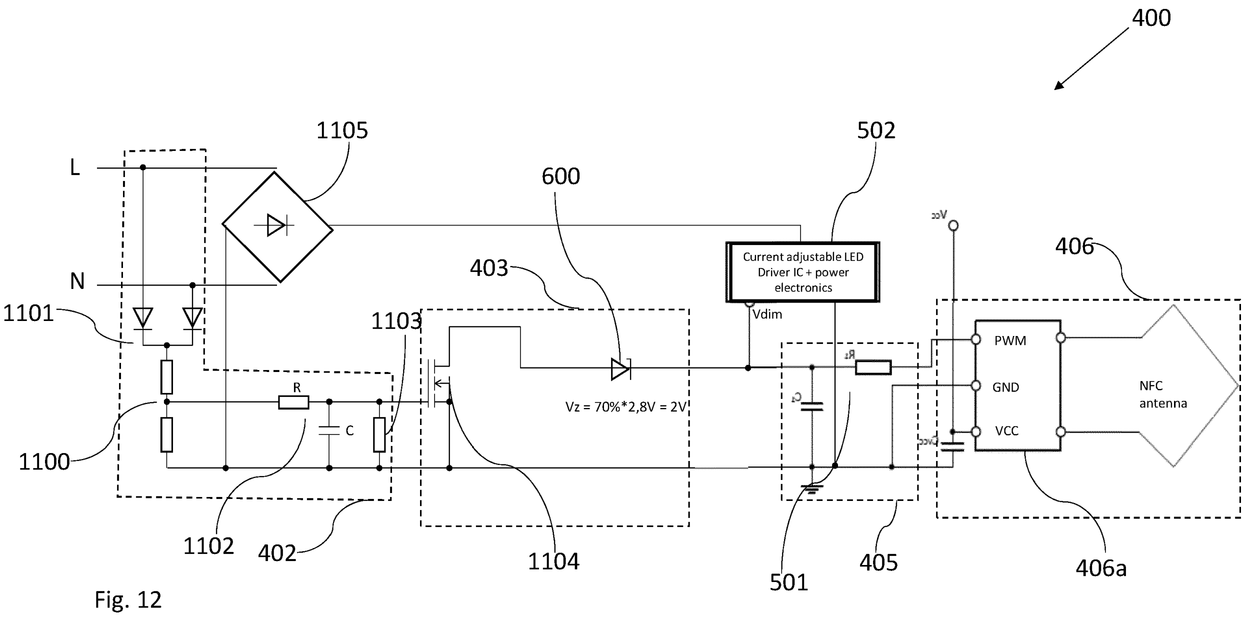
400
1105
502
600
L
N
403
406
Current adjustable LED Driver IC + power electronics
Vdim
1101
1103
R
C
Vz = 70%*2,8V = 2V
PWM
GND
VCC
NFC antenna
1100
1102
402
1104
501
405
406a

Fig. 12

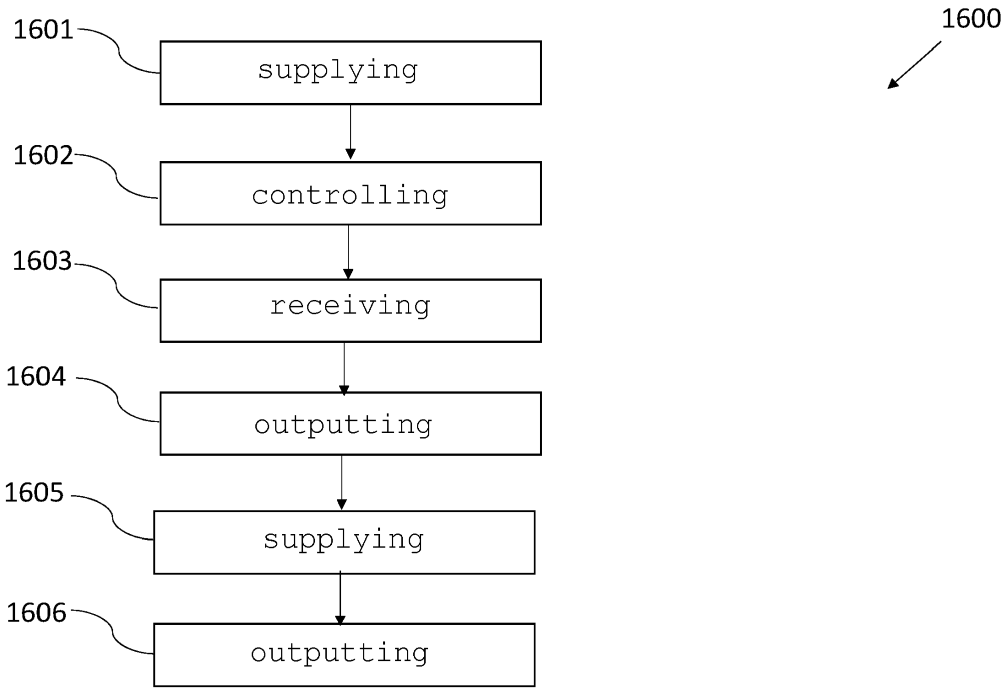
1600
1601
supplying
1602
controlling
1603
receiving
1604
outputting
1605
supplying
1606
outputting

Fig. 13

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20200313727 A1 **[0007]**