(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 September 2018 (13.09.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/163091 A1

(51) International Patent Classification:
B60Q 1/00 (2006.01) *B60R 16/00* (2006.01)

(21) International Application Number:
PCT/IB2018/051498

(22) International Filing Date:
08 March 2018 (08.03.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201741008241 09 March 2017 (09.03.2017) IN

(71) Applicant: **TVS MOTOR COMPANY LIMITED** [IN/IN]; Jayalakshmi Estates, No.29 (Old No.8) Haddows Road, Chennai 600 006 (IN).

(72) Inventors: **BISWAS, Partha**; Tvs Motor Company Limited Jayalakshmi Estates, Jayalakshmi Estates, No.29 (Old No.8) Haddows Road, Chennai 600 006 (IN). **SIVAKUMAR, Arumugham**; Tvs Motor Company Limited Jayalakshmi Estates, Jayalakshmi Estates, No.29 (Old No.8) Haddows Road, Chennai 600 006 (IN).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: VEHICLE ELECTRICAL SYSTEM

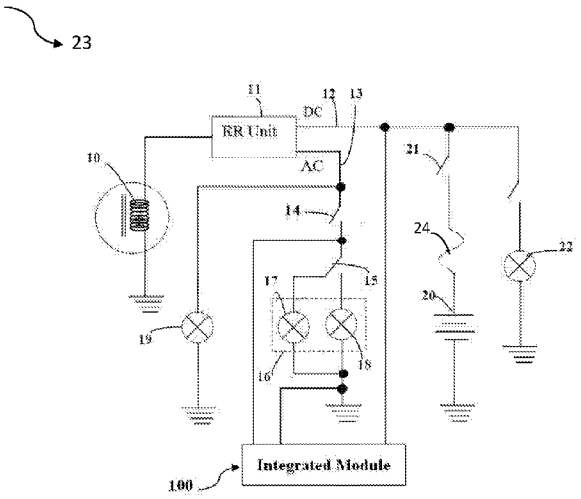

Fig.2

(57) Abstract: The present invention relates to a vehicle electrical system (23) comprises an integrated module (100) enclosed in a housing (108). The integrated module (100) includes at least one light source (104) and at least one electronic circuitry (106) integrally installed therein and said at least one electronic circuitry (106) includes a LED driver circuit (104) and a shutdown circuit (105). The LED driver circuit (104) having one terminal being electrically connected to said output regulated voltage D.C power (12) and other terminal being electrically connected to a common ground (200) to form a first ground path (201a). The shutdown circuit (105) having one terminal being electrically connected to said output regulated voltage A.C power (13) and other terminal to said common ground (200) to form a second ground path (201b) such said first ground path (201a) and said second ground path (201b) are electrically isolated.

WO 2018/163091 A1

[Continued on next page]

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

VEHICLE ELECTRICAL SYSTEM

TECHNICAL FIELD

[0001] The present subject matter relates to a vehicle. More particularly, the present subject matter relates to a vehicle electrical system.

BACKGROUND

[0002] For many years it has been recognized that a vehicle operating with its headlamps on during the day is more easily seen by drivers of other vehicles. Accordingly, a number of drivers, with a view to that advantage, turn their headlamps on during the day. However, there are several disadvantages associated with the use of headlamps during the day. For example, at full power, headlamps draw considerable energy from the vehicle. There is also a danger that the vehicle headlamps may be left on when the vehicle is parked which may drain the battery to the extent that the vehicle will not restart. A need had therefore been perceived to provide for daytime running lights (DRL) which can operate at reduced glare, with low energy consumption and which are automatically turned on when the engine is running and are automatically turned off when the engine is not running. Further, an increase in requirements with regard to signalling for automobiles has in particular been embodied by a number of daytime running lights (DRL) regulations and hence are addressed to newly manufactured vehicles.

[0003] Typically, the daytime running lights (DRL) are positioned on a front of the vehicle; either integrated with the headlamps or separate, and emit a white or yellow light when the ignition is activated. Generally, solid-state lighting (SSL) devices, such as light-emitting diodes, are increasingly being used with the daytime running lights (DRL) because of their low power consumption, long lifetime and reliability. Generally, one or more light-emitting diodes are associated with a photometry of the daytime running lights (DRLs) function.

[0004] In an existing vehicle with an arrangement of the daytime running lights (DRL) on the front of the vehicle, a carrier made of polyethylene

terephthalate based polymer, glass fibres and Laser Directed Structure (LDS) additives acts as a housing for enclosing a Light Emitting Diode (LED) based daytime running lights (DRLs). However, such design for the arrangement of the daytime running lights (DRL) alone does not ensure optical set-up to meet the photometry specifications. Hence, an additional electronic circuitry is required to switch OFF the daytime running lights (DRLs) when a headlamp switch is turned ON. Thus, two or more hardware units in the form of the printed circuit board (PCB) provides a complete circuitry for the design of the daytime running lights (DRL) to function on the vehicle.

[0005] In a known design for the daytime running lights (DRL), a plurality of light sources in the form of Light Emitting Diodes (LEDs) and a reflector are installed on the printed circuit board (PCB). Further, as per the photometric requirements, the electronic circuitry for activating the light sources are installed on another printed circuit board (PCB). Hence, the electronic circuitry and the light sources are electrically connected through one or more electrical connections on the two printed circuit boards (PCBs).

[0006] In another known arrangement for the daytime running lights (DRL) on the vehicle, the design for the daytime running lights (DRL) comprises a lens, a flexible printed circuit board (PCB) and a fixing support. Typically, at least two LED light sources are arranged on the flexible printed circuit board (PCB). The flexible printed circuit board (PCB) is positioned right behind the lens and mounted at the front end of the fixing support through a bolt. The lens is connected with the fixing support in a positioning manner. However, the conventional design for the daytime running lights (DRL) does not explain the photometry requirements for the lens design.

[0007] The conventional arrangement of the daytime running lights (DRL) on the vehicle comprises a complicated design for the daytime running lights (DRL) including at least two hardware units in the form of the printed circuit board (PCB), one or more LEDs etc., and hence increases the overall number of components, parts, wirings on the vehicle. Thus, providing a complex design for

the daytime running lights (DRL) with increased cost of installation of the daytime running lights (DRL) on the vehicle.

[0008] Hence, it is desirable to provide a compact, simple and cost-effective installation of the daytime running lights (DRL) on the vehicle. Further, it is desirable to design the daytime running lights (DRL) in the manner so as to reduce packaging constraints, reduce cost of the arrangement of the daytime running lights (DRL) on the vehicle, reduce the number of Light Emitting Diodes (LEDs) used in the design for the daytime running lights (DRL). Furthermore, it is needed to provide a design for the daytime running lights (DRL) on the vehicle which is compactly packaged and conveniently installed in existing vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The detailed description is described with reference to the accompanying figures. The same numbers are used throughout the drawings to reference like features and components.

[00010] **Fig.1** is a schematic block diagram of an integrated module adapted to form a daytime running lights (DRL) as per one embodiment of the present invention.

[00011] **Fig.2** is a schematic circuit diagram illustrating a vehicle electrical system including one or more electrical connections of the integrated module as per one embodiment of the present invention.

[00012] **Fig.3** is a schematic circuit diagram illustrating a first ground path created by a LED driver circuit and a second ground path created by a shutdown circuit as per one embodiment of the present invention.

[00013] **Fig. 4** is a schematic circuit diagram illustrating a low-pass filter added to an input of the shutdown circuit as per another embodiment of the invention.

[00014] **Fig. 5a** illustrates voltage waveforms explaining the superimposition of the output regulated voltage A.C power on a D.C line of the output regulated voltage D.C power when a headlamp switch is turned ON and **Fig.5b** illustrates

voltage waveforms with the low pass filter added to the shutdown circuit as per another embodiment of the present invention.

[00015] **Fig. 6** illustrate a front view of a two-wheeled vehicle illustrating the arrangement of the integrated module adapted to form the day time running lights (DRL) on the vehicle, as per one embodiment of the present invention.

[00016] **Fig.7** is a perspective exploded view of the integrated module, at least one light source as per one embodiment of the present invention.

DETAILED DESCRIPTION

[00017] Automatic headlamp and daytime running lights (DRL) systems are known for use with automotive vehicles. Such systems are designed to provide illumination of vehicle headlamps and, in some cases, parking or taillights and for purposes of improving the manner in which a vehicle is made conspicuous in the daytime to thereby increase safety. Generally, the daytime running lights (DRL) provided in the vehicles, has to automatically turn ON whenever engine is running and it has to automatically turn OFF whenever a headlamp switch is turned ON.

[00018] In an existing arrangement for the daytime running lights (DRL) in the vehicle, the design for the daytime running lights (DRL) includes one or more LEDs and at least one electronic circuitry. Typically, said one or more LEDs are installed on a printed circuit board (PCB) and said at least one electronic circuitry controlling the actuation of said one or more LEDs are installed on another printed circuit board (PCB). Thus, the conventional design for the daytime running lights (DRL) on the vehicle includes one or more printed circuit boards (PCB) electrically connected with each other. Thus, facilitating an electrical pathway or coupling between electrical components including said one or more LEDs and said and at least one electronic circuitry mounted on the two circuit boards.

[00019] Generally, two-wheeled vehicles including a motorcycle type two-wheeled vehicle and a scooter type two-wheeled vehicle includes a permanent magnet generator for converting the mechanical energy produced by an internal combustion engine into electricity for charging a vehicle battery and for

supplying to at least one electrical load such as lamps, control units, sensors and actuators. The alternating voltage generated by the permanent magnet generator is regulated and rectified by a regulator and rectifier (RR) unit for charging the battery and for supplying to various D.C (Direct Current) loads. Further, the alternating voltage generated by the permanent magnet generator is also regulated and supplied to A.C (alternating current) loads. The regulator and rectifier (RR) unit performs the function of rectification and regulation to ensure that vehicle electrical loads are operated with optimum voltage levels. Conventionally, most of the two-wheeled vehicles have a headlamp operated with A.C (Alternating Current) supply. Typically, in an arrangement for the daytime running lights (DRL) on the vehicle, the design for the daytime running lights (DRL) includes said one or more light emitting diodes (LEDs) in the form of the light source installed on the printed circuit board (PCB) and said electronic circuitry installed on another printed circuit board (PCB). The electronic circuitry for the daytime running lights (DRL) design includes a LED driver circuit and a shutdown circuit. Generally, the LED driver circuit is being connected with the regulator and rectifier (RR) unit A.C output. Thus, the repetitive voltage spikes in the regulator and rectifier (RR) unit A.C voltage output increases voltage stresses on the LED driver circuit. The voltage stress is particularly high for the LED driver circuit as the line resistances are small to achieve wide operating voltage range and sufficient light output meeting photometry requirements.

[00020] The conventional arrangement of the daytime running lights (DRL) on the vehicle includes at least two printed boards, more number of Light Emitting Diodes (LEDs) in the form of the light source, electronic circuitry and one or more electric connections between two printed boards of said at least two-printed boards. Hence, providing complex, costly installation of the daytime running lights (DRL) on the vehicle. Furthermore, with said at least two-printed boards, the number of electrical components increase thus resulting in overall weight, cost and number of parts on the vehicle.

[00021] Hence, it is desirable to provide a simple and compact design for the daytime running lights (DRL) on the vehicle which is cost effective, easy installation on the vehicle and additionally provides an improved electrical characteristics and reliability with decreased overall size, weight, cost and number of components required in designing the daytime running lights (DRL).

[00022] With the above objectives in view, the present invention relates to the compact and cost-effective design for the daytime running lights (DRL). The present invention related to a single hardware unit adapted to describe the circuitry for the daytime running lights (DRL). Thus, providing cost effective, easy installation with reduced number of components and parts.

[00023] The present invention relates to a vehicle electrical system comprising of an integrated module enclosed in a housing. As per one embodiment of the present invention, said integrated module includes said at least one light source and said at least one electronic circuitry integrally installed therein. Referring to one embodiment of the present invention, said at least one electronic circuitry includes the LED driver circuit and the shutdown circuit. In one embodiment, said LED driver circuit having one terminal being electrically connected to said output regulated voltage D.C power of the regulator and rectifier (RR) unit and other terminal being electrically connected to a common ground to form a first ground path. As per one embodiment, said shutdown circuit includes one terminal being electrically connected to said output regulated voltage A.C power of the regulator and rectifier (RR) unit and other terminal to said common ground to form a second ground path such that said first ground path and said second ground path are electrically isolated. Referring to one embodiment, said at least one light source includes at least one Light Emitting Diodes (LEDs). In one embodiment of the present invention, said integrated module forms day time running lights (DRL) circuit.

[00024] As per one embodiment of the present invention, a cost-effective and simple installation of the daytime running lights (DRL) on the vehicle includes the electronic circuitry and the shutdown circuit of the daytime running lights (DRL)

being integrally installed on the integrated module in the form of the single printed circuit board (PCB). Thus, the daytime running lights (DRL) including the electronic circuitry and the shutdown circuit is integrated on the single hardware unit. Thus, facilitating low cost and easy installation of the daytime running lights DRL on the vehicle. Thus, said electronic circuitry including the LED driver circuit for operating the LEDs and the shutdown circuit to switch OFF the LEDs by sensing headlamp status are integrated within a single PCB.

[00025] According to one embodiment of the present invention, said at least one light source in the form of the LEDs is electrically connected to the output regulated D.C power of rectifier and the regulator unit. Thus, voltage spikes in the regulator and rectifier (RR) unit are limited by a capacitor and the vehicle battery. Further, as per one embodiment, the driver circuit having one terminal being electrically connected to the common ground forms the first ground path. In one embodiment, said shutdown circuit having one terminal being electrically connected to said common ground forms a second ground path. As per one embodiment, said first ground path and said second ground path are electrically isolated.

[00026] It is an object of the present invention to provide improved, compact and cost effective design for the daytime running lights (DRL) that can meet the statutory requirements without compromising on reliability. Further, the improved design for the daytime running lights (DRL) on the single printed circuit board provides an improved circuitry which prevents superimposition of voltages supplied to the corresponding input lines of the daytime running lights (DRL) from the regulator and rectifier (RR).

[00027] As per one embodiment of the present invention, said improved design for the daytime running lights (DRL) on the vehicle includes said at least one light source including said LEDs and said at least one electronic circuitry are integrally installed on the single metal core printed circuit board (MC-PCB). Further, as per one embodiment, said at least one light source includes one or more lens for collimating the light produced by said at least one light source. As

per one embodiment of the present invention, said one or more lens produces a narrow light beam from the central LED and wider light beam from adjacent LEDs. In one embodiment, the electronic circuitry comprises the LED driver circuit for activating the LEDs when the headlamp switch is in an OFF position and the shutdown circuit for shutting down said LEDs when the headlamp switch is in ON condition. As per one embodiment, said output regulated D.C power is utilized by the LED driver circuit for LED operation and said output regulated A.C power is used by the shutdown circuitry. In one embodiment, said output regulated A.C power is electrically isolated from the LED driver circuit by isolating the first ground path of the LED driver circuit from the second ground path of the shutdown circuit.

[00028] It is another object of the present invention to provide the integrated module in the form of the single printed circuit board (PCB) for establishing the daytime running mode of operation of vehicle headlamps.

[00029] It is yet a further object of this invention to provide the integrated module adapted to form the day time running lights (DRL) such that the daytime running mode is automatically selected and activated when the vehicle engine is running and said at least one lightening and signalling device including the headlamp is not turned ON.

[00030] Further, the object of the invention to provide the integrated module for establishing a daytime running mode of operation which can be conveniently manufactured as a unit for easy installation in the vehicle.

[00031] The present invention relates to the integrated module in the form of the single printed circuit board adapted to represent design for the daytime running lights (DRL). More specifically, the present invention relates to the integrated module as the single hardware circuit that creates the daytime running lights (DRL) by integrally installing said at least one light source and said at least one electronic circuitry on the single printed control board (PCB). Thus, reducing the number of components and facilitating cost effective installation of the daytime running lights (DRL) on the vehicle.

[00032] The present invention relates to the vehicle electrical system including the integrated module adapted to form the day time running lights (DRL).

[00033] The present invention relates to the daytime running lights (DRL) that is especially well suited for integration with existing exterior illumination systems of an automotive vehicle, and specifically in the disclosed embodiment, integration with the existing headlamp circuit of the vehicle. Accordingly, the invention is readily compatible both as original equipment in new vehicles and for retrofit of many vehicles already in service. Moreover, the circuit of the present invention can be fabricated with a comparatively small number of conventional individual circuit devices. These devices can be conveniently packaged for expeditious installation in both new and older vehicles. The invention possesses novel and unique features which individually and collectively contribute to its attributes.

[00034] Various other features and advantages of the invention are described in detail below with reference to the accompanying drawings. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawing in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number. With reference to the accompanying drawings, wherein the same reference numerals will be used to identify the same or similar elements throughout the several views. It should be noted that the drawings should be viewed in the direction of orientation of the reference numerals.

[00035] **Fig. 1** is a schematic diagram of the integrated module **(100)** adapted to form the daytime running lights (DRL) as per one embodiment of the present invention. In one embodiment of the present invention the vehicle electrical system **(23)** comprises the integrated module **(100)** enclosed in the housing **(108)** (shown in Fig.7). In one embodiment, said integrated module **(100)** includes said at least one light source **(104)** and at least one electronic circuitry **(106)** integrally installed therein. As per one embodiment, said at least one electronic circuitry **(106)**

includes the LED driver circuit **(103)** and the shutdown circuit **(105).** As per one embodiment, said at least one light source **(104)** includes at least one light emitting diode (LEDs) **(104).** In one embodiment, said integrated module **(100)** forms a day time running lights (DRL) circuit.

[00036] Further in **Fig.1**, as per one embodiment of the present invention the integrated module **(100)** with said LED driver circuit **(103)** activates said at least one light source including said at least one LED **(104)** through input voltage supply **(101)** from said vehicle battery **(20)** (shown in Fig.2). As per one embodiment, said regulator and rectifier (RR) unit **(11)** on the vehicle electrical system performs rectification and regulation of said alternating current for supplying an output regulated voltage D.C power **(12)** and said output regulated voltage A.C power **(13)** (shown in Fig.2). As per one embodiment, at least one lighting and signalling device **(16)** is having an input connected to an output of said regulator and rectifier (RR) unit **(11)** for receiving said output regulated voltage A.C power **(13).** In one embodiment, said at least one lighting and signalling device is a headlamp **(16).** Referring to one embodiment, a switch module **(14)** selectively operable to off and on positions for selectively actuating said at least one lighting and signalling device **(16).** As per one embodiment, said switch module **(14)** is a headlamp switch **(21).** In one embodiment, said shutdown circuit **(105)** deactivates said at least one light source **(104)** including said at least one LED **(104)** when the input **(102)** from the headlamp switch **(21)** is received. As per one embodiment, said LED driver circuit **(103)** is having one terminal being electrically connected to said output regulated voltage D.C power **(12)** of the rectifier and regulator (RR) unit **(11)** (shown in Fig.2) and other terminal being electrically connected to a common ground **(200)** to form the first ground path **(201a)**. In one embodiment, said shutdown circuit **(105)** having one terminal being electrically connected to said output regulated voltage A.C power **(13)** of the rectifier and regulator (RR) unit **(11)** (shown in Fig.2) and other terminal to said common ground **(200)** to form a second ground path **(201b)**. As per one embodiment, said first ground path **(201a)** and said second ground path **(201b)** are electrically isolated.

[00037] **Fig. 2** is a schematic circuit diagram illustrating the vehicle electrical system **(23)** with one or more electrical connections of the integrated module **(100)** as per one embodiment of the present. In one embodiment, the vehicle electrical system **(23)** comprises the permanent magnet generator **(10)** for producing an alternating current, the vehicle battery **(20)** operatively connected to said permanent magnet generator **(10)** to be charged therefrom. In one embodiment, the permanent magnet generator **(10)** is coupled with a crankshaft of an internal combustion engine for generating alternating voltage. As per one embodiment, the regulator and rectifier (RR) unit **(11)** is operatively connected to said permanent magnet generator **(10)**. In one embodiment, said regulator and rectifier (RR) unit **(11)** performs the rectification and regulation of said alternating current generated by the permanent magnet generator **(10)** for supplying the output regulated voltage D.C power **(12)** and the output regulated voltage A.C power **(13)** to at least one D.C load **(22)** and at least one A.C load **(16), (19)** respectively. For example, the output regulated voltage A.C power **(13)** is supplied to said at least one A.C electrical load including at least one signalling and lightening device such as headlamp **(16)** and tail lamp **(19)**. As per one embodiment, the headlamp **(16)** has a high beam filament **(17)** and a low beam filament **(18)**.

[00038] Further in **Fig.2**, as per one embodiment, a fuse **(24)** protects the wiring harness against the vehicle battery **(20)** short circuit condition and an ignition switch **(21)** connects or disconnects battery **(20)** from said at least one D.C load **(22)**. The switch module **(14)** in the form of the headlamp switch **(14)** connects the A.C output voltage from the rectifier and regulator (RR) Unit **(11)** with a beam control switch **(15)** which in turn is connected with headlamp **(16)**. The supply input of the integrated module **(100)** adapted to form the daytime running lamp (DRL) **(100)** is connected on the D.C side of the RR Unit **(11)** such that the integrated module **(100)** adapted to form the daytime running lamp (DRL) **(100)** will turn ON automatically when ignition switch **(21)** is closed and the integrated module **(100)** adapted to form the daytime running lamp (DRL) **(100)** will turn OFF automatically when headlamp switch **(14)** is turned ON.

[00039] **Fig. 3** is a schematic circuit diagram illustrating the first ground path (**201a**) created by the LED driver circuit (**103**) and the second ground path (**201b**) created by the shutdown circuit (**105**) as per one embodiment of the present invention. As per one embodiment, said vehicle electrical system comprises the integrated module (**100**) enclosed in the housing unit (**108**) (shown in Fig.7. As per one embodiment, said integrated module (**100**) includes said at least one light source (**104**) and said at least one electronic circuitry integrally installed therein. In one embodiment, said at least one electronic circuitry (**106**) includes the LED driver circuit (**103**) and the shutdown circuit (**105**). Referring to one embodiment, said LED driver circuit (**103**) is having one terminal being electrically connected to said output regulated voltage D.C power (**12**) of the regulator and the rectifier (RR) unit (**11**) and other terminal being electrically connected to the common ground (**200**) to form the first ground path (**201a**). In one embodiment, said shutdown circuit (**105**) is having one terminal being electrically connected to said output regulated voltage A.C power (**13**) and other terminal to said common ground (**200**) to form the second ground path (**201b**). As per one embodiment, said first ground path (**201a**) and said second ground path (**201b**) are electrically isolated. In one embodiment, said at least one light source (**104**) includes at least one Light Emitting Diodes (LED) (**104**) being activated by the LED driver circuit (**103**) of the electronic circuitry (**106**). In one embodiment, said integrated module (**100**) forms the day time running lights (DRL) circuit. Further in **Fig.3**, as per one embodiment, the LED driver circuit (**103**) of the electronic circuitry (**106**) of the integrated module (**100**) comprises a diode **D1 f**or protection against reverse voltage, a capacitor **C1** for reducing voltage ripple. In one embodiment, said LED driver circuit (**103**) controls current in said at least one light source (**104**) including at least one LED (**104**) as **LED1, LED2 and LED 3**. As per one embodiment, a resistor **R1 t**hrough resistor **R4** and diode **D3 t**urns ON a transistor **Q2 s**uch that said at least one light source (**104**) **i**s activated by said LED driver circuit (**103**). As per one embodiment, when the switch module (**14**) including the headlamp switch (**14**) is turned ON, the output regulated A.C power (**13**) is supplied to the bridge rectifier **D2 w**hich along with capacitor **C2 a**nd resistor **R2**

turns ON the transistor **Q1.** As per one embodiment, when a transistor **Q1** is turned ON, the transistor **Q2** turns OFF which in turn deactivates the said at least one light source (**104**). Thus, the shutdown circuit (**105**) turns OFF said at least one light source (**104**) when the headlamp switch is turned ON. Thus, as per one embodiment, the bridge ground path forming the second ground path (**201b**) is electrically isolated from a LED current path forming the first ground path (**201a**). As per one embodiment, when the transistor **Q1** is turned ON due to switching ON of headlamp switch (**21**), the collector is pulled to bridge ground which is at a negative potential compared with the common ground (GND) (**200**). In one embodiment, diode **D3** is in reverse bias and hence transistor **Q2** is turned OFF thus switching OFF said at least one light source (**104**).

[00040] **Fig. 4** is a schematic circuit diagram illustrating a low-pass filter (**202**) added to an input of the shutdown circuit (**105**) as per another embodiment of the invention. In another embodiment, a circuit for the low pass filter circuit (**202**) comprises a resistor **R3** and a capacitor **C3.** As per another embodiment, said resistor **R3** and the capacitor **C3** are connected at the input of shutdown circuit (**105**) of the electronic circuitry (**106**) of the integrated module (**100**). In another embodiment, one or more high frequency components in the repetitive spikes in the output regulated voltage A.C power (**13**) of the regulator and rectifier (RR) Unit (**11**) are eliminated by the low pass filter (**202**) and hence the output regulated voltage A.C power (**13**) on a D.C line (**107**) of the output regulated voltage D.C power (**12**) are reduced.

[00041] **Fig. 5a** illustrates voltage waveforms (**300**) explaining the superimposition of the output regulated voltage A.C power (**13**) on the D.C line (**107**) of the output regulated voltage D.C power (**12**) when the headlamp switch (**14**) is turned ON and **Fig.5b** illustrates voltage waveforms (**301**) with low pass filter (**202**) added to the shutdown circuitry (**105**) as per another embodiment of the present invention. **Fig. 5a** illustrates the voltage waveforms (**300**) for a conventional daytime running lights (DRL) when the headlamp switch (14) is in ON condition. In the conventional daytime running lights (DRL), the supply

voltage for the daytime running lights (DRL) is the output regulated voltage D.C power. Thus, the voltage across the D.C line **(107)** of the output regulated voltage D.C power **(12)** and the common ground **(200)** has the output regulated voltage A.C power **(13)** superimposed on the output regulated voltage D.C power **(12)**. Further in **Fig.5b**, as per another embodiment of the present invention, the low pass filter circuit **(202)** (shown in Fig.2) comprises the resistor **R3** and capacitor **C3** being connected at the input of shutdown circuitry **(105).** As per another embodiment of the present invention, the high frequency components in the repetitive spikes in the output regulated voltage A.C power **(13)** of the regulator and rectifier (RR) unit **(11)** are eliminated by the low pass filter circuit **(202)** (shown in Fig.4) and hence the output regulated voltage A.C power **(13)** superimposed in the D.C line **(107)** of the output regulated voltage D.C power **(12)** are reduced. Further, in another embodiment, the voltage across shutdown circuitry **(105)** capacitor **C2** indicates that transistor **Q1** is turned ON and transistor **Q2** is turned OFF.

[00042] **Fig. 6** illustrate a front view of a two-wheeled vehicle **(1)** illustrating the arrangement of the integrated module **(100)** adapted to form the daytime running lights (DRL) on the vehicle **(1)** as per one embodiment of the present invention. In one embodiment, a handlebar **(2L), (2R)** is rotatably integrally connected to a steering shaft for steering the vehicle **(1)** and is connected to a front wheel **(6)** through the steering shaft. In one embodiment, the handlebar **(2l), (2R)** is rotatably supported, independently of a front fork assembly **(6).**As per one embodiment, a portion lying ahead of the front fork assembly **(6)**, at least one signalling and lighting device such as a headlamp **(16),** a pair of signaling devices such as turn signal lamps (not shown), a display device such as a speedometer **(7)** are housed by a holding structure (not shown) mounted thereto.In one embodiment, a two legged stand **(8)** is used to support and hold the vehicle **(1).** The stand **(8)** moves on a pivot (not shown) to take up two positions, one folded up and the other on the ground. In one embodiment**,** a pair of foot pedal **(5)** for the vehicle **(1)** comprises a pedal main body. As per one embodiment of the present invention, the integrated module **(100)** adapted to form the daytime running lights

(DRL) is arranged on a front of the vehicle **(1)**, below the headlamp **(16),** and emit a white or yellow light when the ignition switch **(21)** (shown in Fig.2) is activated. In one embodiment, the switch module **(14)** in the form of the headlamp switch **(14)** is provided on at least a portion of said handlebar **(2l), (2R).** As per one embodiment, the headlamp **(16)** is connected in parallel with the headlamp switch **(14)** input sensing line. In one embodiment, said integrated module **(100)** adapted to form the daytime running lights (DRL) includes said at least one light source **(104)** including said at least one LED **(104)** and said at least one electronic circuitry **(106).** In one embodiment, said at least one electronic circuitry **(106)** including the LED driver circuit **(103)** and the shutdown circuit **(105)** can withstand transient high voltages generated in the supply line.

[00043] **Fig. 7** is a perspective exploded view of the integrated module **(100),** at least one light source **(104)** as per one embodiment of the present invention. As per one embodiment, the integrated module **(100)** is adapted to form the daytime running lights (DRL). In one embodiment, said vehicle electrical system **(23)** comprises the integrated module **(100)** including said at least one light source **(104)** and at least one electronic circuitry **(106)** (shown in Fig 2) integrally installed therein. In one embodiment, said housing **(108)** is configured to form an enclosure for the integrated module **(100)**. As per one embodiment, said at least one light source **(104)** includes said at least one Light Emitting Diodes (LEDs) **(104)**. In one embodiment, one or more lens **(107)** collimates the light output in order to meet the photometry requirements. In one embodiment, said one or more lens **(107)** converts a LED light output of one LED **(104)** of said at least one LED **(104)** into narrow beam and the LED light output of said two LEDs **(104)** of said at least one LED **(104)** into wider beams respectively. As per embodiment, said housing **(108)** is detachably attached on a vehicle chassis.

[00044] In one embodiment, said integrated module **(100)** in the form of the single printed circuit board (PCB) **(202)** is the metal core PCB (MC-PCB). As per one embodiment, said housing **(108)** for the integrated module is detachably secured to the integrated module **(100)**. As per one embodiment said at least one LED **(104)** generates light output when the engine is operating and the switch module **(14)** (shown in Fig.2) in the form of the headlamp switch is OFF. Further in **Fig.7**, as per one embodiment, said one or more lens **(107)** are fixedly connected with thehousing **(108))** by snap fit or through one or more fasteners made of synthetic materials including flexible resins such as nylon so that the design for the integrated module **(100)** is uniform. As per one embodiment, said integrated module **(100)** ensures sufficient heat dissipation from said at least one LED **(104)** and facilitates in achieving wide operating temperature range.

[00045] Advantageously, the present invention discloses the integrated module being adapted to form the daytime running lights (DRLs) and hence reduces the number of components and parts required in the design for the daytime running lights (DRL) and thus provides an improved, compact and simple design for the daytime running lights (DRL). Thus, as per one embodiment, the integrated module as a single printed circuit board (PCB) includes all electrical connections and components of the daytime running lights (DRLs) and hence provides a cost-effective installation of the daytime running lights (DRLs) on the vehicle. Further, as per another embodiment of the present invention, the low pass filter added to the input of the shutdown circuit of the electronic circuitry of the integrated module eliminates the one or more high frequency components in the repetitive spikes present in the output regulated voltage A.C power of the regulator and rectifier (RR) Unit.

[00046] Improvements and modifications may be incorporated herein without deviating from the scope of the invention.

We claim:

1. A vehicle electrical system **(23),** said system **(23)** comprising:

a permanent magnet generator **(10)** for producing an alternating current;
a battery **(20)** operatively connected to said permanent magnet generator **(10)** to be charged therefrom;
a regulator and rectifier (RR) unit **(11)** operatively connected to said permanent magnet generator **(10)**, said regulator and rectifier (RR) unit **(11)** performing rectification and regulation of said alternating current generated by the permanent magnet generator **(10)** for supplying an output regulated voltage D.C power **(12)** and an output regulated voltage A.C power **(13)** to at least one D.C load **(22)** and at least one A.C load **(16), (19)** respectively,
said at least one A.C load **(16), (19)** having an input connected to an output of said regulator and rectifier (RR) unit **(11)** for receiving said output regulated voltage A.C power **(13)**; and

a switch module **(21)** selectively operable to off and on positions for selectively actuating said at least one lighting and signalling device **(16)**;

an integrated module **(100)** enclosed in a housing **(108)**; said integrated module **(100)** includes at least one light source **(104)** and at least one electronic circuitry **(106)** integrally installed therein; and said at least one electronic circuitry **(106)** includes a LED driver circuit **(104)** and a shutdown circuit **(105)**.

2. The vehicle electrical system **(23)** as claimed in claim 1, wherein said LED driver circuit **(104)** having one terminal being electrically connected to said output regulated voltage D.C power **(12)** and other terminal being electrically connected to a common ground **(200)** to form a first ground path **(201a).**

3. The vehicle electrical system **(23)** as claimed in claim 1, wherein said shutdown circuit **(105)** having one terminal being electrically connected to said output regulated voltage A.C power **(13)** and other terminal to said common ground **(200)** to form a second ground path **(201b)** such said first ground path **(201a)** and said second ground path **(201b)** are electrically isolated.

4. The vehicle electrical system **(23)** as claimed in claim 1, wherein said at least one light source **(104)** includes at least one Light Emitting Diodes (LEDs) **(23)**.

5. The vehicle electrical system as claimed in claim 2, wherein said at least one Light Emitting Diode (LED) **(104)** is activated by the LED driver circuit **(103)** of the electronic circuitry **(106).**

6. The vehicle electrical system **(23)** as claimed in claim 1, wherein said integrated module **(100)** forms a day time running lights (DRL).

7. The vehicle electrical system **(23)** as claimed in claim 1, wherein said at least one A.C load **(16), (19)** includes at least one lighting and signalling device**.**

8. A method for installing a daytime running lights (DRL) on a vehicle, said method comprising steps of:

Activating at least one light source including at least one LED **(104)**, by an integrated module **(100)** including a LED driver circuit **(103)** through an input voltage supply **(101)** from a vehicle battery **(20);**

Performing rectification and regulation of an alternating current, by a regulator and rectifier (RR) unit **(11)** for supplying an output regulated voltage D.C power **(12)** and an output regulated voltage A.C power **(13)** to said integrated module **(100);**

Deactivating said at least one light source including at least one LED **(104)** by a shutdown circuit **(105)** when the input **(102)** from a headlamp switch **(21)** is received;

Electrically connecting one terminal of said LED driver circuit **(103)** to said output regulated voltage D.C power **(12)** of the rectifier and regulator (RR) unit **(11)** and other terminal to a common ground **(200)** to form a first ground path **(201a)**; and

Electrically connecting one terminal of the shutdown circuit **(105)** to said output regulated voltage A.C power **(13)** of the rectifier and regulator (RR) unit **(11)** and other terminal to said common ground **(200)** to form a second ground path **(201b)** such that said first ground path **(201a)** and said second ground path **(201b)** are electrically isolated.

9. The vehicle electrical system as claimed in claim 1, wherein said switch module **(21)** is a headlamp switch **(21).**

10. The vehicle electrical system as claimed in claim 1, wherein said integrated module **(100)** is a metal core printed circuit board (MC-PCB).

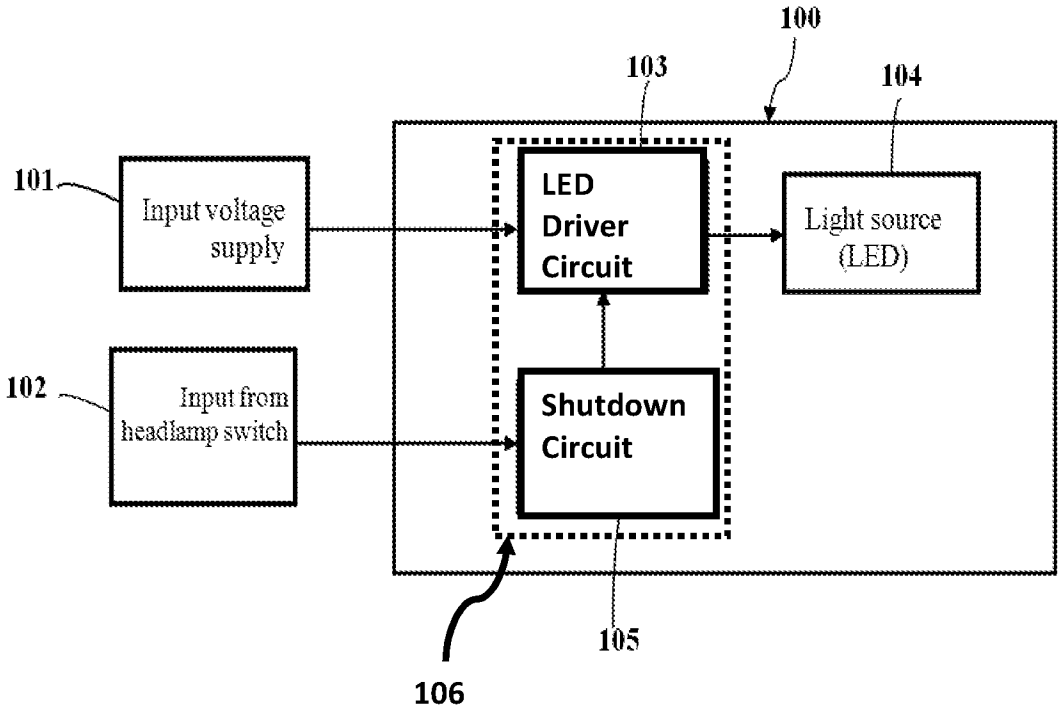
100
103
104
101
Input voltage supply
LED Driver Circuit
Light source (LED)
102
Input from headlamp switch
Shutdown Circuit
105
106

Fig.1

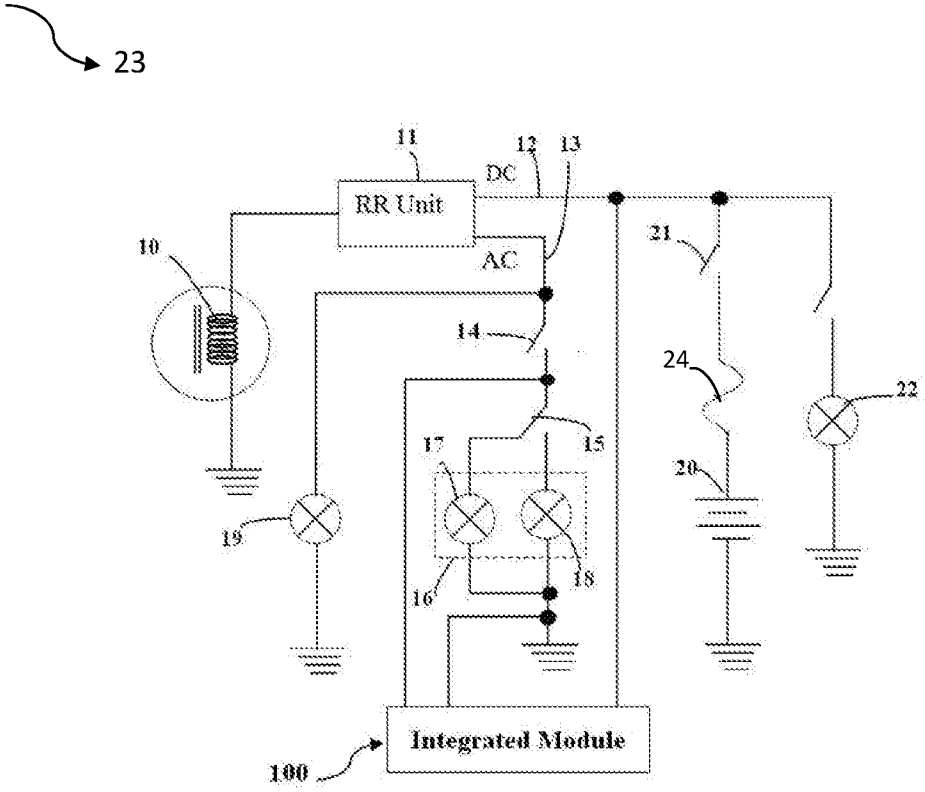
23
11
12
13
DC
RR Unit
AC
10
21
14
24
22
17
15
20
19
18
16
Integrated Module
100

Fig.2

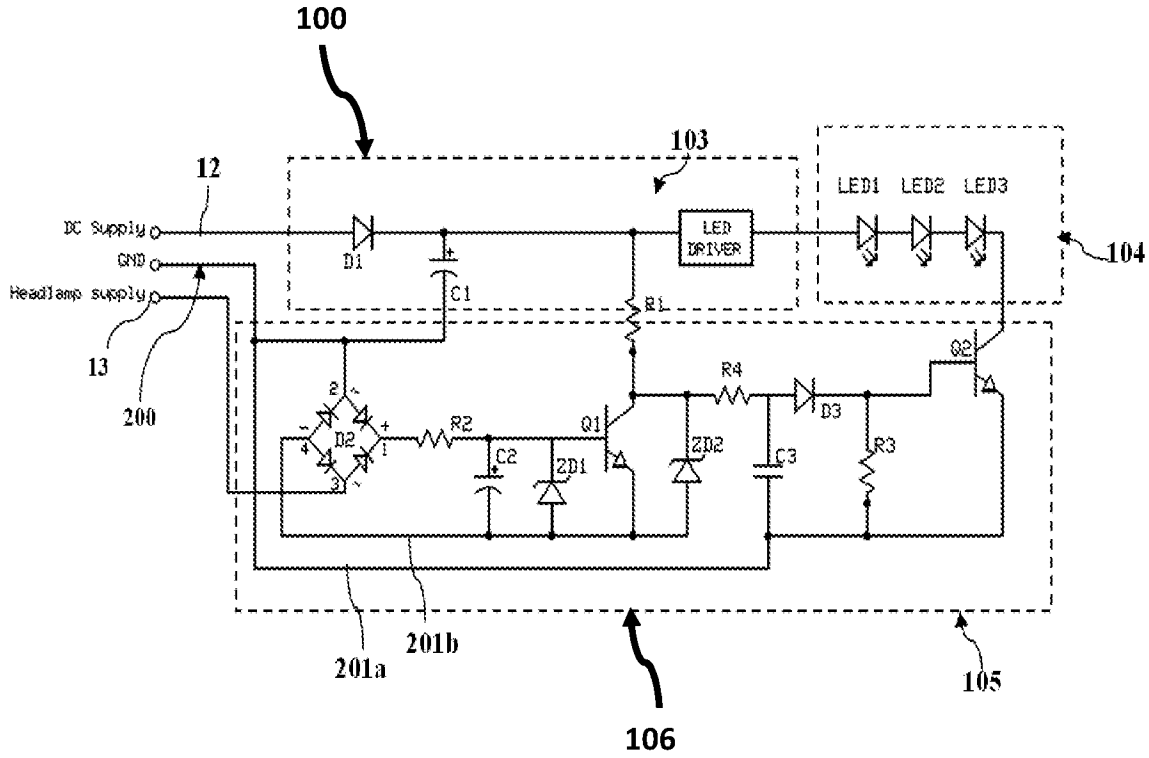
100
103
12
DC Supply
GND
Headlamp supply
13
200
D1
C1
LED DRIVER
LED1 LED2 LED3
104
R1
R4
Q2
D2
R2
Q1
D3
C2
ZD1
ZD2
C3
R3
201a
201b
105
106

Fig. 3

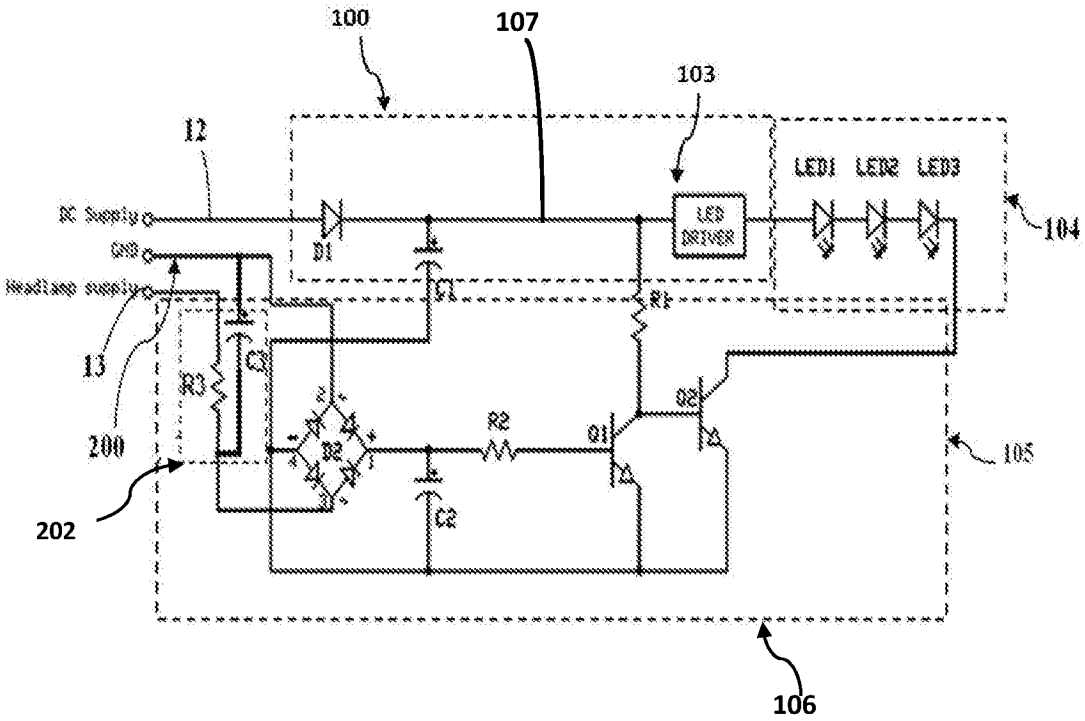
100
107
103
12
LED1
LED2
LED3
LED DRIVER
104
D1
C1
R1
13
R3
C3
200
BR
R2
Q1
Q2
105
202
C2
106

Fig. 4

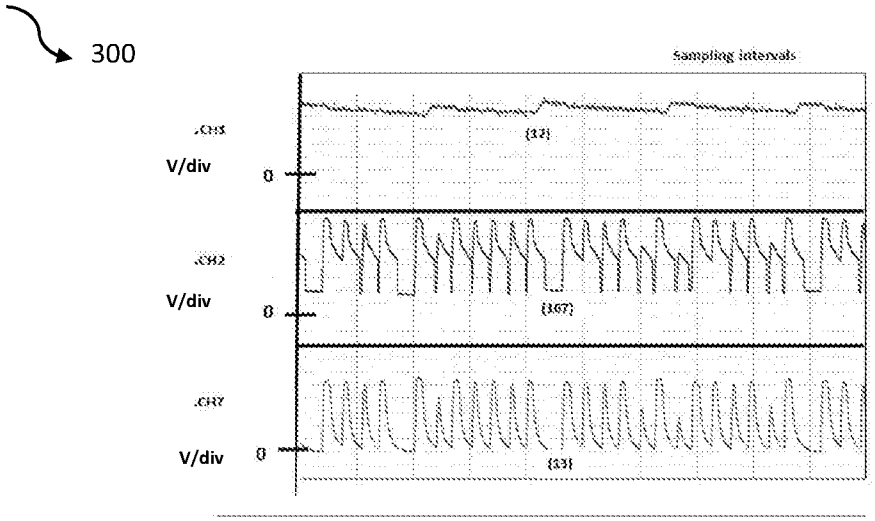
300
Sampling intervals
CH1
V/div
0
(12)
CH2
V/div
0
(107)
CH7
V/div
0
(13)

Fig. 5a

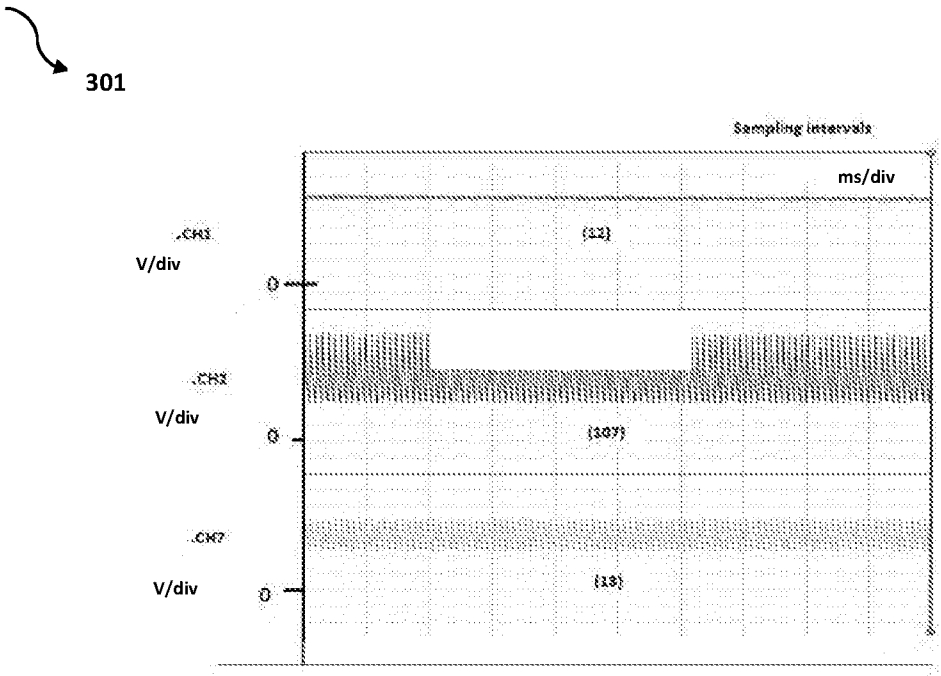
301
Sampling intervals
ms/div
CH1
V/div
0
(12)
CH2
V/div
0
(107)
CH7
V/div
0
(13)

Fig. 5b

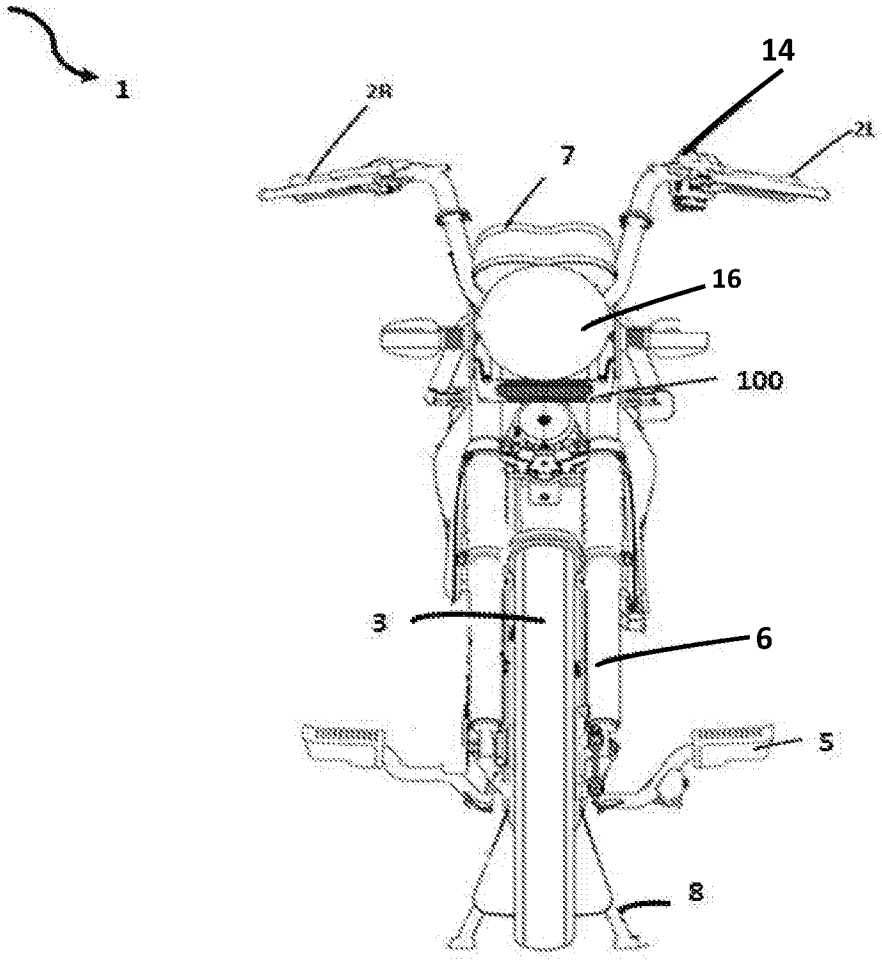

Fig. 6

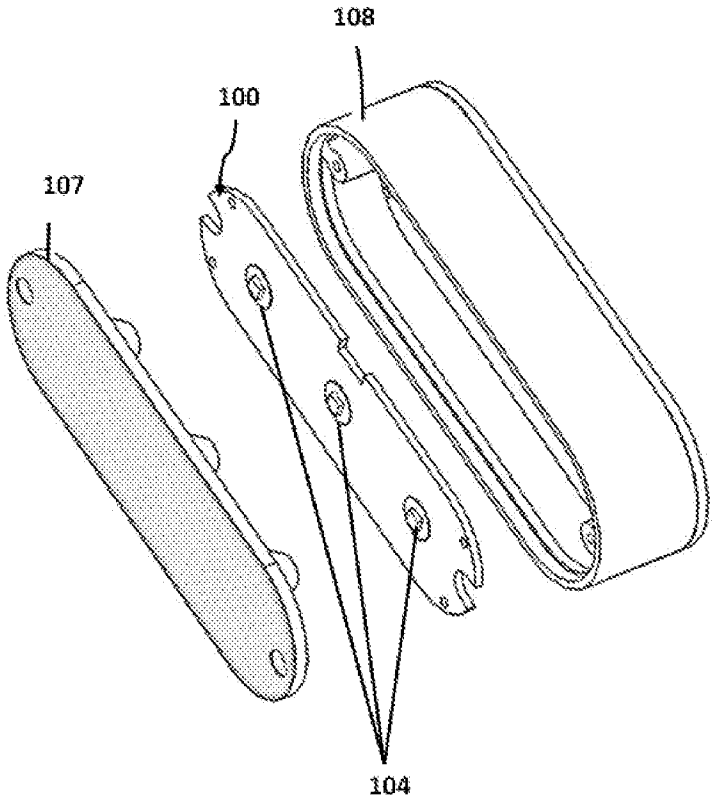

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/051498

A. CLASSIFICATION OF SUBJECT MATTER
B60Q1/00,B60R16/00 Version=2018.01

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)

B60Q, B60R

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)

Databases: TotalPatent One, IPO Internal Database
Keywords: Vehicle electric system, Day time running lights

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US5656922A (ECOAIR CORPORATION), 12 AUGUST 1997 (12-08-1997); Claim 1; Column 1, lines 10-26; Column 5, lines 44-54; Column 7, lines 7-30, 51-58; Column 8, lines 3-21; Figures 3-4, 13-17; Abstract	1-10
Y	WO2003045733A1 (TYCO ELECTRONICS AMP KOREA LIMITED), 05 JUNE 2003 (05-06-2003); Claims 2-3; Page 2, lines 14-22; Page 5, line 15 to Page 7, line 5; Page 11, line 23 to Page 12, line 4; Figures 1-4, 6; Abstract	1-10
Y	US20020191416A1 (JAM STRAIT INC.), 19 DECEMBER 2002 (19-12-2002); Claim 1; Paragraphs [0028], [0031], [0109], [0113]; Figure 12; Abstract	1-10
Y	USRE37677E1 (SEE ME LIGHTS CORP.), 30 APRIL 2002 (30-04-2002); Claims 1, 3-4, 17; Column 1, lines 32-50; Column 2, lines 19-47; Column 4, line 53 to Column 6, line 13; Figures 2-6	8-10

☐ 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	Date of mailing of the international search report
12-06-2018	12-06-2018

Name and mailing address of the ISA/	Authorized officer
Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Md. Tanveer ur Rahman Telephone No. +91-1125300200

International application No.
PCT/IB2018/051498

Citation	Pub.Date	Family	Pub.Date
US 5656922 A	12-08-1997	WO 1996019039 A1	20-06-1996
WO 2003045733 A1	05-06-2003	KR 20030044637 A	09-06-2003
US 20020191416 A1	19-12-2002	US 6786625 B2	07-09-2004