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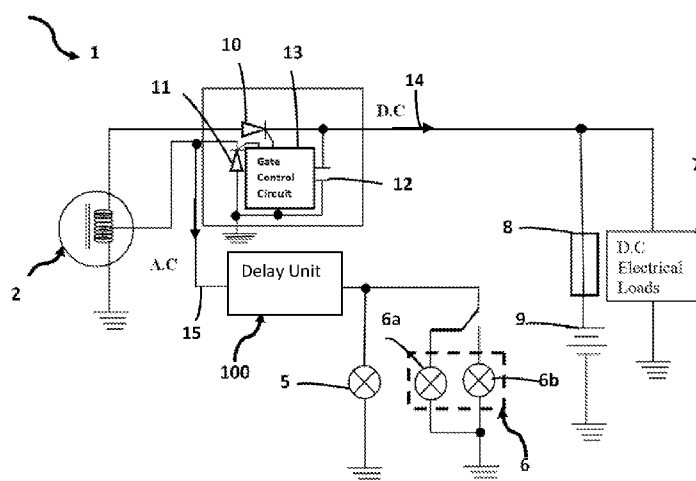


Fig.2

(57) Abstract: The present invention relates to an automatic light system comprising delay unit (100) is electrically coupled to a regulator and rectifier (RR) unit (3) for delaying an output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3). In the present invention, the delay unit (100) includes at least one gate trigger circuit (107) and at least one auxiliary electronic switch (102). Furthermore, said delay unit (100) is a two-wire circuit comprising of at least one input terminal (100a) and at least one output terminal (100b).

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AUTOMATIC LIGHT SYSTEM

TECHNICAL FIELD

[0001] The present subject matter relates to a vehicle. More particularly, the present subject matter relates to an automatic light system for the vehicle.

5

BACKGROUND

[0002] Automotive lighting systems are evolving in several areas including the use of automatic headlight ON system intended to increase the visibility of the motor vehicle to others when vehicle headlamps are turned on. Thus, facilitating an improvement in traffic safety with substantial decline rate in accidents for that group of motor vehicles which operate in the daytime with their headlamps turned on. Hence, automobile manufacturers have begun to factory equip their motor vehicle products with headlamp activation systems, which will automatically turn on at least the headlamp low beams when the vehicle is being operated, and turning them off when the vehicle engine is turned off. Thus, millions of automobiles on the road could benefit from the enhanced visibility and safety offered by daytime headlamp operation.

[0003] Furthermore, safety requirements on automatic headlamp ON (AHO) necessitates that the headlamps of two-wheeled vehicles must turn ON automatically when the engine is running or alternatively an additional at least one electrical device including a Daytime Running Lamp (DRL) should be installed in the vehicle which shall turn ON automatically when engine is running and it shall turn OFF when headlamp is turned ON. Thus, a number of modifications in plurality of wiring connections and mechanical mounting provisions on the vehicle are made to ensure that the headlamp turns ON automatically whenever the engine is running, or alternatively said at least one electrical device including the Daytime Running Lamp (DRL) turns ON automatically when engine is running and turns OFF if the headlamp is switched ON.

[0004] However, the number of modifications of wiring connections, the mechanical mountings and the installation of said at least one electrical device including the Daytime Running Lamp (DRL) on vehicle increases the number of components and assembly time on the vehicle. Thus, increasing the overall cost
5 for the vehicle and further imparting a complicated wiring installation.

[0005] Further, the headlamp being a huge electrical load is actuated through an A.C (alternating current) power supply (alternating current) generated by a permanent magnet generator. Thus, the headlamp is kept constantly actuated following the starting of the engine which deteriorates the engine startability and
10 thus increases the engine load. Thus, reducing fuel efficiency of the vehicle.

[0006] In a known automatic light system, an engine loading and startability due to high output power by headlamp is avoided by switching over to at least one LED headlamps of lower power consumption. However, such installation of LED headlamp on vehicle is expensive and further increases the number of components
15 with increased wiring connections on the vehicles. Further; another problem with continuous actuation of the headlamp is that the headlamp keeps drawing power from the permanent magnet generator even during engine cranking. Thus, resulting in increased cranking energy requirement.

[0007] Another known automatic light system for the vehicle includes a
20 method of improving engine startability wherein the load on the permanent magnet generator load is reduced during engine starting. In such light system, a battery charging voltage is reduced to a lower target value during engine starting and a headlamp supply voltage is reduced using Pulse Width Modulation (PWM) PWM. However, such system requires a DC (Direct Current) supply for the
25 headlamp which increases the size of the permanent magnet generator.

[0008] An existing vehicle lighting system includes at least one electronic control unit and at least one switch controlled to supply an output regulated A.C power from a regulator and rectifier unit to at least one A.C load including the vehicle headlamp. In this lighting system, said at least one electronic control unit
30 receives input from said regulator and rectifier unit (RR) to estimate the frequency

of the signal which is the rotational speed of the engine crankshaft. The electronic control unit fetches this frequency reading and decides when to allow power to the lighting loads depending upon the frequency threshold set in the internal logic. This enables engine speed based control of power delivery to lighting loads.

5 Further, the system is not immune to coupled noise or transients in the input signal and it might estimate wrong frequency which in turn leads to wrong engine speed estimation. Furthermore, said vehicle lighting system with said at least one electronic control unit and said at least one switch increases the number of the parts and components on the vehicle, hence increasing the number of wiring

10 connections and additionally increasing assembly time for the parts and components on vehicle.

[0009] While numerous automatic light systems have been developed, in general, these systems have had serious drawbacks due to complexity, high cost, increased number of wiring connections, increased number of components and

15 hence complex circuitry for the vehicle light system. These shortcomings, particularly in the area of complicated circuit with plurality of wiring connections for the vehicle automatic light system, have been directly responsible for the increase in the engine load, deterioration of the engine startability and hence reduction in fuel efficiency of the vehicle.

20 [00010] Hence, it is desirable to provide an improved automatic light system for the vehicle which automatically turns ON the headlamps when the engine starts running and turns OFF the headlamp when the engine is stopped without requiring an increased number of wiring connections and hence providing a relatively simple structure. Further, it is needed to provide the improved automatic

25 light system which is cost effective and is easy to install on the vehicle. Further, it is desirable to provide an improved automotive light system for the vehicle with minimal changes to existing vehicle design and simultaneously meets the statutory requirements. Additionally, it is needed to provide an improved automatic light system for the vehicle which provides a compact, simple and cost-effective

30 installation on the vehicle. Further, it is needed to provide an improved automatic

light system facilitating improved engine startability with reduced engine load and hence providing better and enhanced fuel economy for the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [00011] 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.

[00012] Fig.1 is a schematic circuit diagram of an automatic light system illustrating a delay unit as per first embodiment of the present invention.

10 [00013] Fig.2 is a schematic circuit diagram of the automatic light system illustrating the delay unit as per second embodiment of the present invention.

[00014] Fig.3 is a schematic circuit diagram of the delay unit illustrating at least one gate trigger circuit including a first resistor of at least one current limiting resistor as per first and second embodiment of the present invention.

15 [00015] Fig. 4 is a schematic circuit diagram of the delay unit illustrating said at least one gate trigger circuit including a second resistor and a third resistor of said at least one current limiting resistor as per first and second embodiment of the present invention.

DETAILED DESCRIPTION

20 [00016] Generally, a continuous headlamp ON condition for motor vehicles involves a plurality of electronic and electrical modifications in the vehicle light system. For example, a headlamp switch module electrically coupled to the headlamp and one or more wiring connections in the circuitry of the headlamp are modified in order to change the circuitry design for the vehicle light system.

25 However, the headlamp being a huge electrical load for a permanent magnet generator is actuated through an A.C (alternating current) power supply (alternating current). Thus, the automatic light system with the continuous ON headlamp following the starting of the engine deteriorates the engine startability

and thus increases the engine load. Thus, degrading the fuel economy of the vehicle. Further, the problem of the engine startability and the engine loading can be overcome by switching over to LED headlamps, one or more light sources of lower power consumption or alternatively installing daytime running lamp (DRL) on the vehicle. However, installation of the LED headlamps or alternatively daytime running lights (DRL) on the vehicle increases the number of components, number of wiring connections on the vehicle and thus increasing the overall cost and assembly time on the vehicle and furthermore providing a complex design to the automatic light system for the vehicle.

10 **[00017]** It is apparent that the problems of the motor vehicle light system with the automatic headlamp ON (AHO) have not heretofore escaped attention. The above described existing light systems reflect an appreciation of the urgent need for a completely satisfactory improved automatic light system with a headlamp control arrangement, but it is apparent from the deficiencies in each of
15 those prior expedients that the application of known art & skill has not sufficed to satisfy the recognized need.

[00018] Hence, it is desirable to provide an improved automatic light system including reduced number of wiring connections, mounting provisions, reduced number of components and hence a simple design. Further, it is needed to provide
20 an improved automatic light system facilitating improved engine startability with reduced engine load and hence providing better and enhanced fuel economy for the vehicle.

[00019] With the above objective in view, it is an object of the present invention to provide a new automatic light system which incorporates a delay unit
25 as a control circuitry responsible for controlling the actuation of the headlamp ON following the starting of the engine. It is further an object of the present invention to provide the delay unit facilitating a delaying effect on supply of AC power to the headlamp following starting of the engine and thus improving engine startability.

[00020] The present invention relates to an improved automatic light system for the vehicle including a permanent magnet generator coupled with the engine for producing an alternating current, a battery operatively connected with said permanent magnet generator to be charged therefrom, a regulator and rectifier (RR) unit operatively connected to said permanent magnet generator for receiving the alternating current. As per present invention, said regulator and rectifier (RR) unit includes at least one gate control circuit and a shunt configuration of at least two primary electronic switches. In present invention, said at least one gate control circuit is configured to regulate said alternating current on said at least two primary electronic switches for supplying an output regulated and rectified voltage D.C power and an output regulated voltage A.C power to at least one D.C load and at least one A.C load respectively. Further, said at least one A.C load includes at least one lighting and signalling device having an input connected to an output of said regulator and rectifier (RR) unit for receiving said output regulated voltage A.C power. As per first and second embodiment, said at least one lighting and signalling device is the headlamp. As per first and second embodiment of the present invention, said automatic light system for the vehicle further comprises the delay unit including at least one gate trigger circuit and at least one auxillary electronic switch. Referring to first and second embodiment of the present invention, said delay unit is a two-wire circuit comprising of at least one input terminal and at least one output terminal. In first and second embodiment, said at least one auxillary electronic switch is electrically connected between said at least one input terminal and said at least one output terminal of the delay unit. In first and second embodiment of the present invention, each of said at least two primary electronic switches is a Silicon Controlled Rectifier (SCR) and said at least one auxillary electronic switch is from a group consisting a TRIAC, reverse parallel connected transistors, thyristors, MOSFETs and electromechanical relay. In first and second embodiment of the present invention, said at least one gate trigger circuit is electrically coupled to said at least one auxillary electronic switch. As per first and second embodiment, said at least one gate trigger circuit comprises at

least one current limiting resistor R, R1, R2 and at least one zener diode ZD1, ZD2.

[00021] As per first and the second embodiment of the present invention, said regulator and rectifier (RR) unit includes said at least one gate control circuit and the shunt configuration of said at least two first electronic switches. In present invention, said at least one gate control circuit is configured to regulate said alternating current on said at least two primary electronic switches for supplying an output regulated and rectified voltage D.C power and an output regulated voltage A.C power to at least one D.C load and at least one A.C load respectively.

10 In first and second embodiment of the present invention, delaying a gate trigger through said at least one gate control circuit to an A.C line of said output regulated voltage A.C power of said regulator and rectifier (RR) unit doesnot provide delay in the supply of said output regulated voltage A.C power to said at least one A.C load including the headlamp. Therefore, as per first embodiment,

15 said delay unit is electrically coupled between the permanent magnet generator and the regulator and rectifier (RR) unit and as per second embodiment, said delay unit is electrically coupled between said output regulated voltage A.C power of said regulator and rectifier (RR) unit and said at least one A.C load.

[00022] The present invention relates to the improved automatic light system including the delay unit to prevent actuation of said at least one signalling and lighting device including the headlamp before the engine attains the predetermined speed following start-up. As per first and second embodiment of the present invention, said at least one gate trigger circuit controls power delivery to said at least one signalling and lighting device including the headlamp, until the

20

25 engine attains the predetermined speed of 1000 rpm following start-up.

[00023] The object of the present invention is to provide the improved automatic light system with the delay unit as a two-wire circuit and hence provides a compact, cost effective installation on the vehicle and further involves minimum number of the wiring connections and mounting provisions and

30 provides a delaying effect in supplying the A.C power supply to said at least one

lighting and signalling device including the headlamp. Hence, improving the engine startability and providing better fuel economy with lower cranking load.

[00024] The purpose of the present invention is to provide an improved automotive light system for automotive vehicular use. A particular objective is to
5 install the delay unit as the two-wire circuit on the vehicle and hence provide a simple design with said delaying effect in actuation of the headlamp following the starting of the engine.

[00025] The present invention relates to the delay unit provided with the two-wire circuit including said at least one input terminal and said at least one
10 output terminal and hence, imparting a simple structure and minimum number of wiring connections for installation on the vehicle. As per first and second embodiment of the present invention, the delay unit actuates the headlamp after a predetermined period of time following the starting of the engine and hence facilitating reduced engine load and improved engine startability. In first and
15 second embodiment, said at least one gate control circuit of said regulator and rectifier (RR) unit controls the power delivery to the headlamp, after the engine attains the predetermined speed. As per first and second embodiment of the present invention, said predetermined engine speed is 1000 rpm.

[00026] The present invention provides the improved automatic light system
20 with the delay unit. In first and second embodiment of present invention, the delay unit is the two-wire circuit and thus comprises few electronic components including said at least one gate trigger circuit and said at least one auxillary electronic switch. Hence, the delay unit in said automatic light system can be packaged within a small enclosure and attached with minimum number of wiring
25 harness on motor vehicles including the motorcycle type of two wheeled vehicles and the scooter type of two-wheeled vehicles. Also, the delay unit can be arranged within said regulator and rectifier (RR) unit and thereby the aluminium heat sink of the shunt configuration of said two Silicon Controlled Rectifier (SCRs) within the regulator and the rectifier (RR) unit can dissipate the heat generated due to
30 power dissipation in the TRIAC (Triode for Alternating Current).

[00027] Further, a more precise triggering of said at least one auxillary electronic switch including the TRIAC can be achieved with an electronic control unit used for spark ignition in the vehicle such as a Capacitive Discharge Ignition (CDI) unit or a Transistor Controlled Ignition (TCI) unit. Thus, the electronic control unit reciving the input from an engine speed sensor can also triggers the TRIAC when the engine speed attains the predetermined speed which is 1000 rpm.

[00028] The present invention relates generally to the automatic light system and more particularly to the light system with a delay unit for delaying the time within which said at least one A.C load including said at least one lighting and signalling device such as the headlamps of the vehicle is energized after the engine of the vehicle attains the predetermined speed. Thus, the delay unit controls power delivery to said at least one A.C load including the vehicle headlamp by allowing the power to reach the vehicle headlamp only after the engine attains the predetermined speed which is 1000 rpm. Thus, facilitating improved engine startability and idling stability, particularly in cold conditions. As per first and second embodiment of the present invention, said at least one auxillary electronic switch as said TRIAC enables gradual increase in power delivery to said at least one signalling and lighting device including the vehicle headlamps as compared to said conventional automatic light system with an electromechanical relay having disadvantages of interrupting supply instantaneously resulting in huge currents in said at least one A.C load including the headlamp and thus reducing the shelf-life of the headlamps.

[00029] It is a further object of the present invention to provide the improved automatic light system including the two-wire delay unit for delaying the energization of the headlights only when the engine attains the predetermined speed.

[00030] As per first and second embodiment of the invention, the delay unit is connected in an A.C (alternating current) line of the output regulated voltage A.C power of the regulator and rectifier (RR) unit. As per first embodiment of the

present invention, said delay unit is electrically coupled between the permanent magnet generator and the regulator and rectifier (RR) unit. As per second embodiment of the present invention, said delay unit is connected between said output regulated voltage A.C power of said regulator and rectifier (RR) unit and said at least one A.C load of automatic light system. As per first and second embodiment of the present invention, the delay unit comprises said at least one auxillary electronic switch as the TRIAC which allows current supply in said at least one A.C load including the vehicle headlamp only when the amplitude of generated said output regulated voltage A.C power of said regulator and rectifier (RR) unit exceeds a predetermined value.

[00031] The present invention relates to the two-wire delay unit provided for delaying the actuation of the vehicle headlamp for the predetermined period of time until the engine has attained the predetermined speed that is, 1000 rpm. As per first and second embodiment, the delay unit employs an effective said at least one gate trigger circuit and said at least one auxillary electronic switch. In first and second embodiment of the present invention, said at least one gate trigger circuit is electrically coupled to said at least one auxillary electronic switch. In present invention, said at least one gate trigger circuit comprises said at least one current limiting resistor R, R1, R2 and at least one zener diode ZD1, ZD2. In first and second embodiment of the present invention, said at least one auxillary electronic switch is a TRIAC. As per present invention, said TRIAC, which allows current flow in both directions based on an input of said at least one gate trigger input. The TRIAC receives trigger signals through said at least one gate trigger circuit including said at least one current limiting resistor R, R1, R2 and at least one zener diode ZD1, ZD2. As per one embodiment of the present invention, the ratings of R, R1, R2, ZD1 and ZD2 are selected as per the alternating voltage generated by the permanent magnet generator for the required load condition and the predetermined speed of the engine beyond which the generated power should be delivered to said at least one A.C load.

[00032] As per first and second embodiment of the present invention, the two-wire delay unit prevents the headlamps of the motor vehicle from being actuated until the engine attains the predetermined speed.

5 [00033] The present invention relates to said improved automatic light system in which the output regulated voltage A.C power of said rectifier and regulator (RR) unit is delayed during engine starting by said at least one gate trigger circuit triggering when amplitude of the alternating voltage of the permanent magnet generator exceeds a predetermined value.

10 [00034] It is therefore a first object of the present invention to provide the improved automatic light system with a delayed effect, which is able to not only effectively improve the problem of power distribution in the instant of starting the vehicle, but also automatically control the actuation of said at least one signalling and lighting device including the vehicle headlamp.

15 [00035] The object of the present invention is to provide the two-wire delay unit. In the first and second embodiment, the main power is supplied to said at least one input terminal of the delay unit by means of switching on the vehicle ignition switch (starting the engine). At the same time, the vehicle is started and the delay unit is delayedly energized to delay output regulated voltage A.C power from the regulator and rectified unit (RR) to the vehicle headlamp. In first and
20 second embodiment of the present invention, said delay unit includes said at least one gate trigger circuit and said at least one auxillary electronic switch. As per first and second embodiment, said at least one auxillary electronic switch including the TRIAC is electrically connected between said at least one input terminal and said at least one output terminal of the delay unit. As per first and
25 second embodiment of the present invention, after the engine is started, the permanent magnet generator parallely generates power for fully supplying power. That is, when said engine attains the predetermined speed of 1000 rpm, then said output regulated voltage A.C power of said regulator and rectifier (RR) unit is distributed to the said at least one A.C load including the vehicle headlamp. Thus,
30 with such delay unit when installed in the vehicle avoids excessive engine load

and hence provide a simple, improved, compact and cost effective installation of the delay unit on the vehicle.

[00036] Yet another object of this invention is to provide the delay unit as a two-wire control circuitry for the automatic light system for the vehicle for providing a delaying effect in supplying the A.C (alternating current) power supply to the vehicle headlamp after the predetermined period of the time following the starting of the engine. Most specifically, present invention relating to the delay unit is electrically coupled between the permanent magnet generator and the regulator and rectifier (RR) unit, as per first embodiment of the present invention. And as per second embodiment of the present invention, the two-wire delay unit is electrically coupled between said output regulated voltage A.C power of said regulator and rectifier (RR) unit and said at least one A.C load.

[00037] The present invention relates to the delay unit being a two-wire circuit for controlling the energization of motor vehicle headlamps.

[00038] It is accordingly an object of this invention to provide a simple, low power delay unit in the form of said two-wire circuit that automatically turns on the headlamps after the engine attains the predetermined speed following when a vehicle ignition switch is turned to an "on" position.

[00039] The present invention relates to the two-wire delay unit for turning ON the headlamps of the motor vehicle. Further, the present invention relates to an automatic light system for controlling the actuation of the vehicle headlight.

[00040] The object of the invention is to provide the delay unit as a headlamp control apparatus which can cause the headlamps to be turned on after a predetermined period of time following the starting of the engine.

[00041] The present invention provides the improved automatic light system that is adapted for normal operation when the vehicle engine is in operation, and the delay unit automatically turns ON the headlamp after the engine attains the predetermined speed.

[00042] It is advantageous to install said delay unit as the two-wire circuit in the vehicle automatic light system which involves at least two wiring connection including said at least one input terminal and said at least one output terminal and hence provides simple structure to the delay unit and hence easy installation the
5 vehicle.

[00043] Exemplary embodiments detailing features of the vehicle automatic light system illustrating the delay unit, in accordance with the present invention will be described hereunder. Exemplary embodiments detailing features of the three-wheeled vehicle, in accordance with the present invention will be described
10 hereunder. The present invention is not restricted in its application and is applicable to two-wheeled vehicles, three-wheeled vehicles and four -wheeled vehicles employing an internal combustion engine or either by an internal combustion engine or the drive motor selectively or by the drive motor alone.

[00044] Various other features and advantages of the invention are described
15 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
20 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.

[00045] **Fig.1** is a schematic circuit diagram of the automatic light system (1) as per first embodiment of the present invention. In the first embodiment, the
25 automatic light system (1) for the vehicle comprises the permanent magnet generator (2) coupled with the vehicle engine for producing the A.C (alternating current), the vehicle battery (9) operatively connected to said permanent magnet generator (2) to be charged therefrom, the regulator and rectifier (RR) unit (3) operatively connected to said permanent magnet generator (2) and includes said at
30 least at least one gate control circuit (13) and the shunt configuration of said at

least two primary electronic switches (10), (11). As per first embodiment of the present invention, said at least one gate control circuit (13) is configured to regulate said alternating current on said at least two primary electronic switches (10) for supplying the output regulated and rectified voltage D.C power (14) and the output regulated voltage A.C power (15) to said at least one D.C load (7) and said at least one A.C load (5), (6) respectively. For example, the output regulated voltage A.C power (15) is supplied to said at least one A.C load including (5), (6) such as tail lamp (5) and the headlamp (6). As per one embodiment, the headlamp (6) has a high beam filament (6a) and a low beam filament (6b). Further, as per first embodiment of the present invention, said at least one A.C load (5), (6) includes said at least one lighting and signalling device (6) having an input connected to an output of said regulator and rectifier (RR) unit (3) for receiving said output regulated voltage A.C power (15). In first embodiment, said at least one lighting and signalling device (6) is the vehicle headlamp (6). According to the present invention, the fuse (8) protects the wiring harness against a short circuit condition of the vehicle battery (9) and the vehicle ignition switch (not shown) connects or disconnects battery (9) from said at least one D.C load (7).

[00046] Further in Fig.1, referring to first embodiment of the present invention, said automatic light system (1) for the vehicle includes the delay unit (100) as said two-wire circuit installed therein for providing a delaying effect in supply of the output regulated voltage A.C power (15) to said at least one signalling and lighting device (6) such as the vehicle headlamp (6). As per first embodiment of the present invention, said delay unit (100) is electrically coupled between said permanent magnet generator (2) and the regulator and rectifier (RR) unit (3). As per first embodiment of the present invention, the delay unit (100) includes said at least one gate trigger circuit (107) and said at least one auxiliary electronic switch (102). Further, as per first embodiment of the present invention, said delay unit (100) is the two-wire circuit comprising of said at least one input terminal (100a) and said at least one output terminal (100b). In first embodiment, said at least one auxiliary electronic switch (102) is electrically connected between said at least one input terminal (100a) and said at least one output terminal (100b) of the delay

unit (100). As per first embodiment of the present invention, said delay unit (100) is being electrically coupled between the permanent magnet generator (2) and the regulator and rectifier (RR) unit (3) and thus providing the delay of said output regulated voltage A.C power (15) to said at least one A.C load (5), (6) including the headlamp (6) until the voltage amplitude of the permanent magnet generator (2) exceeds the predetermined value.

[00047] Fig.2 is a schematic circuit diagram of the automatic light system (1) illustrating as per second embodiment of the present invention. Referring to second embodiment, the automatic light system (1) for the vehicle comprises the permanent magnet generator for producing the A.C (alternating current), the vehicle battery (9) operatively connected to said permanent magnet generator (2) to be charged therefrom, the regulator and rectifier (RR) unit (3) including said at least one gate control circuit (13) and the shunt configuration of at least two primary electronic switches (10), (11). As per first embodiment of the present invention, said at least one gate control circuit (13) of said regulator and rectifier (RR) unit (3) is configured to regulate said alternating current on said at least two primary electronic switches (10), (11) for supplying the output regulated and rectified voltage D.C power (14) and the output regulated voltage A.C power (15) to said at least one D.C load (7) and said at least one A.C load (5), (6) respectively. For example, the output regulated voltage A.C power (15) is supplied to said at least one A.C load including (5), (6) such as tail lamp (5) and the headlamp (6). As per second embodiment, said at least one A.C load (5), (6) includes said at least one signalling and lighting device (6). In second embodiment, said at least one signalling and lighting device (6) is the vehicle headlamp (6). In second embodiment, the headlamp (6) has the high beam filament (6a) and the low beam filament (6b). As per second embodiment, said automatic light system (1) for the vehicle further includes said at least one lighting and signalling device (6) including said vehicle headlamp (6) having the input connected to the output of said regulator and rectifier (RR) unit (3) for receiving said output regulated voltage A.C power (15). According to the present invention, the fuse (8) protects the wiring harness against the short circuit condition of the vehicle battery (9) and the

vehicle ignition switch (not shown) connects or disconnects battery (9) from said at least one D.C load (7).

[00048] Further in Fig.2, said automatic light system (1) for the vehicle includes the two-wire delay unit (100) installed therein for providing the delaying effect in supply of the output regulated A.C power (15) to the vehicle headlamp (6). As per second embodiment, said delay unit (100) is electrically coupled between said output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3) and said at least one A.C load (5), (6). As per second embodiment of the present invention, said at least one A.C load includes the tailamp (5) and the headlamp (6). In second embodiment of the present invention, said delay unit is connected between said output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3) and said at least one A.C load (5), (6). Hence, the permanent magnet generator (2) is not loaded by the A.C (alternating current) line of the output regulated voltage A.C power (15) of the regulator and rectifier (RR) unit (3) comprising of the shunt configuration of said two Silicon Controlled rectifiers (SCRs) (10), (11) before engine starting as said the output regulated voltage A.C power (15) of the regulator and rectifier (RR) unit (3) is not high enough for shunting condition to start.

[00049] Fig.3 is a schematic circuit diagram of the delay unit (100) illustrating said at least one gate trigger circuit (107) including a first resistor R (101) of at least one current limiting resistor R (101), R1 (105), R2 (106) as per first and second embodiment of the present invention. In first and second embodiment of the present invention, the delay unit (100) is the two-wire circuit including said at least one input terminal (100a) and said at least one output terminal (100b). Further, said delay unit (100) includes said at least one gate trigger circuit (107) and said at least one auxillary electronic switch (102). As per first and second embodiment of the present invention, said at least one auxillary electronic switch (102) is TRIAC TR (102). In first and second embodiment, said TRIAC TR (102) is electrically connected between said at least one input terminal (100a) and said at least one output terminal (100b) of the delay unit (100). As per first and

second embodiment of the present invention, said at least one gate trigger circuit (107) is electrically coupled to said at least one auxillary electronic switch (102). In first and second embodiment, said at least one gate trigger circuit (107) comprises said first resistor **R** (101) of said at least one current limiting resistor **R** (101), **R1** (105), **R2** (106) and a zener diode **ZD1** (103) and a second zener diode **ZD2** (104) of at least one zener diode **ZD1** (103), **ZD2** (104).

[00050] Further in Fig.3, as per first and second embodiment of the present invention, said **TRIAC TR** (102) allows current flow in both directions based on a gate trigger input of said at least one gate trigger circuit (107). As per first and second embodiment, the **TRIAC TR** (102) receives the trigger signals through said at least one gate trigger circuit (107) comprising of the first resistor **R** (101) of said at least one current limiting resistor **R** (101), **R1** (105), **R2** (106) and the first zener diode **ZD1** (103) and the second zener diode **ZD2** (104) of said at least one zener diode **ZD1** (103), **ZD2** (104). As per the first and second embodiment, the ratings of the first resistor **R** (101), the first zener diode **ZD1** (103) and the second zener diode **ZD2** (104) are selected as per the alternating voltage generated by the permanent magnet generator (2) for the required load condition and the engine predetermined speed beyond which the output regulated A.C power (15) generated by the regulator and rectifier (RR) unit (3) is supplied to said at least one A.C load (5), (6) including said vehicle headlamp (6). As per first and second embodiment, during a positive half cycle of the output regulated voltage A.C power (15), the first zener diode **ZD1** (103) is forward biased and the second diode **ZD2** (104) is reverse biased. Thus, whenever a positive going the output regulated voltage A.C power (15) exceeds a breakdown voltage of the second diode **ZD2** (104), a gate trigger current flows through said at least one gate trigger circuit (107) including the first resistor **R** (101) and the first zener diode **ZD1** (103) and the second zener diode **ZD2** (104), thus triggering said **TRIAC TR** (102) and hence allowing the **TRIAC TR** (102) to conduct. Further, during negative half cycle of the output regulated voltage A.C power (15), the second zener diode **ZD2** (104) is forward biased and the first zener diode **ZD1** (103) is reverse biased. Thus, whenever a negative going said output regulated voltage

A.C power (15) exceeds a breakdown voltage of the first zener diode **ZD1 (103)**, the gate trigger current flows through said at least one gate trigger circuit (107) including the first resistor **R (101)** and the first zener diode **ZD1 (103)** and the second zener diode **ZD2 (104)**, thus triggering said **TRIAC TR (102)** and hence
5 allowing the **TRIAC TR (102)** to conduct.

[00051] **Fig. 4** is a schematic circuit diagram of the delay unit (100) illustrating said at least one gate trigger circuit (107) including the second resistor **R1 (105)** and the third resistor **R2 (106)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** as per first and second embodiment of the present
10 invention. In first and second embodiment of the present embodiment, the delay unit (100) is the two-wire circuit including said at least one input terminal (100a) and said at least one output terminal (100b). Further, said delay unit (100) includes said at least one gate trigger circuit (107) and said at least one auxillary electronic switch (102). As per first and second embodiment of the present
15 invention, said at least one auxillary electronic switch (102) is the **TRIAC TR (102)**. In first and second embodiment, said **TRIAC TR (102)** is electrically connected between said at least one input terminal (100a) and said at least one output terminal (100b) of the delay unit (100). As per first and second embodiment of the present invention, said at least one gate trigger circuit (107) is
20 electrically coupled to said at least one auxillary electronic switch (102). In first and second embodiment, said at least one gate trigger circuit (107) comprises the second resistor **R1 (105)**, and the third resistor **R2 (106)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** and the first zener diode **ZD1 (103)** and the second zener diode **ZD2 (104)** of at least one zener diode **ZD1 (103)**, **ZD2 (104)**.
25

[00052] Further in **Fig.4**, the delay unit (100) includes said at least one auxillary electronic switch (102) as the **TRIAC TR (102)** to control the output regulated A.C power supply (15) to said at least one A.C load (5), (6) including the vehicle headlamp (6). As per first and second embodiment of the invention,
30 said at least one gate trigger circuit (107) includes the second resistor **R1 (105)**,

and the third resistor **R2 (106)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** and the first zener diode **ZD1 (103)** and the second zener diode **ZD2 (104)** of said at least one zener diode **ZD1 (103)**, **ZD2 (104)**. In the present invention, the ratings for the second resistor **R1 (105)**, and the third resistor **R2 (106)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** and the first zener diode **ZD1 (103)** and the second zener diode **ZD2 (104)** of said at least one zener diode **ZD1 (103)**, **ZD2 (104)** are selected as per the alternating voltage generated by the permanent magnet generator (2) for the required load condition and the engine predetermined speed beyond which the output regulated A.C power (15) generated by the regulator and rectifier (RR) unit (3) is supplied to said at least one A.C load (5), (6) including said vehicle headlamp (6).

[00053] As per first and second embodiment, during the positive half cycle of the output regulated voltage A.C power (15), the first zener diode **ZD1 (103)** is forward biased and the second diode **ZD2 (104)** is reverse biased. During negative half cycle of the output regulated voltage A.C power (15), the second zener diode **ZD2 (104)** is forward biased and the first zener diode **ZD1 (103)** is reverse biased. As per present invention, the **TRIAC TR (102)** receives triggering current through the third resistor **R2 (106)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** and the second diode **ZD2 (104)** of said at least one zener diode **ZD1 (103)**, **ZD2 (104)** in positive half cycle and through the second resistor **R1 (105)** of said at least one current limiting resistor **R (101)**, **R1 (105)**, **R2 (106)** and the first zener diode **ZD1 (103)** of said at least one zener diode **ZD1 (103)**, **ZD2 (104)** **ZD1**. Thus, as per first and second embodiment of the present invention, an arrangement of said at least one gate trigger circuit (107) including the second resistor **R1 (105)**, the third resistor **R2 (106)**, the first zener diode **ZD1 (103)** and the second zener diode **ZD2 (104)** in said delay unit (100) ensures that the **TRIAC TR (102)** receives the trigger current even when said at least one input terminal (100a) and said at least one output terminal (100b) of the delay unit (100) are swapped.

[00054] Advantageously, the present invention discloses the two-wire delay unit installed in the automatic light system for the vehicle and hence provides a simple, compact and cost-effective vehicle automatic light system. As per first and second embodiment of the second invention, the delaying effect provided by
5 said delay unit controls the output regulated voltage A.C power delivered to said vehicle headlamp after the engine attains the predetermined speed and hence provide the improved engine startability and idling stability with better fuel economy for the vehicle. It is advantageous to provide the improved automatic light system that is adapted for normal operation when the vehicle engine is in
10 operation, and the delay unit automatically turns ON the headlamp after the engine attains the pre-determined speed. Further, it is advantageous to install said delay unit as the two-wire circuit in the vehicle automatic light system which involves at least two wiring connection including said at least one input terminal and said at least one output terminal and hence provides simple structure to the
15 delay unit and hence easy installation the vehicle.

[00055] Improvements and modifications may be incorporated herein without deviating from the scope of the invention.

We Claim:

1. An automatic light system (1) for a vehicle, said system (1) comprising:
 - a permanent magnet generator (2) coupled with an internal combustion engine for producing an alternating current;
 - a regulator and rectifier (RR) unit (3) operatively connected to said permanent magnet generator (2) for receiving said alternating current, said regulator and rectifier (RR) unit (3) includes at least one gate control circuit (13) and a shunt configuration of at least two primary electronic switches (10), (11) said at least one gate control circuit (13) configured to regulate said alternating current on said at least two primary electronic switches (10) for supplying an output regulated and rectified voltage D.C power (14) and an output regulated A.C power (15) to at least one D.C load (7) and at least one A.C load (5),(6) respectively; and
 - a delay unit (100) is electrically coupled to said regulator and rectifier (RR) unit (3) for delaying said output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3); said delay unit (100) includes at least one gate trigger circuit (107) and at least one auxiliary electronic switch (102); and said delay unit (100) is a two-wire circuit comprising of at least one input terminal (100a) and at least one output terminal (100b).
2. The automatic light system for the vehicle (1) as claimed in claim 1, wherein said at least one auxiliary electronic switch (102) is electrically connected between said at least one input terminal (100a) and said at least one output terminal (100b) of the delay unit (100).
3. The automatic light system for the vehicle (1) as claimed in claim 1 or claim 2, wherein said at least one A.C load (5), (6) includes at least one lighting and signalling device (6) having an input connected to an output

of said regulator and rectifier (RR) unit (3) for receiving said output regulated A.C power (15).

4. The automatic light system for the vehicle (1) as claimed in claim 4, wherein said delay unit (100) prevents actuation of said at least one lighting and signalling device (6) including a headlamp after the engine attains a predetermined speed.
5. The automatic light system for the vehicle (1) as claimed in claim 2, wherein each of said at least two primary electronic switches (102) are Silicon Controlled Rectifiers (SCRs).
- 10 6. The automatic light system for the vehicle (1) as claimed in claim 2, wherein said at least one auxiliary electronic switch (102) is from a group consisting a TRIAC, reverse parallel connected transistors, thyristors, MOSFETs and electromechanical relay.
- 15 7. The automatic light system for the vehicle (1) as claimed in claim 2, wherein said at least one gate trigger circuit (107) comprises at least one current limiting resistor R (101), R1 (105), R2 (106) and at least one zener diode ZD1 (103), ZD2 (104).
- 20 8. The automatic light system for the vehicle (1) as claimed in claim 2, wherein the delay unit (102) is electrically coupled between the permanent magnet generator (2) and the regulator and rectifier (RR) unit (3).

9. The automatic light system for the vehicle **(1)** as claimed in claim 1, wherein said delay unit **(100)** is electrically coupled between said output regulated voltage A.C power **(15)** of said regulator and rectifier (RR) unit **(3)** and said at least one A.C load **(5), (6)**.

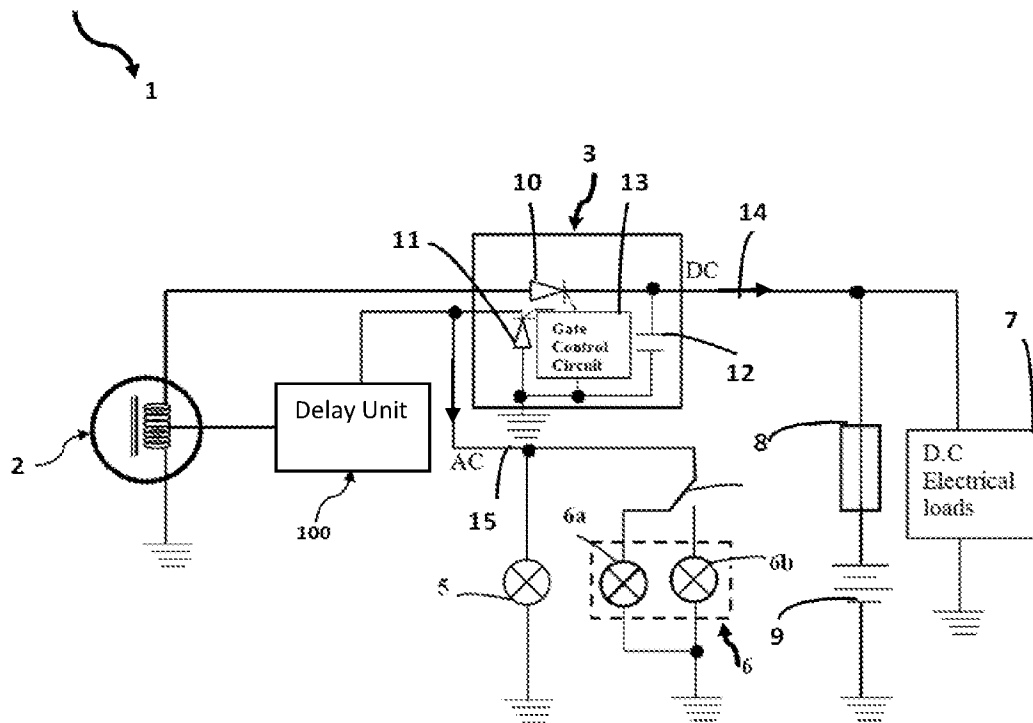


Fig.1

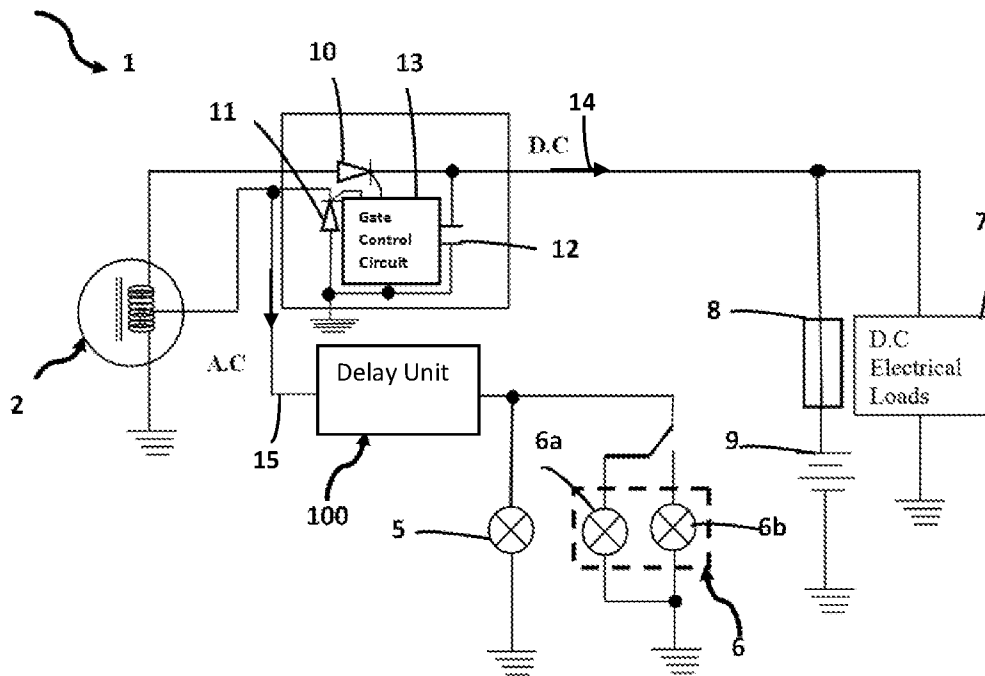


Fig.2

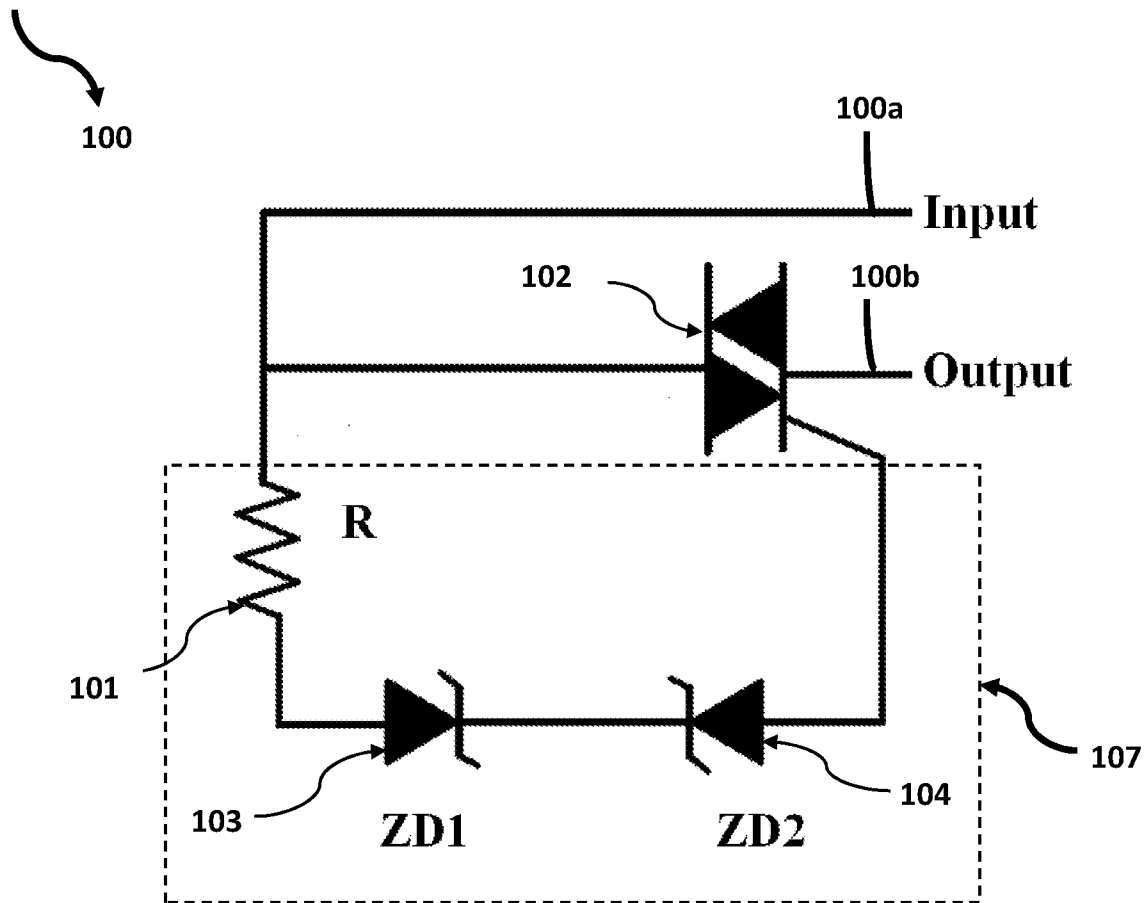


Fig. 3

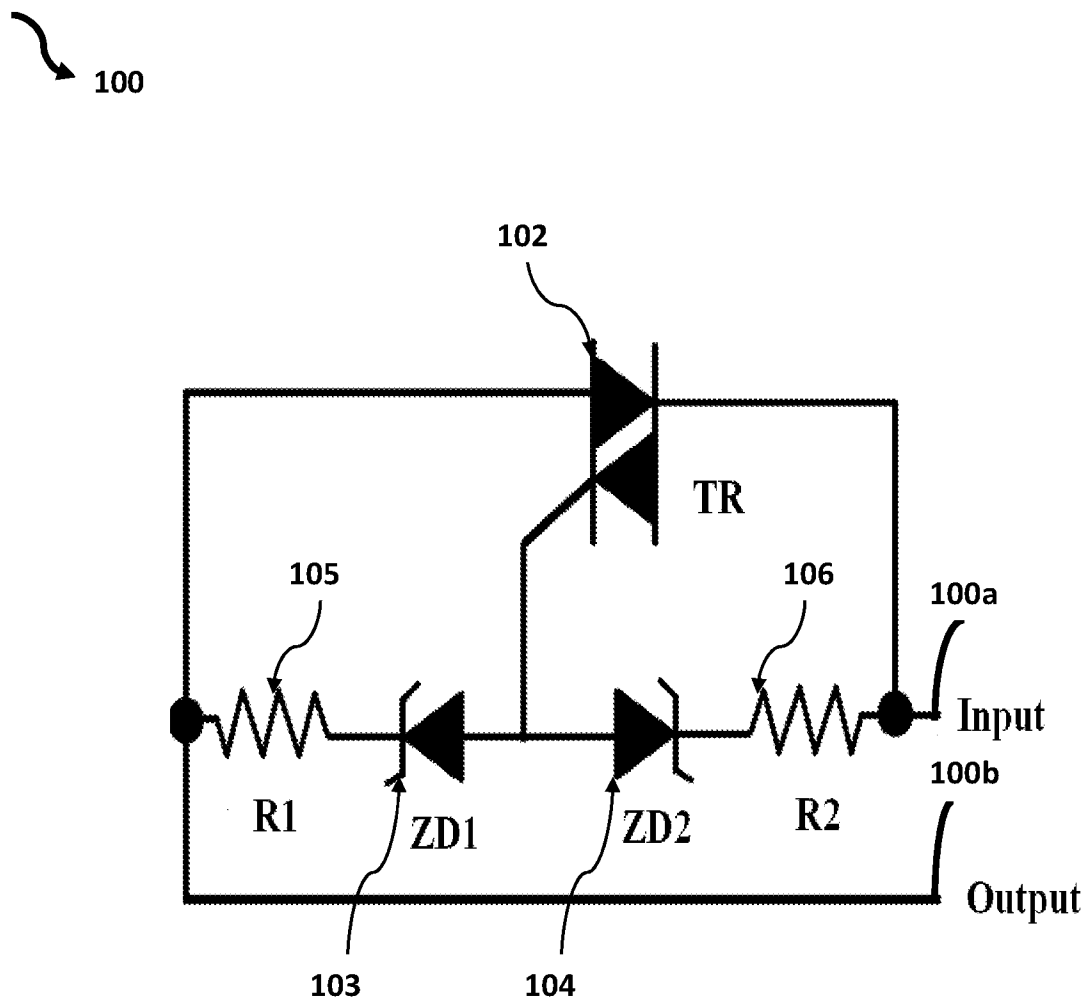


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2018/051798

A. CLASSIFICATION OF SUBJECT MATTER
B60Q1/00, B60Q3/80, F21S41/00 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, F21S

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, WIPO PATENTSCOPE

KEYWORDS: automatic light system, generator, control circuit, delay unit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20130049585A1 (O2MICRO INTERNATIONAL LTD) 28 February 2013 (28-02-2013) [Abstract, Description, claims 1-22, figures 1-9]	1-9
Y	JP2000313275A (MISATO COMPUTER INSATSU KK, MISATO COMPUTER PRINT CO., LTD.) 14 November 2000 (14-11-2000) [Abstract, Description, claims 1-2, figures 1-5]	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

27-07-2018

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2018/051798

Citation	Pub.Date	Family	Pub.Date
US 20130049585 A1	28-02-2013	CN 102963292 A	13-03-2013
		DE 102012201320 A	28-02-2013