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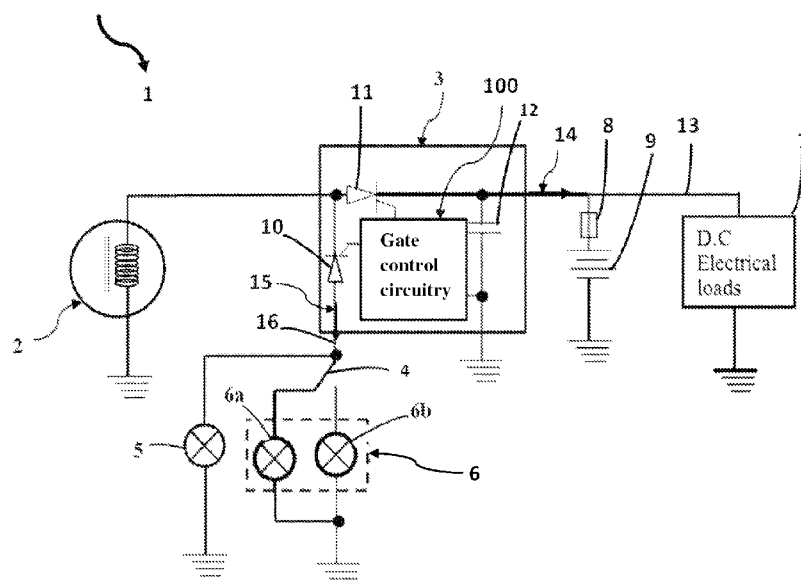


Fig.1

(57) Abstract: The present invention relates to a vehicle lighting system (1) comprising a delay circuit (200) being integrally installed in said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3). The delay circuit (200) prevents 5 actuation of said at least one lighting and signalling device (6) after the engine attains a predetermined speed following start-up.

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VEHICLE LIGHTING SYSTEM

TECHNICAL FIELD

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

BACKGROUND

5 [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
10 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
15 offered by daytime headlamp operation.

[0003] Furthermore, a number of regulatory and statutory requirements on automatic headlamp ON (AHO) as promulgated by regulatory agencies mandates 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
20 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 mechanical mounting provisions and installation of at least one additional component on the vehicle are implemented to ensure that the headlamp turns ON automatically
25 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 in mechanical mountings and the installation of said at least one additional component including the Daytime Running Lamp (DRL) on the vehicle increases the number of components and assembly time on the vehicle. Thus, increasing the overall cost for the vehicle and
5 further imparting a complicated design for the vehicle lighting system.

[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 headlamps kept constantly actuated following the starting of the engine deteriorates the engine startability and
10 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 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 vehicle lighting system includes a method of
20 improving engine startability wherein the load on the permanent magnet generator load is reduced during engine starting. In such a 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 headlamp
25 which increases the size of the permanent magnet generator.

[0008] In another known vehicle lighting system, a device for controlling the vehicle headlamp of an automobile is installed in the vehicle. The device actuates the headlamp following the starting of the vehicle. However, the provision of a delaying effect in the actuation of the vehicle headlamp requires at least one
30 additional component to be installed on the vehicle for delaying the headlamp

operation and hence installation of said at least one additional component becomes difficult in small vehicles such as motorcycle type two-wheeled vehicles and scooter type two-wheeled vehicles.

[0009] An existing vehicle lighting system includes at least one an electronic control unit and at least one switch controlled to supply an output regulated voltage 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 receives input from said regulator and rectifier unit (RR) to estimate the frequency of the signal which represents 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. However, such vehicle lighting system doesnot provide an interface circuitry or the signal conditioning circuitry to read the alternator or regulator output. 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 assembly time for the parts and components on vehicle.

[00010] While numerous vehicle lighting systems have been developed, in general, these systems have had serious drawbacks due to complexity, high cost, increased number of components and hence complex circuitry for the vehicle lighting system. These shortcomings, particularly in the area of complicated circuit with increased number of components for the vehicle lighting system, have been directly responsible for the increase of cost, increase in the engine load, deterioration of the engine startability and hence reduction in fuel efficiency of the vehicle.

[00011] Hence, it is desirable to provide an improved vehicle lighting system 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 components on the vehicle and hence providing a relatively simple structure. Further, it is needed to provide the improved vehicle lighting system which is cost effective and is easy to install on the vehicle. Further, it is desirable to provide an improved vehicle lighting system for the vehicle with minimal changes to the existing vehicle design and simultaneously meets the statutory requirements. Additionally, it is needed to provide an improved vehicle lighting system which provides a compact, simple and cost-effective installation on the vehicle. Furthermore, it is needed to provide an improved vehicle lighting 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

[00012] 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.

[00013] Fig.1 is a schematic circuit diagram of a vehicle lighting system as per one embodiment of the present invention.

[00014] Fig.2 is a schematic circuit diagram of the vehicle lighting system illustrating at least one gate control circuitry as per one embodiment of the present invention.

[00015] Fig.3 is a schematic circuit diagram of said at least one gate control circuitry illustrating a delay circuit integrally installed therein as per one embodiment of the present invention.

DETAILED DESCRIPTION

[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. 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 vehicle lighting 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 vehicle lighting system.

[00017] It is apparent that the problems of the motor vehicle lighting 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 an improved vehicle lighting system with a headlamp control arrangement, but it is apparent from the deficiencies in each of those prior expedients that the application of mere skill has not sufficed to satisfy the recognized need.

[00018] Hence, it is desirable to provide an improved vehicle lighting system including reduced number of wiring connections, mounting provisions, reduced number of components and hence a simple design. Further, it is needed to provide an improved vehicle lighting 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 an improved vehicle lighting system including a delay circuit 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
5 to provide the delay circuit facilitating a delaying effect on supply of an AC power to the headlamp following starting of the engine and thus improving engine startability.

[00020] The present invention relates to the vehicle lighting system comprising the permanent magnet generator coupled with the engine for
10 producing an alternating current and a regulator and rectifier (RR) unit operatively connected to said permanent magnet generator for receiving the alternating current. As per one embodiment, said regulator and rectifier (RR) unit includes at least one gate control circuitry and a series configuration of at least two electronic switches. As per one embodiment of the present invention, said at least one gate
15 control circuitry is configured to regulate said alternating current on said at least two 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. In one embodiment, said at least one A.C load includes at least one lighting and signalling device having an input connected
20 to an output of said regulator and rectifier (RR) unit for receiving said output regulated voltage A.C power. In one embodiment, said at least one lighting and signalling device is the vehicle headlamp. Referring to one embodiment of the present invention, said vehicle lighting system further comprises the delay circuit integrally installed in said at least one gate control circuitry of said regulator and
25 rectifier (RR) unit. In one embodiment, said delay circuit prevents actuation of said vehicle headlamp after the engine attains a predetermined speed following start-up. In one embodiment, said at least two electronic switches of said regulator and rectifier (RR) unit are Silicon Controlled Rectifiers (SCRs). As per one embodiment, said at least two electronic switches includes a first electronic switch
30 and a second electronic switch. In one embodiment, said first electronic switch of said at least two electronic switches is a first SCR (Silicon Controlled Rectifier)

and said second electronic switch of said at least two electronic switches is a second SCR (Silicon Controlled Rectifier). Further, as per one embodiment of the present invention, said at least one gate control circuitry includes a first gate control circuit coupled to said first SCR (Silicon Controlled Rectifier) being
5 electrically connected in an AC supply line of said regulator and rectifier (RR) unit. Further, said at least one gate control circuitry includes a second gate control circuit coupled to said second SCR (Silicon Controlled Rectifier) being electrically connected in a DC supply line of said regulator and rectifier (RR) unit. As per one embodiment of the present invention, said delay circuit being
10 integrally installed in said at least one gate control circuitry controls power delivery to said vehicle headlamp until the engine attains said predetermined speed of 1000 rpm following start-up.

[00021] The present invention relates to the delay circuit being integrally installed in said at least one gate control circuitry and hence, imparting a simple
15 structure without entailing the increase in number of component and parts in the vehicle lighting system. As per one embodiment of the present invention, the delay circuit actuates the headlamp after the engine attains the predetermined speed hence facilitating reduced engine load and improved engine startability. In one embodiment, said delay circuit being integrally installed in said at least one
20 gate control circuitry of said regulator and rectifier (RR) unit controls the power delivery to the headlamp, until the engine attains the predetermined speed following start-up. As per one embodiment, said predetermined engine speed is 1000 rpm.

[00022] The object of the present invention is to provide the improved vehicle
25 lighting system with the delay circuit being integrally installed on said at least one gate control circuitry of said regulator and rectifier (RR) unit and hence provides a compact, cost effective installation on the vehicle and further involves minimum number of the wiring connections and mounting provisions and 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.

[00023] The purpose of the present invention is to provide an improved vehicle lighting system for automotive vehicular use. Further, the present invention provides the improved vehicle lighting system with the delay unit integrally installed in said at least one gate control circuitry of said regulator and rectifier (RR) unit hence providing a simple design with said delaying effect in actuation of the headlamp following the starting of the engine. In one embodiment of present invention, the delay circuit is integral circuit of said at least one gate control circuitry. Hence, the delay circuit in said vehicle lighting system can be packaged within said at least one gate control circuitry of said regulator and rectifier (RR) unit without addition of an additional electrical or electronic components on vehicles. As per one embodiment of the present invention, said delay circuit being integrally installed in said at least one gate control circuitry of said regulator and rectifier (RR) unit delays said output regulated voltage A.C power to said vehicle headlamp by triggering at least one gate of said first SCR (Silicon Controlled Rectifier) of said at least two electronic switches. In one embodiment, said first SCR (Silicon Controlled Rectifier) of said at least two electronic switches is being electrically connected in said AC supply line of said regulator and rectifier (RR) unit.

[00024] The present invention relates generally to the vehicle lighting system and more particularly to the delay circuit for delaying the actuation of said at least one lighting and signalling device such as the vehicle headlamp. In one embodiment, said vehicle headlamp is energized after the engine of the vehicle attains the predetermined speed following start-up. Thus, the delay circuit controls the 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 one embodiment of the present invention, said at least one gate control circuitry of

said regulator and rectifier (RR) unit includes said first gate control circuit coupled to said first SCR (Silicon Controlled Rectifier). In one embodiment, said first SCR of said at least two electronic switches of said regulator and rectifier (RR) unit is being electrically connected in the AC supply line of said regulator and rectifier (RR) unit which maintains the output regulated voltage A.C power of said regulator and rectifier (RR) unit across said at least one AC load within a predetermined value. Further, in one embodiment, said at least one gate control circuitry of said regulator and rectifier (RR) unit includes said second gate control circuit coupled to said second SCR (Silicon Controlled Rectifier). As per one embodiment, said second SCR of said at least two electronic switches of said regulator and rectifier (RR) unit is being electrically connected in the DC supply line of said regulator and rectifier (RR) unit which maintains said at least one DC load within a predetermined value. As per one embodiment, said delay circuit being integrally installed in said at least one gate control circuitry delays the output regulated voltage A.C power during the starting of the vehicle and hence actuates the headlamp after the engine attains the predetermined speed of 1000rpm. In one embodiment, said first gate control circuit and said second gate control circuit of said at least one gate control circuitry prevents said output regulated and rectified voltage D.C power across said at least one DC load from exceeding the predetermined value even at high engine speed and low electrical load condition.

[00025] It is a further object of the present invention to provide the improved vehicle lighting system including the delay circuitry being integrally installed in said at least one gate control circuitry for delaying the energization of the vehicle headlamp following the starting of the engine.

[00026] The present invention relates to said improved vehicle lighting system in which the supply of said output regulated voltage A.C power of said rectifier and regulator (RR) unit to said vehicle headlamp is delayed following the starting of the engine.

[00027] It is a primary object of the present invention to provide the improved vehicle lighting 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 controls the actuation of said at least one signalling and
5 lightening device including the vehicle headlamp.

[00028] The object of the present invention is to provide the delay circuit being integrally installed in said at least one gate control circuitry of said regulator and rectifier (RR) unit. In the one embodiment, the main power is supplied to said at least one input terminal of the delay circuit by means of switching on the
10 vehicle ignition switch (starting the engine). At the same time, the vehicle is started and the delay circuit is delayedly energized to delay output regulated and rectified A.C power from the regulator and rectified unit (RR) to the vehicle headlamp. As per one embodiment of the present invention, after the engine is started, the permanent magnet generator parallelly generates power for fully
15 supplying power. That is, when the 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, the delay circuit being integrally installed in said at least one gate control circuitry of the regulator and rectifier (RR) unit of said vehicle
20 lighting system avoids excessive engine load and hence provide a simple, improved, compact and cost effective installation of the delay circuit on the vehicle without increase in the number of components.

[00029] Yet another object of this invention is to provide the delay circuit for the vehicle lighting system for providing the delaying effect in supplying the A.C
25 (alternating current) power supply to the vehicle headlamp after the engine attains the predetermined speed of 1000rpm following start-up.

[00030] The present invention relates to the integral installation of the delay in said at least one gate control circuitry of the regulator and rectified unit (RR) unit through a simple structure without increase in the number of components. As

per one embodiment, said delay circuit provides the delaying effect in said vehicle lighting system for controlling the energization of motor vehicle headlamps.

[00031] It is accordingly an object of this invention to provide a simple, low power delay circuit being integrally installed in said at least one gate control circuitry 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.

[00032] The present invention relates to the delay circuit for turning ON the headlamps of the motor vehicle. Further, the present invention relates to the improved vehicle lighting system for controlling the actuation of the vehicle headlamp.

[00033] The object of the invention is to provide the delay circuit as a headlamp control circuit being integrally installed in said at least one gate control circuitry of said regulator and rectified (RR) unit. As per one embodiment, said delay circuit causes the headlamps to be turned on after the vehicle attains the predetermined speed of 1000rpm.

[00034] The present invention provides the improved vehicle lighting system that is adapted for normal operation when the vehicle engine is in operation, and the delay circuit automatically turns ON the headlamp after the engine attains the pre determined speed following start-up.

[00035] It is advantageous to provide said delay circuit in the vehicle lighting system which is integrally installed in said at least one gate control circuitry of said regulator and rectified (RR) unit through implementation of one or more gate logics and one or more wiring connections of known circuit design of said at least one gate control circuitry to form said delay circuit as an integral circuit of said known at least one gate control circuitry thus with said delay circuit being integrally installed in said known at one gate control circuitry, the present invention provides a new design of said at least one gate control circuitry for the

vehicle lightening system hence provides simple installation of the delay circuit on the vehicle without installing any additional components on the vehicle.

[00036] Exemplary embodiments detailing features of the vehicle lighting system illustrating the delay circuit, in accordance with the present invention will
5 be described hereunder. Application of the present invention will be extended to two-wheeled vehicles, three-wheeled vehicles and four -wheeled vehicles.

[00037] 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
10 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
15 orientation of the reference numerals.

[00038] **Fig.1** is a schematic circuit diagram of the vehicle lighting system (1) as per one embodiment of the present invention. In one embodiment, said vehicle lighting system (1) comprises said permanent magnet generator (2) coupled with the engine for producing the alternating current, a vehicle battery (9) operatively
20 connected with said permanent magnet generator (2) to be charged therefrom and the regulator and rectifier (RR) unit (3) operatively connected to said permanent magnet generator (2) for receiving the alternating current. In one embodiment, said regulator and rectifier (RR) unit (3) includes said at least one gate circuitry (100) and said series configuration of said at least two electronic switches (10),
25 (11). As per one embodiment, said at least one gate control circuitry (100) is configured to regulate said alternating current on said at least two 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. Referring to one
30 embodiment, said at least one A.C load (5), (6) includes said at least one lighting

and signalling device (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). As per one embodiment, said at least one A.C load (5), (6) includes the tailamp (5) and said at least one lighting and signalling device (6). In one
5 embodiment, said at least one lighting and signalling device (6) is the headlamp. As per one embodiment, at least one lighting and signalling device (6) being the headlamp has a high beam filament (6a) and a low beam filament (6b). In one embodiment, said high beam filament (6a) and said low beam filament (6b) of the headlamp is selected by using a control switch (4). According to the present
10 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).

[00039] Further in Fig.1, as per one embodiment of the present invention, said vehicle lighting system (1) further comprises the delay circuit (200) (shown in Fig
15 2) integrally installed in said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3). In one embodiment, said delay circuit (200) prevents the actuation of said at least one lighting and signalling device (6) after the engine attains the predetermined speed. As per one embodiment, each of said at least two electronic switch (102) of said regulator and rectifier (RR) unit (3) is
20 the Silicon Controlled Rectifier (SCR). In one embodiment, said at least two electronic switches (10), (11) includes the first electronic switch (10) and the second electronic switch (11). As per one embodiment, said first electronic switch (10) of said at least two electronic switches (10), (11) is the first SCR (Silicon Controlled Rectifier) (10) and said second electronic switch (11) is the second
25 SCR (Silicon Controlled Rectifier) (11). Further, as per one embodiment, said at least one gate control circuitry (100) includes the first gate control circuit (100a) coupled to said first SCR (Silicon Controlled Rectifier) (10) being electrically connected across the AC supply line (16) of said regulator and rectifier (RR) unit (3). In one embodiment, said at least one gate control circuitry (100) includes the
30 second gate control circuit (100b) coupled to said second SCR (Silicon Controlled Rectifier) (11) being electrically connected in the D.C supply line (13) of said

regulator and rectifier (RR) unit (3). As per one embodiment, said delay circuit (200) being integrally installed in said at least one gate control circuitry (100) controls power delivery to said at least one A.C load (5), (6) including said vehicle headlamp until the engine attains said predetermined speed of 1000 rpm following start-up. As per one embodiment, a positive half wave of the voltage across said permanent magnet generator (2) is provided for supplying to said at least one D.C load (7) through said second SCR (Silicon Controlled Rectifier) (11) being electrically connected across the D.C supply line of said regulator and rectifier (RR) unit (3). In one embodiment, a capacitor (12) filters the output regulated and rectified voltage D.C power (14) and supplies to said at least one D.C load (7) and said vehicle battery (9). Further in one embodiment, a negative half wave of the voltage across said permanent magnet generator (2) is provided for supplying to said at least one A.C load (5), (6) through the first gate control circuit (100a) coupled to said first SCR (Silicon Controlled Rectifier) (10) being electrically connected in the A.C supply line (16) of said regulator and rectifier (RR) unit (3). In one embodiment, said output regulated voltage A.C power (15) is delayed during the engine starting by triggering the first gate control circuit (100a) coupled to said first SCR (Silicon Controlled Rectifier) (10) being electrically connected across the A.C supply line (16) of said regulator and rectifier (RR) unit (3), until an amplitude of the voltage across the permanent magnet generator (2) exceeds a predetermined value.

[00040] Fig.2 is a schematic circuit diagram of the vehicle lighting system (1) illustrating said at least one gate control circuitry (100) as per one embodiment of the present invention. As per one embodiment, said regulator and rectifier (RR) unit (3) of the vehicle lighting system (1) includes said at least one gate circuitry (100) and the series configuration of said at least two electronic switches (10), (11). In one embodiment, said delay circuit (200) is integrally installed in said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3). As per one embodiment, said delay circuit (200) prevents actuation of said vehicle headlamp (6) until the engine attains the predetermined speed of said 1000rpm. In one embodiment, said at least two electronic switches (10), (11) of said regulator

and rectifier (RR) unit (3) includes the first electronic switch (10) and the second electronic switch (10).

[00041] Further in Fig.2, referring to one embodiment, said at least one gate circuitry (100) of said regulator and rectifier (RR) unit (3) includes the first gate control circuit (100a) and the second gate control circuit (100b). As per one embodiment, said first electronic switch (10) of said at least two electronic switches (10), (11) is the first SCR (Silicon Controlled Rectifier) (10) being electrically connected in the AC supply line (16) of said regulator and rectifier (RR) unit (3) and said second electronic switch (11) is the second SCR (Silicon Controlled Rectifier) (11) being electrically connected across the D.C supply line (13) of said regulator and rectifier (RR) unit (3). In one embodiment, said first gate control circuit (100a) of said at least one gate control circuitry (100) is coupled to said first SCR (Silicon Controlled Rectifier) (10) and said second gate control circuit (100b) of said at least one gate control circuitry (100) is coupled to said second SCR (Silicon Controlled Rectifier). As per one embodiment, said delay circuit (200) being integrally installed in said at least one gate control circuitry (100) controls the power delivery to said at least one lighting and signalling device (6) until the engine attains said predetermined speed of 1000 rpm following start-up.

[00042] Fig.3 is a schematic circuit diagram of said at least one gate control circuitry (100) illustrating the delay circuit (200) integrally installed therein as per one embodiment of the present invention. In one embodiment, said regulator and rectifier (RR) unit (3) includes said at least one gate control circuitry (100), said series configuration of said at least two electronic switches (10), (11) and the delay circuit (200) being integrally installed in said at least one gate control circuitry (100). In one embodiment, said first electronic switch (10) of said at least two electronic switches (10), (11) is the first SCR (Silicon Controlled Rectifier) (10) being electrically connected in the AC supply line (16) of said regulator and rectifier (RR) unit (3) and said second electronic switch (11) is the second SCR (Silicon Controlled Rectifier) (11) being electrically connected in the DC supply

line (13) of said regulator and rectifier (RR) unit (3). In one embodiment, said first gate control circuit (100a) of said at least one gate control circuitry (100) is coupled to said first SCR (Silicon Controlled Rectifier) (10) and said second gate control circuit (100b) of said at least one gate control circuitry (100) is coupled to
5 said second SCR (Silicon Controlled Rectifier) (11). As per one embodiment, at low engine speeds, the alternating voltage across the permanent magnet generator (2) is low. As per one embodiment, when a transistor T5 of said delay circuit (200) is turned ON, then the first gate control circuit (100a) of the first SCR (10) is pulled to ground. Thus, the first SCR (10) being electrically connected in the
10 AC supply line of said regulator and rectifier (RR) unit (3) does not conduct and hence said output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3) is absent. In one embodiment, when the speed of the permanent magnet generator (2) increases, the generated voltage also increases and hence the zener diode Z5 allows the transistor T6 to be turned ON. Thus, the transistor T5 is
15 switched OFF. In one embodiment, the zener diode Z5 value is selected to ensure that said output regulated voltage A.C power (15) of said regulator and rectifier (RR) unit (3) is delayed upto the predetermined engine speed of 1000 rpm. In one embodiment, during a negative half cycle of the voltage across the permanent magnet generator (2), a transistor T2 is turned ON as a base-emitter junction is
20 reverse biased through a diode D2, a zener diode Z3 and a resistor R8. In one embodiment, a capacitor C2 and a resistor R7 helps in ensuring that a voltage across the transistor T2 base-emitter is within a predetermined value and provides a substantially noise-free high-frequency signals. As per one embodiment, when the transistor T2 is in ON condition, the first SCR Silicon Controlled Rectifier
25 (10) is turned ON using a collector current through a resistor R9. In one embodiment, a resistor R10 and a capacitor C3 ensure that the voltage across the first SCR S1 (10) is within permissible limits and is free from high frequency noise signals. In one embodiment, reverse breakdown voltages across said zener diode Z1 and zener diode Z2 are selected in such a manner that a transistor T1
30 remains OFF for a negative peak voltage of the permanent magnet generator (2) below a first predetermined value. In one embodiment, when an output peak

negative voltage across the permanent magnet generator (2) increases beyond the first predetermined value at high engine speeds, the transistor T1 turns ON and connects the transistor T2 base to the ground. Thus, preventing the actuation of the first SCR (10). In one embodiment, the output regulated voltage A.C power
5 (15) across said at least one A.C load (5), (6) is thus maintained to be within the first predetermined value. In one embodiment, said resistors R1, R2, R3, R4, R5 helps in providing precise reference voltage for said zener diodes Z1 and Z2. As per one embodiment, said diode D1 and diode D2 ensure reverse voltage protection for the transistor T1.

10 [00043] Further in Fig.3, according to one embodiment, the second gate control circuit (100b) of said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3) is coupled to said second SCR (Silicon Controlled Rectifier) (11). In one embodiment, said second SCR (Silicon Controlled Rectifier) (11) of said at least two electronic switches (10), (11) is
15 being electrically connected in said DC supply line (13) of said regulator and rectifier (RR) unit (3). As per one embodiment, in said D.C supply line (13), the voltages across the vehicle battery (9) and said at least one D.C load (7) is maintained within a second predetermined value by using the transistor T3 and the transistor T4. In one embodiment, when the output regulated and rectified
20 voltage D.C power (14) across said at least one D.C load (7) is within the second predetermined value, the transistor T4 remains OFF. In one embodiment, the transistor T3 emitter-base junction is forward biased using a resistor R11 and a resistor R12. In one embodiment, a transistor T3 emitter current turns ON the second SCR (11) during each positive half cycle of the output voltage across the
25 permanent magnet generator (2). In one embodiment, when voltage across said at least one D.C load (7) exceeds the predetermined second value, the transistor T4 turns ON due to a reverse break down of the zener diode Z4. Thus, the actuation of said transistor T4 in turn connects a base of the transistor T3 to a ground and prevents the actuation of said second SCR (11).

[00044] Further, in one embodiment, a capacitor **C4** provides a precise reference voltage for the transistor **T4** and allows precise turn OFF of the transistor **T3** after said output regulated and rectified voltage D.C power across said at least one D.C load (7) voltage exceeds the second predetermined value. As
5 per one embodiment, the resistor **R14** and a capacitor **C5** maintain a gate-cathode voltage across said second SCR (11) within permissible limits and hence prevents the high frequency noise signals from affecting a gate cathode junction of said second SCR (11).

[00045] Further, referring to one embodiment, the delay circuit (200) being
10 integrally installed in said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3) delays the said output regulated voltage A.C power (15) to the vehicle headlamp (6) during starting of the vehicle and after the engine attains said predetermined speed of 1000 rpm. In one embodiment, said first gate control circuit (100a) and the second gate control circuit (100b) of said at least
15 one gate control circuitry (100) of said regulator and the rectifier (RR) unit (3) prevents the output regulated and rectified voltage D.C power (14) across said at least one D.C load (7) from exceeding the second predetermined value even at high engine speed and low electrical load condition. At low engine speeds, the second gate control circuit (100b) of said at least one gate control circuitry (100b)
20 along with the delay circuit (200) does not lead to actuation of the headlamp.

[00046] Advantageously, the present invention discloses the delay circuit integrally installed in said at least one gate control circuitry of said regulator and rectifier (RR) unit of the vehicle lighting system and hence provides a simple, compact and cost-effective installation of said delay circuit on vehicle without
25 increasing the number of components and parts on the vehicle. As per one embodiment of the present invention, the delaying effect provided by said delay circuit controls the output regulated 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.

[00047] Improvements and modifications may be incorporated herein without deviating from the scope of the invention.

We claim:

1. A vehicle lighting system (1), said system (1) comprising:

a permanent magnet generator (2) coupled with an internal combustion engine for producing an alternating current; and

a regulator and rectifier (RR) unit (3) operatively connected to said permanent magnet generator (2) for receiving the alternating current, said regulator and rectifier (RR) unit (3) includes at least one gate control circuitry (100) and a series configuration of at least two electronic switches (10), (11); said at least one gate control circuitry (100) configured to regulate said alternating current on said at least two electronic switches (10), (11) for supplying an output regulated and rectified voltage D.C power (14) and an output regulated voltage A.C power (15) to at least one D.C load (7) and at least one A.C load (5),(6) respectively,

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 voltage A.C power (15);

a delay circuit (200) is integrally installed in said at least one gate control circuitry (100) of said regulator and rectifier (RR) unit (3); and said delay circuit (200) prevents actuation of said at least one lighting and signalling device (6) after the engine attains a predetermined speed following start-up.

2. The vehicle lighting system (1) as claimed in claim 1, wherein said at least one lighting and signalling device (6) is a headlamp.
3. The vehicle lighting system (1) as claimed in claim 1, wherein each of said at least two electronic switches (10), (11) is a Silicon Controlled Rectifier (SCR).

4. The vehicle lighting system (1) as claimed in claim 3, wherein said at least two electronic switches (10), (11) includes a first electronic switch (10) and a second electronic switch (11).
5. The vehicle lighting system (1) as claimed in claim 4, wherein said first electronic switch (10) of said at least two electronic switches (10), (11) is a first SCR (Silicon Controlled Rectifier) (10).
6. The vehicle lighting system (1) as claimed in claim 4, wherein said second electronic switch (11) of said at least two electronic switches (10), (11) is a second SCR (Silicon Controlled Rectifier) (11).
7. The vehicle lighting system (1) as claimed in claim 1, wherein said at least one gate control circuitry (100) includes a first gate control circuit (100a) coupled to said first SCR (Silicon Controlled Rectifier) (10) being electrically connected across an AC supply line (16) of said regulator and rectifier (RR) unit (3).
8. The vehicle lighting system (1) as claimed in claim 1, wherein said at least one gate control circuitry (100) includes a second gate control circuit (100b) coupled to said second SCR (Silicon Controlled Rectifier) being electrically connected across a D.C supply line (13) of said regulator and rectifier (RR) unit (3).
9. The vehicle lighting system (1) as claimed in claim 1, wherein said delay circuit (200) being integrally installed in said at least one gate control circuitry (100) controls power delivery to said at least one A.C load (5), (6) said at least one lighting and signalling device (6) after the engine attains said predetermined speed of 1000 rpm.
10. The vehicle lighting system (1) as claimed in claim 1, wherein said output regulated voltage A.C power (15) is delayed during the engine starting by triggering the first gate control circuit (100a) coupled to said first SCR (Silicon Controlled Rectifier) (10), until an amplitude of the voltage across the permanent magnet generator (2) exceeds a predetermined value.

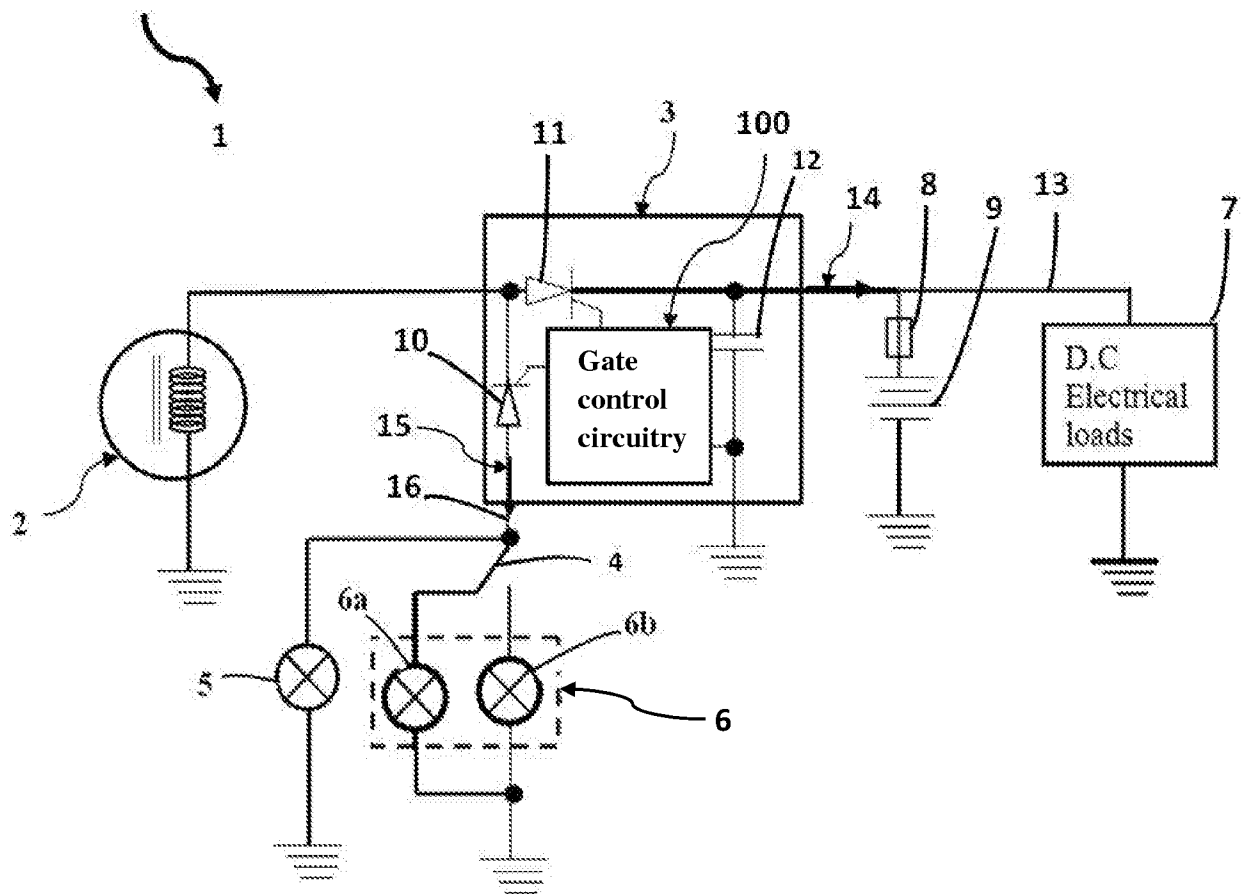


Fig.1

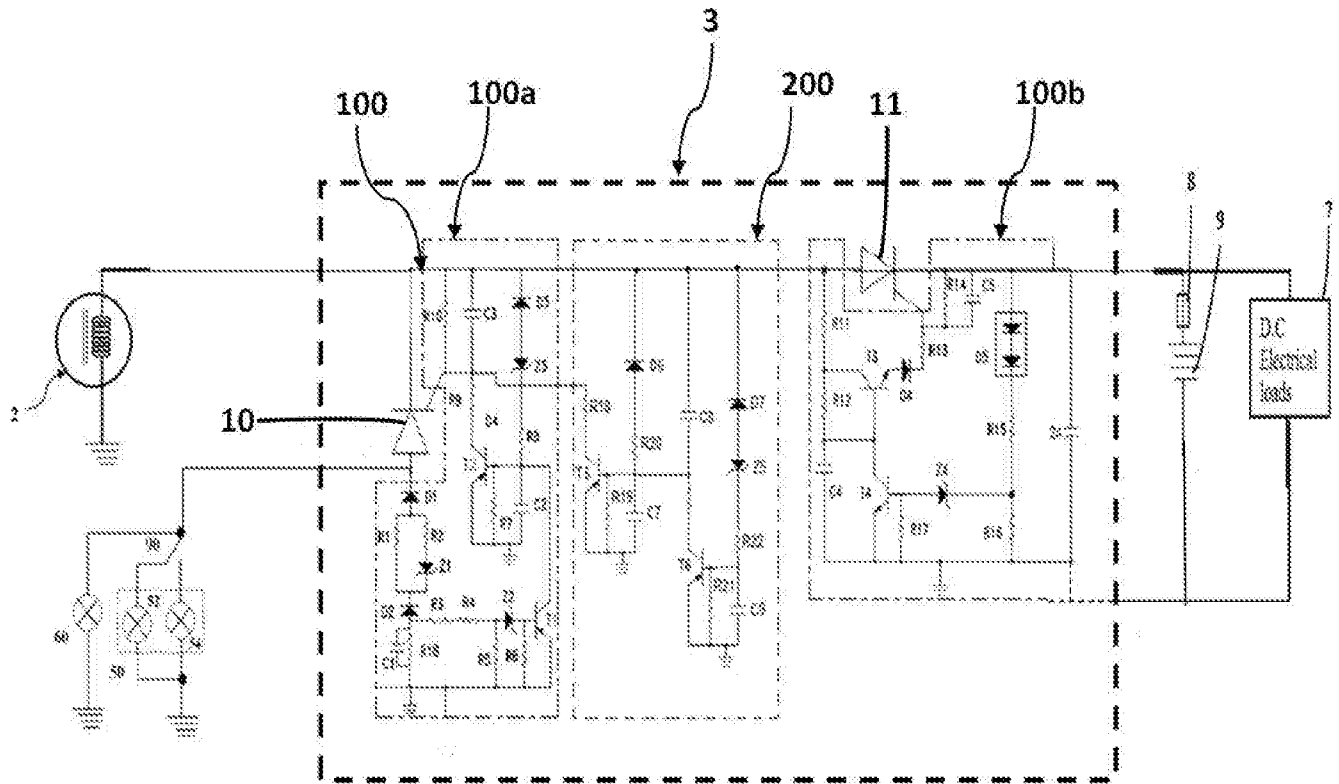


Fig. 2

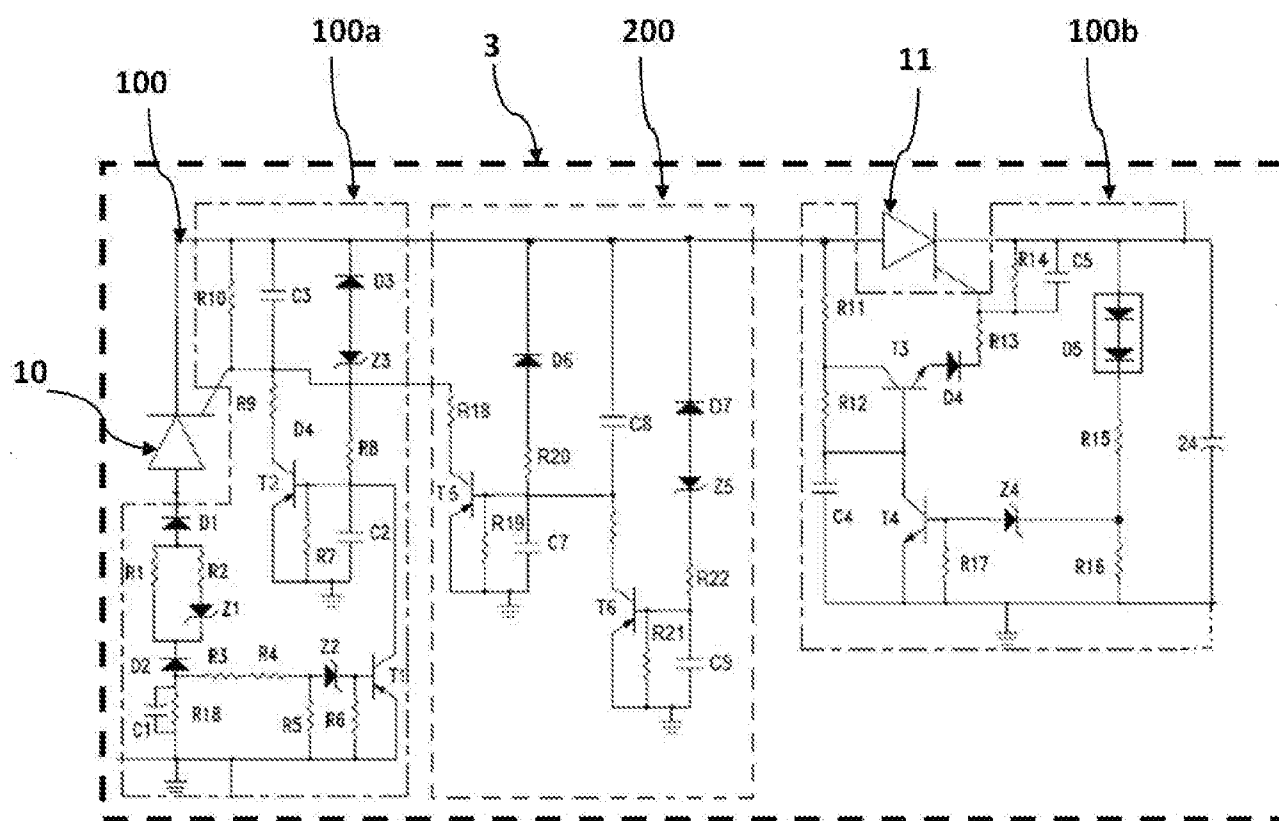


Fig.3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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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, F02N

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)

TotalPatent One, IPO Internal Database

Keywords used:-headlamp, delay, generator, I.C. engine

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20070120366A1 (BLACK AND DECKER INC) 31.05.2007 (31 May, 2007) paragraphs [0043],[0045] and [0050]; claim 1; figures 1, 4 and 7 and abstract	1-10
Y	US5811888A (HSIEH, Cheng-Tien) 22.09.1998 (22 September, 1998) column 1, lines 53 to 67; column 3, lines 3 to 22 and lines 49 to 56; claims 1, 4 and 5; figures 1 and 2 and abstract	1-10

☐ 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
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"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	

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Citation	Pub.Date	Family	Pub.Date
US 20070120366 A1	31-05-2007	CA 2636362 A1	12-07-2007
		WO 2007079002 A3	24-04-2008