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(54) **APPARATUS FOR CONTROLLING BRIGHTNESS OF LED LAMP**

(57) The present disclosure relates to an apparatus for controlling brightness of a LED lamp. The apparatus includes: a sensing switch and at least one LED control device. A transimpedance amplification unit converts a current signal into a voltage signal, and converts the voltage signal into a square wave signal in cooperation with a Schmidt circuit, such that the sensing switch can be connected to multiple LED control devices via a single wire, thereby controlling multiple LED lamps simultaneously. The sensing switch is independently disposed at a position to be sensed, therefore only a single wire is required to be disposed between the sensing switch and the LED control devices such that wiring is more easily implemented for the multiple LED control devices connected in parallel, and the number of the wires used is also greatly reduced, thereby simplifying the wiring between the sensing switch and the LED control devices and reducing a manufacture cost.

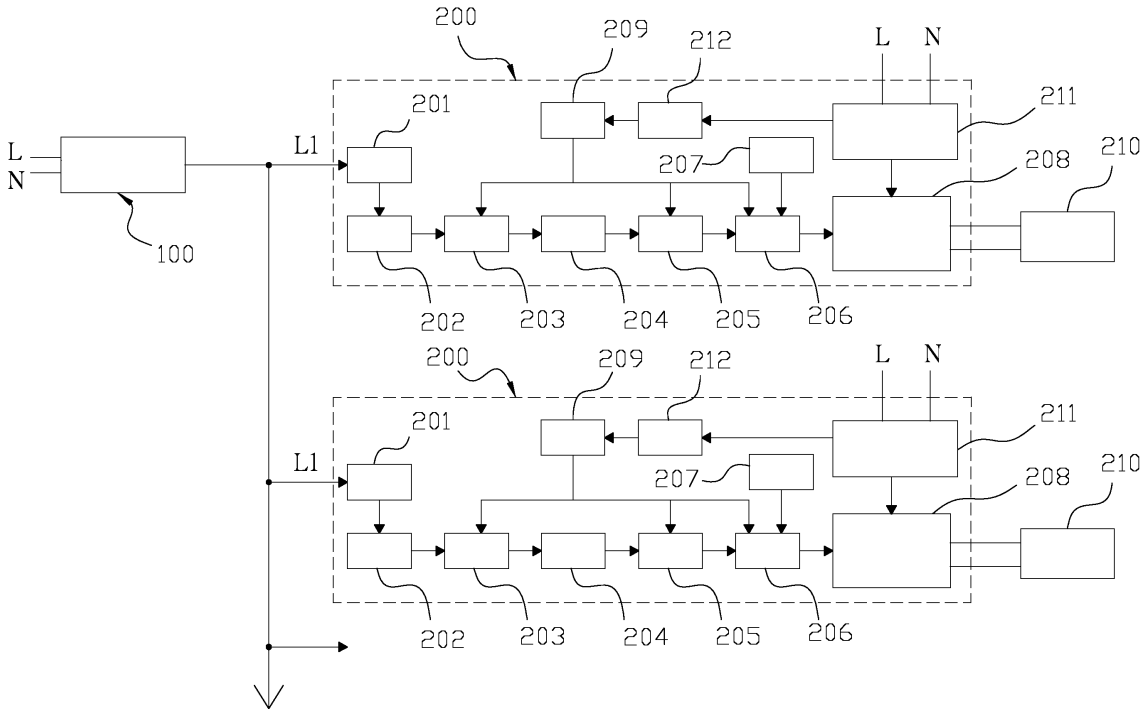


Fig. 1

EP 3 621 413 A1

Description

FIELD OF THE INVENTION

[0001] The present disclosure relates to a LED control device, and in particular to an apparatus for controlling brightness of a LED lamp which can both simplify wiring and reduce a manufacture cost.

BACKGROUND OF THE INVENTION

[0002] FIG. 3 shows an apparatus for controlling brightness of a LED lamp according to the conventional technology. As shown in FIG. 3, the apparatus includes a sensing switch 301, multiple LED drivers 302 and multiple LED lamps 303. The sensing switch 301 is connected to the LED drivers 302 via two wires 304, 305. The LED lamp 303 is each directly fixed to the LED driver 302, that is, the LED driver 302 and the LED lamp 303 form an integral structure. In the sensing switch, a relay functions as an ON/OFF operation element. In a case that the sensing switch senses dynamic change in a sensing range, the sensing switch transmits a voltage signal to the LED drivers 302 via the wires 304, 305. The LED driver 302 controls the timing of lighting up the LED lamp 303 as well as the brightness of the LED lamp 303, thereby controlling the LED lamp 303. The conventional apparatus described above has some disadvantages mainly for the following reasons. During use, the sensing switch 301 is required to be connected to multiple LED drivers 302 and multiple LED lamps 303 simultaneously. The sensing switch 301 is far away from the positions where lighting is required, and thus two wires 304, 305 are required to be provided. As the number of the LED lamps 303 increases, the wiring difficulty for the wires 304, 305 significantly increases, further resulting in the necessity of using a large number of wires. Therefore, with the conventional voltage sensing manner, wiring is complicated and the cost is high. In addition, the sensing switch 301 is limited by wattages of the LED drivers 302, and the voltage drop is significant in a case that the sensing switch 301 is connected to multiple LED lamps 303. Therefore, the number of the LED lamps 303 to which the sensing switch 301 is simultaneously connected is limited, and thus flexible configuration and usage cannot be realized.

[0003] The problems as described above are solves as specified in the accompanying claims.

SUMMARY OF THE INVENTION

[0004] In view of the above disadvantages existing in the conventional technology, an object of the present disclosure is to provide an apparatus for controlling brightness of a LED lamp.

[0005] The apparatus includes a sensing switch and at least one LED control device. The sensing switch is configured to sense a current signal generated due to environmental change, and the current signal is output through a wire. The LED control device includes a current rectifying unit, a current limiting unit, a transimpedance amplification unit, a voltage division circuit unit and a Schmidt circuit unit. The current rectifying unit is connected to a wire of the sensing switch via an anode of a diode and rectifies the current signal by using the diode. The current limiting unit includes a first resistor and a second resistor connected in series, an input terminal of the first resistor is connected to a cathode of the diode, and the current signal is limited by the current limiting unit. The transimpedance amplification unit includes an optical output coupler, an optical receiving coupler and a voltage amplifier. One end of the optical output coupler is connected to an output terminal of the second resistor, and another end of the optical output coupler is grounded. The current signal is converted into an optical signal by the optical output coupler. An emitter of the optical receiving coupler is connected to a non-inverting terminal of the voltage amplifier, and a collector of the optical receiving coupler is connected to an inverting terminal of the voltage amplifier. A base of the optical receiving coupler receives the optical signal to generate a voltage signal corresponding to the current signal. An output terminal of the voltage amplifier is connected to the voltage division circuit unit, the voltage signal is amplified by the voltage amplifier, and the amplified voltage is then divided by the voltage division circuit unit. A non-inverting terminal of the Schmidt circuit unit is connected to the voltage division circuit unit, and the Schmidt circuit unit receives the voltage signal and generates a square wave signal indicating ON/OFF of the lamp. An output terminal of the Schmidt circuit unit outputs the square wave signal so that the control is achieved.

[0006] The transimpedance amplifier further includes a third resistor, a filter, a protector, a fourth resistor and a capacitor. The optical output coupler is connected to the second resistor via the third resistor. One end of a branch formed by the filter and the protector connected in parallel is connected between the third resistor and the second resistor, and another end of the branch is connected to the grounded end of the optical output coupler. One end of a branch formed by the fourth resistor and the capacitor connected in parallel is connected between the optical receiving coupler and the inverting terminal of the voltage amplifier, and another end of the branch is connected between the output terminal of the optical receiving coupler and an input terminal of the voltage division circuit unit.

[0007] The voltage division circuit unit includes a fifth resistor and a sixth resistor. The fifth resistor and the sixth resistor are connected in series, an input terminal of the fifth resistor is connected to the output terminal of the optical receiving coupler, and the non-inverting terminal of the Schmidt circuit unit is connected between the fifth resistor and the sixth resistor.

[0008] The LED control device further includes a microcontroller and a function setting unit. The microcon-

troller is connected to the output terminal of the optical receiving coupler. The function setting unit is connected between an output terminal of the sixth resistor and the microcontroller. The sixth resistor, the microcontroller and the function setting unit share a common grounded end. The function setting unit can be set manually so that the microcontroller is controlled to activate a set lighting mode after the square wave signal is received.

[0009] The LED control device further includes a reference power supply unit. The reference power supply unit includes a first terminal, a second terminal and a third terminal. A direct current voltage is input via the first terminal, the second terminal is grounded, the third terminal of the reference power supply unit is connected to the voltage amplifier, the Schmidt circuit unit and the microcontroller, and a control direct current power supply providing a low voltage is output via the third terminal.

[0010] The reference power supply unit is a low dropout regulator (LDO).

[0011] The LED control device further includes a LED drive control unit. One end of the LED drive control unit is connected to the output terminal of the microcontroller, and another end of the LED drive control unit is connected to a LED lamp. The LED drive control unit controls lighting and brightness adjustment of the LED lamp, and the control of the brightness adjustment by the LED drive control unit enables a stepless, gradual lighting or gradual dimming effect of the brightness.

[0012] The LED control device further includes a rectifying unit and a power supplying unit. The rectifying unit is connected to an external power supply, and an output terminal of the rectifying unit is connected to the power supplying unit and the LED drive control unit. The rectifying unit supplies power to the LED lamp, the power supplying unit is connected to the reference power supply unit, voltage drop is performed by the power supplying unit, and then the power is supplied to the reference power supply unit.

[0013] The rectifying unit includes an inductor and a full-wave rectifier. The inductor is connected to the external power supply and the full-wave rectifier, and the rectifying unit is connected to the power supplying unit and the LED drive control unit via the full-wave rectifier.

[0014] The power supplying unit includes a transistor, a seventh resistor, an eighth resistor, a filtering capacitor and a protective diode. A collector of the transistor is connected to the seventh resistor and is connected to the rectifying unit via the seventh resistor. A base of the transistor is connected to the protective diode and is grounded. An emitter of the transistor is connected to the filtering capacitor and is grounded, the emitter of the transistor is also connected to the eighth resistor, and is connected to the first terminal of the reference power supply unit via the eighth resistor.

[0015] In the present disclosure, the transimpedance amplification unit converts the current signal into the voltage signal, and converts the voltage signal into the square wave signal in cooperation with the Schmidt circuit, such that the sensing switch can be connected to multiple LED control devices via a single wire, thereby controlling multiple LED lamps simultaneously. The LED control device is an integrated electronic device, and the sensing switch is independently disposed at a position to be sensed. Therefore, only a single wire is required to be disposed between the sensing switch and the LED control devices such that wiring is more easily implemented for the multiple LED control devices connected in parallel, and the number of the wires used is also greatly reduced, thereby simplifying the wiring between the sensing switch and the LED control devices and reducing a manufacture cost.

[0016] Other objects, advantages and novel characteristics of the present disclosure will become more obvious from the following detailed description and related accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic block diagram according to the present disclosure;

FIG. 2 is a circuit diagram according to the present disclosure; and

FIG. 3 is a schematic block diagram according to the conventional technology.

DETAILED DESCRIPTION OF THE EMBODIMENT(S) OF THE INVENTION

[0018] In order to enable to a further understanding the objects, features and effects of the present disclosure, the present disclosure is described in detail hereinafter with reference to the accompanying drawings illustrating the invention by way of examples.

[0019] The present invention thus relates to an apparatus for controlling brightness of a LED lamp.

[0020] The apparatus comprises a sensing switch 200, configured to sense a current signal, e.g. generated due to environmental change such as change in lighting conditions, wherein the current signal is output through a wire L1.

[0021] It also comprises at least one LED control device 200 connected to the sensing switch output wire L1, wherein the LED control device comprises a current rectifying unit 201 connected to said wire L1 connected to a current limiting unit 202, a transimpedance amplification unit 203, and a Schmidt circuit unit; wherein the transimpedance amplification unit 203 converts the current signal A1 into the voltage signal V1, and converts the voltage signal V1 into the square wave signal F1 in cooperation with the Schmidt circuit 205 being connected to the LED lamp,

[0022] The Schmidt circuit 205 may be connected to

said LED lamp 210 through at least one of a microcontroller 206 and a LED drive control unit for adjusting the brightness of said LED lamp.

[0023] The sensing switch will preferably include connection to an external power supply. A rectifying unit 211 may be connected to the external power supply and power supply unit, being connected to said transimpedance amplification unit 203 and Schmidt circuit.

[0024] The power supply unit 212 may be connected to said transimpedance amplification unit 203 and Schmidt circuit 205 through a reference power supply unit 209.

[0025] Referring to FIG. 1 and FIG. 2, an apparatus for controlling brightness of a LED lamp includes a sensing switch 100 and at least one LED control device 200. The sensing switch 100 is configured to sense a current signal A1 generated due to environmental change, and the current signal A1 is output via a wire L1. The LED control device 200 includes a current rectifying unit 201, a current limiting unit 202, a transimpedance amplification unit 203, a voltage division circuit unit 204 and a Schmidt circuit unit 205. The current rectifying unit 201 is connected to the wire L1 of the sensing switch 100 via an anode of a diode D1, and rectifies the current signal A1 by the diode D1. The current limiting unit 202 includes a first resistor R1 and a second resistor R2 connected in series. An input terminal of the first resistor R1 is connected to a cathode of the diode D1, and the current limiting unit 202 limits the current signal A1, such that a small current flows into the transimpedance amplification unit 203. The transimpedance amplification unit 203 includes an optical output coupler OC1, an optical receiving coupler OC2, a voltage amplifier Q1, a third resistor R3, a filter C1, a protector D2, a fourth resistor R4 and a capacitor C2. One end of the optical output coupler OC1 is connected to an output terminal of the second resistor R2, and the optical output coupler OC1 is connected to the second resistor R2 via a third resistor R3, thereby effectively limiting the current. Another end of the optical output coupler OC1 is grounded, and the current signal A1 is converted into an optical signal through the optical output coupler OC1. One end of a branch formed by the filter C1 and the protector D2 connected in parallel is connected between the third resistor R3 and the second resistor R2, and another end of the branch is connected to the grounded end of the optical output coupler OC1. The filter C1 filters the current signal A1, and the protector D2 can prevent generation of an excessively high current. An emitter of the optical receiving coupler OC2 is connected to a non-inverting terminal of the voltage amplifier Q1, a collector of the optical receiving coupler OC2 is connected to an inverting terminal of the voltage amplifier Q1, and a base of the optical receiving coupler OC2 receives the optical signal to generate a voltage signal VI corresponding to the current signal A1. An output terminal of the voltage amplifier Q1 is connected to the voltage division circuit unit 204. One end of a branch formed by the fourth resistor R4 and the capacitor C2 connected in parallel is connected between the optical receiving coupler OC2 and the inverting terminal of the voltage amplifier Q1, and another end of the branch is connected between an output terminal of the optical receiving coupler OC2 and an input terminal of the voltage division circuit unit 204. The voltage division circuit unit 204 includes a fifth resistor R5 and a sixth resistor R6 connected in series. An input terminal of the fifth resistor R5 is connected to the output terminal of the optical receiving coupler OC2, and the non-inverting terminal of the Schmidt circuit unit 205 is connected between the fifth resistor R5 and the sixth resistor R6. The voltage signal VI is amplified by the voltage amplifier Q1, and then the amplified voltage is divided by the voltage division circuit unit 204, thereby removing a part of the voltage signal A1 which has an excessively large amplitude. The non-inverting terminal of the Schmidt circuit unit 205 is connected to the voltage division circuit unit 204, and the Schmidt circuit unit 205 receives the voltage signal VI to generate a square wave signal F1 indicating ON/OFF of the lamp. The square wave signal F1 is output by the output terminal of the Schmidt circuit unit 205 so that the control is achieved. The transimpedance amplification unit 203 converts the current signal A1 into the voltage signal VI, and converts the voltage signal VI into the square wave signal F1 in cooperation with the Schmidt circuit 205, such that the sensing switch 100 can be connected to the at least one LED control device 200 via the single wire L1, thereby implementing simple wiring between the sensing switch 100 and the LED control device 200.

[0026] Referring to FIG. 1 and FIG. 2 again, the LED control device 200 further includes a microcontroller 206, a function setting unit 207, a LED drive control unit 208 and a reference power supply unit 209. The microcontroller 206 is connected to the output terminal of the optical receiving coupler OC2, and the function setting unit 207 is connected between the output terminal of the sixth resistor R6 and the microcontroller 206. The sixth resistor R6, the microcontroller 206 and the function setting unit 207 share a common grounded end. The function setting unit 207 can be set manually, including setting a lighting timing, a lighting duration, a lighting illumination and the like. In this way, the microcontroller 206 is controlled to activate a set lighting mode after the square wave signal F1 is received. One end of the LED drive control unit 208 is connected to an output terminal of the microcontroller 206, and another end of the LED drive control unit 208 is connected to a LED lamp 210. The LED drive control unit 208 controls lighting and brightness adjustment of the LED lamp 210, and the control of the brightness adjustment by the LED drive control unit 208 enables a stepless, gradual lighting or gradual dimming effect of the brightness. The reference power supply unit 209 is a low dropout regulator (LDO). The reference power supply unit 209 includes a first terminal S1, a second terminal S2 and a third terminal S3. A direct current voltage is input through the first terminal S1, the second terminal S2 is grounded, and the third terminal S3 of the reference

power supply unit 209 is connected to the voltage amplifier Q1, the Schmidt circuit unit 205 and the microcontroller 206. The voltage amplifier Q1 and the Schmidt circuit unit 205 each have a grounded end, and a control direct current power supply providing a low voltage is output via the third terminal S3.

[0027] Referring to FIG. 1 and FIG. 2 again, the LED control device 200 further includes a rectifying unit 211 and a power supplying unit 212. The rectifying unit 211 is connected to an external power supply, and an output terminal of the rectifying unit 211 is connected to the power supplying unit 212 and the LED drive control unit 208. The rectifying unit 211 supplies power to the LED lamp 210. The power supplying unit 212 is connected to the reference power supply unit 209, voltage drop is performed by the power supplying unit 212, and then the power is supplied to the reference power supply unit 209. The rectifying unit 211 includes an inductor L2 and a full-wave rectifier D3. The inductor L2 is connected to the external power supply and the full-wave rectifier D3, and the rectifying unit 211 is connected to the power supplying unit 212 and the LED drive control unit 208 via the full-wave rectifier D3, thereby supplying power. The power supplying unit 212 includes a transistor Q2, a seventh resistor R7, an eighth resistor R8, a filtering capacitor C3 and a protective diode D4. A collector of the transistor Q2 is connected to the seventh resistor R7, and is connected to the rectifying unit 211 via the seventh resistor R7. A base of the transistor Q2 is connected to the protective diode D4 and is grounded. An emitter of the transistor Q2 is connected to the filtering capacitor C3 and is grounded, is also connected to the eighth resistor R8, and is connected to the first terminal S1 of the reference power supply unit 209 via the eighth resistor R8.

[0028] The technical effect is described in the following. Referring to FIG. 1 and FIG. 2 again, in the rectifying unit 211, an external power supply (alternate current) is input via an inductor L2, voltage transformation is performed on the power by the inductor L2, and then the power is supplied to the full-wave rectifier D3. The power having a relatively high voltage after rectification is supplied to the power supplying unit 212 and the LED drive control unit 208. The power having the relatively high voltage flows through the seventh resistor R7, the transistor Q2 and the eighth resistor R8 of the power supplying unit 212, and then a power having a relatively low voltage is generated. The power having the relatively low voltage is input to the first terminal S1 of the reference power supply unit 209. Another voltage drop is performed on the power by the reference power supply unit 209, and the power is then supplied to the voltage amplifier Q1, the Schmidt circuit unit 205 and the microcontroller 206 via the third terminal S3 so that the power is controlled. The power having the relatively high voltage flowing to the LED drive control unit 208 can be used to light up the LED lamp 210. Lighting and brightness control of the LED lamp 210 is further explained below. The sensing switch 100 is connected to the external power supply. In a case that a dynamic change is detected in a sensing range, the sensing switch 100 generates a current signal A1 in an ON/OFF manner. The current signal A1 can simultaneously flow into the current rectifying units 201 of at least one LED control device 200 via a single wire L1. The current signal A1 is firstly rectified by the diode D1 of the current rectifying unit 201, and then is limited by the first resistor R1 and the second resistor R2 of the current limiting unit 202, thereby reducing a current value of the current signal A1. After the current signal A1 is input into the transimpedance amplification unit 203, the current signal A1 is limited again by the third resistor R3, such that the current signal A1 can drive the optical output coupler OC1 to generate an optical signal, and the optical signal increases as the current of the current signal A1 rises. Meanwhile, the optical receiving coupler OC2 receives the optical signal to generate a corresponding voltage signal V1, and the voltage signal V1 also increases as the optical signal rises. The voltage signal V1 is input to the inverting terminal of the voltage amplifier Q1, and is amplified by the output terminal of the voltage amplifier Q1. Then the amplified voltage signal is input to the voltage division circuit unit 204, and voltage division is performed by the fifth resistor R5 and the sixth resistor R6, thereby filtering out excessively large voltage values which go beyond a determination range of the Schmidt circuit unit 205. Between the fifth resistor R5 and the sixth resistor R6, the voltage signal VI on which voltage division is performed is input to the non-inverting terminal of the Schmidt circuit unit 205. The Schmidt circuit unit 205 determines that a corresponding square wave signal F1 is generated from the voltage signal V1. The Schmidt circuit unit 205 can further filter noise, and the square wave signal F1 is input to the microcontroller 206. In cooperation with user-defined setting of the function setting unit 207, the microcontroller 206 controls the LED drive control unit 208, such that the LED lamp 210 can automatic light up and have the brightness thereof automatically adjusted in response to dynamic change of the environment. According to the specific embodiments above, the present disclosure has the following advantageous effects. The transimpedance amplification unit 203 converts the current signal A1 into the voltage signal VI, and converts the voltage signal VI into the square wave signal F1 in cooperation with the Schmidt circuit 205, such that the sensing switch 100 can be connected to multiple LED control devices 200 via a single wire L1, thereby controlling multiple LED lamps 210 simultaneously. The LED control device 200 is an integrated electronic device, and the sensing switch 100 is independently arranged at a position to be sensed. Therefore, only a single wire L1 is required to be disposed between the sensing switch 100 and the LED control devices 200, such that wiring is more easily implemented for the multiple LED control devices 200 connected in parallel, and the number of the wires used is greatly reduced, thereby simplifying the wiring between the sensing switch 100 and the LED control devices 200 and reducing a manu-

facture cost.

[0029] In summary, an improved structural design is disclosed in the present invention, and industrial practicability and progress are realized. The present invention is not disclosed by any publications, thereby having novelty. It will be highly appreciated if the present invention can be granted a legal patent right in accordance with relevant regulations of the patent law.

[0030] Only preferred embodiments of the present disclosure are described above, and the preferred embodiments are not intended to limit the scope of the embodiments of the present disclosure. Equivalent changes and modifications made without departing from the scope of the present disclosure will fall within the scope of the present disclosure.

Reference Numerals

[0031]

100	sensing switch
200	LED control device
201	current rectifying unit
202	current limiting unit
203	transimpedance amplification unit
204	voltage division circuit unit
205	Schmidt circuit unit
206	microcontroller
207	function setting unit
208	LED drive control unit
209	reference power supply unit
210	LED lamp
211	rectifying unit
212	power supplying unit
A1	current signal
C1	filter
C2	capacitor
C3	filtering capacitor
D1	diode
D2	protector
D3	full-wave rectifier
D4	protective diode
F1	square wave signal
S1	first terminal
S2	second terminal
S3	third terminal
L1	wire
L2	inductor
OC1	optical output coupler
OC2	optical receiving coupler
Q1	voltage amplifier
Q2	transistor
R1	first resistor
R2	second resistor
R3	third resistor
R4	fourth resistor
R5	fifth resistor
R6	sixth resistor
R7	seventh resistor
R8	eighth resistor
V1	voltage signal
301	sensing switch
302	LED driver
303	LED lamp
304, 305	wire

Claims

1. An apparatus for controlling brightness of a LED lamp, comprising:

   a sensing switch (200), configured to sense a current signal generated due to environmental change, wherein the current signal is output through a wire; and
   at least one LED control device (200) connected to the sensing switch output wire (L1), wherein the LED control device comprises a current rectifying unit (201) connected to said wire (L1) connected to a current limiting unit (202), a transimpedance amplification unit (203), and a Schmidt circuit unit; wherein the transimpedance amplification unit (203) converts the current signal (A1) into the voltage signal (VI), and converts the voltage signal (VI) into the square wave signal (F1) in cooperation with the Schmidt circuit (205) being connected to the LED lamp,

2. Apparatus according to claim 1, wherein the Schmidt circuit (205) is connected to said LED lamp through at least one of a micro-controller (205) and a LED drive control unit for adjusting the brightness of said LED lamp.

3. Apparatus according to claim 1, where the sensing switch is connected an external power supply.

4. Apparatus according to claim 3, wherein the external power supply is connected to a rectifying unit (211) in said sensing switch being further connected to a power supply unit (212) being connected to said transimpedance amplification unit (203) and Schmidt circuit.

5. Apparatus according to claim 4, wherein said power supply unit (212) is connected to said transimpedance amplification unit (203) and Schmidt circuit (205) through a reference power supply unit (209).

6. Apparatus according to claim 1, comprising:

   the sensing switch, configured to sense a current signal generated due to environmental change, wherein the current signal is output through a wire; and

said at least one LED control device, wherein the LED control device comprises a current rectifying unit, said current limiting unit, said transimpedance amplification unit, said voltage division circuit unit and said Schmidt circuit unit; the current rectifying unit is connected to a wire of the sensing switch via an anode of a diode, and rectifies the current signal by using the diode; the current limiting unit comprises a first resistor and a second resistor connected in series, an input terminal of the first resistor is connected to a cathode of the diode, and the current signal is limited by the current limiting unit; the transimpedance amplification unit comprises an optical output coupler, an optical receiving coupler and a voltage amplifier, one end of the optical output coupler is connected to an output terminal of the second resistor, and another end of the optical output coupler is grounded; the current signal is converted into an optical signal through the optical output coupler; an emitter of the optical receiving coupler is connected to a non-inverting terminal of the voltage amplifier, and a collector of the optical receiving coupler is connected to an inverting terminal of the voltage amplifier; a base of the optical receiving coupler receives the optical signal to generate a voltage signal corresponding to the current signal; an output terminal of the voltage amplifier is connected to the voltage division circuit unit, the voltage signal is amplified by the voltage amplifier and then the amplified voltage is divided by the voltage division circuit unit; a non-inverting terminal of the Schmidt circuit unit is connected to the voltage division circuit unit, the Schmidt circuit unit receives the voltage signal to generate a square wave signal indicating ON/OFF of the lamp; an output terminal of the Schmidt circuit unit outputs the square wave signal so that the control is achieved; the transimpedance amplification unit converts the current signal into the voltage signal, and converts the voltage signal into the square wave signal in cooperation with the Schmidt circuit unit, such that the sensing switch is capable of being connected to the at least one LED control device via a single wire, and simple wiring between the sensing switch and the LED control device is implemented.

7. The apparatus for controlling brightness of a LED lamp according to claim 6, wherein the transimpedance amplifier further comprises a third resistor, a filter, a protector, a fourth resistor and a capacitor; the optical output coupler is connected to the second resistor via the third resistor; one end of a branch formed by the filter and the protector connected in parallel is connected between the third resistor and the second resistor, and another end of the branch is connected to the grounded end of the optical output coupler; one end of a branch formed by the fourth resistor and the capacitor connected in parallel is connected between the optical receiving coupler and the inverting terminal of the voltage amplifier, and another end of the branch is connected between an output terminal of the optical receiving coupler and an input terminal of the voltage division circuit unit.

8. The apparatus for controlling brightness of a LED lamp according to claim 7, wherein the voltage division circuit unit comprises a fifth resistor and a sixth resistor connected in series, an input terminal of the fifth resistor is connected to the output terminal of the optical receiving coupler, and the non-inverting terminal of the Schmidt circuit unit is connected between the fifth resistor and the sixth resistor.

9. The apparatus for controlling brightness of a LED lamp according to claim 8, wherein the LED control device further comprises a microcontroller and a function setting unit; the microcontroller is connected to the output terminal of the optical receiving coupler, the function setting unit is connected between an output terminal of the sixth resistor and the microcontroller; the sixth resistor, the microcontroller and the function setting unit share a common grounded end; and the function setting unit is capable of being set manually so that the microcontroller is controlled to activate a set lighting mode after the square wave signal is received.

10. The apparatus for controlling brightness of a LED lamp according to claim 9, wherein the LED control device further comprises a reference power supply unit, the reference power supply unit comprises a first terminal, a second terminal and a third terminal; a direct current voltage is input via the first terminal, the second terminal is grounded, the third terminal of the reference power supply unit is connected to the voltage amplifier, the Schmidt circuit unit and the microcontroller, and a control direct current power supply providing a low voltage is output via the third terminal.

11. The apparatus for controlling brightness of a LED lamp according to claim 10, wherein the reference power supply unit is a low dropout regulator (LDO).

12. The apparatus for controlling brightness of a LED lamp according to claim 10, wherein the LED control device further comprises a LED drive control unit, one end of the LED drive control unit is connected to an output terminal of the microcontroller, and another end of the LED drive control unit is connected to a LED lamp; the LED drive control unit controls lighting and brightness adjustment of the LED lamp, and the control of the brightness adjustment by the

LED drive control unit enables a stepless, gradual lighting or gradual dimming effect of the brightness.

13. The apparatus for controlling brightness of a LED lamp according to claim 12, wherein the LED control device further comprises a rectifying unit and a power supplying unit; the rectifying unit is connected to an external power supply and an output terminal of the rectifying unit is connected to the power supplying unit and the LED drive control unit; the rectifying unit supplies power to the LED lamp, the power supplying unit is connected to the reference power supply unit, voltage drop is performed by the power supplying unit, and then the power is supplied to the reference power supply unit.

14. The apparatus for controlling brightness of a LED lamp according to claim 13, wherein the rectifying unit comprises an inductor and a full-wave rectifier, the inductor is connected to the external power supply and the full-wave rectifier, and the rectifying unit is connected to the power supplying unit and the LED drive control unit via the full-wave rectifier.

15. The apparatus for controlling brightness of a LED lamp according to claim 13, wherein the power supplying unit comprises a transistor, a seventh resistor, an eighth resistor, a filtering capacitor and a protective diode; a collector of the transistor is connected to the seventh resistor, and is connected to the rectifying unit via the seventh resistor; a base of the transistor is connected to the protective diode and is grounded; an emitter of the transistor is connected to the filtering capacitor and is grounded, the emitter of the transmitter is also connected to the eighth resistor, and is connected to the first terminal of the reference power supply unit via the eighth resistor.

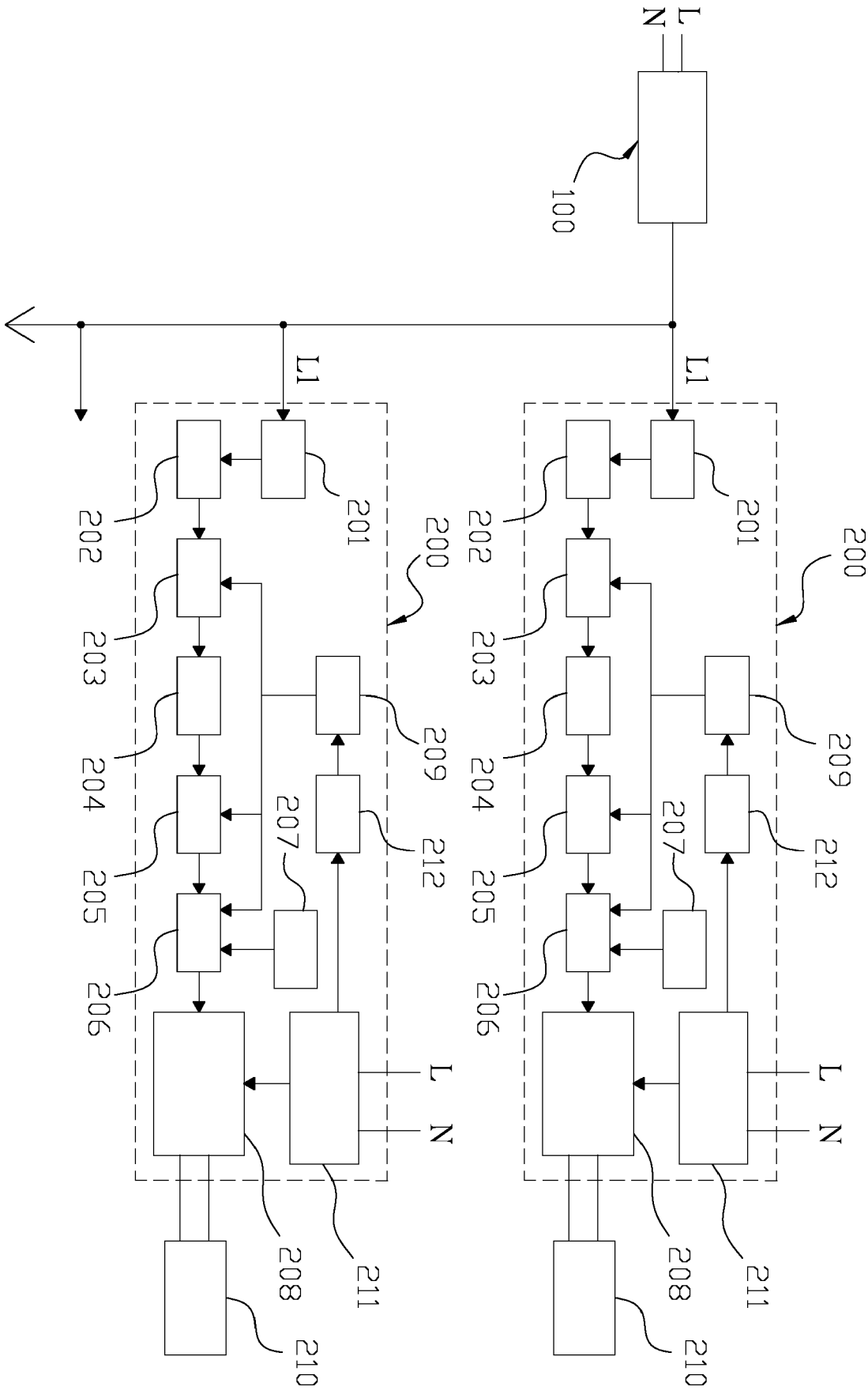


Fig. 1

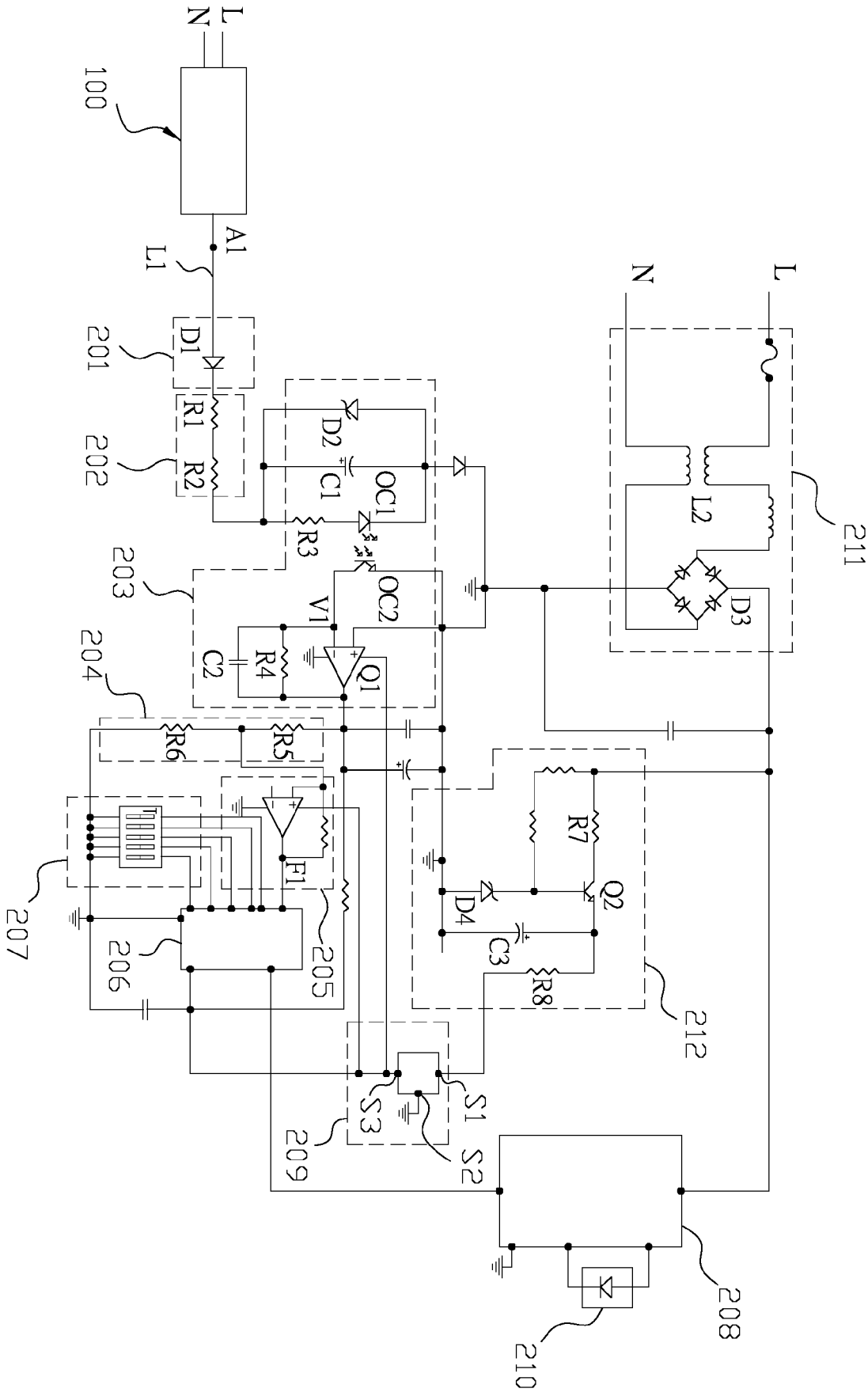

L
N
100
A1
L1
201
D1
R1
R2
202
D2
C1
OC1
R3
203
OC2
V1
C2
R4
Q1
204
R6
R5
F1
205
206
207
L
N
211
L2
D3
R7
Q2
D4
C3
R8
212
S1
S2
S3
209
208
210

Fig. 2

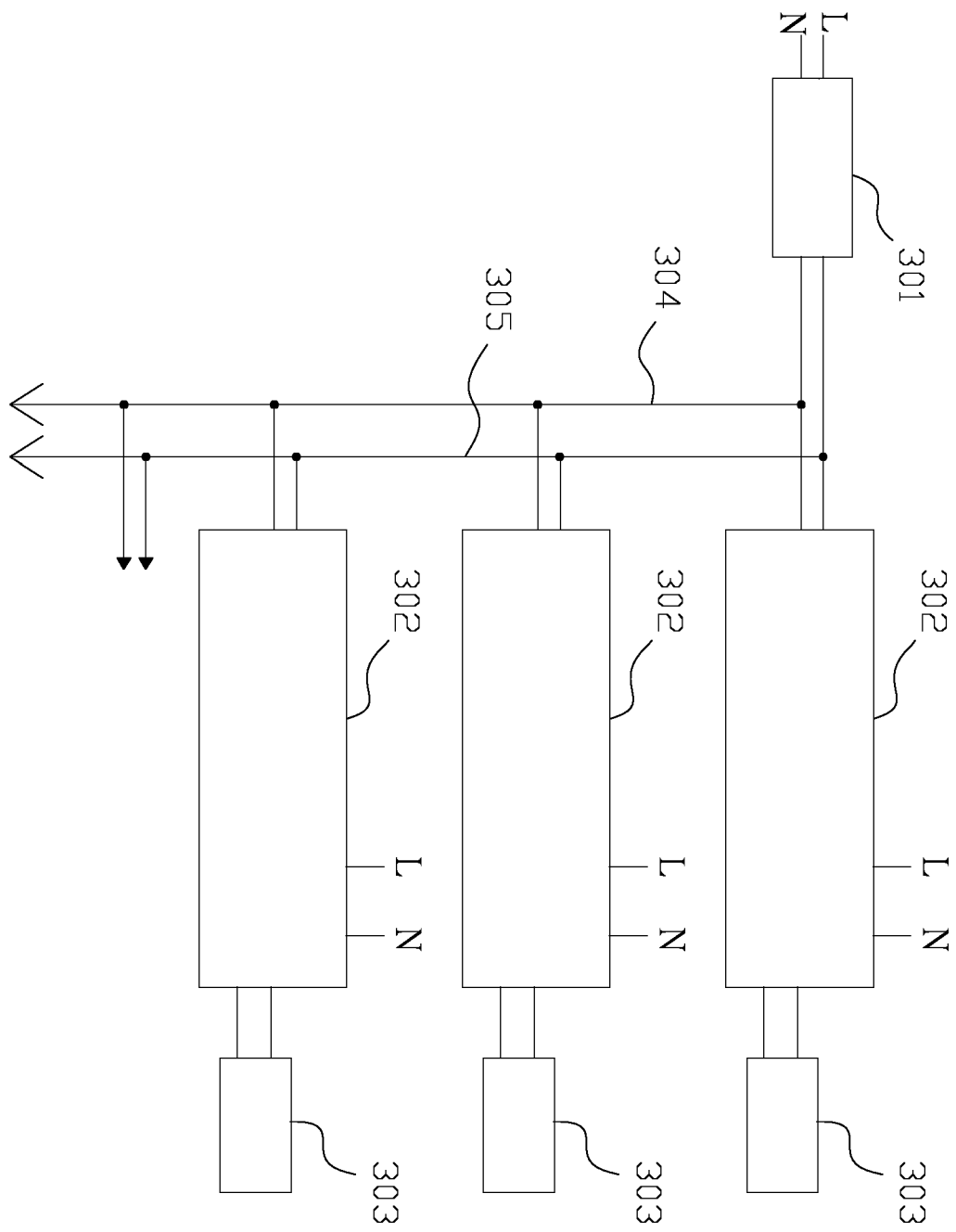


Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 4055

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 December 2019	Morrish, Ian

CATEGORY OF CITED DOCUMENTS

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