(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 837 844 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
26.09.2007 Bulletin 2007/39

(21) Application number: **05700419.4**

(22) Date of filing: **12.01.2005**

(51) Int Cl.:
G09G 3/14 *(2006.01)* ***G09G 3/32*** *(2006.01)*

(86) International application number:
PCT/CN2005/000045

(87) International publication number:
WO 2006/074573 (20.07.2006 Gazette 2006/29)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR

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(54) **SEMICONDUCTOR LAMP**

(57) This invention relates to a semiconductor luminescent module and a semiconductor lamp formed there of, comprising: a luminescent array comprising a plurality of semiconductor luminescent elements; a power supply circuit for providing pulsed power supply voltage to each of the semiconductor luminescent elements in said luminescent array, so as to make the luminance of said semiconductor luminescent elements substantially same as that of the semiconductor luminescent elements by constant DC currents. For GaAs LEDs, the duty ratio of said pulse under a frequency of f=5KC is 50% - 90%, preferably 70% - 80%, and more preferably 75%. Said shift-multiplexer is an integrated circuit. The semiconductor lamp in this invention has the effect of energy saving, and at the same time ensuring even luminance. It also makes the power supply circuits have good performance, simple design, easy to be integrated, convenient for adjustment, such that the fabrication cost is lowered and can be practically and widely used.

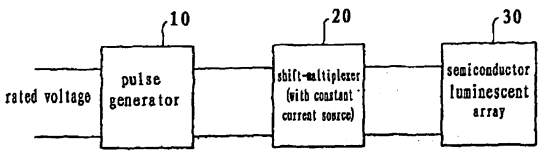

Fig. 2

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Description

Technical Field

[0001] This invention relates to a semiconductor lamp, more specifically, it relates to a power supply technology of a semiconductor lamp comprising semiconductor luminescent elements (such as LEDs).

Background Art

[0002] Semiconductor luminescence technology is one of the most promising new high-tech fields of the 21st Century. As a new highly efficient solid-state light source, semiconductor luminescent elements have the prominent advantages such as long working life, energy saving, safe, environment friendly, rich in colors and very small in size. It is another revolution in the history of luminescence for human beings after the invention of incandescent lamp and fluorescent lamp. Semiconductor luminescence technology is widely used in areas of general luminescence, decorating luminescence (sightseeing, household, recreation and commercial decorations), transportation luminescence for vehicles like cars, traffic signals, background lighting, large-screen display, luminescence for special tasks, military luminescence, tourism and light industry products. A semiconductor lamp with a power consumption of only 4W has a luminosity equivalent to that of an incandescent lamp of more than 30W, and its working life can be as long as 1 million hours, 50 times of an ordinary incandescent lamp.

[0003] Traditionally, a semiconductor luminescent unit and its array are powered with rated direct voltage. A corresponding DC voltage is provided to a semiconductor luminescent unit based on its rated voltage, so as to make the semiconductor luminescent unit emit light normally. For a semiconductor lamp using AC power supply, the AC power supply should be converted into DC power supply with rated voltage, such that the semiconductor lamp can operate normally. Because the luminance of a single semiconductor luminescent unit is limited, general-purpose electrical devices have to adopt the solution of using a plurality of semiconductor luminescent units as an array to emit light together. If every luminescent unit has its own power supply circuit, it will not only make the circuits complicated with high power assumption, it will be unable to solve the problem of differences in luminance of luminescent units because of differences during manufacturing, and also very difficult for adjustment. Even if the circuits can make the luminance of luminescent units be conformed, the structure of the circuits would be very complicated and cost a lot.

[0004] For example, the operating DC voltage of a single LED with a luminance of 20000mcd is usually 3V, with a constant current of 20mA. A semiconductor lamp is usually formed of several to hundreds of LED groups. It is easy to provide an LED with 20mA by using certain electronic circuit, but it is a difficult problem to provide hundreds of LED groups with a constant current of 20mA at the same time. The currently used power supply lines are complicated, and many LEDs do not use constant current, and it is easy to have the result that the LEDs have low luminance when the current is small, and have reduced the life time when the current is large, so that the luminance is uneven and unstable, the effect is bad. Thus, it is a key technology to ensure long lifetime and normal luminescence of the hundreds of LED groups by providing them with a constant current of 20mA.

Contents of Invention

[0005] One of the technical problems to be solved by this invention is to provide a new way of power supply to a luminescent array comprising semiconductor luminescent elements (such as LEDs). It takes less electricity than traditional ways of power supply, and so it has the effect of energy saving.

[0006] One of the technical problems to be solved by this invention is to provide a new way of power supply to a luminescent array comprising semiconductor luminescent elements (such as LEDs), in which each of the luminescent units of the luminescence array can be driven constantly, so that the luminescent array could have even luminescent effects.

[0007] Another technical problem to be solved by this invention is to provide a new way of power supply to a luminescent array comprising semiconductor luminescent elements, in which the power supply circuits have good performance, simple design, easy to be integrated, convenient for adjustment, such that the fabrication cost is lowered and can be practically and widely used.

[0008] Specifically, this invention provides a semiconductor luminescent module, comprising: a luminescent array comprising a plurality of semiconductor luminescent elements; a power supply circuit for providing pulsed voltage to each of the semiconductor luminescent elements in said luminescent array, so as to make the luminance of said semiconductor luminescent elements substantially same as that of the semiconductor luminescent elements of constant DC power supply.

[0009] In a preferred embodiment of this invention, for GaAs LEDs, the duty ratio of said pulse under a frequency of f=5KC is 50% - 90%, preferably 70% - 80%, and more preferably 75%.

[0010] Using pulse power supply voltage can save more electricity than conventional DC power supply, so that the energy saving effect is achieved.

[0011] In a preferred embodiment of this invention, said power supply circuit comprises: a pulse generator for generating pulses; a shift register for converting pulses generated by the pulse generator into pulses providing power supply to each of the semiconductor luminescent elements.

[0012] In a preferred embodiment of this invention, said shift-multiplexer is an integrated circuit, such as the 16-bit IC HM62726 specially designed for constant cur-

rent driving, wherein each of the parallel outputs of the IC HM62726 drives a plurality of semiconductor luminescent elements, preferably two.

[0013] Because this invention uses shift registers that can be easily integrated to provide power supply pulses to the luminescent array comprising semiconductor luminescent elements, it avoids the solution of each luminescent unit having a set of circuits of power supply, which simplifies the circuits and lowers the power assumption.

[0014] By using an IC with constant current source, all luminescent units in a luminescent array have uniform luminance, so that such formed semiconductor lamp can have even luminescent effect.

[0015] Since this invention can use all kinds of general purpose IC module or application specific integrated circuit (ASIC) module, the fabrication cost is lowered, the size of the power supply circuits and of the whole device is minimized, the problem of power supply, clock, control and load expansion are solved with a simple circuit design, making it convenient for commercialization, practical use and product prevalence.

[0016] In a preferred embodiment of this invention, the duty ratio of said pulse generator can be adjusted.

[0017] In a preferred embodiment of this invention, said pulse generator is built with integrated circuits, such as 555 time base circuits.

[0018] In a preferred embodiment of this invention, said power supply circuit has an external circuit for adjusting the luminance of each of the semiconductor luminescent elements.

[0019] In a preferred embodiment of this invention, it also comprises a means for converting external AC power supply into DC power supply, such that the semiconductor luminescent modules can operate with any power supply.

[0020] This invention also provides a semiconductor lamp, which can be formed by integrating said semiconductor luminescent modules.

[0021] According to one embodiment, the semiconductor lamp of this invention comprises:

A pulse generator described above, for generating pulses; a plurality of semiconductor luminescent modules, each of which includes a luminescent array comprising a plurality of semiconductor luminescent elements; a shift-multiplexer described above, for converting pulses generated by said pulse generator into pulses that provide power supply to each of the semiconductor luminescent elements in said luminescent array; a constant current source capable of providing constant current output to the luminescent array comprising a plurality of semiconductor luminescent elements.

Description of Attached Drawings

[0022]

Fig. 1 is a sketch view showing duty ratio of the power supply pulse applied to a semiconductor luminescent element;

Fig. 2 is a circuit block diagram of a semiconductor luminescent module according to an embodiment of this invention;

Fig. 3 is a sketch view showing circuit functions of a shift register according to an embodiment of this invention

Fig. 4 is a functional block diagram of a 16-bit IC HM62726 specially designed for constant current driving.

Fig. 5 is a circuit diagram of a power supply circuit built with ICs according to an embodiment of this invention;

Fig. 6 is a circuit block diagram of a semiconductor luminescent module according to another embodiment of this invention.

Embodiments

[0023] The specific modes for carrying out this invention will be described through the following embodiments.

[0024] The following embodiments illustrate a semiconductor luminescent array formed of light emitting diodes (LED), and a semiconductor lamp formed thereof.

[0025] The operating DC voltage of a single LED with a luminance of 20000mcd and below is usually 3V, with a constant current of 20mA. The inventors of this invention found in experiments: when applying a pulse signal to a GaAs LED, if the frequency of the pulses is adjusted to make the duty ratio of the pulse signal reach a predetermined range, for example, in case the frequency f=5KC (period T=0.2ms), when the duty ratio is 50% - 90%, preferably 70% - 80%, and more preferably 75%, at this time the luminance of said semiconductor luminescent elements is substantially same as that of the semiconductor luminescent elements by constant DC current, a semiconductor lamp formed of semiconductor luminescent LEDs driven in this way can have 75% energy saving effect.

[0026] Fig. 1 illustratively shows the pulse waveform when the duty ratio is 75%. When frequency f=5KC (period T=0.2ms), for a positive pulse, the low level time Tk=0.2-0.15=0.05ms, so the duty ratio Tz/T=75%.

[0027] Why is the luminance of the semiconductor luminescent elements driven by a pulse with certain duty ratio same as that of the semiconductor luminescent elements driven by constant DC supplies? This unobvious effect is not limited by any special theory. It can be assumed as follows: this is because a luminescent semiconductor is a load of capacitance nature and has inertia, it keeps on emitting light for a short period of time even after the power supply is off. It is because of this characteristic that a substantially constant luminance can be maintained by adjusting the duty ratio.

[0028] It should be noted that the above duty ratio is defined with respect to certain semiconductor material

(GaAs LEDs) and under certain pulse frequency (f=5KC, period T=0.2ms). It is not difficult for those skilled in the art to understand that proper pulse duty ratio can be found for different semiconductor materials or at different operating frequencies and so on, so as to make the luminance of other type semiconductor luminescent elements substantially same as that of the semiconductor luminescent elements driven by constant DC currents.

[0029] One embodiment of this invention uses the characteristics of multiplex constant current output of a shift register and corresponding electronic circuits, to obtain a constant current source and provide power supplies simultaneously to a plurality of semiconductor luminescent units (such as a LED array); alternatively, utilizes general purpose or application specific modules (such as HM62672) to provide power supplies simultaneously to a plurality of semiconductor luminescent units (such as a LED array). Such a way of power supplying ensures a consistent luminance of elements in the array, and the problems of power supply, clock, control and load expansion are solved with a simple circuit design.

[0030] Fig. 2 shows a circuit block diagram of a semiconductor luminescent module according to an embodiment of this invention. As shown in the drawing, a semiconductor luminescent module of this invention comprises a pulse generator 10, a shift multiplexer (and constant current source) 20, a semiconductor luminescent element array 30 comprising a plurality of semiconductor luminescent elements, wherein the semiconductor luminescent element array 30 itself may form a semiconductor lamp, alternatively, a plurality of semiconductor luminescent element arrays forming a larger array to form a semiconductor lamp with a larger area. Those skilled in the art may easily understand such way of expansion.

[0031] Fig. 3 is a functional view of a shift-multiplexer (and constant current source) 20 according to an embodiment of this invention. The drawing shows that a 16-bit shift register serves as the shift-multiplexer 20, receiving pulse trains from a pulse generator 10 at its serial input terminal or shift clock terminal CLK, and converting into parallel output pulses of the output terminals $\overline{OUT0}$, $\overline{OUT1}$, ..., $\overline{OUT15}$ whereby driving a plurality of semiconductor luminescent elements at the same time. Each of the output terminal shown in the drawing drives one semiconductor luminescent element (LED 60), a plurality of semiconductor luminescent elements (there are 16 shown in the drawing) form one semiconductor luminescent element array 30. Based on the characteristics of a shift register, by adjusting circuit parameters of the pulse generator, it is possible to make each output terminal of the shift register have a required frequency and pulse duty ratio. Although it is a 16-bit shift register shown in the drawing, those skilled in the art may understand that the shift-multiplexer can be a shift register of any bits. It is shown in the drawing that each of the output terminals $\overline{OUT0}$, $\overline{OUT1}$, ..., $\overline{OUT15}$ drives one semiconductor luminescent element. However, those skilled in the art may understand that based on the loadability and anticipated capacity of the circuits, each of the output terminals can drive two or more semiconductor luminescent elements, so as to form a semiconductor lamp having any number of luminescent units.

[0032] Preferably, the embodiment of this invention uses constant current source to drive semiconductor luminescent elements, so that all the semiconductor luminescent elements can maintain conformed luminance, in favor of forming a practical semiconductor lamp. It is preferable that the current of each semiconductor luminescent element is adjustable (such as functional of the "output current adjustor" in the drawing), so that each of the semiconductor luminescent elements may have the largest luminance under certain pulse frequency and duty ratio.

[0033] Considering the above requirements, and the designed solution of using multiplex shift register by this invention, it is convenient to meet these requirements by using existing general purpose or application specific integrated circuit modules. As an example, Fig. 4 shows a more specific functional block diagram when a 16-bit application specific IC HM62726 serving as the multiplex shift register in Fig. 3.

[0034] As shown in Fig. 4, reference sign 200 generally indicates a structure of IC HM62726, including a 16-bit shift register 50 having a serial data input terminal SDI of the shift register, data shift clock CLK, and a serial data output terminal SDO; a 16-bit output latch 70 for controlling the transmission and holding of serial data based on the status of the data latch terminal LE; a 16-bit output driver 80 for controlling the transmission and holding of data based on the status of the data enable terminal $\overline{OE}$; R-EXT is a constant current adjustment terminal, which is controlled by an external circuit comprising external resistors (such as R5 in Fig. 5), so as to adjust the luminance of each of the luminescent units, for example, the luminance of each of the luminescent elements can be adjusted to maximum. In Fig. 4, each of the output terminals drives a semiconductor luminescent element (LED) 60, a plurality of semiconductor luminescent elements (there are 16 shown in the drawing) form one semiconductor luminescent element array 30. Those skilled in the art may understand that based on the loadability and capacity of the circuits, each of the output terminals can drive two or more semiconductor luminescent elements, so as to form a semiconductor lamp having any number of luminescent units. As for the specifications, parameters and use guide for the IC HM 62726, one may consult the specification and user's guidance of HM 62726 provided, for instance, by Huafang Microelectronic Co. Ltd. Wu Xi, China. By using this IC, it is possible to provide all kinds of flexible connection forms for the design of power supply circuits with control functions of various control terminals (such as the latch terminal LE and enable terminal $\overline{OE}$ and so on).

[0035] Fig. 5 shows a more detailed circuit diagram of a power supply circuit built with ICs. A 555 time base circuit, resistors R3, R4 and R5, and capacitor C2 and

C3 form an oscillation circuit as pulse generator, optionally adding a circuit formed with R2 and C1 to improve the waveform of pulse square wave. Both the 555 time base circuit and HM 62726 are connected to a constant current source Vcc. One terminal of each of the semiconductor luminescent elements (LEDs 60) is connected to the constant current source Vcc, another terminal is connected to the output terminals $\overline{OUT0}$, $\overline{OUT1}$, ..., $\overline{OUT15}$ of the 16-bit power output driver controlled by $\overline{OE}$. The square wave terminal 3 of the 555 time base IC serves for the clock CLK of the HM62726 for beating pulses, and the parallel C1R2 output terminal at the same phase thereof serves for the control signal for driving the semiconductor lamp comprising LEDs. When $\overline{OE}$ is positive, the output is in high voltage, and the lamp does not light; when $\overline{OE}$ is negative, the output is in low voltage, and the lamp lights. That is to say, the oscillation signal of $\overline{OE}$ directly controls the On and Off of the semiconductor luminescent element LEDs 60. The external resistor R5 of the optional R-EXT terminal forms an external circuit for adjusting the luminance of each of the semiconductor luminescent elements. By adjusting the resistor R5, the luminance of each of the semiconductor luminescent elements can be made maximum, alternatively, each of the semiconductor luminescent elements can be made having a desired luminance. It can be seen from the circuits in Fig. 5 and Fig. 4 that by using a shift-multiplexer in a form like IC HM62726, each of the semiconductor luminescent elements sufficiently uses the constant current source of the integrated shift-multiplexer, ensuring the consistency in luminance of all the semiconductor luminescent elements, and therefore ensuring semiconductor lamp to have excellent lighting effect. Meanwhile, it ensures same pulses at desired frequency and duty ratio to be simultaneously applied to the semiconductor luminescent elements.

[0036] With the structure of the circuit shown in Fig. 5, the pulse wave form generated by the pulse generator and applied on the CLK or OE terminal of the HM62726 IC is opposite in phase from the driving voltage pulse waveform applied on the semiconductor luminescent element LEDs 60. That is to say, for a waveform with 75% duty ratio, the non-empty pulse time applied on the semiconductor luminescent elements is 25%. So, the semiconductor lamp formed of the semiconductor luminescent LEDs can have 75% energy saving effect.

[0037] Fig. 5 illustratively demonstrates a case that each of the output paths drives two LEDs 60, such that one HM62726 IC can drive a luminescent array formed of 32 luminescent elements. However, those skilled in the art should understand that based on the loadability and performance of the circuits, each of the output path can drive one or more semiconductor luminescent elements, so as to form a semiconductor lamp having a desired number of luminescent units. Meanwhile, it can be understood that a semiconductor lamp with larger area can be formed by merging any number of such luminescent modules. For example, a semiconductor lamp with larger area can use a same pulse generator, and may include any number of said luminescent arrays each comprising 32 luminescent elements, and may also include corresponding number of HM62726 ICs 200 serving as shift-multiplexers (and constant current sources).

[0038] Those skilled in the art may understand that because this invention uses integrated circuits, by using the controlling effect of various control terminals (such as latch terminal LE or enable terminal $\overline{OE}$), it is possible to provide different flexible connection forms. Those skilled in the art can make changes and modifications to the structure of the circuits without going beyond the scope of this invention. For example, in one embodiment, it is possible to receive trains of pulses from the pulse generator 10 at the serial data input terminal SDI of the 16-bit shift register 50, converting it into parallel output pulses at the output terminals $\overline{OUT0}$, $\overline{OUT1}$, ..., $\overline{OUT15}$ under the control of various control terminals (such as latch terminal LE or enable terminal $\overline{OE}$) and the driving of clock, and at the same time, driving the plurality of semiconductor luminescent elements (LEDs) 60, each of the output terminals has the frequency and duty ratio corresponding to the input terminals. When it is necessary to form a semiconductor lamp with larger area with a plurality of luminescent modules, serial output terminal SDO can be used as the pulse input of the next IC stages.

[0039] Those skilled in the art may also understand that the pulse generator in this invention is not limited to the pulse circuits formed of the 555 time base circuits 100 described in Fig. 5, any suitable pulse circuits may be used. After each of the parameters are determined, the pulse outputted by these pulse circuits shall have predetermined frequency and duty ratio that meet the requirements, for example, duty ratio can be 50% - 90%, preferably 70% - 80%, and more preferably 75%, such that the luminance of said semiconductor LEDs 60 can be substantially same as that of the semiconductor LEDs driven by constant DC currents. As an option, within the capability of those skilled in the art, the pulse circuit can also be designed into frequency adjustable and duty ratio adjustable, so as to obtain a substantially same luminance as that of the constant DC driven semiconductor LEDs, or make the semiconductor LEDs have the maximum luminance, or make the semiconductor LEDs have the desired luminance, by adjusting the frequency or duty ratio of the pulse circuit,.

[0040] Another embodiment in Fig. 6 shows that the semiconductor luminescent array or semiconductor lamp can use any kinds of power supplies. Compared with the power supply circuit block diagram of the semiconductor luminescent module shown in Fig. 2, it also includes AC or DC power supply of any voltage, it is only necessary to convert the power supply voltage (such as urban electricity of 220V AC) into a constant current source with rated operating voltage for the semiconductor (such as IC's operation voltage 5V DC, and LED's operating voltage 3V DC, and so on) through a transformation and rectification circuit 40, so as to develop a practical com-

mercial product according to this invention.

[0041] The preferred embodiments of this invention are described above in reference to the attached drawings. It should be understood that this invention is not exactly limited to these illustrated embodiments. Those skilled in the art may make some changes and modification to the invention without departing from the spirit and scope of this invention characterized by the claims.

Claims

1. A semiconductor luminescent module, comprising:

a luminescent array comprising a plurality of semiconductor luminescent elements;
a power supply circuit for providing pulsed power supply voltages to the semiconductor luminescent elements in said luminescent array, so as to make the luminance of said semiconductor luminescent elements substantially same as that of the semiconductor luminescent elements otherwise driven by constant DC currents.

2. The semiconductor luminescent module according to Claim 1, wherein for GaAs LEDs, the duty ratio of said pulse under a frequency of f=5KC is 50% - 90%, preferably 70% - 80%, and more preferably 75%.

3. The semiconductor luminescent module according to Claim 1 or 2, wherein said power supply circuit comprises:

a pulse generator for generating pulses;
a shift-multiplexer for converting pulses generated by the pulse generator into pulses providing power supply to each of the semiconductor luminescent elements.

4. The semiconductor luminescent module according to Claim 3, wherein said power supply circuit further comprises a constant current source, for providing constant current input to the luminescent array comprising the semiconductor luminescent elements.

5. The semiconductor luminescent module according to Claim 4, wherein said shift-multiplexer is an integrated circuit (IC), such as an application specific IC HM62726 for 16-bit constant current driving LEDs.

6. The semiconductor luminescent module according to Claim 5, wherein each of the parallel outputs of the IC drives a plurality of semiconductor luminescent elements, preferably two.

7. The semiconductor luminescent module according to Claim 3, wherein the duty ratio of said pulse generator is adjustable.

8. The semiconductor luminescent module according to Claim 3, wherein said pulse generator is built with integrated circuits, such as a 555 time base circuit.

9. The semiconductor luminescent module according to Claim 4, wherein said power supply circuit has an external circuit for adjusting the luminance of each of the semiconductor luminescent elements.

10. The semiconductor luminescent module according to Claim 3, wherein said power supply circuit further comprises a circuit for improving pulse waveform.

11. The semiconductor luminescent module according to Claim 4, further comprises a means for converting external AC power supplies into DC power supplies, such that the semiconductor luminescent modules can operate with any power supplies.

12. A semiconductor lamp, comprising:

a pulse generator for generating pulses;
a plurality of semiconductor luminescent modules, each of which includes:

a luminescent array comprising a plurality of semiconductor luminescent elements;
a shift-multiplexer for converting pulses generated by said pulse generator into pulses that provide power supplies to the semiconductor luminescent elements in said luminescent array so as to make the luminance of said semiconductor luminescent elements substantially same as that of the semiconductor luminescent elements otherwise driven by constant DC currents.
a constant current source capable of providing constant current outputs to the luminescent arrays each comprising a plurality of semiconductor luminescent elements.

13. The semiconductor lamp according to Claim 12, wherein for GaAs LEDs, the duty ratio of said pulse under a frequency of f=5KC is 50% - 90%, preferably 70% - 80%, and more preferably 75%.

14. The semiconductor lamp according to Claim 12 or 13, wherein said shift-multiplexer is an integrated circuit (IC), such as an application specific IC HM62726 for 16-bit constant current driving LEDs.

15. The semiconductor lamp according to Claim 14, wherein each of the parallel outputs of the IC drives a plurality of semiconductor luminescent elements, preferably two.

16. The semiconductor lamp according to Claim 12, wherein the duty ratio of said pulse generator is ad-

justable.

17. The semiconductor lamp according to Claim 12 or 13, wherein said pulse generator is built with integrated circuits, such as a 555 time base circuit.

18. The semiconductor lamp according to Claim 12 or 13, wherein said power supply circuit has an external circuit for adjusting the luminance of each of the semiconductor luminescent elements.

19. The semiconductor lamp according to Claim 12 or 13, wherein said power supply circuit further comprises a circuit for improving pulse waveform.

20. The semiconductor lamp according to Claim 12, further comprises a means for converting external AC power supplies into DC power supplies, such that the semiconductor lamp can operate with any power supplies.

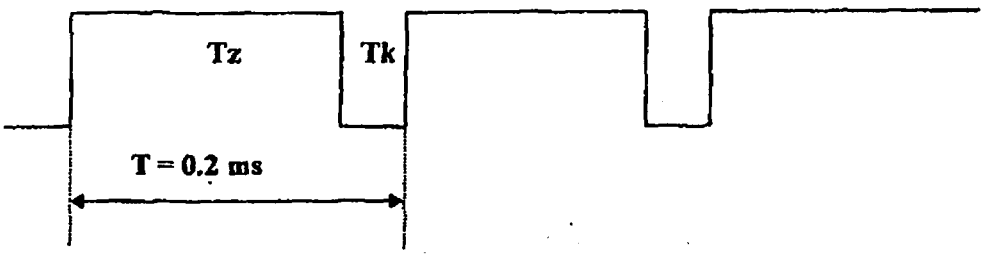
Tz
Tk
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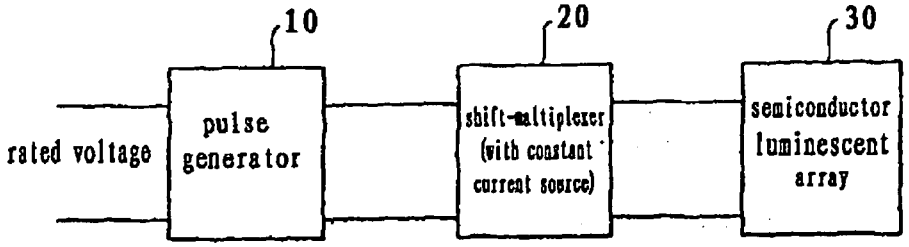
Fig. 1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20
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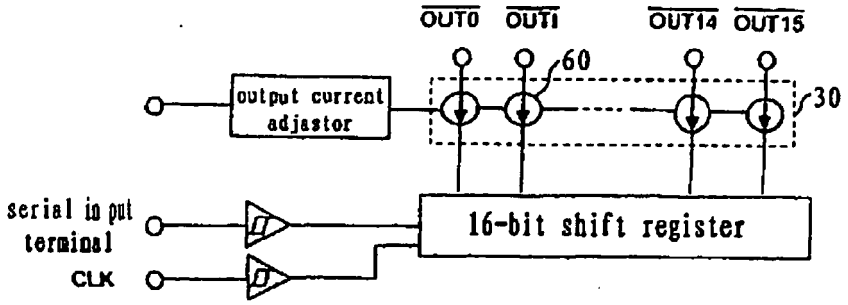
rated voltage
pulse generator
shift-multiplexer (with constant current source)
semiconductor luminescent array

Fig. 2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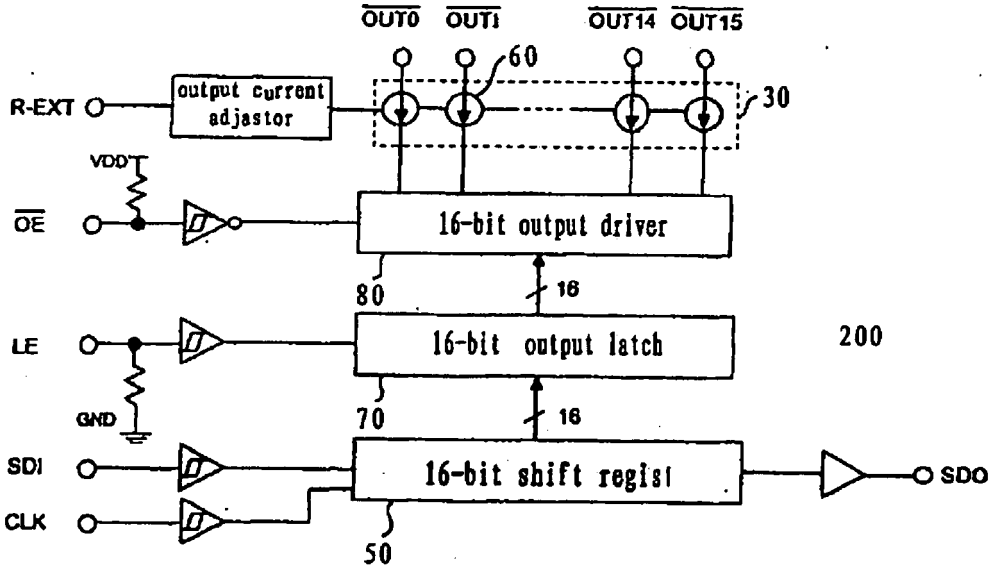
OUT1
OUT14
OUT15
60
30
output current adjastor
serial in put terminal
CLK
16-bit shift register

Fig. 3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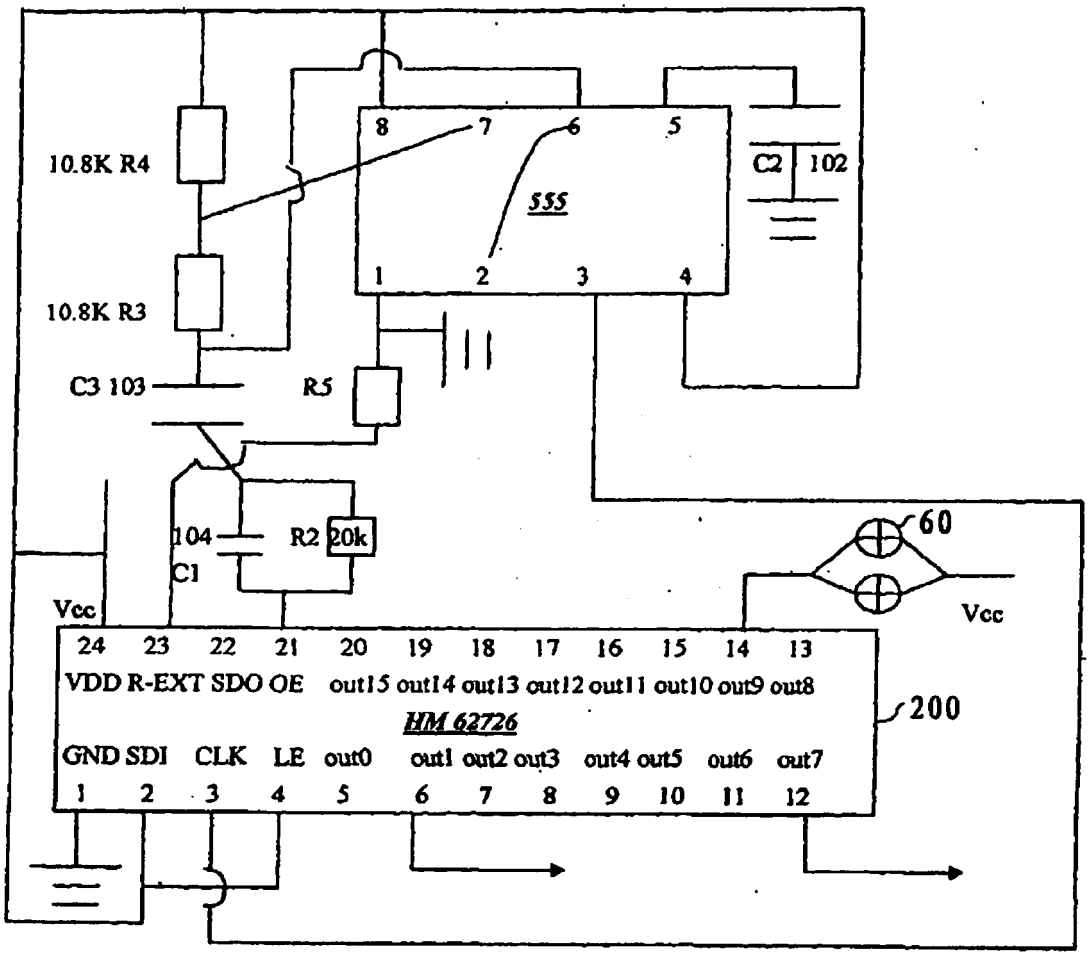
OUT1
OUT14
OUT15
60
30
R-EXT
output current adjastor
VDD
OE
16-bit output driver
80
16
LE
16-bit output latch
200
GND
70
16
SDI
16-bit shift regist
SDO
CLK
50

Fig. 4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R5
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C1
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VDD R-EXT SDO OE out15 out14 out13 out12 out11 out10 out9 out8
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Fig. 5

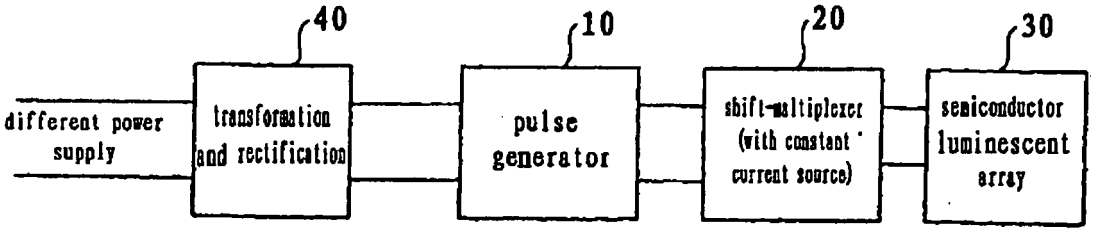
40
10
20
30
different power supply
transformation and rectification
pulse generator
shift-multiplexer (with constant current source)
semiconductor luminescent array

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2004/000045

A. CLASSIFICATION OF SUBJECT MATTER

G09G 3/14,3/32

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)

IPC[7]: G09G 3/14, 3/12, 3/06, 3/04, 3/32, 3/30, 3/22, 3/20, 3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

PATENT DOCUMENTATION OF CHINA (1985~)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, WPI, EPODOC, PAJ

SEMICONDUCTOR, LED, LUMINANCE, PULSE, DUTY W RATIO, SHIFT+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN1558704A(ANDEN CO.), 29.DEC.2004 (29.12.2004), whole document	1
X	CN1172280C (SONY CO.), 20.OCT.2004 (20.10.2004), whole document	1
X	US2004/0150355A1 (ANDEN C0.), 05.AUG.2004 (05.08.2004), whole document	1
X	CN2452246Y (Lin Wenxian), 03.OCT.2001(03.10.2001), whole document	1
A	JP10-193683A (FUJI XEROX CO LTD), 28.JUL.1998 (28.07.1998), whole document	1-20
A	CN2425428Y (SUZHOU Semiconductor Plant), 28.MAR.2001 (28.03.2001), whole document	1-20

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10.OCT.2005(10.10.2005)	20 · OCT 2005 (20 · 10 · 2005)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer Liu Jun Telephone No. 62085830

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2005/000045

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		DE102004004319A1	12.AUG.2004(12.08.2004)
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CN2452246Y	03.OCT.2001(03.10.2001)	/	/
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CN2425428Y	28.MAR.2001(28.03.2001)	/	/

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