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(54) **Light-emitting diode display**

(57) A light-emitting diode (LED) display includes an LED, a light sensor, and at least one amplifier. The light sensor is on the same side as the LED to sense the ambient brightness, and produce a regulating current ac-

cording to the sensed ambient brightness. At least one amplifier is electrically connected to the light sensor and the LED, and is adapted to amplify the regulating current, so that the amplified regulating current may be used to regulate the brightness of the LED.

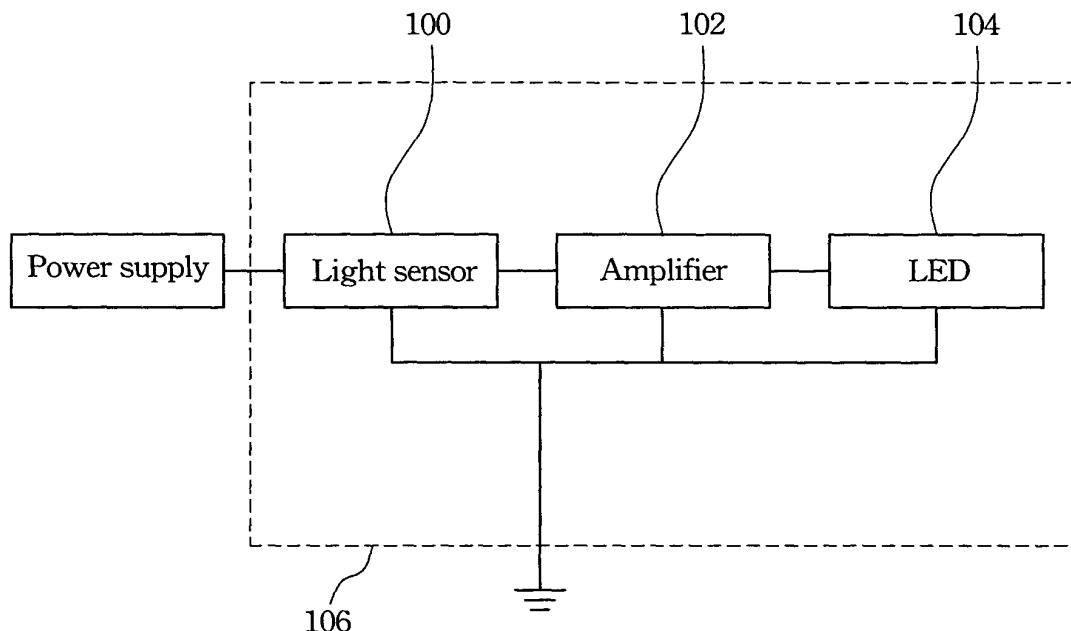


Fig. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a display, and more particularly to a light-emitting diode (LED) display.

AMBIENT OF THE INVENTION

[0002] Electric appliances have become indispensable in people's daily life. Most electric appliances include a display to show messages in the form of digits or letters. Ambient light may cause these digit messages or word messages to not be clearly viewed and or even be incorrectly read. For instance, when an experimentalist is taking measurements or readings in a lab and the electronic instruments being used always show on the displays digits of the same brightness no matter what the ambient brightness is, the digits or letters on the display, which are usually low in brightness, may not be clearly identified when the ambient brightness is greater than the brightness of the displayed digits or letters. The experimentalist might even read the message incorrectly in such conditions.

[0003] On the other hand, the displays on most electronic instruments have digit or word messages always having the same brightness. That is, electronic instruments are continuously supplied with the same nominal current to drive the lights of the digits or letters on the display. However, when the ambient brightness is lower than the brightness of the digits in the display, the experimentalist may clearly view the values or measurements to be taken, and it is not necessary for the electronic instruments to consume such a high nominal current to drive the lights of the digits or letters on the display. That is, the electronic instrument needs only a relatively smaller current to drive the lights of the digits or letters on the display and may be clearly viewed by the experimentalist.

[0004] In other words, when the same nominal current is consumed to drive the lights of the digits or letters on the display, the lightened digits might not be easily read when the ambient brightness is higher than the digit brightness; and power is unnecessarily wasted when the ambient brightness is lower than the brightness of the digits and the digits can not be clearly viewed.

[0005] Therefore, it is desirable to develop a display that allows a user to clearly observe the messages on a screen under any ambient brightness, and effectively reduce the power consumption of the electric appliance, on which the display is mounted.

SUMMARY OF THE INVENTION

[0006] A primary object of the present invention is to provide a light-emitting diode (LED) display to eliminate the drawbacks existing in the conventional display.

[0007] To achieve the above and other objects, the LED display according to a preferred embodiment of the

present invention includes an LED, a light sensor, and at least one amplifier. The light sensor is provided on the same side of the LED to sense ambient brightness, and produce a regulating current according to the sensed ambient brightness. At least one amplifier is electrically connected to the light sensor and the LED, and is adapted to amplify the regulating current, so that the amplified regulating current may be used to regulate the brightness of the LED.

[0008] The LED display of the present invention may further include a variable resistance electrically connected to and between the light sensor and an external power supply to regulate the sensitivity of the light sensor. The LED display of the present invention also includes a display panel, on which the LED and the light sensors are mounted.

[0009] With the above arrangements, the regulating current changes when the ambient brightness is changed to thereby achieve the objective of changing the brightness of the LED on the display. That is, the brightness of the LED is no longer fixed, but may be changed by regulating the current supplied thereto according to the ambient brightness. In this manner, power consumed by the LED is reduced and the usable life of the LED may be extended. Most importantly a user may always clearly view the letters or digits shown on the LED display no matter what the ambient brightness is. The user would not incorrectly read the messages or measurements because of the ambient brightness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

Fig. 1 is a block diagram of an LED display according to a preferred embodiment of the present invention;

Fig. 2 is a top view of an LED display according to the preferred embodiment of the present invention; and

Fig. 3 is a circuit diagram of an LED display according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Please refer to Fig. 1 and Fig. 2. Fig. 1 is a block diagram and Fig. 2 is a top view of a light-emitting diode (LED) display 106 according to a preferred embodiment of the present invention.

[0012] As shown in Fig. 1, the LED display 106 internally includes a light sensor 100, an amplifier 102, and

a light-emitting diode (LED) 104. The amplifier 102 is electrically connected to the light sensor 100 and the LED 104. And, as can be seen from Fig. 2, the light sensor 100 and the LED 104 are located on the same side of a display panel 108 of the LED display 106. The light sensor 100, the amplifier 102, and the LED 104 are all electrically connected to a printed circuit board (not shown). The light sensor 100 senses the brightness in the ambient environment in which the LED display 106 is being used, and produces a regulating current according to the ambient brightness. The produced regulating current is input to and amplified by the amplifier 102. The amplified regulating current is then used to control and regulate the brightness of the LED 104.

[0013] Fig. 3 is a circuit diagram of an LED display according to a preferred embodiment of the present invention. An internal operation of the LED display of the present invention will now be described with reference to Fig. 3. When a light sensor 300 senses the ambient brightness, the resistance of the light sensor 300 is thereby changed. The resistance of the light sensor 300 has a positive correlation with the ambient brightness. That is, when the ambient brightness is high, the resistance of the light sensor 300 also becomes high; and when the ambient brightness is low, the resistance of the light sensor 300 also becomes low.

[0014] An external power supply 307 provides the whole circuit of the LED display with a fixed voltage. When the light sensor 300 senses the ambient brightness and the resistance of the light sensor 300 is increased, the current from the external power supply 307 passes a point P and is divided into two paths namely, a first and a second path 301 and 302, respectively. The current passing through the first path 301 is larger than the current passing through the second path 302, and becomes a regulating current. When the regulating current is larger than the default values for a first transistor 303 and a second transistor 304, it is amplified by the first and the second transistor 303, 304 to become an amplified regulating current to increase the brightness of the LED 305 of the LED display.

[0015] On the other hand, when the light sensor 300 senses the ambient brightness and the resistance of the light sensor 300 is decreased, the current from the external power supply 307 passing the point P is divided into two paths, namely, a first and a second path 301 and 302, respectively. The current passing through the first path 301 is smaller than the current passing through the second path 302, and becomes a regulating current. When the regulating current is smaller than the default value for the first transistor 303 or the second transistor 304, it could not pass the first or the second transistor 303 or 304, and does not increase the brightness of the LED 305 of the LED display.

[0016] Since every one of different light sensors might have a different resistance, a variable resistance 306 may be electrically connected between the light sensor 300 and the external power supply 307 to regulate the

sensitivity of the light sensor 300. When it is desired for the light sensor 300 to have a relatively high sensitivity, the variable resistance 306 can be regulated to be lower. On the other hand, when it is desired for the light sensor 300 to have a relatively low sensitivity, then the variable resistance 306 can be regulated to be higher.

[0017] In brief, no matter if the LED display of the present invention is being used in a bright or a dark ambient light, the light sensor would always properly regulate the brightness of the light emitting diodes in response to the ambient brightness. Therefore, a user could always clearly observe the LED display without the risk of incorrectly reading the LED display because the ambient light is relatively high or relatively low. And, when the ambient brightness is too low, the light sensor may regulate and decrease the current flow through the light emitting diodes to thereby reduce power consumed by the LED and extend the usable life of the LED.

[0018] The present invention has been described with a preferred embodiment thereof and it is understood that many changes and modifications in the described embodiment can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

Claims

1. A light-emitting diode (LED) display, comprising:
 - a light-emitting diode;
 - a light sensor located on the same side as that of the said light-emitting diodes to sense the ambient brightness, and to produce a regulating current according to the said sensed ambient brightness; and
 - at least one amplifier electrically connected to the said light sensor and the said LED to amplify the said regulating current, so that the said amplified regulating current may be used to regulate the brightness of the said LED.
2. The LED display as claimed in claim 1, further comprising a variable resistance electrically connected to and between the said light sensor and an external power supply to adjust the said light sensor to different sensitivities.
3. The LED display as claimed in claim 1, further comprises a display panel, on which the said LED and the said light sensor are mounted.
4. The LED display as claimed in claim 1, wherein the said light sensor has a resistance value having a positive correlation with the said ambient brightness.
5. The LED display as claimed in claim 1, wherein the said at least one amplifier is a transistor.

6. The LED display as claimed in claim 1, wherein the said light sensor, the said at least one amplifier, and the said LED are all electrically connected to a printed circuit board.

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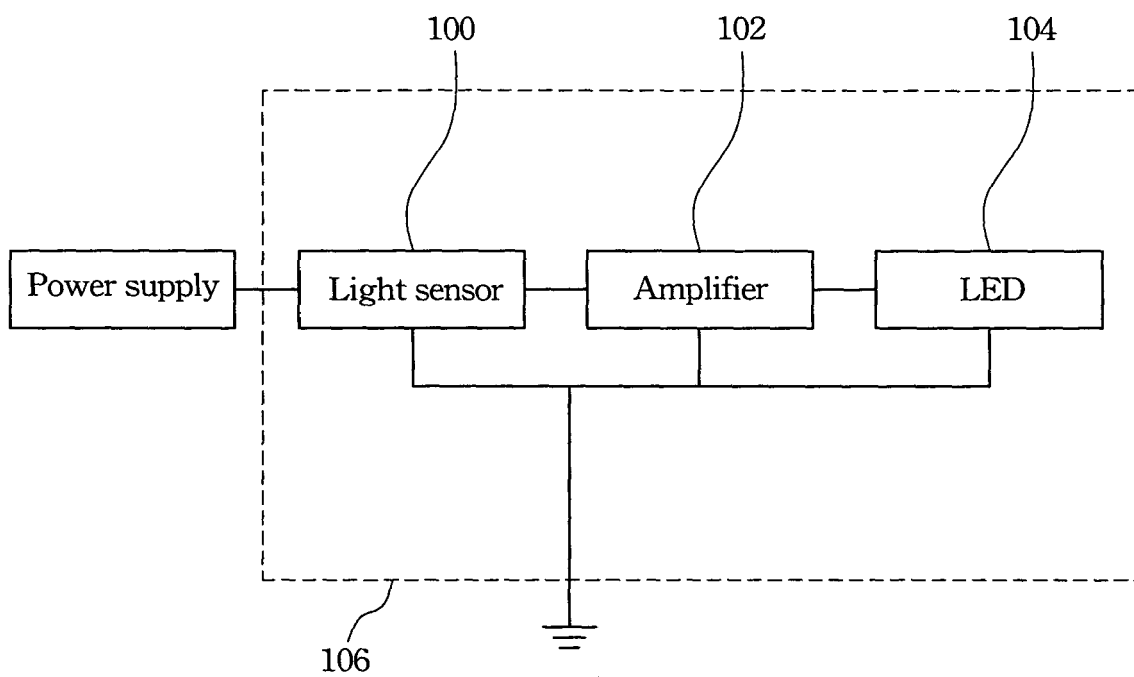


Fig. 1

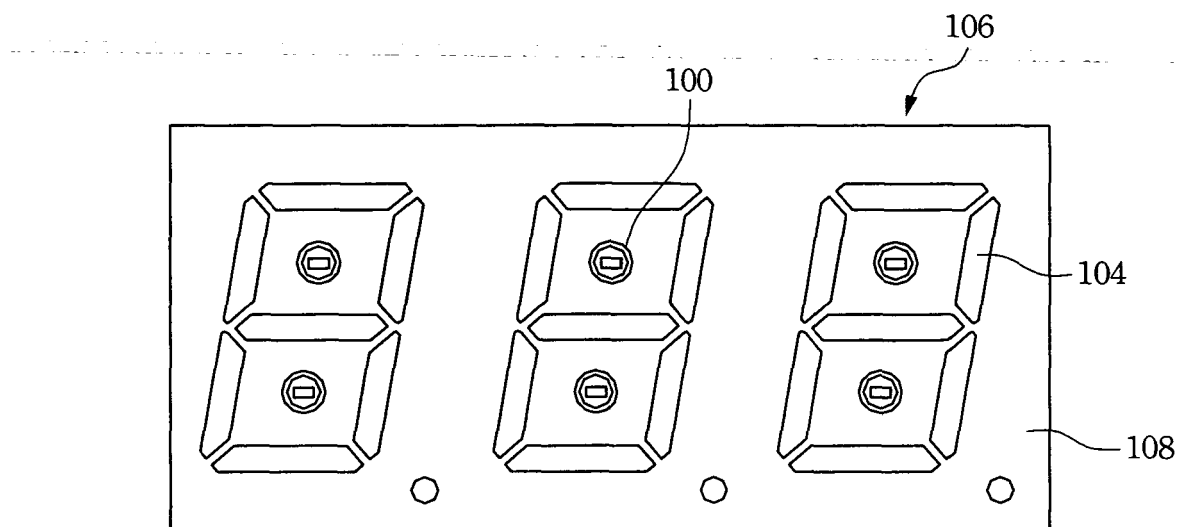


Fig. 2

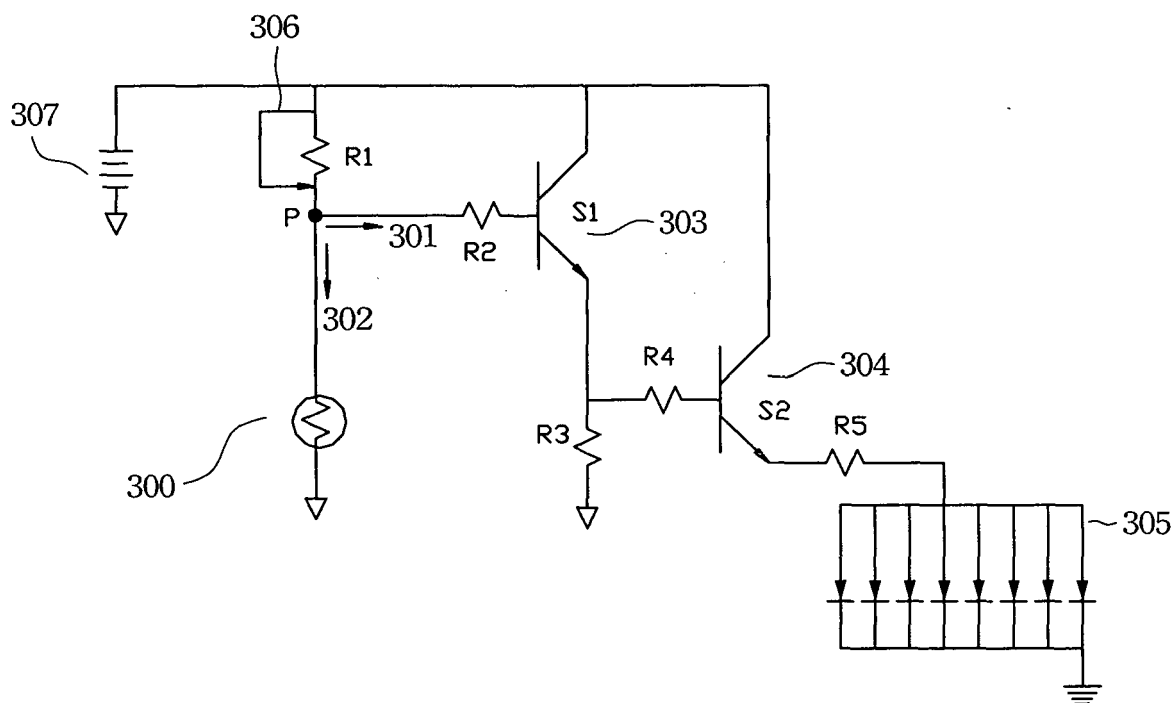


Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 02 3243

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 March 2007	Examiner Taron, Laurent
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 02 3243

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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