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

(11) EP 1 521 144 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.04.2005 Bulletin 2005/14

(51) Int Cl.[7]: **G04G 9/00**

(21) Application number: **04018653.8**

(22) Date of filing: **06.08.2004**

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

(30) Priority: **30.09.2003 CN 03107043**

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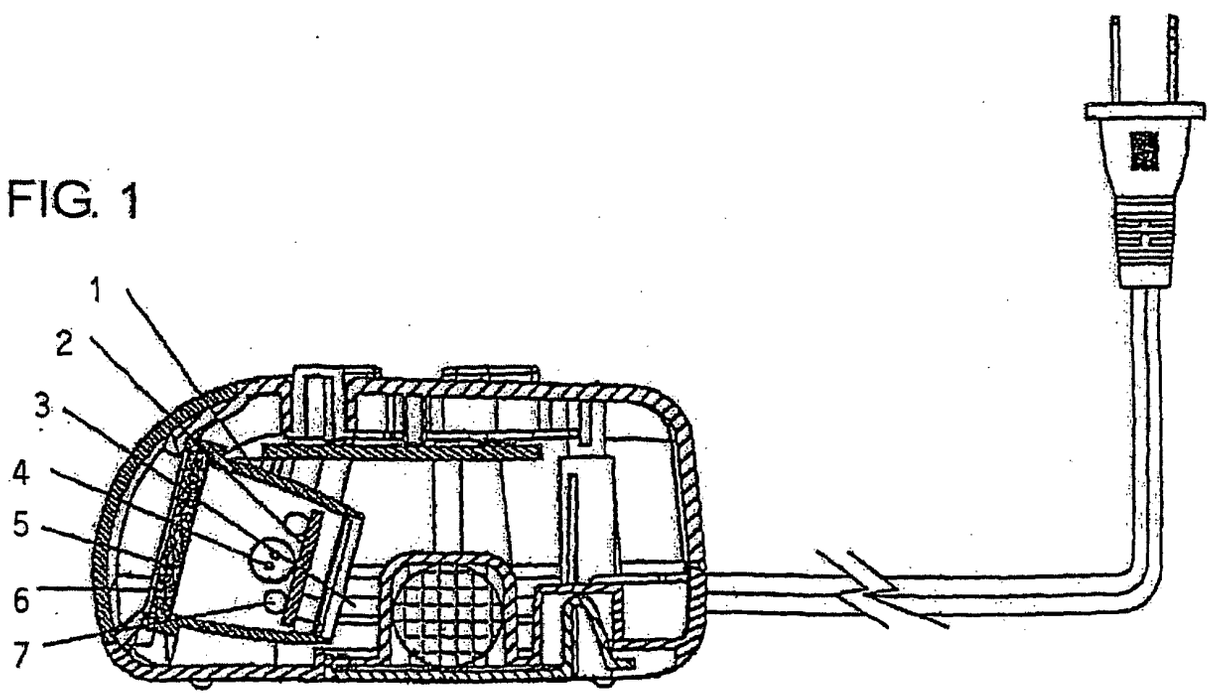
(54) Neon lamp backlight device for liquid crystal display timepieces

(57) This invention relates to a backlight device for liquid crystal display timepieces such as alarm clocks and alarm watches. It comprises a casing (1), a printed circuit board (2), an electric wire (3), neon lamps (4), limiting resistors (7) and a lens (5). The printed circuit board (2) is installed at the inside back of the casing (1), on which there is a hole (11) for the electric wire (3) to pass through for connecting the printed circuit board (2) to a power supply. One or more limiting resistors (7) and neon lamps (4) are installed on the front surface of the printed circuit board (2). The limiting resistors (7) and the neon lamps (4) are electrically connected to the printed circuit board (2). The lens (5) is installed on the front of the casing (1). This invention does not require any transformer and consumes low energy and is simple in structure and susceptible of a low manufacturing cost. It can provide evenly-distributed, bright and various color light sources.

FIG. 1



EP 1 521 144 A2

Description

[0001] The present invention relates to an illuminating device for liquid crystal display (LCD) timepieces and more particularly pertains to a neon lamp backlight device for LCD timepieces such as alarm clocks and alarm watches.

[0002] Timepieces are daily necessities and are generally classified as analog or digital. Analog timepieces available in the marketplace are usually equipped with luminous devices so that the time as shown can be seen clearly in a dark environment. By pressing a button, the user can turn on the light which illuminates the dial and the user can then see clearly the time as indicated by the arms, but it is quite difficult to find the timepiece and press the button in the dark. There are also timepieces available in the marketplace showing time by light emitting diodes (LED) and the time as shown is clearly visible in the dark. However, such a timepiece consumes high level of energy and dry batteries cannot be used and alternating current (AC) is required, thus a transformer has to be installed. If there is a blackout, the time of the timepiece will have to be reset for use. Besides, LED timepieces are usually larger in size and it is difficult to apply the same onto the increasingly compact electronic products. Furthermore, graphics displayed by LED timepieces have lower resolution and so it is commonly used to display only simple numerals or texts in monotonous style. As a result, digital timepieces available in the marketplace are mainly those showing time by LCD. LCD consumes less energy than LED, and is able to display graphics of higher resolution. However, LCD is not luminous by itself and a light source is required for displaying graphics.

[0003] If a LCD is not equipped with any backlight device, the user will have to rely on ambient light to see the display on the screen, and the display is not visible in the dark. Backlight devices can be installed at the back of the LCD screen. At present, there are mainly three categories of backlight sources: electroluminescent lamps (EL), cold cathode fluorescent lamps (CCFL), and LED. The light sources can shed light laterally or vertically. The basic principle is to allow the light passing through the display screen to display graphics. However, these backlight devices are susceptible of higher production costs, complicated structure and more advanced manufacturing technology. These devices also require the installation of transformers and consume more energy. Therefore, they are only applicable to relatively high-end electronic products such as electronic calculators and mobile phones, but not suitable for lower-end electronic products such as alarm clocks and alarm watches.

[0004] In view of the aforesaid disadvantages now present in the prior art, the present invention provides a neon lamp backlight device for LCD timepieces which does not require any transformer and consumes low energy. It is simple in structure and susceptible of a low manufacturing cost. It can also provide evenly-distributed, bright and various color light sources. The neon lamp backlight device of the present invention is powered by alternating current (AC), thus providing continuous illumination. It is easily replaceable and simple and practical to use. The present invention uses an independent power source and does not share its power supply with the LCD timepiece. Even if there is any breakdown of power supply, the operation of the LCD timepiece will not be affected.

[0005] To attain this, the neon lamp backlight device for LCD timepieces of the present invention is installed at the back of the LCD screen. It generally comprises a casing, a printed circuit board, an electric wire, neon lamps, limiting resistors and a lens, which is characterized in that the printed circuit board is installed at the inside back of the casing, on which there is a hole for the electric wire to pass through for connecting the printed circuit board to a power supply; one or more limiting resistors and neon lamps are installed on the front surface of the printed circuit board; the limiting resistors and the neon lamps are electrically connected to the printed circuit board; and the lens is installed on the front of the casing.

[0006] The casing which is made of plastic material is in the shape of a bowl and is molded into one piece by injection molding. The front area is larger than the back area. It has a curved side surface, the inside of which can be covered by white paint or reflective coating so as to achieve brighter and more evenly-distributed light sources.

[0007] The quantity of the neon lamps installed is in direct proportion to the size of the area of the lens and the LCD screen.

[0008] The quantity of the limiting resistors installed is in direct proportion to the quantity of the neon lamps installed.

[0009] The neon lamps are arranged in row or in column or in a matrix on the printed circuit board.

[0010] The limiting resistors are arranged in row or in column or in a matrix on the printed circuit board.

[0011] The neon lamps are neon glow lamps which emit orange glows. Each of the neon glow lamps has a working current of 0.3mA to 1.5mA.

[0012] The neon lamps are fluorescent glow lamps which emit glows in green, blue or other colors. Each of the fluorescent glow lamps has a working current of 0.4mA to 1.2mA.

[0013] At the front opening of the casing, there is a groove along the edge for positioning the lens securely.

[0014] The lens is made of diffusing glass sheet or transparent diffusing plastic sheet so as to cover the neon lamps to provide more evenly-distributed light sources.

[0015] The electric wire is connected to an electric plug. The electric plug is inserted to an AC electric socket to supply electricity to the printed circuit board independently. The present invention operates with a power

source of alternating current at a voltage of 100V to 130V, a frequency of 60 hertz and a power of 2W, or a power source of alternating current at a voltage of 200V to 240V, a frequency of 50 hertz and a power of 2W.

[0016] The neon lamp backlight device for LCD timepieces is removably mounted at the back of the LCD screen and can be replaced, if necessary.

FIG. 1 shows the schematic diagram of a LCD clock incorporating the neon lamp backlight device of the present invention.

FIG. 2 shows the circuit diagram of the LCD clock incorporating the neon lamp backlight device of the present invention.

FIG. 3 shows the vertical cross-sectional diagram of the neon lamp backlight device of the present invention.

FIG. 4 shows the horizontal cross-sectional diagram of the neon lamp backlight device of the present invention.

[0017] As illustrated in FIG. 1 to 4, the neon lamp backlight device of the present invention is applied to a conventional digital alarm clock. The neon lamp backlight device of the present invention is installed at the back of the LCD screen. It generally comprises a casing 1, a printed circuit board 2, an electric wire 3, neon lamps 4, limiting resistors 7 and a lens 5. The LCD screen 6 of the alarm clock is powered by dry batteries. The neon lamp backlight device connects to an AC electric socket by the electric wire 3, and AC is used to power the printed board circuit 2. The casing 1 which is made of plastic material is in the shape of a bowl and is molded into one piece by injection molding. The front area is larger than the back area. It has a curved side surface, the inside of which can be covered by white paint or reflective coating so as to achieve brighter and more evenly-distributed light sources. The printed circuit board 2 is installed at the inside back of the casing 1, on which there is a hole 11 for the electric wire 3 to pass through for connecting the printed circuit board 2 to a power supply. Five neon glow lamps 4 which emit orange glows are installed on the front surface of the printed circuit board 2. The neon glow lamps 4 are arranged on the printed circuit board 2 in a single file in H shape, and are electrically connected to the printed circuit board 2. Five limiting resistors 7 are also installed on the front surface of the printed circuit board 2, the quantity and the arrangement of which are identical with those of the neon glow lamps 4, and are also electrically connected to the printed circuit board 2. There is a groove 12 along the edge at the front opening of the casing 1 to position the transparent diffusing plastic sheet 5 securely. The transparent diffusing plastic sheet 5 covers the neon glow lamps 4 to provide more evenly-distributed light sources.

[0018] After the circuit is connected, AC is supplied to the printed circuit board 2 through the electric wire 3 and drives the neon glow lamps 4 to glow, and the glow passes through the LCD screen 6. The neon lamp backlight device of the present invention can provide light sources in the dark and the user can see the time or other graphics or texts as shown on the LCD screen 6 at night.

List of reference numbers

[0019]

1 casing
2 circuit board
3 electric wire
4 neon lamps
5 lens
6 LCD screen
7 imiting resistors

11 hole
12 groove

Claims

1. A neon lamp backlight device for LCD timepieces installed at the back of the LCD screen which generally comprises a casing, a printed circuit board, an electric wire, neon lamps, limiting resistors and a lens, which is **characterized in that** the printed circuit board is installed at the inside back of the casing, on which there is a hole for the electric wire to pass through for connecting the printed circuit board to a power supply, whereat one or more limiting resistors and neon lamps are installed on the front surface of the printed circuit board; the limiting resistors and the neon lamps are electrically connected to the printed circuit board, and the lens is installed on the front of the casing.

2. The neon lamp backlight device for LCD timepieces according to claim 1, wherein the neon lamp backlight device for LCD timepieces is removably mounted at the back of the LCD screen and can be replaced.

3. The neon lamp backlight device for LCD timepieces according to claim 1, wherein the casing which is made of plastic material is in the shape of a bowl and is molded into one piece by injection molding; the front area of which is larger than the back area; and it has a curved side surface, the inside of which is covered by white paint or reflective coating.

4. The neon lamp backlight device for LCD timepieces according to claim 1, wherein the quantity of the neon lamps installed is in direct proportion to the size

of the area of the lens and the LCD screen.

5. The neon lamp backlight device for LCD timepieces according to claim 1, wherein the quantity of the limiting resistors installed is in direct proportion to the quantity of the neon lamps installed.

6. The neon lamp backlight device for LCD timepieces according to claim 1 or 4, wherein the neon lamps are arranged in row or in column or in a matrix on the printed circuit board.

7. The neon lamp backlight device for LCD timepieces according to claim 1 or 5, wherein the limiting resistors are arranged in row or in column or in a matrix on the printed circuit board.

8. The neon lamp backlight device for LCD timepieces according to claim 1 or 4 or 5, wherein the neon lamps are neon glow lamps which emit orange glows, whereat each of the neon glow lamps has a working current of 0.3mA to 1.5mA.

9. The neon lamp backlight device for LCD timepieces according to claim 1 or 4 or 5, wherein the neon lamps are fluorescent glow lamps which emit glows in green or blue colour, whereat each of the fluorescent glow lamps has a working current of 0.4mA to 1.2mA.

10. The neon lamp backlight device for LCD timepieces according to claim 1 or 3, wherein there is a groove along the edge at the front opening of the casing for positioning the lens securely, whereat the lens is made of diffusing glass sheet or transparent diffusing plastic sheet.

FIG. 1

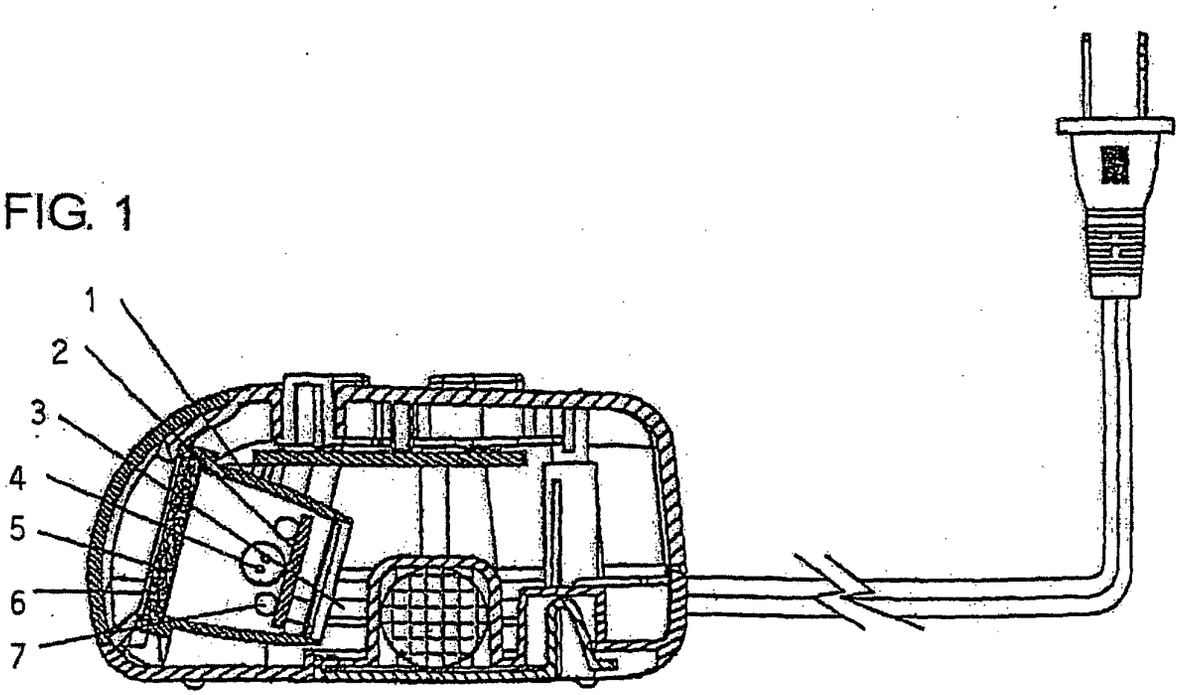


FIG. 2

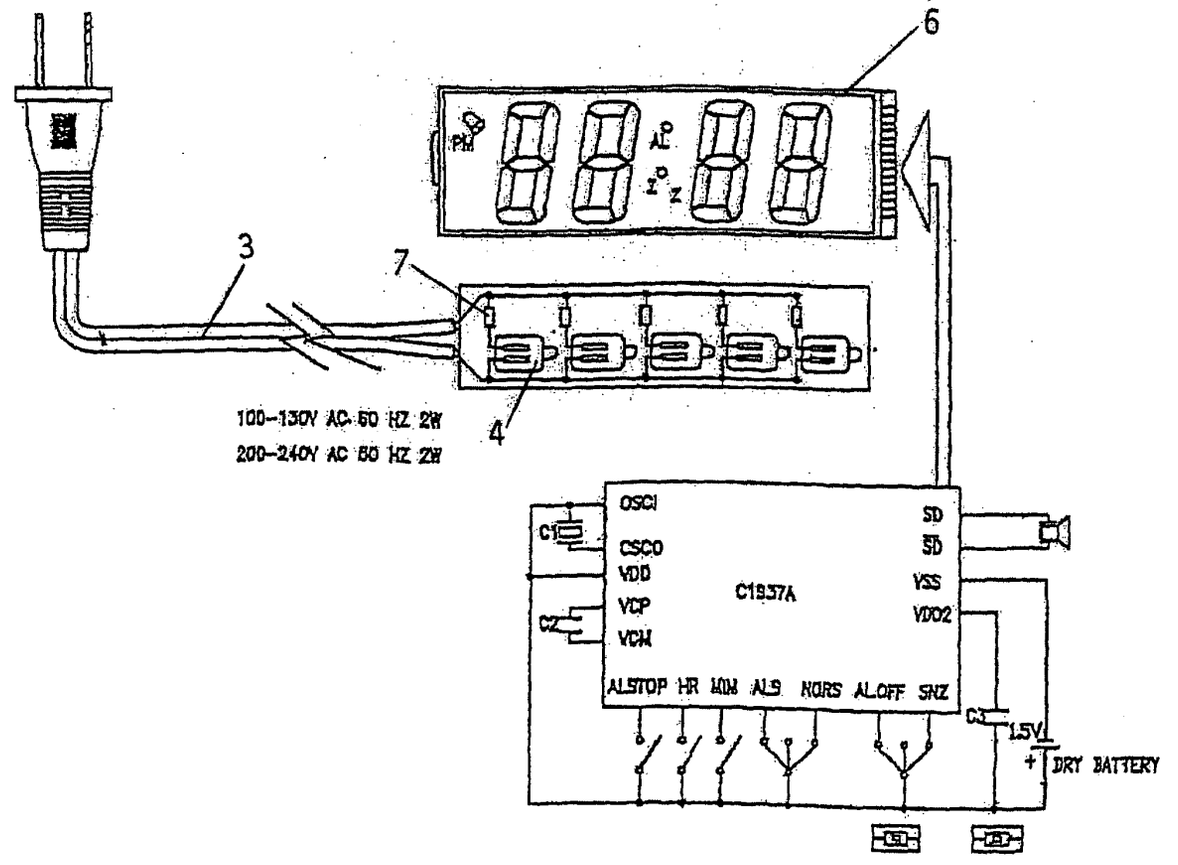

6
3
7
4
100-130V AC 60 HZ 2W
200-240V AC 50 HZ 2W
OSCI
OSCO
VDD
VCP
VCM
C1937A
SD
SD
VSS
VDD2
ALSTOP HR MIN ALS NORS ALOFF SNZ
C1
C2
C3
1.5V
DRY BATTERY

FIG. 3

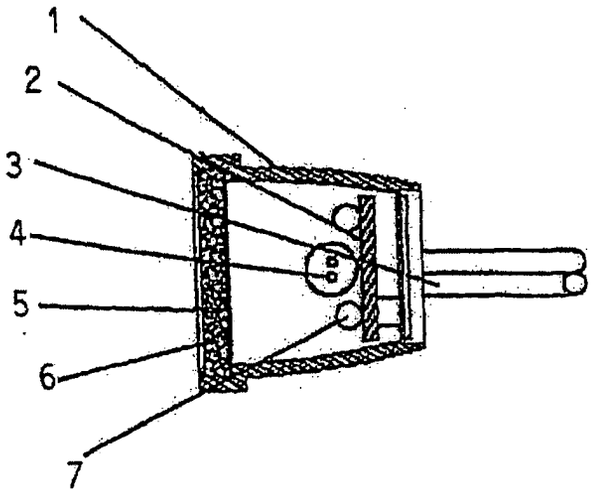


FIG. 4