

TITLE OF THE INVENTION
REVOLVING MULTI-COLOR LED DISPLAY UNIT

BACKGROUND OF THE INVENTION

(a) Field of the invention

The present invention relates to a LED display unit, and more particularly, to a revolving multi-colour LED display unit, wherein a plurality of colours of RGB LED are mounted around the surface of a rotatable cylindrical drum which is driven by a stepper motor and stationary and/or moving colour images are obtained and can be seen from all angles.

(b) Description of the prior art

Conventional LED displays employ a plurality of LEDs arranged onto a surface to visibly display a plurality of characters, numbers, or images. In most cases, the LEDs being formed either from a single colour, such as red colour, or multi-colours formed on the surface are normally not visible from all angles. Accordingly, such a LED display unit is expensive to produce as a great number of LEDs have to be employed in the unit.

Other conventional displays, include the so-called seven-segment displays, are composed of individual luminous bars for the numerals or symbols and in normal condition, with a total of seven segments, the numerals 0 to 9 can be represented, and some limited number of letters.

These conventional LED displays, either a single colour or multi-colour, form their images (characters, numbers or the like) by switching on the plurality of columns of LEDs one by one. The LEDs are static and therefore only a very low percentage of all the LEDs are effectively utilized at one instant to produce the images. Accordingly, more LEDs are actually required and the cost of the display will increase, in particular, for LED Display units employing RGB LEDs.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a revolving multi-colour LED display unit that a minimum number of LEDs are used and thus the cost of manufacturing the display unit is greatly reduced.

Another object of the present invention is to provide a revolving multi-colour LED display unit that the produced images are readable at all angles.

Yet another object of the present invention is to provide a revolving multi-colour LED display unit that the produced images can be viewed in all light conditions.

Yet a further object of the present invention is to provide a revolving multi-colour LED display unit, wherein the images formed by rotating columns of the LEDs are with high effective resolution than the number of LEDs used.

Another object of the present invention is to provide a revolving multi-colour LED display unit, wherein the display data are shifted to the LED column drivers synchronized with the stepper motor.

Other and further objects and features of the present invention will become obvious upon an understanding of the illustrative embodiment about to be described in connection with the accompanying drawings or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon embodying of the invention in practise.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a revolving multi-colour LED display unit of the present invention;

Fig. 2 is a perspective view of a revolving multi-colour LED display unit, showing a stepper motor, and a driving mechanism with a plurality of contact rings in accordance with the present invention;

5 Fig. 3 is a perspective view, illustrating a plurality of 16 RGB LEDs being mounted onto a rotating base in accordance with the present application;

Fig. 4 is an elevational view of a revolving multi-colour LED display unit in accordance with the present invention;

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Fig. 5 is a sectional view of the LED display unit along line A-A of Fig. 4 of the present invention; and

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Fig. 6 is a sectional view of the LED display unit along line B-B of Fig. 4 of the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

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While the present invention will be described in connection with the preferred embodiment, it will be understood that we do not intend to limit the invention to this embodiment. On the contrary, we intend to cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the attached claims.

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Referring now to Fig. 1, in accordance with a preferred embodiment of the present, a revolving multi-colour LED display unit 100 comprises a stationary means 200, a revolving means 300, and an electrical/electronics module 400 (refer to Fig. 3) being enclosed within a cylindrical drum 17.

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In accordance with the present invention, and referring to Figs. 1 & 2, the stationary means 200 comprises a fixed base 18 and a fixed stationary shaft 11

mounted thereon. Referring to Figs. 2, and 6, the revolving means 300 comprises a cylindrical revolving fixed 19, a plurality of contact rings 7 surrounding the central stationary shaft 11 having a cap 14 on the top end thereof, an insulating sleeve 5 and a plurality of insulating disc 6 and a spur gear 20 all being mounted onto the stationary shaft 11. A stepper motor 26 is mounted onto the base 19, and is closely located to the stationary shaft 11 of the stationary means 200. Referring to Fig. 6, a shaft holder 3 enclosing the stationary shaft 11 is provided at the central region of the stationary means 200, wherein the stationary shaft 11 is then disposed onto the cylindrical fixed base 18. In accordance with the present invention, a plurality of power lines (not shown) are connected to the contact rings 7 through the shaft 11. Accordingly, electrical current is transmitted to the stepper motor 26, a plurality of LEDs 50 and their respective drivers 41 mounted onto LED boards 43 and a main controller board 42 via the plurality of the contact rings 7.

Referring to Figs 1 to 3, the revolving means 300 in accordance with the present invention includes the cylindrical drum 17 (refer to Fig. 1) which is mounted onto a rotating base 19 by means of screws. The rotating base 19 is cylindrical arranged adjacent to the fixing base 18. In the present preferred embodiment, a total of eight columns of 16 RGB LEDs 50 are evenly spaced around the surface of the drum 17. The LEDs 50 are arranged in vertical, which are shown in Figs. 1,3 and 4. The revolving means 300 are rotatably mounted onto the shaft 11 by means of a pair of deep groove ball bearings 24, 25 which are located respectively at the top and bottom of the shaft 11. The rotational movement of the revolving means 300 is imparted by the stepper motor 26 on the cylindrical rotating base 19 via the spur gear 20. In this case, the spur gear 20 is obtained by injection moulding.

Referring to Fig. 3, the stepper motor 26 rotates when current is provided from a DC source (not shown). The spur gear 20 of the stepper motor 26 is driving another spur gear 20 which is mounted on the shaft 11. As a result of the rotation of the stepper motor 26, the revolving means 300 revolves round the shaft 11. When the revolving means 300 revolves, a centrifugal force is generated to the rotating

base 18 and hence a metal counterweight 12, such as a brass counter weight, is mounted on the opposite side of the rotating base 18 so as to balance the generated centrifugal force. Therefore, the revolving means 300 maintains a stable state while rotating.

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Referring to Fig. 3, the electronics/electrical module 400 comprises a plurality of columns of LEDs 50 and the main controller board 42. In the present preferred embodiment, each column of the LEDs 50 includes 16 RGB (red, green, blue) LEDs, and every RGB LED comprises four LED dices, one red, one green and two blue. As shown in Figs. 3 and 6, the plurality of LEDs 50 are mounted onto a PCB together with their driving circuits (not shown) mounted on a LED driver board 43. The data for the displayed color of each LED 50 are sent to the LED driver boards 43 as serial data at a clock rate of 1 MHz from the main controller board 42 using a 80C31 microcontroller (not shown). After the main controller board 42, the stepper motor 26 and the motor driver 44, the driver boards 43 for the LED 50 have been mounted at their respective position on the rotating base 19, and the cylindrical drum 17 which also encloses all these components within the revolving means 300. In the present preferred embodiment, the revolving means 300 rotates about the stationary shaft 11 at a speed of 300 rpm.

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Fig. 5 is a sectional view of the LED display unit along line A-A of Fig. 4 of the present invention. In the figure, some of the components within the drum 17 have been depicted, such as the counter weight 12, a contact brush 8 and a brush holder 9, a motor bracket 1, a plurality of socket head cap screw 30, 31, 32, 34, etc, and numeral 13 denotes a flag, numeral 37 denotes a self tapping screw, and numeral 39 is a plain washer.

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Fig. 6 is a sectional view of the LED display unit along line B-B of Fig. 4 of the present invention. The main components in this figure have been described in the above. Some other components depicted in the figure include a motor collar 2, a PCB bracket 16 and a PCB below bracket 16, an external circlip 21, a plurality of

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dowel pins 22, a collar 10, a plurality of socket head cap screw 33, 35, a stopper 4, and numeral 27 denotes a PCB stand, and numeral 27 denotes a spring pin

5 In accordance with the present invention, a 12 V DC power is connected to a control circuitry 42, 43 mounted within the electronics/electrical module 400 via a pair of contact rings 7 located closely to the stationary shaft 11. A third contact ring 7 is used for serial data transmission for sending display data to the main controller board from a computer (not shown).

10 In the illustrative embodiment of the invention in Figs 1 to 6, the revolving means 300 rotates at a speed of 300 rpm and is controlled by the stepping rate of the stepper motor 26. For one complete rotation of the cylindrical drum 17, the stepper motor 26 moves 200 steps, i.e. for each step, the drum 17 moves 1.8 degree. Each step of the stepper motor 26 lasts for 1 ms and the corresponding bit-mapped data
15 for the eight column of LEDs 50 for the present position will be sent to the LED driver boards 43 from the main controller 42. Then the stepper motor 26 will advance to the next step position and the corresponding bit-mapped data will be sent. After the stepper motor 26 has generated 25 steps, the drum 17 will have rotated $\frac{1}{8}$ of a complete round and the eight columns of LEDs 50 will together form one complete
20 picture frame. Accordingly, each picture frame takes 25 ms or in other words there are 40 frames per second. As human eyes tends retain image for a short while, this frame rate gives a flicker-free image. In accordance with the present invention, the effective image solution is 16 x 200 pixels, and each pixel can have one in sixteen different colors.

25 The bit-mapped image can also be down loaded via a serial link to the controller board 42 via the contact rings 7. For each pixel, 4 bits are used to represent one in sixteen possible colors. For each display frame, 1600 bytes of data are required. For animation, multiple frames can be sent, and stored in the memory. The revolving
30 multi-color display unit 100 containing the electronic/electrical module 400 is then mounted onto the stationary base 200 which is then mounted onto the circular brass

plate to ensure stability during operation.

These has been shown and described a revolving multi-color LED display unit. Many modifications, changes, variations and other uses and applications of the subject matter will become apparent to those skilled in the art after considering this specification and the accompanying drawing which disclose the preferred embodiment thereof. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention which is limited by the claims which follow

CLAIMS

1. A revolving multi-color LED display unit comprising
- 5 (a) a cylindrical fixed base being mounted thereon a stationary shaft at the centre thereof and a rotating base being rotatably mounted on top of the cylindrical fixed base;
- 10 (b) a revolving means including a cylindrical drum mounted to said rotating base, and a stepper motor with a first spur gear to drive a second spur gear mounted on the stationary shaft so that the revolving means rotates, when the stepper motor is supplied with current from a DC power source;
- 15 (c) a plurality of column of LEDs being evenly spaced around the surface of the cylindrical drum,
- 20 thereby the cylindrical drum rotates at an appropriate speed synchronized with the LEDs to form color images which can be seen from all angles.
2. A revolving multi-color LED display unit as set forth in Claim 1, wherein the LEDs are arranged in eight vertical columns of 16 RGB around the surface of the cylindrical drum.
- 25 3. A revolving multi-color LED display unit as set forth in Claim 1, wherein a pair of deep groove ball bearings are located at the top and the bottom of the hollow shaft to provide rotation for the revolving means.
- 30 4. A revolving multi-color LED display unit as set forth in Claim 1, or 2,



wherein the eight columns of LEDs comprises four LED dices, one red, one green and two blue.

5. A revolving multi-color LED display unit as set forth in Claim 4,
5 wherein each column of 16 RGB LEDs consists of one red, one green
and two blue being mounted onto a PCB.
6. A revolving multi-color LED display unit as set forth in Claim 1,
10 wherein the displayed colors of each LED are sent to LED driver
boards.
7. A revolving multi-color LED display unit as set forth in Claim 1,
wherein the revolving means rotates at a speed of 300 rpm.

