

PATENT SPECIFICATION

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(19)



(54) CHARACTER DISPLAY DEVICE

(71) I, YASUO WAKABAYASHI, a Japanese citizen, of No. F-191 Kamakura-Zushi, Highland No. 1362-293, Hisaki-machi, Zushi-shi, Kanagawa-ken, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to a character display device and finds particular, though not exclusive, application to seven segment numeric displays.

15 It is common practice to display alpha-numeric characters and particularly numbers by a device in which each character is displayed by selective illumination of a number of elongate segments arranged such that by selection of appropriate segments any character within the repertoire of the device can be shown. In the case where the repertoire of the display device is restricted to the numerals 0 to 9 these numerals can be realised by selection among seven character segments arranged in a pattern such as is illustrated in Figure 1a of the accompanying drawings.

25 In a seven segment numerical display device in which each segment is illuminated by a respective electric light source placed directly behind the segment, non-uniform brightness of a segment is likely to result if the light source is too close to the segment. To obviate this problem the light source, which may be an electric bulb, is usually located inside the display device behind but away from the associated segment thus resulting in the device having a greater thickness or depth than would be dictated by the size of the parts of the device alone. This in turn leads to the equipment in which one or more of such display devices are used being made bulkier by the bulk of the display device or devices. This is undesirable in view of the general tendency

to seek compactness in equipment.

There will be described hereinafter a seven segment numerical display device embodying the present invention and which is believed to at least substantially mitigate the problems above mentioned. However as already indicated the invention is not restricted to seven segment displays.

Broadly stated, the present invention provides a character display device comprising a housing having a plurality of compartments and a front wall containing a plurality of light transmissive slots which define character segments and which communicate with respective ones of said compartments, and a respective electric light source in each compartment for producing light to issue through the associated slot, wherein each compartment has a substantially triangular shape in a cross-section taken in a plane parallel to said front wall, the associated slot extending along one side of the triangular shape and the associated light source being located adjacent the triangle apex opposite said one side thereof, and each compartment having a reflective surface at said one side thereof behind the associated slot and sloping relative to said front wall so as to reflect light produced in the compartment to issue through the associated slot.

In order that the invention and its preferred practice may be better understood, embodiments of it will now be described and compared with prior proposed devices, the following description being taken in conjunction with the accompanying drawings in which:

FIGURE 1a is a front view of a prior proposed seven segment numerical display device;

FIGURE 1b is a cross-sectional view of the device of Figure 1a, taken along the line A-A thereof;

[Price 25p]

Price 33p

FIGURE 2a is a front view of a seven segment numerical display device embodying the present invention;

FIGURE 2b is a cross-sectional view of the device of Figure 2a, taken along the line B-B thereof;

FIGURE 3 is a lateral cross-sectional view (i.e. taken parallel to the front wall of the device) of the device of Figures 2a and 2b;

FIGURE 4a is a front view of another display device embodying the present invention; and

FIGURE 4b is a cross-sectional view of the device of Figure 4a, taken along the line C-C thereof.

Firstly, a prior proposed display device will be described with reference to Figures 1a and 1b. There is shown a seven segment type numerical display device in which each segment is illuminated by a respective electric light bulb. The elongate segments are light transmissive slots 1 in the front wall of the device. The light sources which are miniature electric bulbs 2 are located in respective compartments in the casing 3, each segment slot opening into the associated compartment to allow light produced by the bulb therein to issue from the slot. Each bulb is located directly behind the associated slot but to the rear of its compartment well away from the inner surface of the front wall so as to try and achieve a well distributed brightness along the length of the slot. If the light bulbs were disposed close to the slots 1, the brightness of the display would be increased as a whole to some degree but the brightness at the extremities of a slot would be considerably lower than that of the centre portion thereof assuming the associated bulbs were disposed mid-way along the slot. This in turn results in uneven brightness of the display of a given numeral. To allow the bulbs 2 to be set back from the front wall the depth of the compartments and hence of the casing 3 is greater than that required to accommodate the bulbs having regard to their size alone.

Figures 2 and 3 show a seven segment display device embodying the present invention. The housing 4 contains seven compartments each having a triangular cross-section taken in a plane parallel to the front wall seen in Figure 2a. Each compartment is associated with a respective segment which is constituted by a slot 5 in the front wall of the housing, the slot extending along one side of its associated compartment. An electric lamp 7 is disposed in each compartment in the angle of the triangle defined by the apex that is opposite the side of the compartment at which the associated slot 5 is located. Each compartment is further

shaped to have a reflective wall 6 located at the side of the triangle adjacent the associated slot, the wall 6 sloping behind the slot at an angle of 30° to 60° to the front wall of the housing, and preferably 45°. This surface 6 serves to reflect light produced by the lamp 7 in the compartment so as to issue through the segment slot 5, the reflection from the lamp 7 being preferably perpendicular to the front wall. As is seen best in Figure 2b the lamps 7 are disposed closely adjacent the front wall of the housing to one side of the slots so that the latter are illuminated by reflected light. The compartments are thus of a depth little greater than the length of the bulbs and the depth or thickness of the housing is likewise kept as small as possible.

Each compartment is defined by the interior surface 9 of a pair of angled partition walls 8, a rear surface 10, and the interior surface of an aluminium plate 11 which forms the front wall of the housing and has the slots 5 therein. The walls and surfaces 6, 9, 10 and 11 are all made reflective as by aluminium vacuum-evaporation or chromium plating thereby aiding in achieving uniform illumination of the segment slots 5.

Placed on top of the outer surface of the aluminium plate 11 is a semitransparent white or frosted glass sheet 12, which may be coloured to give a red or green display for example, and which aids in diffusing the light issuing from the slots. Each lamp 7 has two lead wires 13 which are soldered directly to the printed wiring of a printed circuit board 14 which provides the rear wall of the housing. This arrangement eliminates the use of a bulb having a connecting base so as to lessen the thickness or depth of the housing. The connections to the bulbs 7 are made, via the printed wiring, through a connector terminal 15 provided as an extension of the printed circuit board 14 at the lower edge thereof thereby also saving depth.

In operation, when the miniature electric bulb 7 is lit, then the light therefrom is reflected on the various mirror surfaces such as that of the sloping wall 6, the rear surface 10, the inner surface of the aluminium plate 11, and the surfaces 9 of the partition walls 8, and eventually issues through the associated segment slot to illuminate the semitransparent frosted glass sheet 12 from behind at a uniform intensity of illumination. Although the distance from the light source 7 to the glass sheet 12 is small, yet uniform intensity of illumination is presented throughout the illuminated segment when viewed from the front of the display.

It should be noted that, in this embodiment, the electric bulb 7 is located close to the aforementioned apex of the of the com-

partment triangle in the angle defined thereby and with its axis normal to the front wall of the display and the lead wires projecting rearwardly from the bulb.

- 5 Figures 4a and 4b show another embodiment of the present invention, in which electric bulbs are located with their axes parallel to the front wall of the housing and the lead wires bent toward the rear of the housing. The thickness or depth of the display is smaller than that shown in Figures 2a and b, because the width of the bulbs is less than their axial length and the depth of the housing need only be sufficient to
15 accommodate the width of the bulbs in their respective compartments. The electric bulbs in this embodiment are of a size having a diameter of 2.4 mm or 3.15 mm, with the rated amperage and voltage being 0.15 A
20 and 5 V respectively and an expected service life of around 20,000 hours. Shown at 16 is the light source in the form of a miniature electric bulb and at 18 a reflecting surface inclined at 45° to the front wall of
25 the display which is an aluminium plate 19 having the segment slots 20 therein. The wire leads of the bulbs are connected to the wiring of a printed circuit board 17 which provides the rear of the housing. The device
30 is generally like that of Figures 2 and 3 in other respects. In a modification the surface 18 is coloured red or green by applying coloured light-reflective-coating thereon, so that light issuing from the slot 20 is correspondingly coloured and can issue directly
35 from the segment slot without colouration by a coloured semitransparent glass sheet placed in front of the plate 19.

As is apparent from the foregoing description, there has been described a segment type, electric light numerical display device having a housing of a comparatively small thickness or depth, yet providing a broad figure indicating surface with uniform brightness throughout the character segments. A further feature is the capability of providing a coloured display from the segments themselves.

WHAT I CLAIM IS:—

- 50 1. A character display device comprising a housing having a plurality of compartments and a front wall containing a plurality of light transmissive slots which define character segments and which communicate
55 with respective ones of said compartments, and a respective electric light source

in each compartment for producing light to issue through the associated slot, wherein each compartment has a substantially triangular shape in a cross-section taken in a plane parallel to said front wall, the associated slot extending along one side of the triangular shape and the associated light source being located adjacent the triangle apex opposite said one side thereof, and each compartment having a reflective surface at said one side thereof behind the associated slot and sloping relative to said front wall so as to reflect light produced in the compartment to issue through the associated slot.

2. A device as claimed in Claim 1 wherein the interior surfaces of each compartment are all light-reflective.

3. A device as claimed in Claim 1 or 2 wherein each light source is disposed adjacent the inner surface of said front wall.

4. A device as claimed in Claim 1, 2 or 3 wherein the rear wall of said housing comprises a printed circuit board, and said light sources have wire leads which are soldered to the printed wiring of said board.

5. A device as claimed in Claim 4 wherein a terminal for making electrical connections to said light sources is located at one edge of said printed circuit board.

6. A device as claimed in any preceding claim wherein said sloping surface of each compartment is at an angle of between 30° and 60° to said front wall.

7. A device as claimed in Claim 6 wherein said sloping surface of each compartment is at an angle of 45° to said front wall.

8. A device as claimed in any preceding claim wherein each of said sloping surfaces is coloured to provide a colouration of light reflected thereby.

9. A device as claimed in any preceding claim wherein there are seven compartments and slots defining a seven segment numeric display.

10. A character display device substantially as hereinbefore described with reference to Figures 2a, 2b and 3; or to Figures 4a and 4b of the accompanying drawings.

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As is apparent from the foregoing description, there has been described a segment type, electric light numerical display device having a housing of a comparatively small thickness or depth, yet providing a broad figure indicating surface with uniform brightness throughout the character segments. A further feature is the capability of providing a coloured display from the segments themselves.

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1. A character display device comprising a housing having a plurality of compartments and a front wall containing a plurality of light transmissive slots which define character segments and which communicate with respective ones of said compartments, and a respective electric light source

in each compartment for producing light to issue through the associated slot, wherein each compartment has a substantially triangular shape in a cross-section taken in a plane parallel to said front wall, the associated slot extending along one side of the triangular shape and the associated light source being located adjacent the triangle apex opposite said one side thereof, and each compartment having a reflective surface at said one side thereof behind the associated slot and sloping relative to said front wall so as to reflect light produced in the compartment to issue through the associated slot.

2. A device as claimed in Claim 1 wherein the interior surfaces of each compartment are all light-reflective.

3. A device as claimed in Claim 1 or 2 wherein each light source is disposed adjacent the inner surface of said front wall.

4. A device as claimed in Claim 1, 2 or 3 wherein the rear wall of said housing comprises a printed circuit board, and said light sources have wire leads which are soldered to the printed wiring of said board.

5. A device as claimed in Claim 4 wherein a terminal for making electrical connections to said light sources is located at one edge of said printed circuit board.

6. A device as claimed in any preceding claim wherein said sloping surface of each compartment is at an angle of between 30° and 60° to said front wall.

7. A device as claimed in Claim 6 wherein said sloping surface of each compartment is at an angle of 45° to said front wall.

8. A device as claimed in any preceding claim wherein each of said sloping surfaces is coloured to provide a colouration of light reflected thereby.

9. A device as claimed in any preceding claim wherein there are seven compartments and slots defining a seven segment numeric display.

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