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DISPLAY ELEMENT FOR AN ELECTROMAGNETIC DISPLAY DEVICE

1. Field of the Invention

The present invention relates to a display element, and more particularly to a display element for an electromagnetic display device.

2. Description of Related Art

An electromagnetic display device is normally formed by an array of display elements that collectively produce indicia or signs in public transportation vehicles such as buses. The display element in accordance with the prior art generally has a frame, a disc pivotally mounted on the frame and an electromagnetic drive system securely mounted on the frame. The disc has an ON-side and an Off-side on two surfaces. The ON-side with a yellow or white color contrasting against the background of the frame is directed in the viewing direction. The Off-side has essentially the same color as the background of the frame.

The electromagnetic drive system comprises a permanent magnet securely attached to the disc and two electromagnets fixed on the frame. The two electromagnets are located on two side of the pivotal axle of the disc. In such a manner, the disc can pivotally rotate relative to the frame between the ON-side and the OFF-side due to the interaction of the magnetic fields between the permanent magnet and the two electromagnets. Thus, the display element can show a bright point or a dark point to combine a message and sign by using all of the display elements on the electromagnetic display device.

However, because each conventional display element needs two electromagnets to activate the disc to pivotally rotate relative to the frame, the number of electromagnets on the whole display device is very huge. This will increase the cost of manufacturing and using the electromagnetic display device.

To overcome the shortcomings, the present invention tends to provide an improved



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display element to mitigate or obviate the aforementioned problems.

The main objective of the invention is to provide a display element for an electromagnetic display device comprising a frame; a disc pivotally mounted on said frame with a lateral pivotal axle; a cutout portion defined on one edge of said disc; a permanent magnet mounted on said disc near said cutout portion of said disc; an electromagnet fixedly mounted on said frame and located on one side of said pivotal axle of said disc, said electromagnet substantially comprising a core rod and a coil surrounding the rod, said core rod having a top end higher than said pivotal axle of said disc by 0.1 millimeters to 3 millimeters; an LED mounted on said frame; and a limit integrally protruding from said frame on the other side of said pivotal axle of the disc; wherein the disc will actually rotate relative to the frame by the interaction of the magnetic fields between the electromagnet and the permanent magnet in addition to the nonsymmetric shape of the disc. Each display element only needs a single electromagnet mounted thereon to cause the disc to rotate. This will reduce the cost of manufacturing and using the display device.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

In accordance with a first aspect of invention, there is provided a display element for an electromagnetic display device comprising:

- a frame;
- a disc pivotally mounted on said frame with a lateral pivotal axle;
- a cutout portion defined on one edge of said disc;
- a permanent magnet mounted on said disc near said cutout portion of said disc;

an electromagnet fixedly mounted on said frame and located on one side of said pivotal axle of said disc, said electromagnet substantially comprising a core rod and a coil surrounding the rod, said core rod having a top end higher than said pivotal axle of said disc by 0.1 millimeters to 3 millimeters;

an LED mounted on said frame; and

a limit integrally protruding from said frame on the other side of said pivotal axle of said disc;

wherein the disc will actually rotate relative to the frame by the interaction of the magnetic fields between the electromagnet and the permanent magnet in addition to the nonsymmetric shape of the disc.

IN THE DRAWINGS

Fig. 1 is an exploded perspective view of a display element in accordance with the present invention;

Fig. 2 is a circuit diagram of a control circuit for the display element in Fig. 1.

Fig. 3 is a front plan view of the display element in Fig. 1 in an On-position;

Fig. 4 is a side plan view in partial section of the display element in Fig. 3;

Fig. 5 is a front plan view of the display element in Fig. 1 in an Off-position; and

Fig. 6 is a side plan view in partial section of the display element in Fig. 5.

Referring to Fig. 1, a display element in accordance with the present invention forms a part of an electromagnetic display device which comprises many display elements arranged in an array (normally in rows and columns) to collectively display indicia such as letters or numbers. Each display element has frame (10) and a disc (20) pivotally mounted on the frame (10) with a

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lateral pivotal axle. Two posts (12, 13) protrude upwardly from opposite corners of the frame (10). One of the posts (12, 13) has

two fingers (122) integrally extending from the top end. A recess (124) is defined between the fingers (122). A blind hole (132) is defined on the side of the other post (13) facing the recess (124). The disc (20) has a pivot (202) laterally formed on opposite edges of the disc (20). One of the pivots (202) is securely received on the recess (124) and is clamped between the fingers (122), and the other is received on the blind hole (132). The disc (20) can rotate relative to the frame (10) with a lateral axle.

A tubular holder (14) is integrally formed on the frame (10). An electromagnet (24) is securely held in the holder (14). The electromagnet (24) substantially comprises a core rod (242) and a coil (244) surrounding the rod (242). In a preferred embodiment, the top end of the rod (242) is higher than the pivotal axle of the disc by about 0.1 millimeter (mm) to 3 mm. Referring to Figs. 1 and 2, each end of the coil (244) is respectively electrically connected to one of the electric switches SW1 and SW2.

A through hole (16) is defined in the frame (10) near the holder (14). An LED (26) is fixedly mounted in the through hole (16) to serve as light source for operation of the display device in the dark. The LED (26) is electrically connected to a switch SW3. A limit (18) protrudes up from the frame (10). The holder (14) and the limit (18) are located on the opposite sides of the pivotal axis of the disc (20).

The disc (20) has a cutout portion (204) defined on one edge such that the shape of the disc (20) is nonsymmetrical. Consequently, the disc (20) is pivotally mounted on the frame (10) eccentrically. This causes a substantial non-symmetric the weight distribution of the disc (20) with respect to the pivotal axis of the disc (20). A permanent magnet (22) is mounted on the disc (20) near the cutout portion (204) in a nonsymmetric position.

In operation, referring to Figs. 1-4, when the circuit to the coil (244) is closed through either SW₁ or SW₂, a magnetic field will be generated around the electromagnet (24). The magnet field of the electromagnet (24) will interact with that of the permanent

magnet (22) on the disc (20) to cause the disc (20) to pivotally rotate relative to the frame (10). In one operational direction, the disc (20) is pushed to rotate away from the electromagnet (24) and is blocked by the limit (18) such that an ON-side of the disc (20) is directed toward the viewing direction in addition to having a color contrasting with the background of the frame (10). Thus, a bright dot in which the disc (20) represents the ON-side is clearly visible. In addition, the LED (26) will be turned on through the SW₃ so as to provide a light source to the ON-side of the disc (20) through the cutout portion (204) in a dark environment.

In another operational direction, referring to Figs. 5 and 6, the disc (20) will be pulled to rotate toward the electromagnet (24) and blocked by the top end of the core rod (242) such that an OFF-side of the disc (20) is directed towards the viewing direction in addition to having a color contrasting with the background of the frame (10). The electromagnet (24) and the LED (26) will be covered by the disc (20), and the LED (26) will be turned off. Because the disc (20) has the cutout portion (204) defined thereon, the disc (20) can rotate without interference with the electromagnet (24) and the LED (26) during the pivoting movement.

In addition, there is a substantial non-symmetric weight distribution of the disc (20) with respect to the pivotal axis due to the cutout portion (204). The non-symmetric weight distribution of the disc (20) with respect to the pivotal axis is achieved by using the force of gravity to supplement movement of disc (20) from one of operating positions to the other. This causes a torque that supplements movement of disc (20) from the ON-side to the OFF-side.

By such an arrangement, the disc (20) will actually rotate between the ON-side and OFF-side by the interaction of the magnet fields between the electromagnet (24) and the permanent magnet (22) on the disc (20) in addition to the nonsymmetric shape of the disc

(20). Therefore, each display element only needs a single electromagnet (24) to cause the disc (20) to rotate. This will reduce the cost of the manufacturing and using the electromagnetic display device.

CLAIMS:

1. A display element for an electromagnetic display device comprising:

a frame;

a disc pivotally mounted on said frame with a lateral pivotal axle;

a cutout portion defined on one edge of said disc;

a permanent magnet mounted on said disc near said cutout portion of said disc;

an electromagnet fixedly mounted on said frame and located on one side of said pivotal axle of said disc, said electromagnet substantially comprising a core rod and a coil surrounding the rod, said core rod having a top end higher than said pivotal axle of said disc by 0.1 millimeters to 3 millimeters;

an LED mounted on said frame; and

a limit integrally protruding from said frame on the other side of said pivotal axle of said disc;

wherein the disc will actually rotate relative to the frame by the interaction of the magnetic fields between the electromagnet and the permanent magnet in addition to the nonsymmetric shape of the disc.

2. The display element as claimed in claim 1, wherein two posts protrude upward from opposite corners of said frame to pivotally mount said disc therebetween.

3. The display element as claimed in claim 2, wherein a pivot laterally protrudes from opposite sides of said disc;

two fingers extend upwardly from the top end of one of said posts and a recess is defined between said fingers to securely receive one of said pivots; and

a blind hole is defined in the side of the other post facing said recess of said post to receive the other pivot of said disc.

4. The display element as claimed in claim 1, wherein a holder with a through hole defined therein is formed in said frame to securely hold said electromagnet.
5. The display element as claimed in claim 1, wherein a bore is defined in said frame to securely receive said LED.