# United States Patent [19]

**Watanabe et al.**

[11] **3,792,540**

[45] **Feb. 19, 1974**


[54] **MULTI-WINDOW TYPE DISPLAY DEVICE**


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[73] Assignee: **Aiphone Kabushiki Kaisha (Aiphone Co., Ltd.),** Aichi-ken, Japan



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[21] Appl. No.: **202,844**

[30] **Foreign Application Priority Data**

| | | |
|---|---|---|
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| Dec. 3, 1970 | Japan | 45/120769 |
| Aug. 19, 1971 | Japan | 46/74464 |
| Aug. 19, 1971 | Japan | 46/74465 |

[52] **U.S. Cl.** ..... **40/28 C,** 40/130 E, 340/373

[51] **Int. Cl.** ..... **G09f 11/00**

[58] **Field of Search** ..... 40/28 R, 28 C, 52 R, 61 R, 40/62, 65, 106.45, 130 E, 132 R; 335/234, 272; 340/372, 373, 376



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[57] **ABSTRACT**

Disclosed herein is a multi-window type display device provided with display units each of which has a display body operated or moved to appear in its display window by means of a permanent magnet which is stably moved by attraction and repulsation forces created electro-magnetically, said display body being irradiated by only one light source common with all the display bodies.


**2 Claims, 10 Drawing Figures**

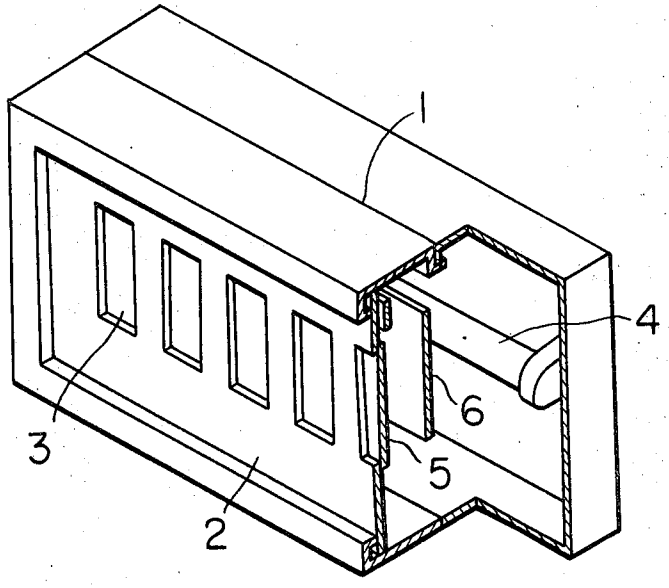

FIG. 1

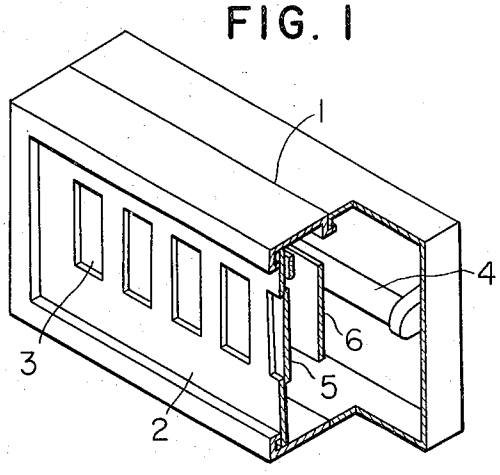


FIG. 2

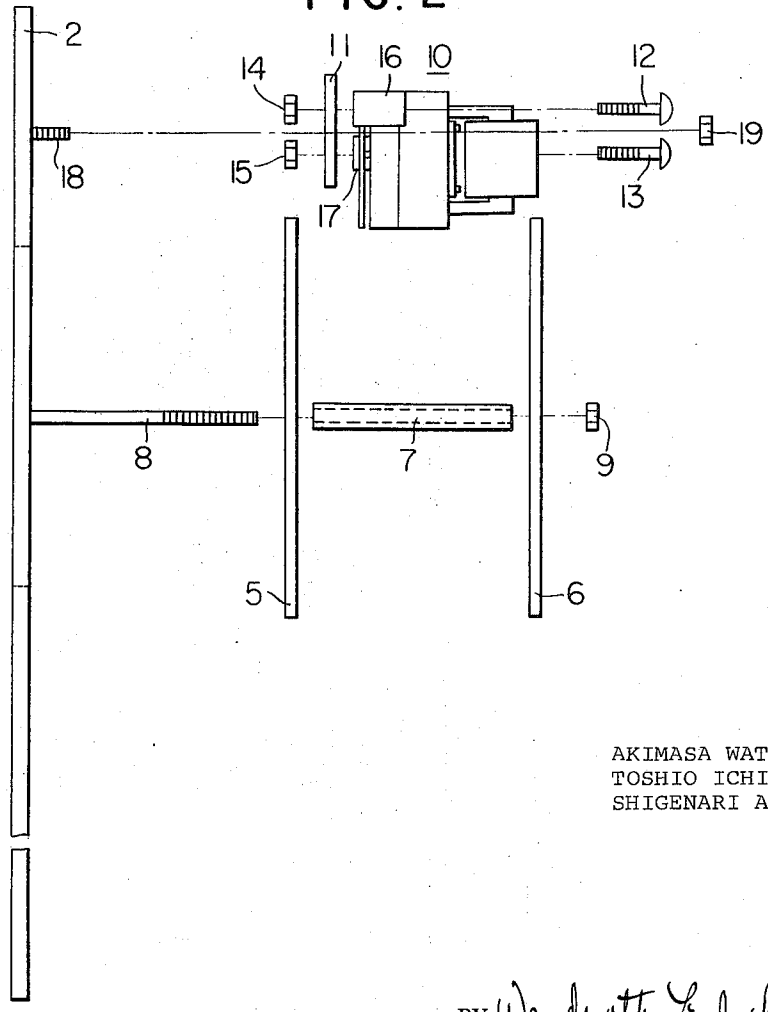


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FIG. 3

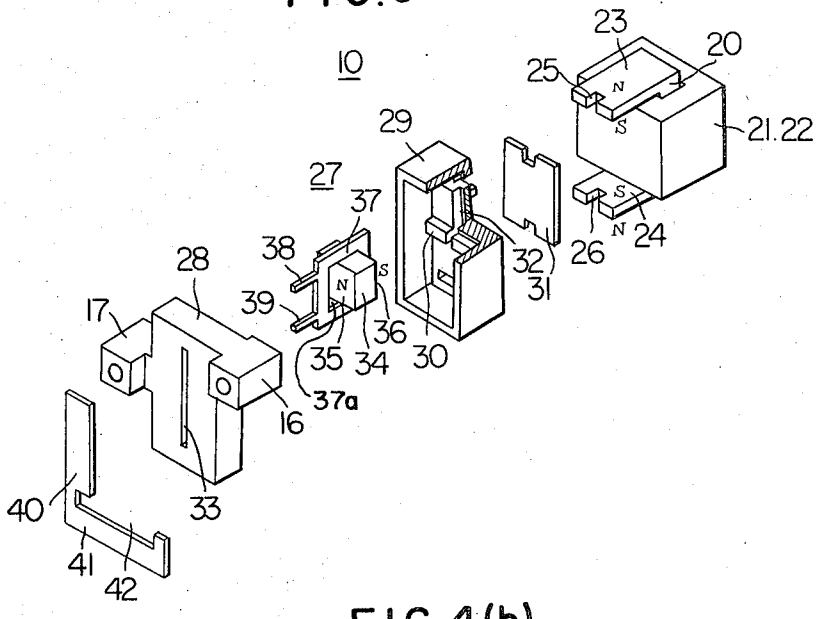


FIG. 4(a)

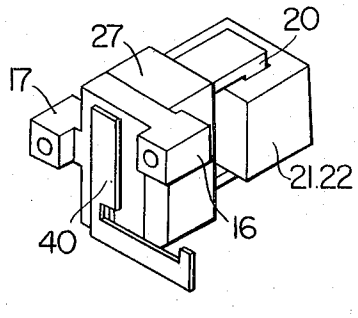


FIG. 4(b)

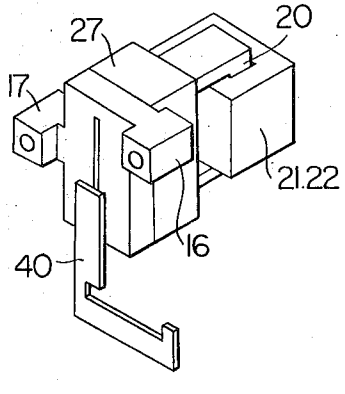


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FIG. 5(a)

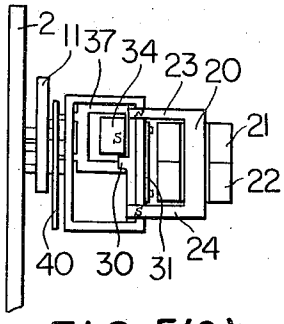



FIG. 5(b)

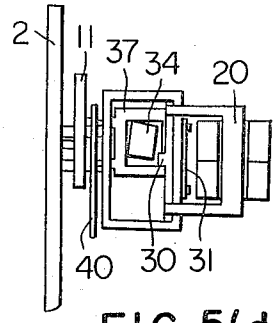



FIG. 5(c)

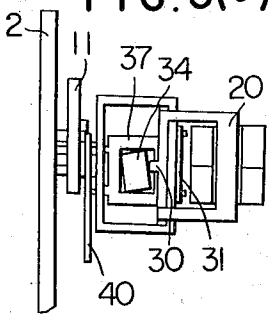



FIG. 5(d)

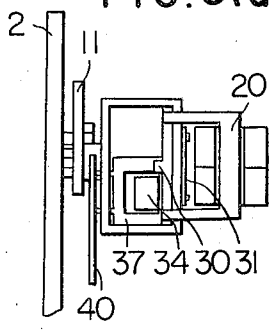
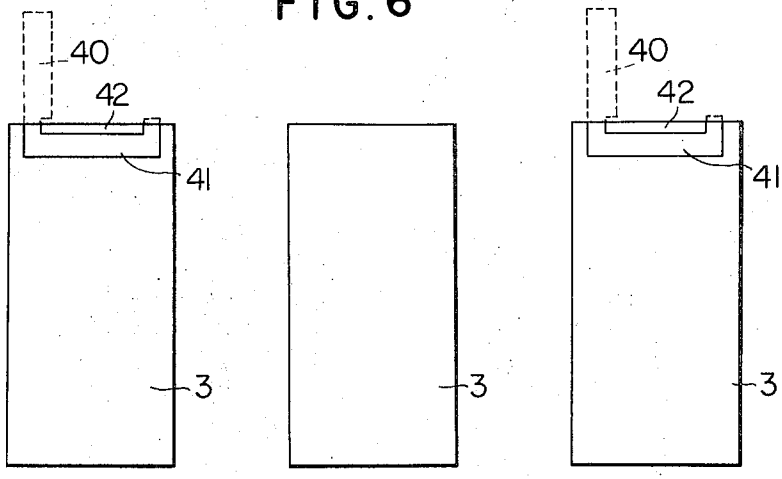



FIG. 6

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# MULTI-WINDOW TYPE DISPLAY DEVICE

## BACKGROUND OF THE INVENTION

The present invention relates to a multi-window type display device which is effective and simply for a number of displays.

Heretofore, there have generally been two types of display devices of the class disclosed; one is a lamp type display device which utilizes a light, and the other is a magnet type display device which uses an electromagnet. However, the former involves many drawbacks, that is, inferior in economization, low in dependability, and difficult in maintenance and inspection due to the following reaons. The conventional, lamp type display device requires a light source such as a lamp for every display window thereof. When the frequency of use of the lamps is high, the lamps are apt to be broken easily, and even if only one lamp is broken or becomes out of order, the whole display device becomes unserviceable. Furthermore, an electric current flows through the lamps for the time period of the display with the result of a great electric power comsumption.

On the other hand, in the conventional magnet type display device, a display plate is rotated or moved by the utilization of the force of an electro-magnet thereby to display information with letters or colors on the display plate. However, this type of display device also suffers from disadvantages such that it is hard to see the display from far away or at a dark place, and the display device is apt to cause erroneous operations.

## SUMMARY OF THE INVENTION

An object of the present invention is accordingly to provide a display device which is simple in maintenance and inspection, in which colored transparent display bodies are operated by respective electro-magnets thereby to appear in respective display windows where displays is to be made, and the display bodies are irradiated by one light source common to all the display bodies whereby the display can be recognized from far off or at a dark place.

The above object and other objects as well as the characteristic features of the present invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawings:

FIG. **1** is a perspective view illustrating an embodiment of the display device according to the present invention;

FIG. **2** is a diagram showing the arrangement of various parts to be assembled with a display panel in the embodiment shown in FIG. **1**;

FIG. **3** is a disassembled perspective view of a display unit in he embodiment shown in FIGS. **1** and **2**;

FIGS. **4***a* and **4***b* are perspective veiws illustrating the external appearances of the display unit shown in FIG. **3**;

FIGS. **5***a* to **5***d* are diagrams explaining the operation of a permanent magnet in a unit case in the embodiment shown in FIGS. **1** to **4**; and

FIG. **6** is a diagram exhibiting a display operation of the above-mentioned embodiment.



## DETAILED DESCRIPTION OF THE INVENTION

With reference now to FIG. **1**, there is shown an embodiment, namely, a display device according to the present invention, which comprises a case **1**, a display panel **2**, display windows **3** opened through the display panel **2**, a common light source **4** such as a fluorescent lamp, an transparent entry plate **5**, and a milk-white light-shielding plate **6** which is adapted to prevent the light of the fluorescent lamp **4** from directly coming into the eyes of a man.

As shown in FIG. **2**, the entry plate **5** and the light-shielding plate **6** are spaced with a support pipe **7** and are mounted on the panel **2** with a female-threaded nut **9** and a male-threaded bolt **8** provided on the panel **2**. A display unit **10** is fixedly mounted on a supplementary plate or a unit holder **11** with female-threaded nuts **14** and **15** and male-threaded bolts **12** and **13** which go through mounting hole members **16** and **17** provided on the display unit **10**. The unit holder **11** is in turn fixedly mounted on the panel **2** by means of a female-threaded nut **19** and a male-threaded bolt **18** provided on the panel **2** so that the display unit **11** is fixed on the panel **2**.

Referring now to FIG. **3**, there is shown disassembled view of the display unit **10**, whcih comprises an electromagnet composed of two windings **21** and **22** and a U-shaped iron core **20** the magnetic poles **23** and **24** of which have grooves **25** and **26** in the center of their respective ends and a unit case **27** comprising a top part **28** and a bottom part **29**. The bottom part **29** is mounted over the magnetic poles **23** and **24** of the iron core **20**. A convex shoulder on step **30** is provided on the lower center part of the inside of the bottom part **29**, and on the outside of the bottom part **29** an iron piece **31** is provided between the magnetic poles **23** and **24** of the iron core **20**.

On the other hand, the top part **28** is provided with the mounting hole members **16** and **17** which are used to mount the display unit **10** on the unit holder **11** as described in connection with FIG. **2**. A permanent magnet **34** has a front side **35** and a rear side **36** which are a north pole and a south pole, respectively. The permanent magnet **34** is provided with a sliding piece **37**. This sliding piece **37** is made of a thin, non-magnetic material, and has a rectangular hole **37***a* at the center thereof and arms **38** and **39** on the front end thereof. The permanent magnet **34** is inserted in the rectangular hole **37***a* of the sliding piece **37** so that the sliding piece **37** can follow the movement of the permanent magnet **34**. The assembly of the permanent magnet **34** and the sliding piece **37** is then placed inside the unit case **27**. Furthermore, the sliding piece **37** is inserted into a groove **32** provided on the bottom part **29** of the unit case **27**. A display body **40** is made of a light-transparent colored material, and has a notch **42** in a part of its display surface **41**, said display body **40** being fixed on arms **38** and **39** of the sliding piece **37** through a slot **33** in the top part **28**. Therefore, the display body **40** can operate in cooperation with the movement of the permanent magnet **34**.

The display unit **10** operates as follows:

Now, let's assume that the permanent magent **34** is initially positioned on the side of the magnetic pole **23** of the U-shaped iron core **20**. Under this condition, when the magnetic poles **23** and **24** are magnetized to be a north pole and a south pole, respectively, by flow-

ing an electric current through one of the windings of the U-shaped iron core **20**, the permanent magnet **34** is attracted to the magnetic pole **23** and at the same time repulsed by the other magnetic pole **24**, because the rear side **36** of the permanent magnet **34** is a south pole as mentioned before, as a result of which the permanent magnet **34** stably remains at its initial position. Under this condition, even if the flow of current is ceased, the permanent magnet **34** is fixed by its own attraction force to the side of the magnetic pole **23**, as shown in FIG. **5***a*.

Then, when an electric current is made to flow through the other winding **22** in a direction opposite to the direction of the current passed through the winding **21**, the magnetic poles **23** and **24** are magnetized into a south pole and a north pole, respectively. As a result, by the repulsion force due to the magnetic pole **23**, the permanent magnet **34** floats off the magnetic pole **23** as shown in FIG. **5***b* and then jumps over the shoulder **30** as shown in FIG. **5***c*. Furthermore, the permanent magnet is moved to the side of the magnetic pole **24** by the attraction force due to the magnetic pole **24**, as shown in FIG. **5***d*. Under this condition, even if the flow of current through the winding **22** is ceased, the permanent magnet **34** is fixed, by its own magnetic attraction force, to the side of the magnetic pole **24**. It goes without saying that the display body **40** is also moved together with the permanent magnet **34**, as illustrated in FIGS. **5***a* to **5***d*, whereby displaying can be effectively attained through the display windows **3**.

The permanent magnet **34** is initially fixed to the side of the magnetic pole **23** of the iron core **20**, but when any force such as vibration which is greater than the coercive force of the magnet **34** is applied to the permanent magnet **34** from outside the display unit **10**, the permanent magnet **34** is moved over to the side of the magnetic pole **24**. This has been a cause for the erroneous operations of the display unit. However, this drawback is eliminated, according to the present invention, by providing the shoulder **30** on the lower part of the unit case so as to prevent the permanent magnet from movement caused by such external force, that is, to prevent the erroneous operations.

In general, the display panel **2** is made of a metal such as iron. Therefore, when the display unit **10** is mounted on the display panel **2**, a force of a permanent magnet **34** housed in the unit case **27** acts greatly on the display panel **2**, as a result of which it is required to feed a large electric current through the windings in order to operate or move the permanent magnet. This is uneconomical and is one of the drawbacks involved in the conventional display unit. However, according to the present invention this drawback is solved by provision of the iron piece **31** which serves to neutralize the force of the permanent magent **34** which acts on the display apnel **2**, and thereby allows the permanent magnet to be moved by a small electric current.

The display device according to the present invention utilizes the operation of the display unit described above. The display unit operates as follows.

The fluorescent lamp **4** is kept in illuminated state at all times regardless of the presence or absence of a display. For display, the display surface **41** and notch **42** of the display body **40** are inserted between the entry plate **5** and the light-shielding plate **6** thereby to appear in the display window **3**, as shown in FIG. **6**. If the display body **40** is made of a red transparent plate, we can see only the display body brightened in red. Therefore, the display window having the thus brightened display body is readily distinguished from the other windows not displayed. Furthermore, since we can see the notch **42** brightened in the same color as that of the display window **3**, the colored display surface **41** is emphasized in brightness by the effect of the notch, as a result of which the display can be clearly recognized from afar.

The above-described embodiment according to the present invention corresponds to the case in which a two value display is carried out by providing the display unit on the upper side of the display window, but the display units may be provided on the upper and lower sides of the display window or the upper, lower, right and left sides thereof for the display of four or more values.

As is apparent from the above description, according to the present invention, since the fluorescent lamp is kept in a brightened state at all the times, the display can be clearly recognized even at a dark position or even from afar. In addition, the fluorescent lamp has a longer service life than other lamp types, the frequency of replacement of the fluorescent lamp is only once a year or once every two years. In conclusion, the display device according to the present invention is simple in maintenance and inspection, superior from an economical view point, and significant in a practical effect.

We claim:

**1.** A multi-window type display device, whcih comprises, in combination, a plurality of display windows, a plurality of display units at least one of which is provided at each of said display windows, and one light source common to all the display units and located to the rear of said display units; each of said display units comprising a display body disposed at the rear side of one of said display windows; an electromagnet comprising a U-shaped iron core, the legs of said U-shaped core extending towards said display window and terminating in two pole ends and an energizing winding means adapted to alternately magnetize said iron core in one direction or the other opposite direction such that said two pole ends are always oppositely polarized; a unit case mounted over the surfaces of both poles of said iron core, said case including a passage and containing therein a permanent magnet, one pole of said permanent magnet facing in the direction of said display window and the other pole of said permanent magnet facing away from said display window, said permanent magent being adapted to be slid along said passage formed in said case from one pole to the other pole of said electromagnet, said passage being provided with a convex shoulder at the center portion of the sliding surface of said passage and protruding towards the interior of said passage, whereby said permanent magent is stopped by said shoulder irrespective of any vibration shock from outside and is made to jump over said convex shoulder when said magnet is moved from one pole tip to the other pole tip of said electromagnet in response to the magnetization direction of said electromagnet poles, said case having a slot positioned therein and said permanent magnet being provided with arm means protruding from said case through said slot, said arm means supporting said display body, whereby said display body is, while being irradiated by said light source from the rear side thereof, moved to a position corresponding to the position of said permanent magnet, thereby achieving a display operation.

**2.** A multi-window type display device as claimed in claim **1** wherein said electromagnet is provided with a magnetizable plate positioned between the poles thereof, thereby to cause effective passing of the magnetic flux produced by said electromagnet.

* * * * *