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(54) LIQUID CRYSTAL DISPLAY WITH MIRROR FACE FUNCTION

(76) Inventor: **Po Hsien Wang**, Taichung (TW)

Correspondence Address:
ROSENBERG, KLEIN & LEE
3458 ELLICOTT CENTER DRIVE-SUITE 101
ELLICOTT CITY, MD 21043 (US)

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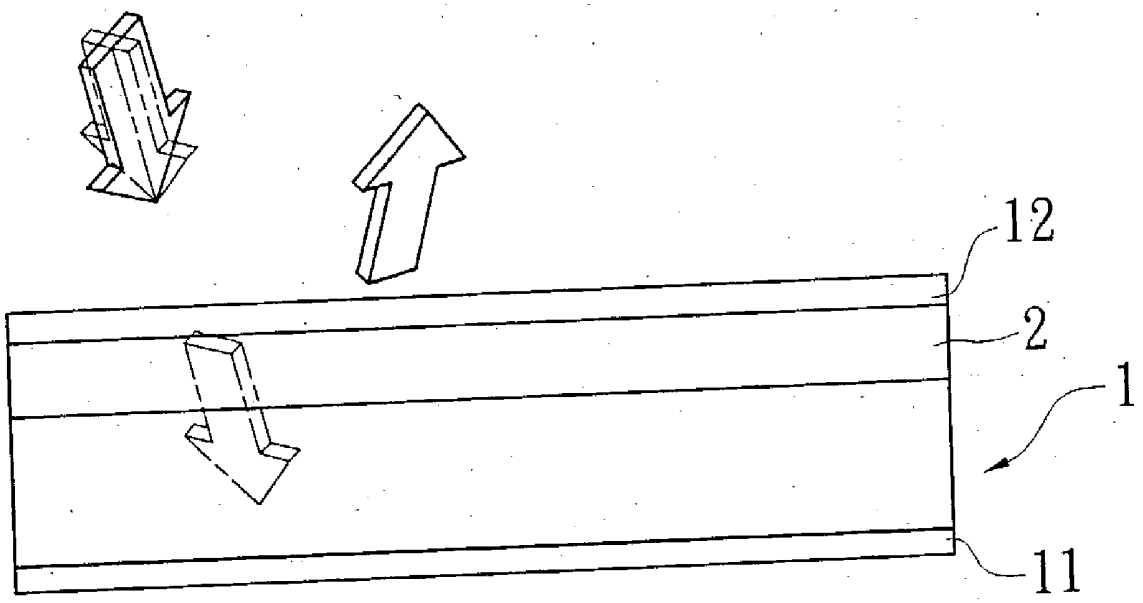
(57) ABSTRACT

A liquid crystal display with mirror face function. A light deflecting plate is disposed on one face of the liquid crystal display module opposite to the backlight element. A brightness enhancement film is disposed between the liquid crystal display module and the light deflecting plate. The direction of the light penetration axis of the brightness enhancement film is identical to the direction of the light penetration axis of the liquid crystal display module, whereby external light is reflected by the brightness enhancement film to achieve a mirror face effect. The light emitted by the liquid crystal display module can easily pass through the brightness enhancement film so that the light penetrability of the liquid crystal display module is enhanced.



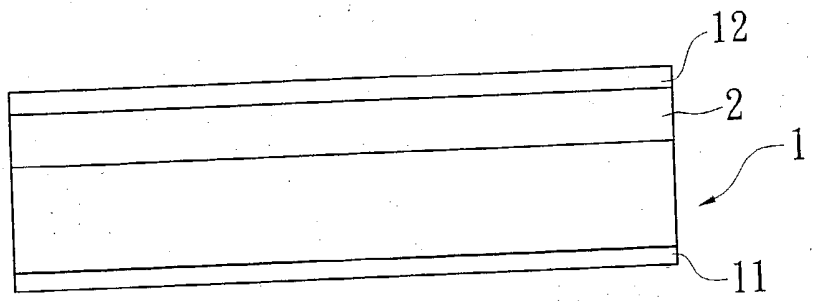


FIG. 1

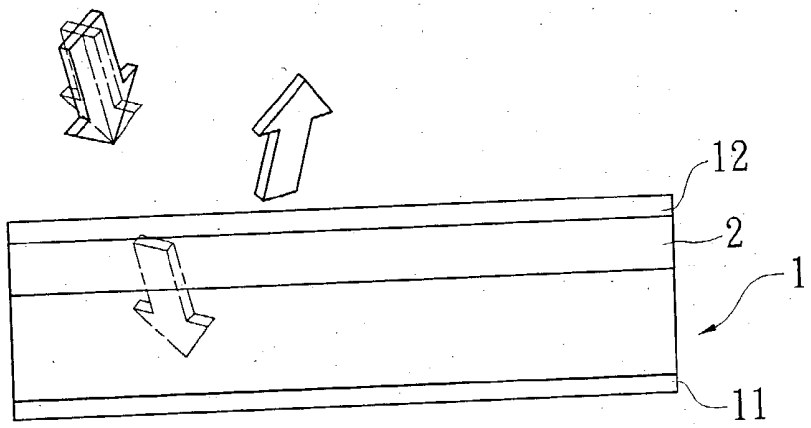


FIG. 2

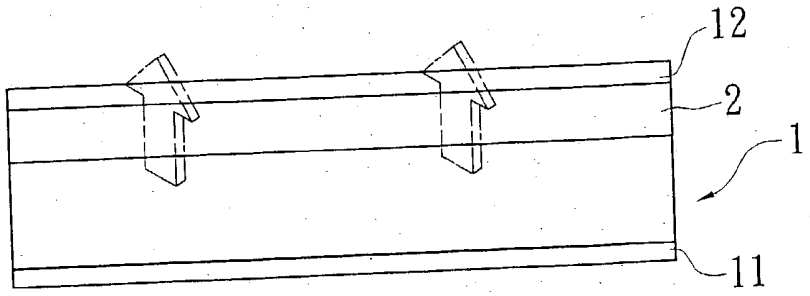


FIG. 3

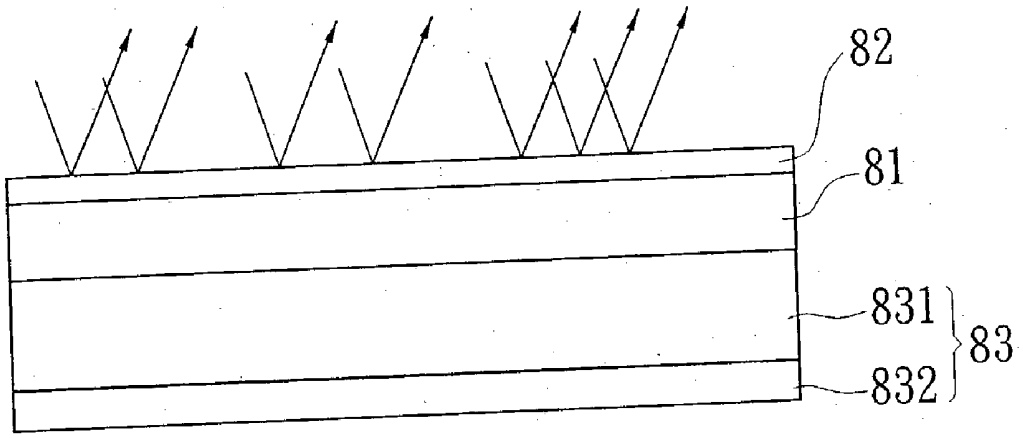


FIG. 4
PRIOR ART

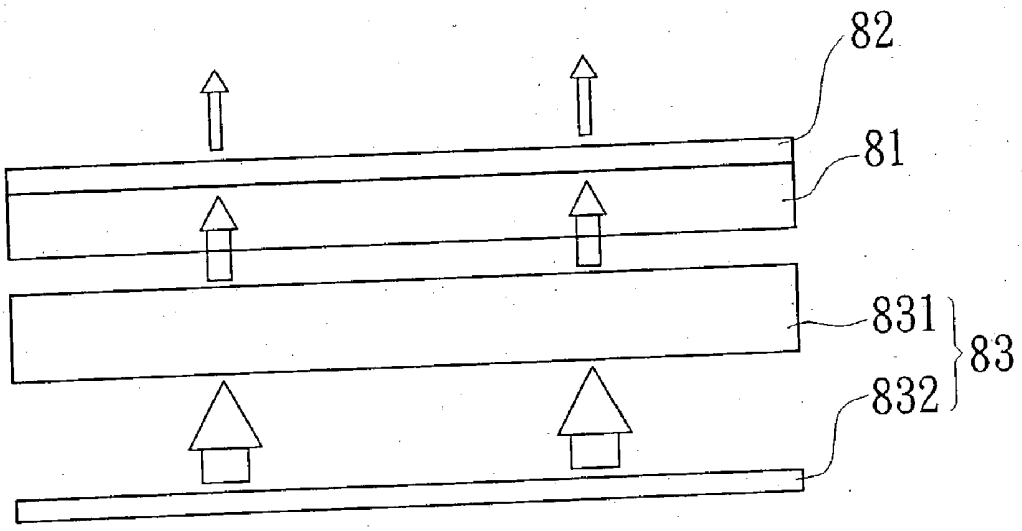


FIG. 5
PRIOR ART

LIQUID CRYSTAL DISPLAY WITH MIRROR FACE FUNCTION

BACKGROUND OF THE INVENTION

[0001] The present invention is related to a liquid crystal display with mirror face function, and more particularly to a liquid crystal display with better optical efficiency and thinner thickness. In addition, the liquid crystal display is manufactured at lower cost.

[0002] Some liquid crystal displays need to have mirror face function due to special requirement. **FIG. 4** shows an in-car rearview mirror capable of showing information. A semitransparent reflecting film **82** is disposed on one face of the lens **81** of the rearview mirror. A light emitting display **83** is disposed on rear side of the lens **81**. In normal state, the lens **81** can reflect external light to serve as a mirror. When the display **83** emits light, the light partially penetrates through the semitransparent reflecting film **82** to achieve display effect.

[0003] The conventional liquid crystal light-emitting display **83** includes a liquid crystal display module **831** and a backlight module **832**. When the display **83** emits light, the backlight module **832** serves as the light source. Due to the working characteristic of the liquid crystal display module **831**, only about one half of the emitted light can pass through the liquid crystal display module **831**. The semitransparent reflecting film **82** will absorb a part of the light beam. Therefore, only about one half of the light beam passing through the liquid crystal display module **831** can pass through the semi transparent reflecting film **82**. In other words, only about 25% of the light emitted by the backlight module **832** can pass through the semi transparent reflecting film **82** as shown in **FIG. 5**. Therefore, the aforesaid in-car rearview mirror capable of showing information has poor optical efficiency. As a result, a high brightness backlight module **832** is necessary for enhancing the brightness. This greatly increases power consumption. In the case that such display is applied to a portable implement such as a mobile phone, PDA and notebook-type computer, the great power consumption will shorten the using time. Moreover, the high brightness backlight module **832** will lead to the problem of overheating.

[0004] Another type of liquid crystal display is additionally equipped with a switch-type display (such as TN-LCD). The turning on/off of the switch-type display is controlled by means of a circuit. When the switch-type display works, the external light is reflected to achieve a mirror face effect. When the switch-type display is turned off, the light emitted by the internal liquid crystal display module can pass through the switch-type display to serve as a display panel. Such display is thicker and has complicated structure. In addition, such display is manufactured at higher cost. Therefore, such display fails to meet the requirements for lightweight, thinness and low power consumption.

[0005] Therefore, it is necessary to provide a liquid crystal display which meets the requirements for lightweight, thinness and low power consumption and is applicable to portable implement.

SUMMARY OF THE INVENTION

[0006] It is therefore a primary object of the present invention to provide a liquid crystal display with mirror face function. The direction of the light penetration axis of the brightness enhancement film is identical to the direction of the light penetration axis of the liquid crystal display module, whereby the light emitted by the liquid crystal display module can easily pass through the brightness enhancement film. The light beam of the external light in the direction normal to the penetration axis of the brightness enhancement film is reflected to achieve a mirror face effect. Therefore, the light penetrability of the liquid crystal display module is enhanced. In addition,while achieving mirror face function and enhancing the optical efficiency, the liquid crystal display meets the requirements for lightweight, thinness and low power consumption.

[0007] According to the above object, the liquid crystal display with mirror face function of the present invention includes a liquid crystal display module. A backlight element is disposed on one face of the liquid crystal display module to serve as a light source thereof. A light deflecting plate is disposed on the other face of the liquid crystal display module opposite to the backlight element. A dual brightness enhancement film (DBEF) is disposed between the liquid crystal display module and the light deflecting plate. The direction of the light penetration axis of the brightness enhancement film is identical to the direction of the light penetration axis of the liquid crystal display module, whereby external light is reflected by the brightness enhancement film to achieve a mirror face effect and the light emitted by the liquid crystal display module can easily pass through the brightness enhancement film.

[0008] The present invention can be best understood through the following description and accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** is a view showing the structure of the present invention;

[0010] **FIG. 2** shows that the present invention achieves a mirror face effect under external light;

[0011] **FIG. 3** shows that when the present invention works, the light emitted by the liquid crystal display module passes through the brightness enhancement film;

[0012] **FIG. 4** is a view showing the structure of a conventional in-car rearview mirror capable of showing information; and

[0013] **FIG. 5** shows the using state of the conventional in-car rearview mirror capable of showing information.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Please refer to FIGS. **1** to **3**. The liquid crystal display with mirror face function of the present invention includes a liquid crystal display module **1** and a dual brightness enhancement film (DBEF) **2**. A backlight element **11** is disposed on one face of the liquid crystal display module **1** to serve as the light source thereof. A light deflecting plate **12** is disposed on the other face of the liquid crystal display module **1** opposite to the backlight element **11**. The DBEF **2** is disposed between the liquid crystal display module **1** and the light deflecting plate **12**. The direction of the light penetration axis of the DBEF **2** is

identical to the direction of the light penetration axis of the liquid crystal display module **1**. Therefore, the light emitted from the liquid crystal display module **1** can easily pass through the DBEF **2**.

[**0015**] The DBEF **2** is a product of 3M (An American company). The DBEF **2** has special prism structure. The light beam (P light) in the direction of the penetration axis of the prism structure is permitted to pass through the DBEF **2**, while the light beam (S light) in the direction normal to the penetration axis is reflected. This is a characteristic of the DBEF **2**. The DBEF **2** is applied to the present invention to achieve the necessary mirror face effect by means of the above characteristic.

[**0016**] Referring to **FIG. 2**, when the liquid crystal display module **1** does not work, the backlight element **11** will not emit light. At this time, when external light is projected onto the DBEF **2**, the light beam (S light) of the external light in the direction normal to the penetration axis of the DBEF **2** is reflected to present a mirror state. When the liquid crystal display module **1** works, the light emitted by the backlight element **11** will pass through the liquid crystal display module **1**. The direction of the light penetration axis of the DBEF **2** is identical to the direction of the light penetration axis of the liquid crystal display module **1**. Therefore, the light (P light) passing through the liquid crystal display module **1** can easily pass through the DBEF **2** as shown in **FIG. 3**. Accordingly, the penetrability of the light is enhanced.

[**0017**] In actual test of the liquid crystal display with mirror face function of the present invention, with ordinary arrangement, when the liquid crystal display module **1** works, the brightness is up to 120 cd/m^2. Therefore, a good display effect can be achieved without using the high brightness backlight module with higher power as in the prior art.

[**0018**] In conclusion, the direction of the light penetration axis of the DBEF **2** is identical to the direction of the light penetration axis of the liquid crystal display module **1**. Therefore, the light emitted by the liquid crystal display module **1** can easily pass through the DBEF **2**. The light beam of the external light in the direction normal to the penetration axis of the DBEF **2** is reflected by the DBEF **2** to achieve a mirror face effect. Therefore, the light penetrability of the liquid crystal display module **1** is enhanced.

[**0019**] The above embodiment is only used to illustrate the present invention, not intended to limit the scope thereof. Many modifications of the above embodiment can be made without departing from the spirit of the present invention.

What is claimed is:

1. A liquid crystal display with mirror face function, comprising a liquid crystal display module and a brightness enhancement film, a backlight element being disposed on one face of the liquid crystal display module to serve as a light source thereof, a light deflecting plate being disposed on the other face of the liquid crystal display module opposite to the backlight element, the brightness enhancement film being disposed between the liquid crystal display module and the light deflecting plate, the direction of the light penetration axis of the brightness enhancement film being identical to the direction of the light penetration axis of the liquid crystal display module, whereby external light is reflected by the brightness enhancement film to achieve a mirror face effect and the light emitted by the liquid crystal display module can easily pass through the brightness enhancement film.

2. The liquid crystal display with mirror face function as claimed in claim 1, wherein the brightness enhancement film is a DBEF.

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专利名称(译)	具有镜面功能的液晶显示器		
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申请号	US10/449005	申请日	2003-06-02
[标]申请(专利权)人(译)	王珀HSIEN		
申请(专利权)人(译)	王珀HSIEN		
当前申请(专利权)人(译)	王珀HSIEN		
[标]发明人	WANG PO HSIEN		
发明人	WANG, PO HSIEN		
IPC分类号	G02F1/1335		
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外部链接	Espacenet USPTO		

摘要(译)

具有镜面功能的液晶显示器。光偏转板设置在液晶显示模块的与背光元件相对的一个面上。亮度增强膜设置在液晶显示模块和光偏转板之间。亮度增强膜的透光轴的方向与液晶显示模块的透光轴的方向相同，由此外部光被亮度增强膜反射，以实现镜面效果。由液晶显示模块发出的光可以容易地通过亮度增强膜，从而提高液晶显示模块的光穿透性。