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(54) BACKLIGHT MODULE WITH INTEGRALLY MOLDED METAL BACK PLATE-FRAME AND LIQUID CRYSTAL DISPLAY USING THE SAME

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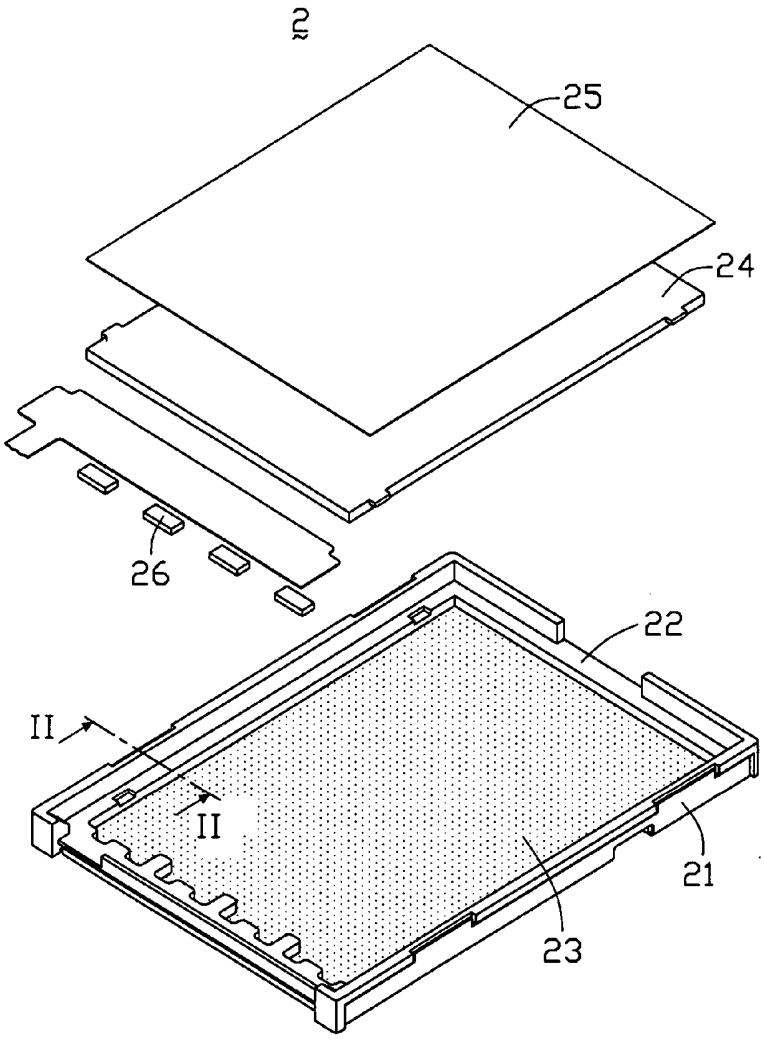
(57) **ABSTRACT**

An exemplary backlight module (**2**) includes a metal back plate (**21**) and a frame (**22**) formed together as a single body, a light guide plate (**24**) having a light incident surface, and plural light sources (**26**) arranged adjacent to the light incident surface. The combined metal back plate and frame defines a space accommodating the light guide plate and the light sources. The combined metal back plate and frame can protect the light guide plate and the light sources from being displaced in the event of collision or shock. Therefore the backlight module can maintain reliable optical performance even in rugged application environments or when an accident occurs. A liquid crystal display using the backlight module is also provided.



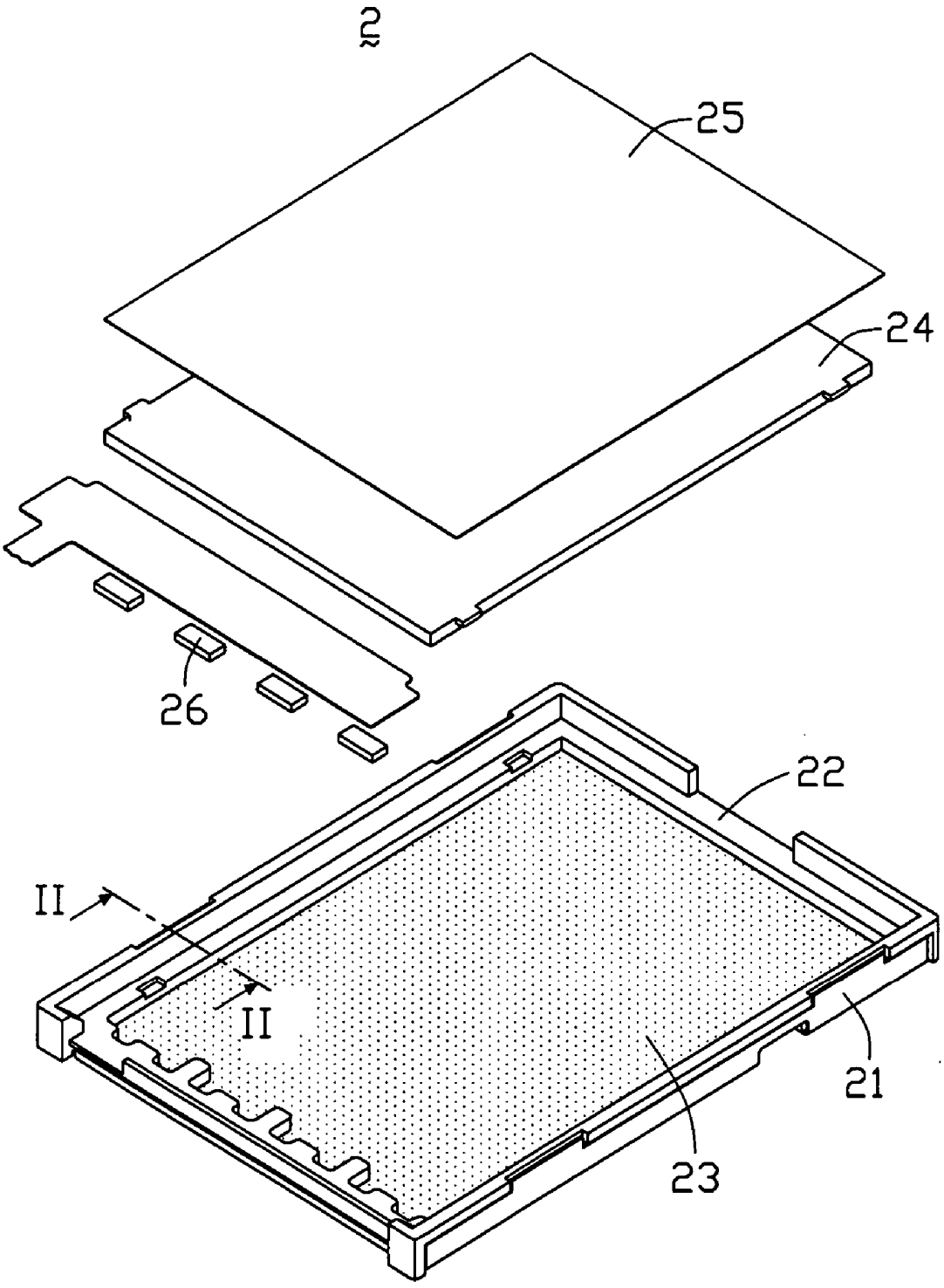


FIG. 1

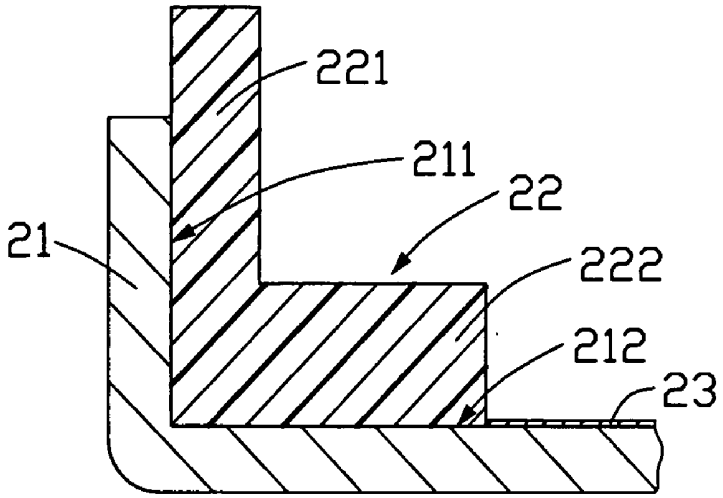


FIG. 2

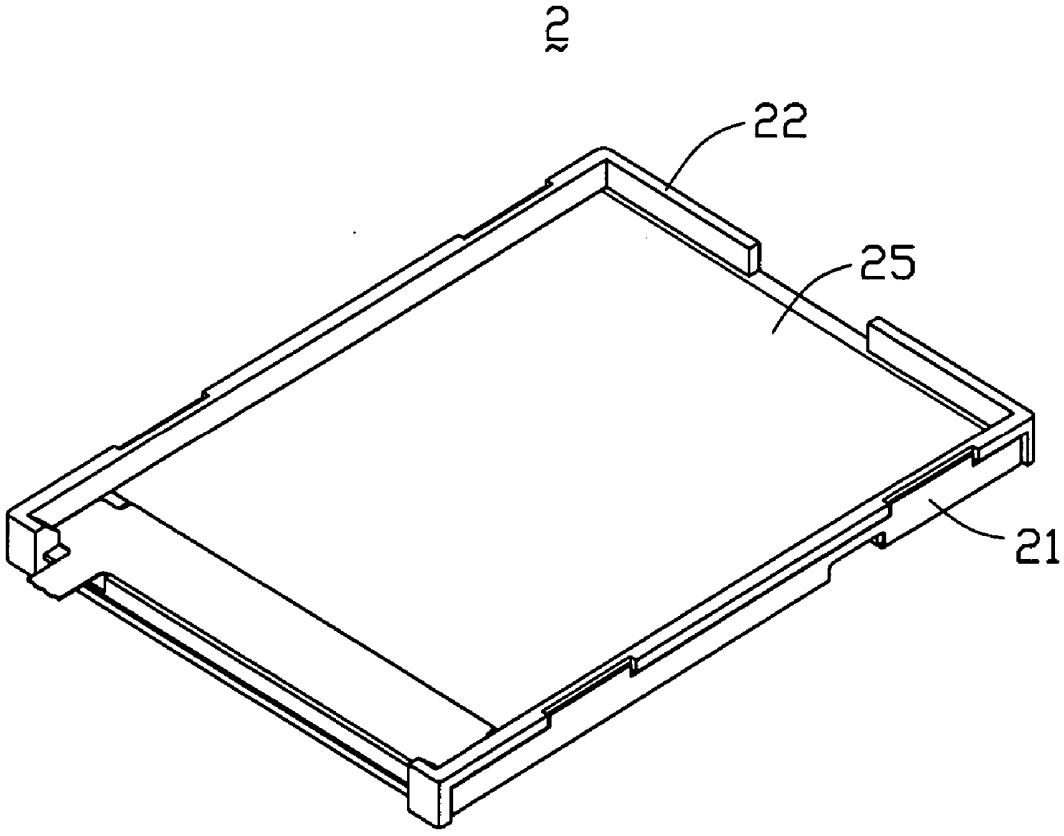


FIG. 3

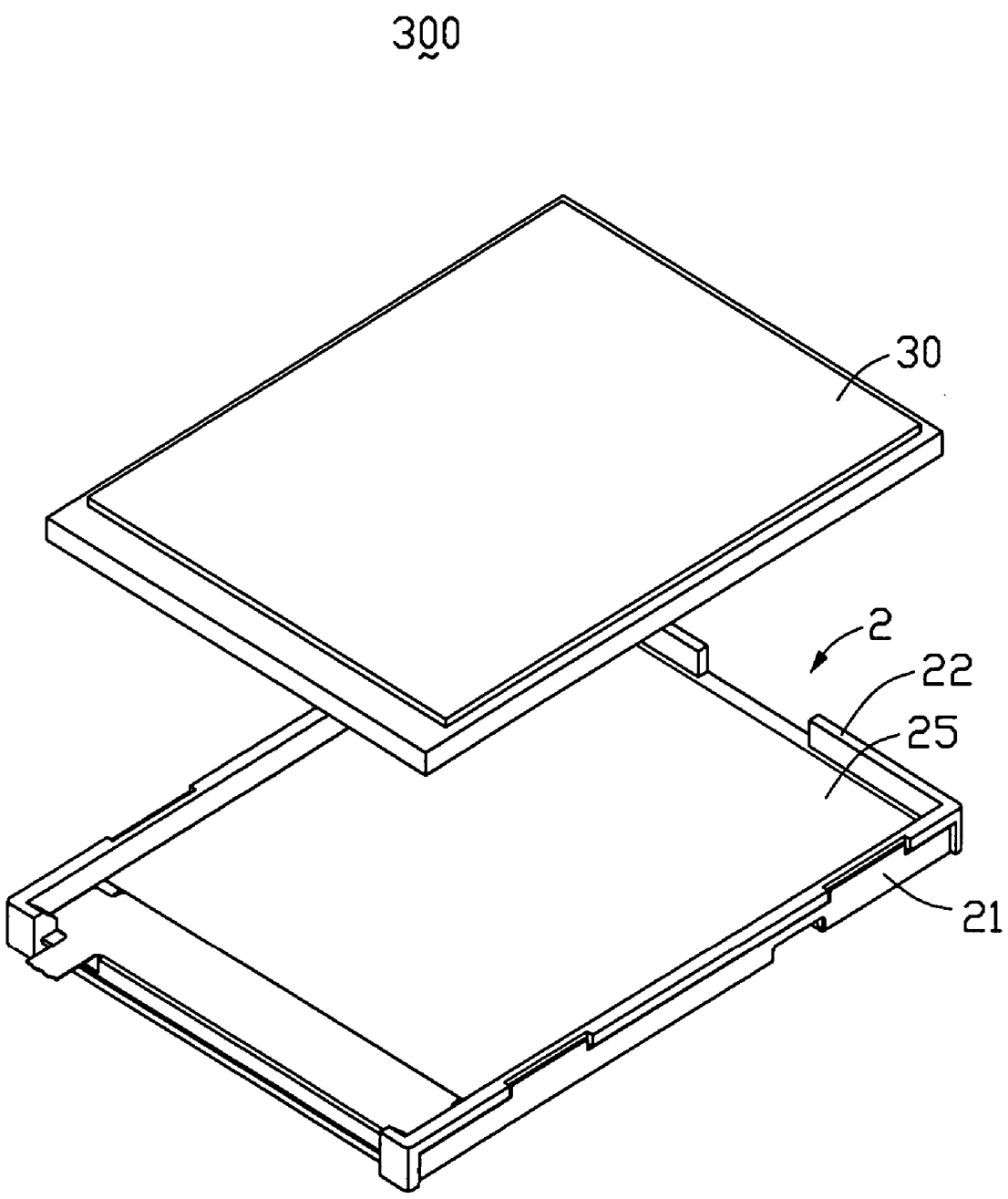


FIG. 4

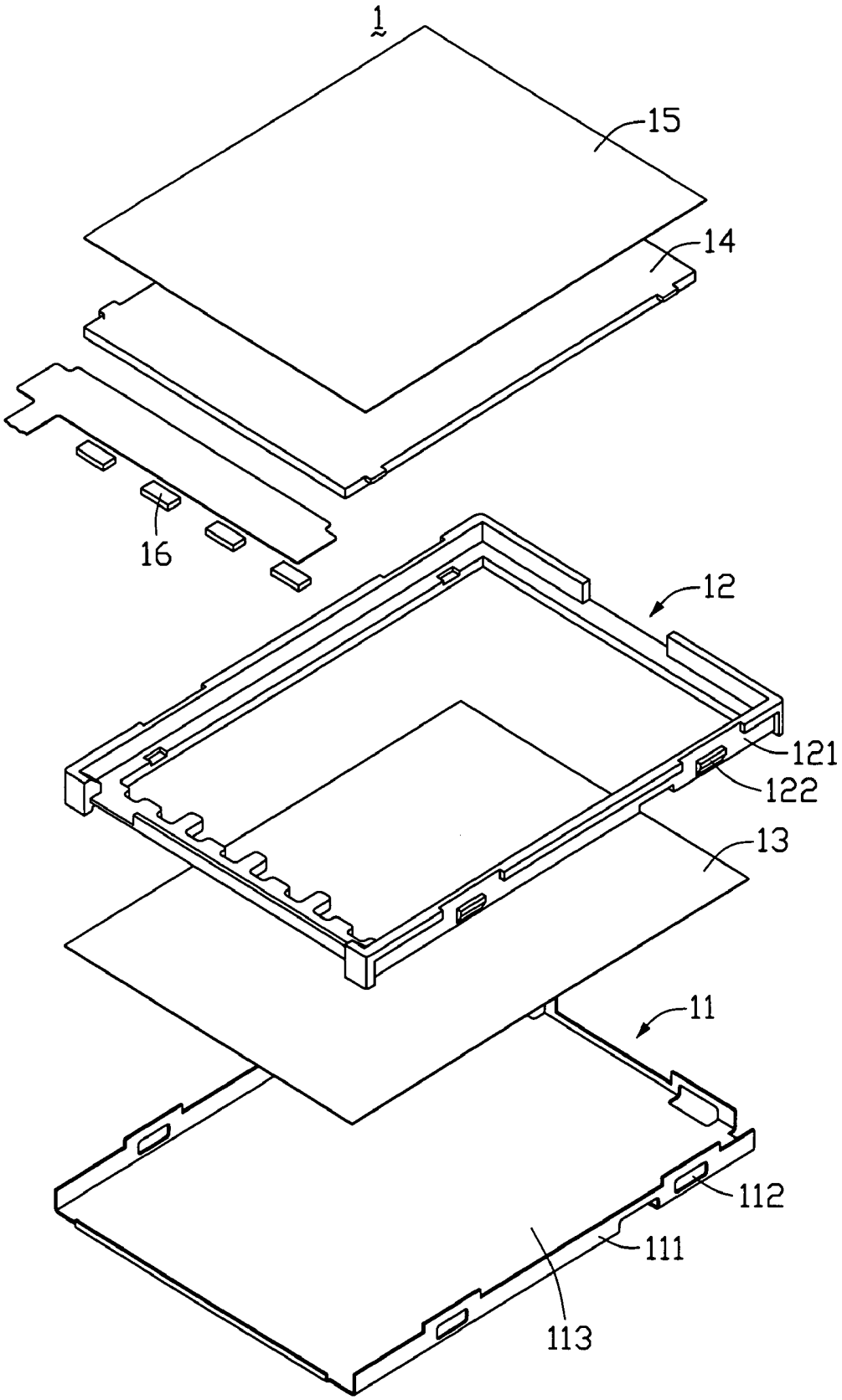


FIG. 5
(RELATED ART)

BACKLIGHT MODULE WITH INTEGRALLY MOLDED METAL BACK PLATE-FRAME AND LIQUID CRYSTAL DISPLAY USING THE SAME

FIELD OF THE INVENTION

[0001] The present invention relates to backlight modules and liquid crystal displays (LCDs) using backlight modules; and particularly to a backlight module with an integrally molded back plate and frame, and an LCD using the backlight module.

BACKGROUND

[0002] A typical LCD device includes a liquid crystal display panel, and a backlight module mounted under the liquid crystal display panel for supplying light beams thereto. Backlight modules can generally be classified into one of two types—direct types or edge types—according to the light source installation position in the backlight module's backlight unit.

[0003] Referring to FIG. **5**, a typical edge type backlight module **1** includes a metal back plate **11**, a frame **12**, a reflective plate **13**, a light guide plate **14**, and a diffusion sheet **15**. The metal back plate **11** includes an inner bottom surface **113**, and a plurality of sides **111** with a plurality of holding holes **112**. The frame **12** includes a plurality of sidewalls **121** with a plurality of catches **122** protruding outward from the sidewalls **121**. The frame **12** is arranged on the inner bottom surface **113**. The catches **122** engage in the holding holes **112**, thereby fastening the metal back plate **11** to the frame **12**. The combined metal back plate **11** and frame **12** accommodate the reflective plate **13**, the light guide plate **14**, and the diffusion sheet **15** in bottom-to-top order. A plurality of lamps **16** are arranged at one side of the light guide plate **14**.

[0004] In the backlight module **1**, the catches **122** and the holding holes **112** cooperate with each other to fasten the metal back plate **11** to the frame **12**. However, if the backlight module **1** undergoes collision or shock, the catches **122** may become separated from the holding holes **112**, and the frame **12** may thus become separated from the metal back plate **11**. Furthermore, if the frame **12** becomes even slightly separated from the metal back plate **11**, the reflective plate **13**, the light guide plate **14**, and the diffusion sheet **15** are liable to be displaced. This may in turn degrade the optical performance of the backlight module **1**.

[0005] What is needed, therefore, is a backlight module which has a compact and robust structure. What is also needed is an LCD utilizing such a backlight module.

SUMMARY

[0006] A backlight module includes a metal back plate and a frame formed together as a single body, a light guide plate having a light incident surface, and at least one light source arranged adjacent to the light incident surface. The combined metal back plate and frame defines a space accommodating the light guide plate and the at least one light source.

[0007] A liquid crystal display includes a display panel, and a backlight module positioned adjacent to the display panel. The backlight module includes a metal back plate and a frame formed together as a single body, a light guide plate having a light incident surface, and at least one light source arranged adjacent to the light incident surface. The combined metal back plate and frame defines a space accommodating the light guide plate and the at least one light source.

[0008] In the backlight module, the metal back plate and the frame are formed together as a single body, and thus the metal back plate and the frame are securely joined to each other. If the backlight module sustains collision or shock, the locations of the metal back plate and the frame remain unchanged relative to each other. Therefore, the light guide plate and the at least one light source are protected from displacement. Thus, unlike the above-described conventional backlight module, the backlight module including the integrally molded metal back plate and frame can maintain reliable optical performance even in rugged application environments or when an accident occurs. The liquid crystal display utilizing the backlight module has similar advantages.

[0009] Other advantages and novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present backlight module and liquid crystal display. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0011] FIG. **1** is an exploded, isometric view of a backlight module according to a first preferred embodiment of the present invention.

[0012] FIG. **2** is a cross-sectional view taken along line II-II of FIG. **1**.

[0013] FIG. **3** is an assembled view of the backlight module of FIG. **1**.

[0014] FIG. **4** is an exploded, isometric view of a liquid crystal display according to a second preferred embodiment of the present invention, the liquid crystal display using the backlight module of FIG. **1**.

[0015] FIG. **5** is an exploded, isometric view of a conventional backlight module.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] FIGS. **1** and **2** show a backlight module according to a first preferred embodiment of the present invention. The backlight module **2** includes an integrally molded metal back plate **21** and frame **22**, a reflective element **23**, a light guide plate **24**, and a diffusion sheet **25**. The metal back plate **21** and the frame **22** are integrally formed together as a single body, which defines a space for accommodating the reflective element **23**, the light guide plate **24**, and the diffusion sheet **25** in that order from bottom to top. The light guide plate **24** includes a light incident surface (not labeled) at a side edge thereof. A plurality of light sources **26** is arranged adjacent to the light incident surface. The metal back plate **21** may be made of aluminium. The frame **22** may be made of polycarbonate. The light sources **26** may be light

emitting diodes (LEDs). The light guide plate **24** may be made of poly-methyl meth-acrylate (PMMA).

[**0017**] Referring to FIG. **2**, the metal back plate **21** includes a pair of opposite inner side surfaces **211** (only one shown), and an inner bottom surface **212** between the inner side surfaces **211**. The frame **22** is closely joined to the metal back plate **21** in a manner such that the frame **22** contacts the inner side surfaces **211** and the inner bottom surface **212**. The frame **22** has a pair of opposite first sides **221** (only one shown) in contact with the inner side surfaces **211** respectively, and a pair of second sides **222** (only one shown) in contact with opposite lateral side portions of the inner bottom surface **212** respectively. Preferably, each of the first sides **221** is longer than the corresponding inner side surface **211**, with opposite enlarged ends of the first side **221** abutting and surrounding opposite ends of the metal back plate **21** at the inner side surface **211**. With this configuration, the metal back plate **21** is protected from deformation in the event of collision or shock. Each of the second sides **222** is much shorter than a corresponding width of the inner bottom surface **212**, so that the reflective element **23** can be large-sized and located on a major portion of the inner bottom surface **212** between the second sides **222**. The reflective element **23** can be a reflective sheet either substantially or almost completely covering the inner bottom surface **212**. The reflective element **23** is made of reflective metallic material, such as silver or aluminium.

[**0018**] The metal back plate **21** and the frame **22** can be integrally molded together using an insert molding method. The insert molding method generally includes steps where an insert body is positioned in a mold, material forming a covering body is injected into the mold, and the insert body and the covering body are then fused together, whereby the material of the insert body and the material of the covering body are joined together to create a single integrally molded body. The insert body may be a metal body or a plastic body, and the covering body may be a plastic body.

[**0019**] FIG. **3** shows an assembled view of the backlight module **2**. The reflective element **23**, the light guide plate **24**, the diffusion sheet **25**, and the light sources **26** are positioned in the space of the combined metal back plate **21** and frame **22**. In assembly of the backlight module **2**, the reflective element **23** is arranged on the inner bottom surface **212** of the metal back plate **21**. The light guide plate **24** is positioned on the reflective element **23**, and the light sources **26** are arranged adjacent to the light incident surface of the light guide plate **24**. The diffusion sheet **25** is positioned on the light guide plate **24**. When the backlight module **2** is fully assembled and operating, light beams from the light sources **26** pass through the light guide plate **24** with or without reflection by the reflective element **23**, exit a top surface of the light guide plate **24**, and are evenly diffused by the diffusion sheet **25**.

[**0020**] In summary, in the backlight module **2**, the integrally formed metal back plate **21** and frame **22** are securely joined to each other. If the backlight module **2** sustains collision or shock, the locations of the metal back plate **21** and the frame **22** remain unchanged relative to each other. Therefore the reflective element **23**, the light guide plate **24**, the diffusion sheet **25**, and the light sources **26** are protected from displacement. Thus unlike with the above-described conventional backlight module **1**, the backlight module **2** can maintain reliable optical performance even in rugged application environments or when an accident occurs.

[**0021**] FIG. **4** shows a liquid crystal display using the backlight module **2**. The liquid crystal display **300** includes a display panel **30**, and the backlight module **2** positioned under the display panel **30**. That is, the diffusion sheet **25** is positioned adjacent to the display panel **30**. The backlight module **2** provides an even light source for illuminating the display panel **30**. The backlight module **2** includes the integrally molded metal back plate **21** and frame **22**, and therefore can maintain reliable optical performance even if subjected to collision or shock. Accordingly, the liquid crystal display **300** using the backlight module **2** can provide reliable optical performance even in rugged application environments or when an accident occurs.

[**0022**] The backlight module of the present invention is not limited to the embodiments described above. For example, in an alternative embodiment, the light sources **26** may be replaced by one or more cold cathode fluorescent lamps (CCFLs). In another alternative embodiment, the reflective element **23** may be a reflective layer formed on the inner bottom surface **212** by way of electroplating or sputtering.

[**0023**] It is to be further understood that even though numerous characteristics and advantages of various embodiments have been set forth in the foregoing description, together with details of the structures and functions of the embodiments, the disclosure is illustrative only, and changes may be made in detail to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A backlight module, comprising:

a metal back plate and a frame formed together as a single body;

a light guide plate having a light incident surface; and

at least one light source arranged adjacent to the light incident surface;

wherein the combined metal back plate and frame defines a space accommodating the light guide plate and the at least one light source.

2. The backlight module as recited in claim 1, wherein the metal back plate and the frame are insert molded together.

3. The backlight module as recited in claim 1, further comprising a reflective element arranged between the frame and the light guide plate.

4. The backlight module as recited in claim 3, wherein the reflective element is made of reflective metallic material.

5. The backlight module as recited in claim 3, wherein the reflective element is a reflective sheet, or a reflective layer formed directly on the metal back plate.

6. The backlight module as recited in claim 1, wherein the metal back plate is made of aluminium.

7. The backlight module as recited in claim 1, wherein the frame is made of polycarbonate.

8. A liquid crystal display, comprising:

a display panel; and

a backlight module positioned adjacent to the display panel, the backlight module comprising:

a metal back plate and a frame formed together as a single body;

a light guide plate having a light incident surface; and

at least one light source arranged adjacent to the light incident surface;

wherein the combined metal back plate and frame defines a space accommodating the light guide plate and the at least one light source.

9. The liquid crystal display as recited in claim 8, wherein the metal back plate and the frame are insert molded together.

10. The liquid crystal display as recited in claim 8, further comprising a reflective element arranged between the frame and the light guide plate.

11. The liquid crystal display as recited in claim 10, wherein the reflective element is made of reflective metallic material.

12. The liquid crystal display as recited in claim 10, wherein the reflective element is a reflective sheet, or a reflective layer formed directly on the metal back plate.

13. The liquid crystal display as recited in claim 8, wherein the metal back plate is made of aluminium.

14. The liquid crystal display as recited in claim 8, wherein the frame is made of polycarbonate.

15. A backlight module, comprising:

a metal back plate and a frame integrally formed together as a single body;

a light guide plate having a light incident surface; and

at least one light source arranged adjacent to the light incident surface;

wherein a bottom of the frame is directly seated upon a top face of the metal back plate.

16. The backlight module as claimed in claim 15, wherein the combined metal back plate and frame defines a space accommodating the light guide plate and the at least one light source.

* * * * *

专利名称(译)	背光模块采用整体模制金属背板框架和使用其相同的液晶显示器		
公开(公告)号	US20070046859A1	公开(公告)日	2007-03-01
申请号	US11/510884	申请日	2006-08-28
[标]申请(专利权)人(译)	群创光电股份有限公司		
申请(专利权)人(译)	群创光电股份有限公司.		
当前申请(专利权)人(译)	群创光电		
[标]发明人	HUANG SIN TUNG CHEN YING CHIEH		
发明人	HUANG, SIN-TUNG CHEN, YING-CHIEH		
IPC分类号	G02F1/1335		
CPC分类号	G02B6/0055 G02B6/0086 G02B6/0088 G02F2201/503 G02F1/133308 G02F1/133615 G02F2001/133314 G02B6/0093		
优先权	094129262 2005-08-26 TW		
外部链接	Espacenet USPTO		

摘要(译)

示例性背光模块（2）包括作为单体一起形成的金属背板（21）和框架（22），具有光入射表面的导光板（24），以及邻近布置的多个光源（26）到光入射面。组合的金属背板和框架限定了容纳导光板和光源的空间。组合的金属背板和框架可以保护导光板和光源在发生碰撞或冲击时不会移位。因此，即使在恶劣的应用环境中或发生事故时，背光模块也可以保持可靠的光学性能。还提供了一种使用该背光模块的液晶显示器。