

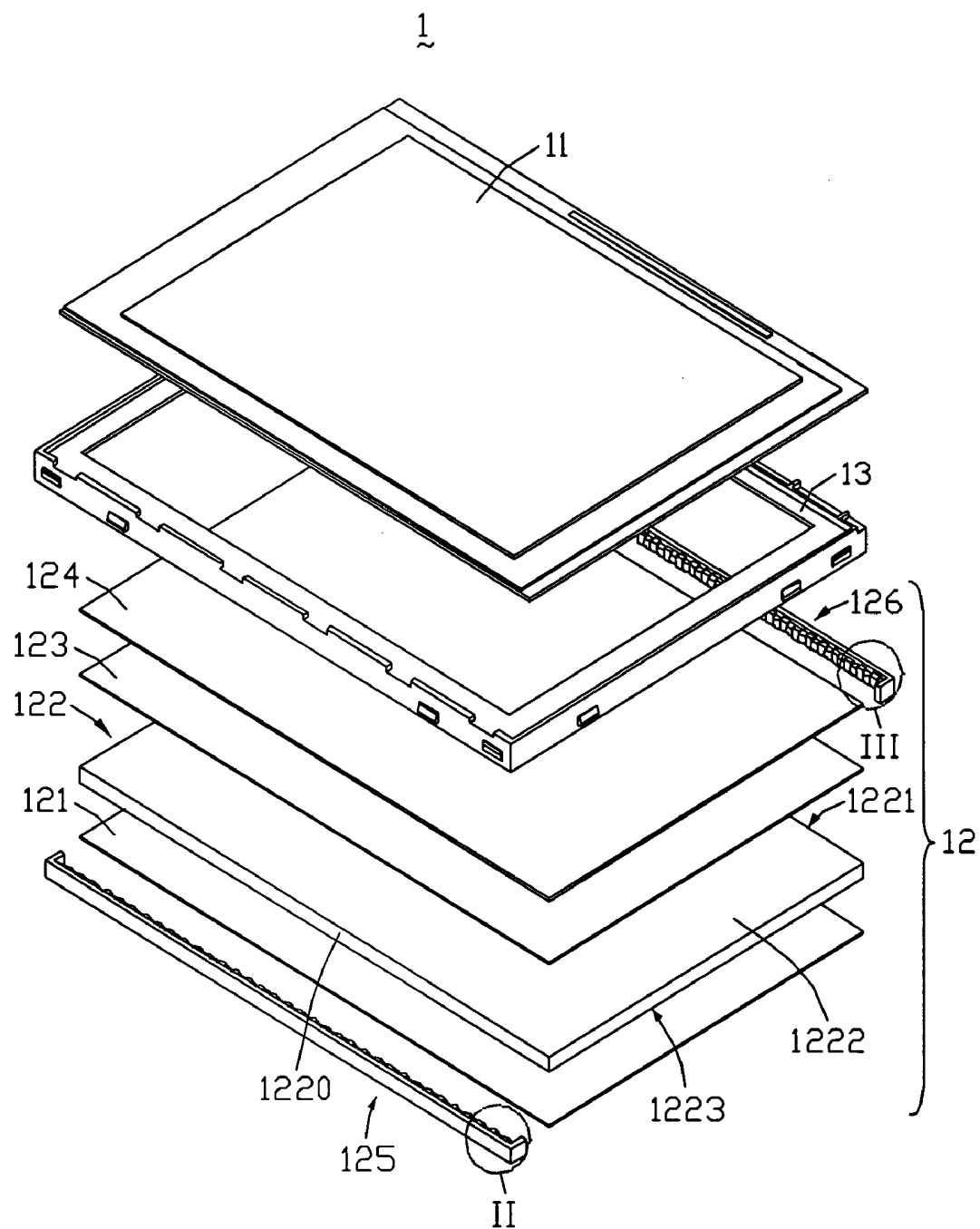


FIG. 1

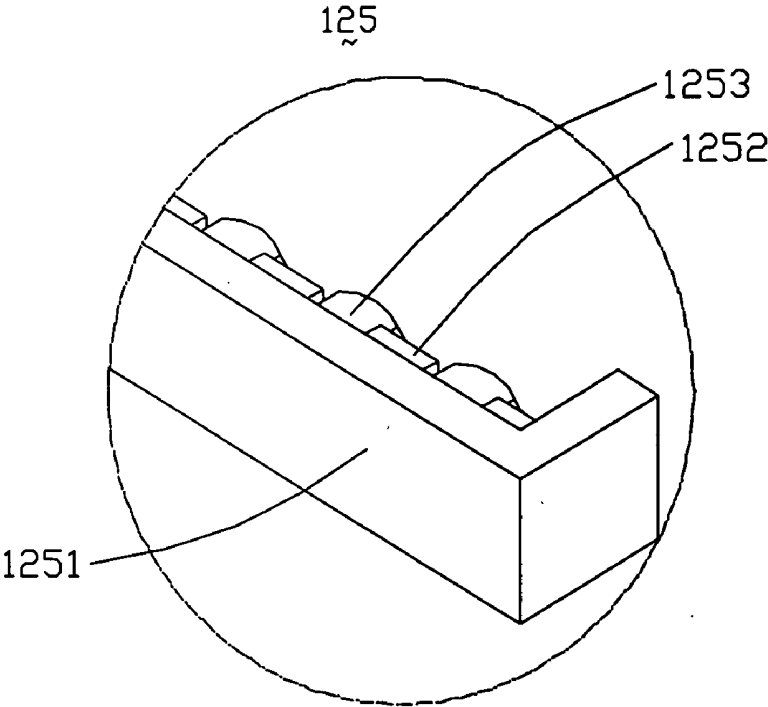


FIG. 2

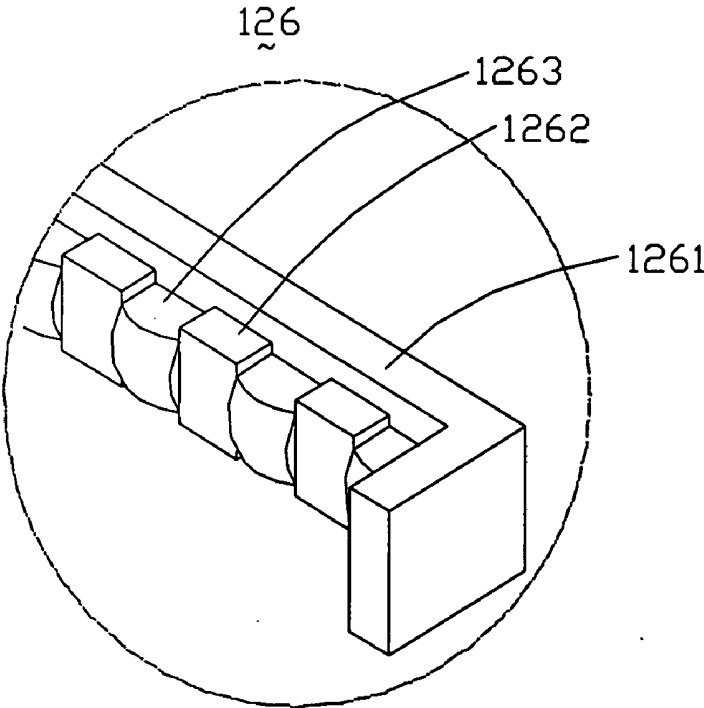


FIG. 3

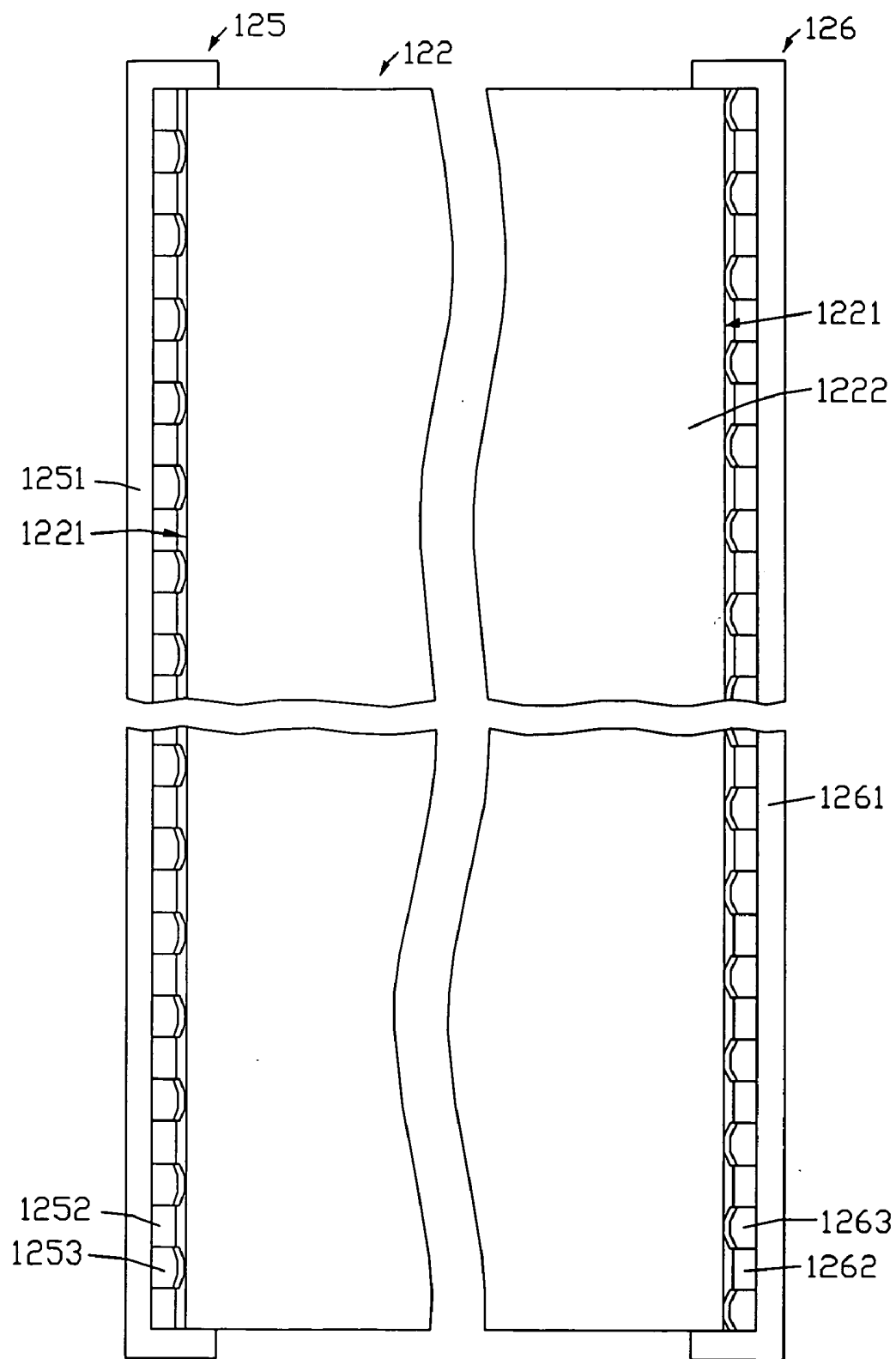


FIG. 4

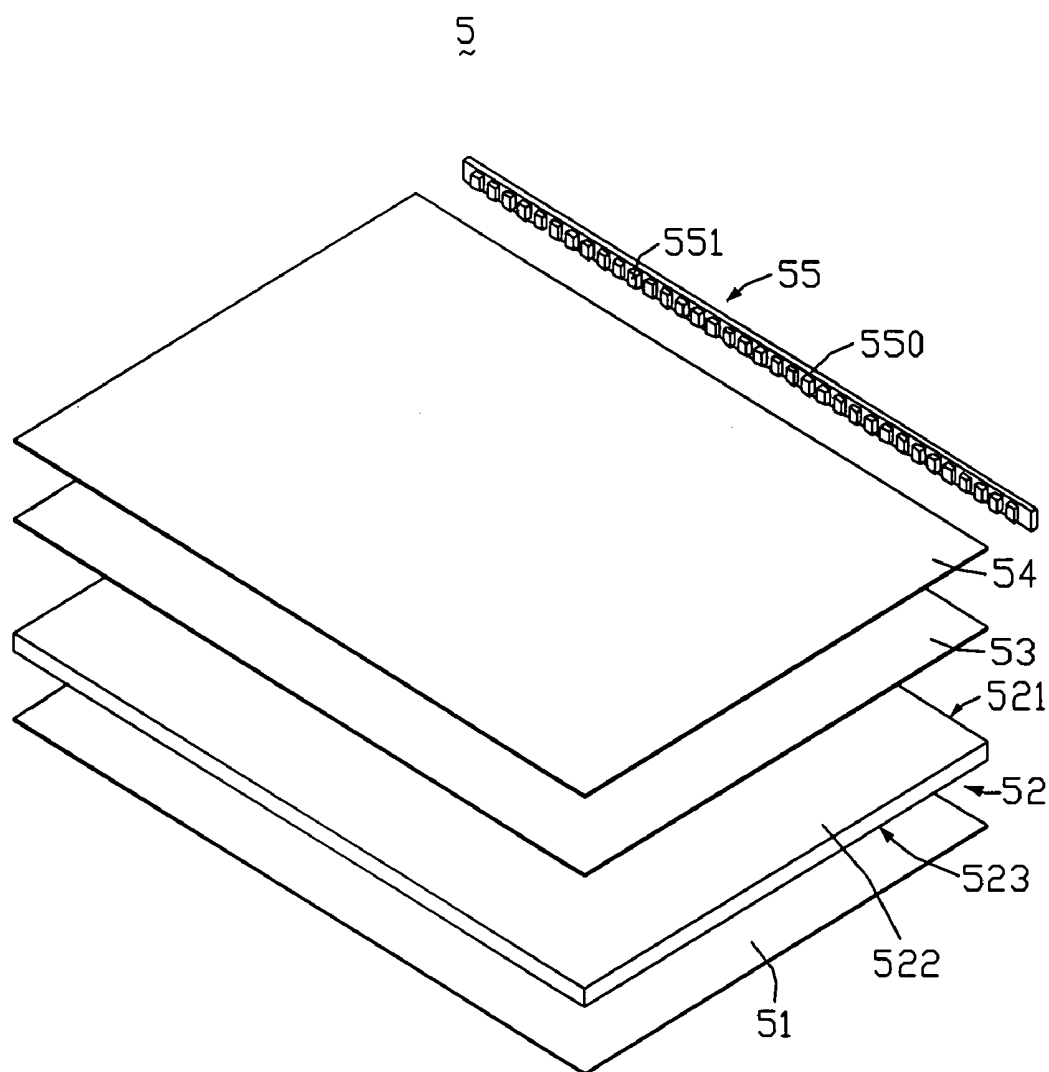


FIG. 5
(RELATED ART)

BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY WITH THE SAME

FIELD OF THE INVENTION

[0001] The present invention relates to backlight modules used in liquid crystal displays, and particularly relates to a backlight module having a plurality of light emitting diodes (LEDs) and a plurality of reflective elements disposed between the LEDs and a liquid crystal display using the backlight module.

GENERAL BACKGROUND

[0002] Liquid crystal displays are commonly used as display devices for compact electronic apparatuses, because they not only provide good quality images but are also very thin. Because liquid crystal molecules in a liquid crystal display do not emit any light themselves, the liquid crystal molecules have to be lit by a light source so as to clearly and sharply display text and images. Therefore, liquid crystal displays usually require a backlight module.

[0003] Referring to FIG. 5, a typical backlight module S includes a reflective film 51, a light guide plate 52, a diffusion film 53 and a brightness enhancement film (BEF) 54 arranged in that order from bottom to top, and a light source 55. The light guide plate 52 includes a light incident surface 521, a light emitting surface 522 perpendicularly adjoining the light incident surface 521 and a bottom surface 523 opposite to the light emitting surface 522. The light source 55 is disposed adjacent to the light incident surface 521 of the light guide plate 52. The reflective film 51 is disposed below the bottom surface 523 of the light guide plate 52. The light source 55 includes a supporting plate 550 and a plurality of LEDs 551 disposed on the supporting plate 550.

[0004] In operation, light beams from the LEDs 551 enter the light guide plate 52 through the light incident surface 521, and penetrate in the light guide plate 52. A majority of the light beams emit out from the light emitting surface 522. A minority of the light beams emit out from the bottom surface 523 and reach the reflective film 51. These light beams are reflected by the reflective film 51 and are utilized again. These light beams enter the light guide plate 52 again through the bottom surface 523, and emit out from the light emitting surface 522. Then, light beams transmit through the diffusion film 53 and the BEF 54 and become uniform.

[0005] However, each of the LEDs 551 has a certain limited angle of divergence of light beams emitted therefrom. Therefore areas adjacent to the light incident surface 521 of the light guide plate 52 beyond the angles of divergence of the LEDs 551 may be relatively dark. That is, light beams emitted from the backlight module 5 may be non-uniform, and the performance of an associated LCD may be impaired.

[0006] What is needed, therefore, is a backlight module that can overcome the above-described deficiencies. What is also needed is a liquid crystal display having such backlight module.

SUMMARY

[0007] In one preferred embodiment, a backlight module includes a light guide plate, a first light source and a second light source. The first light source includes a plurality of first light emitting diodes and a plurality of first reflective members. The second light source includes a plurality of second light emitting diodes and a plurality of second reflective members. The light guide plate includes a first light incident

surface and a second light incident surface opposite to the first light incident surface. The first light source and the second light source are provided adjacent to the first light incident surface and the second light incident surface, respectively. The first light emitting diodes face the second reflective members, and the second light emitting diodes face the first reflective members.

[0008] Other novel features, advantages and aspects will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is an exploded, isometric view of a liquid crystal display according to a preferred embodiment of the present invention, the liquid crystal display including a first light source, a second light source and a light guide plate.

[0010] FIG. 2 is an enlarged view of a circle portion II of FIG. 1.

[0011] FIG. 3 is an enlarged view of a circle portion III of FIG. 1.

[0012] FIG. 4 is an enlarged, assembled view of part of the first light source, the second light source and the light guide plate.

[0013] FIG. 5 is an exploded, isometric view of a conventional backlight module.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0014] Reference will now be made to the drawings to describe the preferred embodiments in detail.

[0015] Referring to FIG. 1, a liquid crystal display 1 according to a preferred embodiment of the present invention is shown. The liquid crystal display 1 includes a liquid crystal panel 11, a backlight module 12 adjacent to the liquid crystal panel 11 and a plastic frame 13. The plastic frame 13 defines a space to accommodate the liquid crystal panel 11 and the backlight module 12.

[0016] The backlight module 12 includes a reflective film 121, a light guide plate 122, a diffusion film 123 and a brightness enhancement film (BEF) 124 arranged in that order from bottom to top, a first light source 125 and a second light source 126. The light guide plate 122 includes a first light incident surface 1220, a second light incident surface 1221 opposite to the first light incident surface 1220, a light emitting surface 1222 perpendicularly adjoining the first light incident surface 1220 and the second light incident surface 1221, and a bottom surface 1223 opposite to the light emitting surfaces 1222. The first light source 125 is disposed adjacent to the first light incident surface 1220. The second light source 126 is disposed adjacent to the second light incident surface 1221.

[0017] Referring also to FIG. 2, the first light source 125 includes a first supporting plate 1251, a plurality of first light emitting diodes (LEDs) 1252 and a plurality of first reflective elements 1253. The first supporting plate 1251 is substantially U-shaped. The first LEDs 1252 and the first reflective elements 1253 are arranged alternately on the first supporting plate 1251. The first reflective elements 1253 have convex-shaped surfaces facing the first light incident surfaces 1220.

[0018] Referring also to FIG. 3, the second light source 126 includes a second supporting plate 1261, a plurality of second LEDs 1262 and a plurality of second reflective elements 1263. The second supporting plate 1261 is substantially

U-shaped. The second LEDs **1262** and the second reflective elements **1263** are alternately arranged on the supporting plate **1261**. The second reflective elements **1263** have convex-shaped surfaces facing the second light incident surface **1221**.

[0019] The first reflective elements **1253** and the second reflective elements **1263** are both made of materials with a high reflective ratio. The first reflective elements **1253** and the first supporting plate **1251** can be integrally made as one piece. The second reflective elements **1263** and the second supporting plate **1262** can be integrally made as one piece.

[0020] Referring to FIG. 4, the first light source **125** and the second light source **126** are disposed adjacent to the first light incident surface **1220** and the second light incident surface **1221**, respectively. The first reflective elements **1253** of the first light source **125** face the second LEDs **1262** of the second light source **126**, respectively. The second reflective elements **1263** of the second light source **126** face the first LEDs **1252** of the first light source **125**, respectively.

[0021] In operation, light beams emitted from the first LEDs **1252** enter the light guide plate **122** through the first light incident surface **1220**, and penetrate in the light guide plate **122**. A majority of the light beams emit out from the light emitting surface **1222**. A minority of the light beams emit out from the bottom surface **1223**. These light beams are reflected by the reflective film **121** and are utilized again. Another minority of light beams emit out from the second light incident surface **1221**, and reach the second reflective elements **1263** of the second light source **126**. These light beams are reflected by the second reflective elements **1263** with a certain angle of divergence. These light beams enhance the brightness in the areas between every two adjacent second LEDs **1262**.

[0022] Similarly, light beams emitted by the second LEDs **1262** enter the light guide plate **122** through the second light incident surface **1221**, and are converted by the light guide plate **122**. A majority of the light beams emit out from the light emitting surface **1222**. A minority of the light beams emit out from the bottom surface **1223**. These light beams are reflected by the reflective film **121** and are utilized again. Another minority of the light beams emit out from the first light incident surface **1220**, and reach the first reflective elements **1253** of the second light source **125**. These light beams are reflected by the first reflective elements **1253** with a certain angle of divergence. These light beams enhance the brightness in the areas between every adjacent two first LEDs **1252**.

[0023] The light beams reflected by the first reflective elements **1253** and the second reflective elements **1263** thus penetrate in the light guide plate **122**, and emit out from the light emitting surface **1222**. Then the light beams transmit through the diffusion film **123** and the BEF **124** and become uniform.

[0024] Unlike conventional liquid crystal displays, the liquid crystal display **1** includes a first light source **125** and a second light source **126** provided adjacent to the two opposite first light incident surface **1220** and second light incident surface **1221** of the light guide plate **122**. The first light source **125** includes the first reflective elements **1253** sandwiched between the first LEDs **1252**. The second light source **126** includes the second reflective elements **1263** sandwiched between the second LEDs **1262**. The first LEDs **1252** face the second reflective elements **1263**, and the second LEDs **1262** face the first reflective elements **1253**. Light beams reflected by first reflective elements **1253** and the second reflective

elements **1263** enhance the brightness and the uniformity in areas between every two first LEDs **1252** or every two second LEDs **1262**. Thus, despite of a certain limited angle of divergence of light beams emitted by the first LEDs **1252** and the second LEDs **1262**, the light beams emitted from the light guide plate **122** are uniform. Therefore, a brightness and a uniformity of the backlight module **12** are improved, and a display quality of the liquid crystal display **1** is improved.

[0025] Further or alternative embodiments may include the following. In a first example, the first reflective elements and the second reflective elements can have wave-shaped surfaces facing a light guide plate. In a second example, the first reflective elements and the second reflective elements can have V-shaped surfaces facing a light guide plate. In still a third example, a first supporting plate and a second supporting plate each includes a plurality of protrusions extending toward a light guide plate. In such case, a plurality of reflective films are attached to the protrusions to function as reflective elements.

[0026] It is to be understood, however, that even though numerous characteristics and advantages of the present embodiments have been set out 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, especially in matters of shape, size, and arrangement of parts within the principles of the invention 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 light guide plate comprising a first light incident surface and a second light incident surface opposite to the first light incident surface;
- a first light source provided adjacent to the first light incident surface, the first light source comprising a plurality of first light emitting diodes and a plurality of first reflective members; and
- a second light source provided adjacent to the second light incident surface, the second light source comprising a plurality of second light emitting diodes facing the first reflective members and a plurality of second reflective members facing the first light emitting diodes.

2. The backlight module as claimed in claim 1, wherein each of the first reflective members and the second reflective members comprises a convex-shaped surface facing the light guide plate.

3. The backlight module as claimed in claim 1, wherein each of the first reflective members and the second reflective members comprises a wave-shaped surface facing the light guide plate.

4. The backlight module as claimed in claim 1, wherein each of the first reflective members and the second reflective members comprises a V-shaped surface facing the light guide plate.

5. The backlight module as claimed in claim 1, wherein the first light source further comprises a first supporting plate, and the first light emitting diodes and the first reflective members are provided alternately on the first supporting plate.

6. The backlight module as claimed in claim 5, wherein every two adjacent first light emitting diodes are spaced by one first reflective member.

7. The backlight module as claimed in claim 5, wherein the first reflective members and the first supporting plate are made integrally as one piece.

8. The backlight module as claimed in claim 5, wherein the second light source further comprises a second supporting plate, and the second light emitting diodes and the second reflective members are provided alternately on the second supporting plate.

9. The backlight module as claimed in claim 8, wherein every two adjacent second light emitting diodes are spaced by one second reflective member.

10. The backlight module as claimed in claim 8, wherein the second reflective members and the second supporting plate are made integrally as one piece.

11. The backlight module as claimed in claim 8, wherein the first supporting plate and the second supporting plate comprise a plurality of protrusions extending toward the light guide plate, each of protrusions being sandwiched between every adjacent two light emitting diodes, the first reflective members and the second reflective members being a plurality of reflective films attached to the protrusions.

12. A backlight module comprising:

a light guide plate comprising two light incident surfaces opposite to each other;

a first light source comprising a plurality of first light emitting regions and a plurality of first reflecting regions provided adjacent to one light incident surface of the light guide plate, and

a second light source comprising a plurality of second light emitting regions and a plurality of reflecting regions provided adjacent to another light incident surface of the light guide plate, the second light emitting regions facing the first reflecting regions, the second reflecting regions facing the first light emitting regions.

13. The backlight module as claimed in claim 12, wherein the first light emitting regions and the first reflecting regions are arranged alternately.

14. The backlight module as claimed in claim 12, wherein the second light emitting regions and the second reflecting regions are arranged alternately.

15. The backlight module as claimed in claim 12, wherein each of the first reflecting regions and the second reflecting regions comprises a convex-shaped surface or a wave-shaped surface or a V-shaped surface facing the light guide plate.

16. The backlight module as claimed in claim 12, wherein each of the first reflecting regions and the second reflecting regions comprises a reflecting film facing the light guide plate.

17. A liquid crystal display comprising a liquid crystal panel and a backlight module facing the liquid crystal panel, the backlight module comprising:

a light guide plate comprising a first light incident surface and a second light incident surface opposite to the first light incident surface;

a first light source provided adjacent to the first light incident surface, the first light source comprising a plurality of first light emitting diodes and a plurality of first reflective members; and

a second light source provided adjacent to the second light incident surface, the second light source comprising a plurality of second light emitting diodes facing the first reflective members and a plurality of second reflective members facing the first light emitting diodes.

18. The liquid crystal display as claimed in claim 17, wherein each of the first reflective members and the second reflective members comprises a convex-shaped surface facing the light guide plate.

19. The liquid crystal display as claimed in claim 17, wherein each of the first reflective members and the second reflective members comprises a wave-shaped surface facing the light guide plate.

20. The liquid crystal display as claimed in claim 17, wherein the first light source further comprises a first supporting plate, and the first light emitting diodes and the first reflective members are provided alternately on the first supporting plate.

* * * * *

专利名称(译)	背光模块与液晶显示器相同		
公开(公告)号	US20080158477A1	公开(公告)日	2008-07-03
申请号	US12/005844	申请日	2007-12-28
[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	HSIAO CHIH CHUNG		
发明人	HSIAO, CHIH-CHUNG		
IPC分类号	G02F1/1335 F21V7/04		
CPC分类号	G02B6/0031 G02B6/0091 G02B6/0068		
优先权	095223099 2006-12-29 TW		
其他公开文献	US8159631		
外部链接	Espacenet USPTO		

摘要(译)

示例性背光模块 (1) 包括导光板 (122) , 第一光源 (125) 和第二光源 (126) 。第一光源包括第一发光二极管 (1252) 和第一反射构件 (1253) 。第二光源包括第二发光二极管 (1262) 和第二反射构件 (1263) 。导光板包括第一光入射表面 (1220) 和与第一光入射表面相对的第二光入射表面 (1221) 。第一光源和第二光源分别与第一光入射表面和第二光入射表面相邻设置。第一发光二极管面对第二反射构件 , 第二发光二极管面对第一反射构件。

