



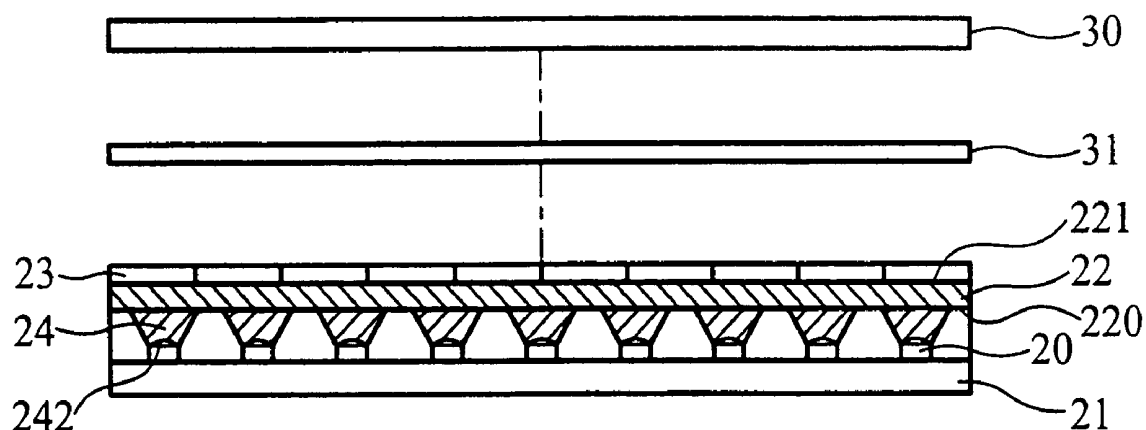
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(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0200773 A1**
Chang (43) **Pub. Date: Sep. 15, 2005**(54) **BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY DEVICE****Publication Classification**(51) **Int. Cl.⁷** **G02F 1/1335**(52) **U.S. Cl.** **349/64**(75) **Inventor: Yi-Hui Chang, Hsinchu City (TW)**

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LOS ANGELES, CA 90071 (US)**(73) **Assignee: Toppoly Optoelectronics Corp.**(21) **Appl. No.: 10/799,502**(22) **Filed: Mar. 11, 2004**(57) **ABSTRACT**

An apparatus of a backlight module and a liquid crystal display. The apparatus includes a plurality of point light sources and a light guide plate. The plurality of point light sources is positioned on a base plate. The light guide plate has a first surface and a second surface parallel to the first surface. The first surface of the light guide plate has a plurality of convex structures corresponding to the point light sources, every convex structure has a distal end portion, and an arc-shaped recess formed therein.

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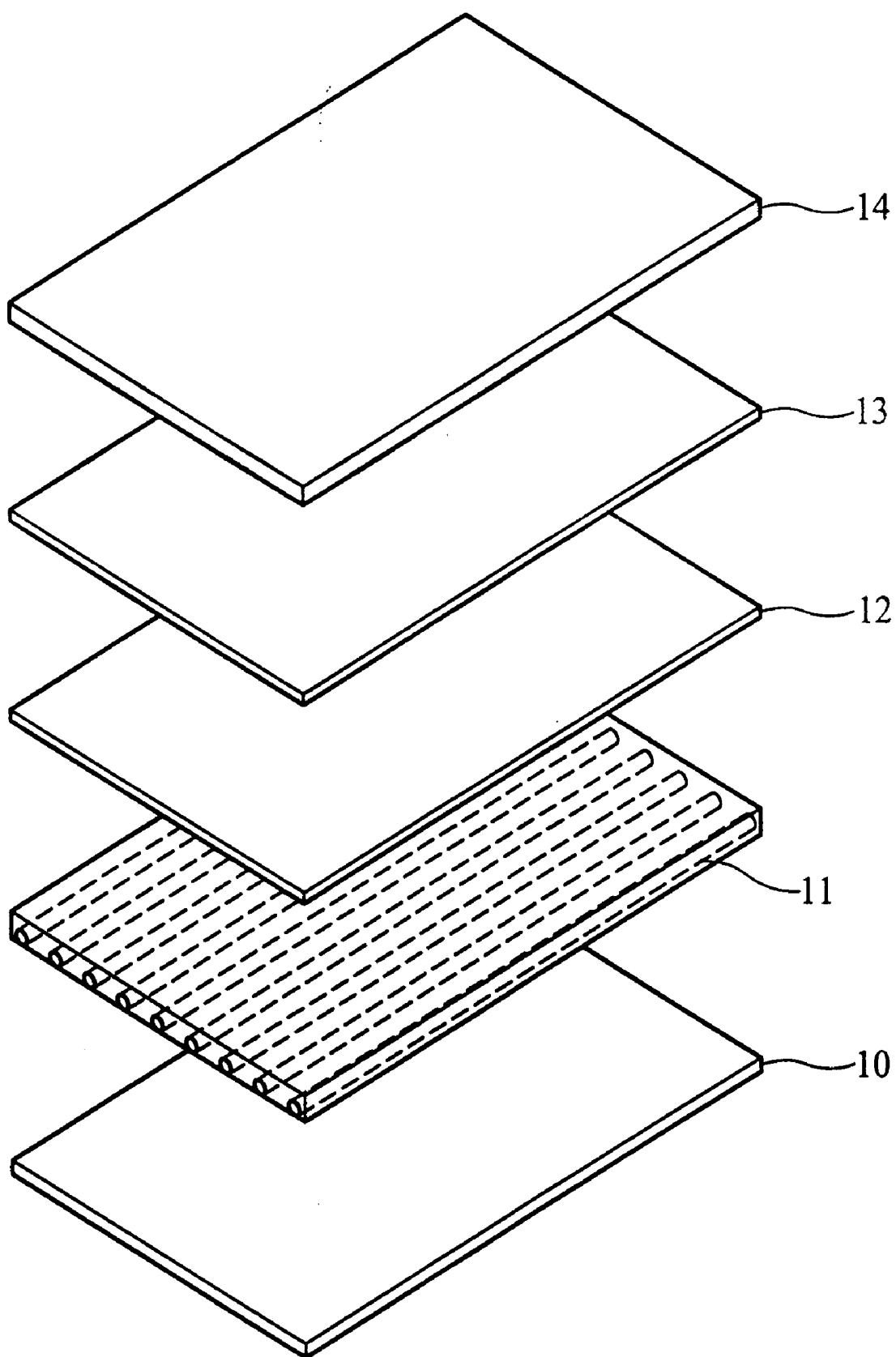


FIG. 1 (RELATED ART)

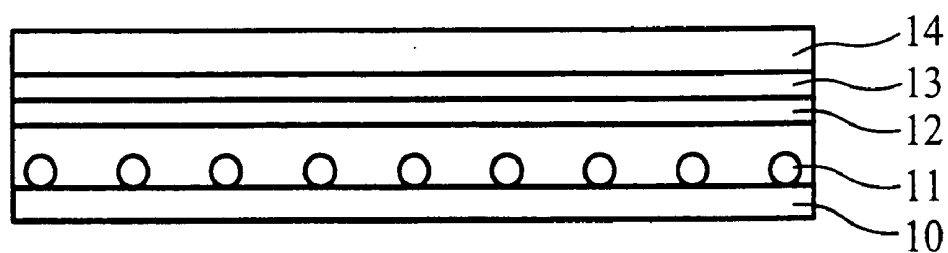


FIG. 2 (RELATED ART)

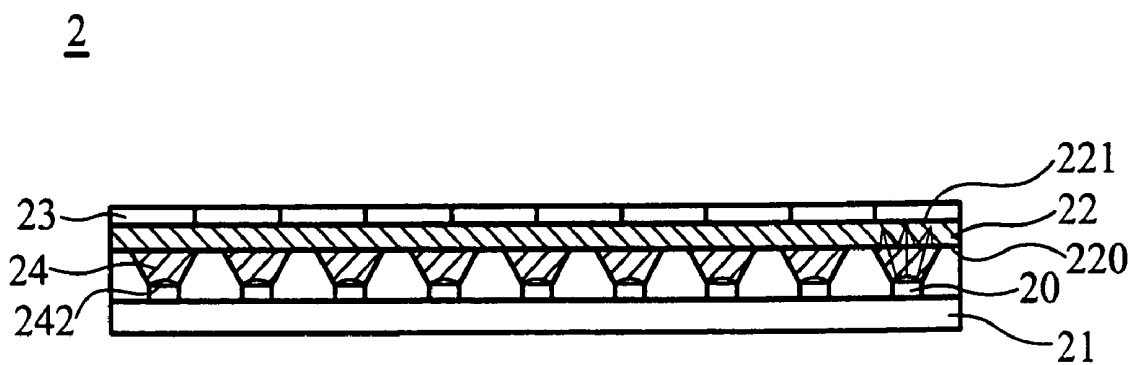


FIG. 3

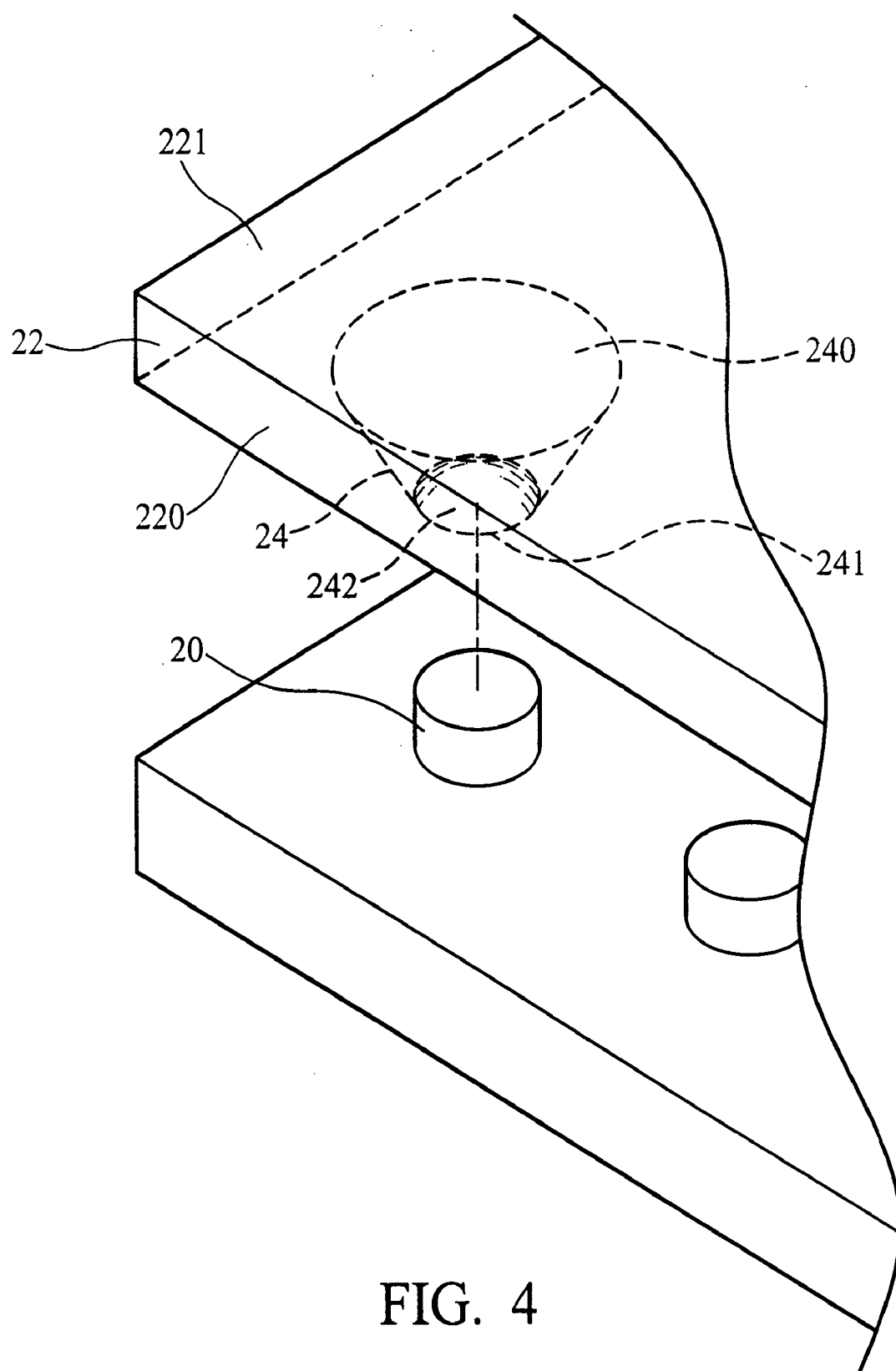


FIG. 4

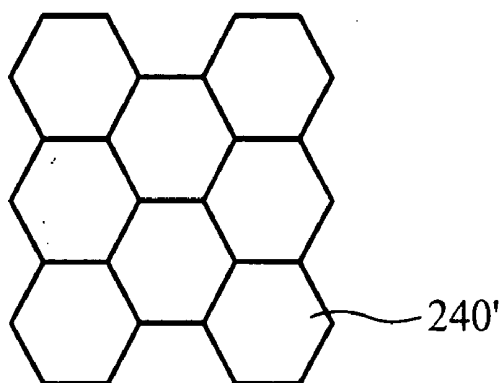


FIG. 5a

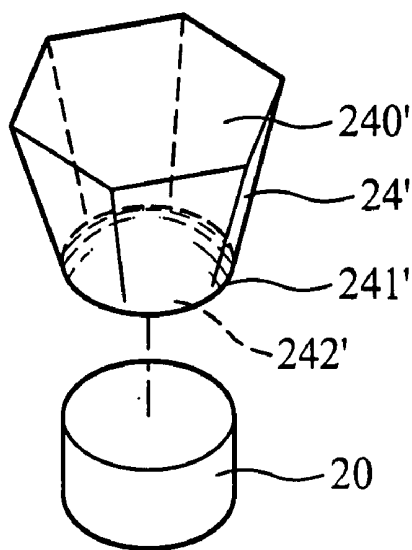


FIG. 5b

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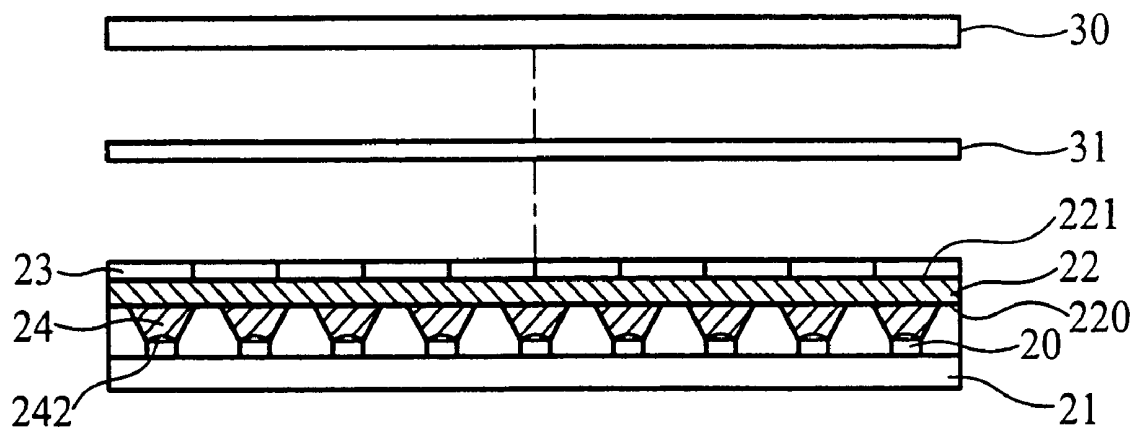


FIG. 6

BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a backlight module and especially a backlight module for use in a liquid crystal display (LCD) device.

[0003] 2. Description of the Related Art

[0004] Recently, liquid crystal displays (LCD) have replaced cathode ray tube (CRT) displays in the mainstream market, due to lower output radiation and thin profile. Generally speaking, cold cathode fluorescent lamps (CCFLs) are used as light sources in traditional LCD backlight modules.

[0005] FIG. 1 shows an exploded view of the traditional backlight module. The backlight module is disposed below an LCD panel 14. The traditional backlight module includes a reflector 10, a plurality of CCFLs 11, a light guide plate 12, and a diffusion sheet 13. FIG. 2 is a combined view. Light emitted by the CCFL is bounced off the reflector 10 and exits the backlight module through the diffusion sheet 13 providing light to the LCD panel 14.

[0006] In conventional backlight modules, a gap exists between the lamps 11 and the light guide plate 12 to increase uniformity of emitted light, resulting in increased thickness of the entire backlight module. Further, overall brightness is altered with respect to disposition of the lamps on the light guide plate 12 adjacent to the liquid crystal panel, resulting in a bright and dark line changes. To prevent this problem, a diffusion sheet with high brume must be employed, this, however, results in reduced illumination.

SUMMARY OF THE INVENTION

[0007] Accordingly, an object of the invention is to provide an apparatus of a backlight module, the backlight module includes a plurality of point light sources and a light guide plate. The plurality of point light sources is positioned on a base plate. The light guide plate has a first surface and a second surface parallel to the first surface. The first surface of the light guide plate has a plurality of convex structures corresponding to the point light sources, every convex structures has a distal end portion, and an arc-shaped recess is formed at the distal end portion of the convex structure.

[0008] The light guide plate with convex structures using LEDs as a light source, of the present invention eliminates the distance between the LEDs and the light guide plate, thus reducing the thickness of the entire backlight module. Additionally, brightness uniformity increases, and a diffusion sheet with lower diffusivity can be used, thus increasing illumination intensity over the entire diffusion sheet.

[0009] A detailed description is given in the following embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention is more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

[0011] FIG. 1 shows an exploded view of the traditional backlight module;

[0012] FIG. 2 is a combination view of the traditional backlight module;

[0013] FIG. 3 is a cross section view of the present invention;

[0014] FIG. 4 is a partially enlarged view illustrating a convex structure of the backlight module of the present invention;

[0015] FIG. 5a is plan view illustrating a convex structure of the backlight module according to another embodiment of the present invention;

[0016] FIG. 5b is a perspective view showing the convex structure in FIG. 5a of the present invention;

[0017] FIG. 6 is a plane view of the liquid crystal display device of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] FIG. 3 is a cross-section of the present invention. In the present invention, the backlight module includes plurality of LEDs 20 and a light guide plate 22.

[0019] The LEDs 20 serve as point light sources and are arrayed on a base plate 21. The light guide plate 22 is made of polymethylmethacrylate (PMMA) or polycarbonate (PC) and has a first surface 220 and a second surface 221 parallel to the first surface 220. Wherein the first surface 220 has a plurality of convex structures 24 corresponding to the LEDs 20, as shown in FIG. 4, the convex structure 24 is formed in a flat frustum shape or truncated cone shape, and the convex structure 24 has a proximal end portion 240 and a distal end portion 241, wherein the cross section area of the proximal end portion 240 is larger than the cross section area of the distal end portion 241. Furthermore, there is an arc-shaped recess 242 formed at the distal end portion 241 of the convex structure 24, to increase light diffusion uniformity. The light guide plate 22 also has a light guide pattern 23 (shown in FIG. 3) on a second surface 221, which may be jagged or uneven. Thus emitted light reaches the first surface 220, enters the light-guide plate 22 through the second surface 221, and exits from the light guide pattern 23, the increasing brightness uniformity.

[0020] As shown in FIG. 4, the cross section of the proximal end portion 240 is circular, and the cross section of the distal end portion 241 is a smaller circle, in the invention, however, the shape of the cross section of the proximal end portion 240 or the distal end portion 241 can comprise other shapes, such as a hexagon-shape as shown in FIGS. 5a and 5b or other polygon-shapes.

[0021] FIG. 5a and FIG. 5b shows another embodiment of the convex structure 24', wherein the cross section of the proximal end portion 240' is hexagonal, the cross section of the distal end portion 241' is circular, and the section of the distal end portion 241' is smaller than the proximal end portion 240'. There is also an arc-shaped recess 242' formed at the distal end portion 241' of the convex structure 24'.

[0022] FIG. 6 shows a perspective view of the liquid crystal display device 3 of the present invention. The liquid crystal display device 3 comprises a LCD panel 30, a

diffusion sheet **31**, a light guide plate **22**, and a plurality of LEDs **20**. Wherein the light guide plate **22** and the LEDs **20** are the same as previously described, hence their description is omitted here. The diffusion sheet **31** is disposed on the light guide plate **22**, and the LCD panel **30** is disposed on the light guide plate **22**. The diffusion sheet **31** increases brightness uniformity. Light emitted from the LEDs **20**, reaches the light guide plate **22**, enters the diffusion sheet **31**, and exits the LCD panel **30**.

[0023] As previously described, by using LEDs **20** as a light source and employing a convex structure **24** in the light guide plate, the distance between the LEDs and the light guide plate is reduced or even eliminated, thereby reducing overall thickness, increasing brightness uniformity, reducing required diffusivity of the diffusion sheet and increasing illumination intensity over the entire diffusion sheet.

[0024] While the invention has been described by way of example and in terms of the preferred embodiments, it is as understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A backlight device, comprising:

a plurality of point light sources positioned on a base plate; and

a light guide plate having a first surface and a second surface parallel to the first surface, wherein the first surface has a plurality of convex structures corresponding to the point light sources, and a recess is formed therein.

2. The backlight device according to claim 1, wherein the recess is an arc-shaped recess.

3. The backlight device as claimed backlight device according to claim 1, wherein the plurality of point light sources are light emitting diodes.

4. The backlight device as claimed backlight device according to claim 1, wherein the convex structure is formed in a flat frustum shape or truncated cone shape.

5. The backlight device according to claim 1, wherein the convex structure has a proximal end portion and a distal end portion, wherein the cross section of the proximal end portion and the cross section of the distal end portion are circular, and the section of the distal end portion is smaller than the proximal end portion.

6. The backlight device according to claim 1, wherein the convex structure has a proximal end portion and a distal end portion, wherein the cross section of the proximal end portion is hexagonal, the cross section of the distal end portion is circular, and the section of the distal end portion is smaller than the proximal end portion.

7. The backlight device according to claim 1, further comprising:

a diffusion film disposed on the first surface of the light guide plate.

8. The backlight device according to claim 1, further comprising a light guide pattern formed on the second surface of the light guide plate, wherein the light guide pattern is jagged or uneven.

9. The backlight device according to claim 1, wherein the material of the light guide plate is selected from: polymethylmethacrylate (PMMA), polycarbonate (PC) and the combination thereof.

10. A liquid crystal display device, comprising:

a plurality of point light sources positioned on a base plate;

a light guide plate having a first surface and a second surface parallel to the first surface, wherein the first surface has a plurality of convex structures corresponding to the point light sources, wherein a recess formed therein;

a diffusion film disposed on the first surface of the light guide plate; and

an LCD panel disposed on the diffusion film.

11. The backlight device according to claim 10, wherein the recess is an arc-shaped recess.

12. The backlight device according to claim 10, wherein the plurality of point light sources are light emitting diodes.

13. The backlight device according to claim 10, wherein the convex structure is formed in a flat frustum shape or truncated cone shape.

14. The backlight device according to claim 10, wherein the convex structure has a proximal end portion and a distal end portion, wherein the cross section of the proximal end portion and the cross section of the distal end portion are circular, and the section of the distal end portion is smaller than the proximal end portion.

15. The backlight device according to claim 10, wherein the convex structure has a proximal end portion and a distal end portion, wherein the cross section of the proximal end portion is hexagonal, the cross section of the distal end portion is circular, and the section of the distal end portion is smaller than the proximal end portion.

16. The backlight device according to claim 10, further comprising a light guide pattern formed on the second surface of the light guide plate, wherein the light guide pattern is jagged or uneven.

17. The backlight device according to claim 10, wherein the material of the light guide plate is selected from: polymethylmethacrylate (PMMA), polycarbonate (PC) and the combination thereof.

18. A light guide plate, comprising:

a first surface and a second surface parallel to the first surface, wherein the first surface has a plurality of convex structures, and a recess is formed therein.

19. The light guide plate according to claim 18, further comprising a plurality of light sources formed below the first surface, and every light source is emitted to a corresponding convex structure, wherein the plurality of point light sources are light emitting diodes.

20. The light guide plate according to claim 18, wherein the recess is an arc-shaped recess.

21. The light guide plate according to claim 18, wherein the convex structure is formed in a flat frustum shape or a truncated cone shape.

22. The light guide plate according to claim 18, wherein the convex structure has a proximal end portion and a distal

end portion, wherein the cross section of the proximal end portion and the cross section of the distal end portion are circular, and the section of the distal end portion is smaller than the proximal end portion.

23. The light guide plate accordind to claim 18, wherein the convex structure has a proximal end portion and a distal end portion, wherein the cross section of the proximal end portion is hexagonal, the cross section of the distal end portion is circular, and the section of the distal end portion is smaller than the proximal end portion.

24. The light guide plate accordind to claim 18, further comprising:

a diffusion film disposed on the first surface of the light guide plate.

25. The light guide plate accordind to claim 18, wherein the material of the light guide plate is selected from: polymethylmethacrylate (PMMA), polycarbonate (PC) and the combination thereof.

26. The light guide plate accordind to claim 18, further comprising a light guide pattern formed on the second surface of the light guide plate, wherein the light guide pattern is jagged or uneven.

* * * * *

专利名称(译)	背光模块和液晶显示装置		
公开(公告)号	US20050200773A1	公开(公告)日	2005-09-15
申请号	US10/799502	申请日	2004-03-11
[标]申请(专利权)人(译)	统宝光电股份有限公司		
申请(专利权)人(译)	统宝光电股份有限公司.		
当前申请(专利权)人(译)	群创光电		
[标]发明人	CHANG YI HUI		
发明人	CHANG, YI-HUI		
IPC分类号	G02F1/1335		
CPC分类号	G02F1/133603 G02B6/0021		
其他公开文献	US7463315		
外部链接	Espacenet USPTO		

摘要(译)

一种背光模组和液晶显示器的装置。该装置包括多个点光源和导光板。多个点光源位于基板上。导光板具有第一表面和平行于第一表面的第二表面。导光板的第一表面具有与点光源对应的多个凸起结构，每个凸起结构具有远端部分和形成在其中的弧形凹口。

