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(54) BACKLIGHT MODULE OF LCD DEVICE

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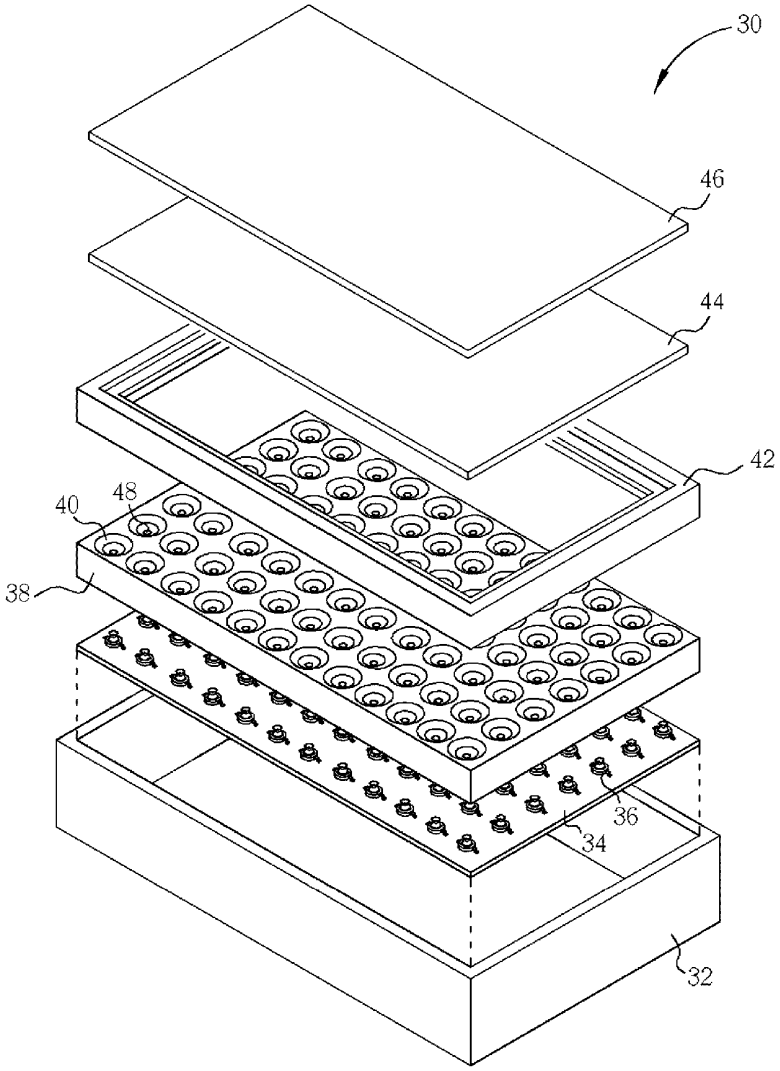
(57) **ABSTRACT**

A backlight module of an LCD device includes a plurality of fillisters formed in a reflection sheet and each of the fillisters having a reflection surface and a symmetrical axis. A plurality of point light source generators set in the fillisters, in which lights generated by the point light source generators are reflected by the reflection surfaces of the fillisters and the reflection sheet, and a profile of the point light source generators determines a shape of the fillisters. At least one diffuser plate installed on the reflection sheet for scattering the lights generated by the point light source generators and reflected by the reflection surfaces of the fillisters and the reflection sheet, in which an air space is formed between the diffuser plate and the reflection sheet.



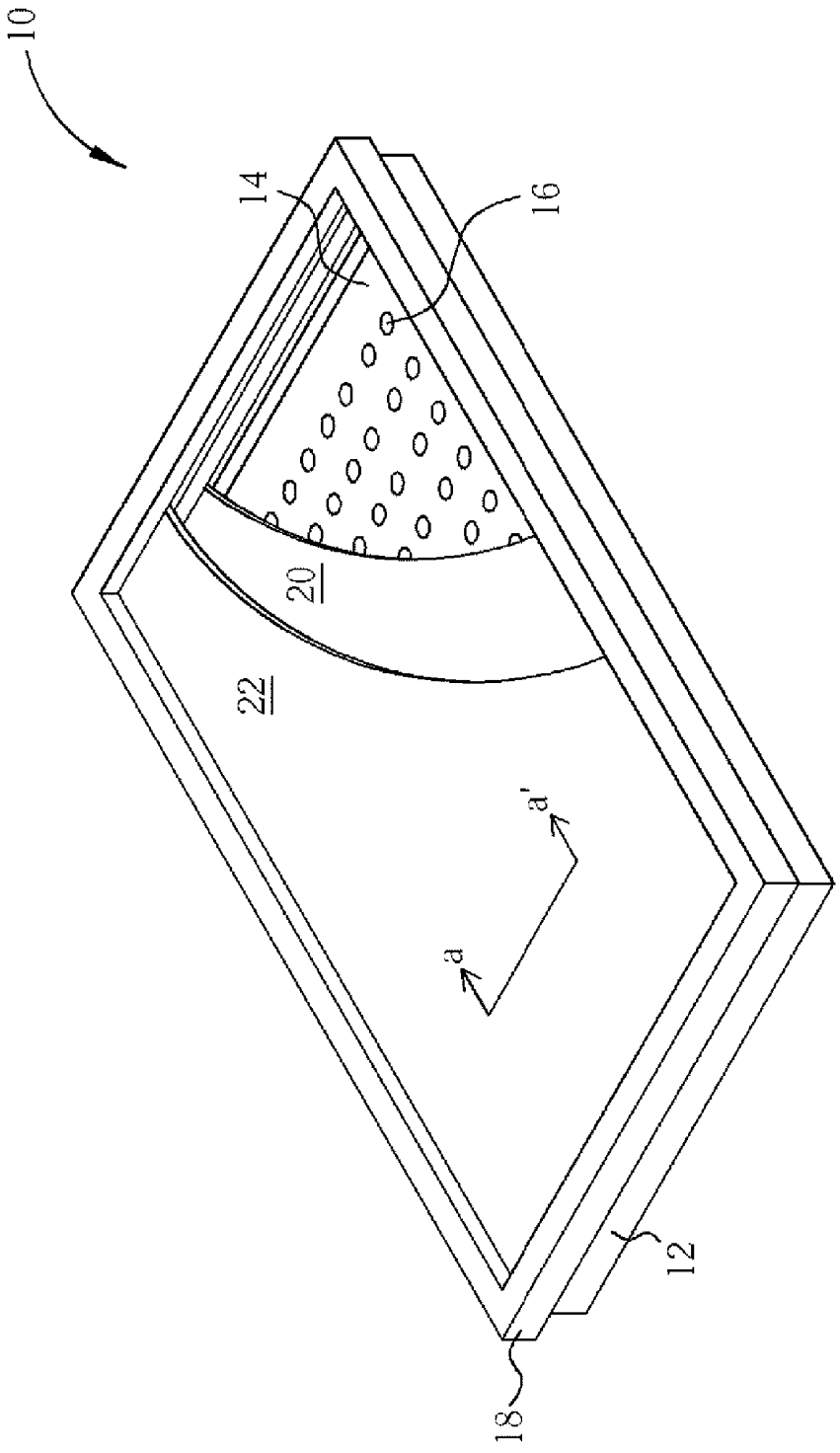


Fig. 1 Prior Art

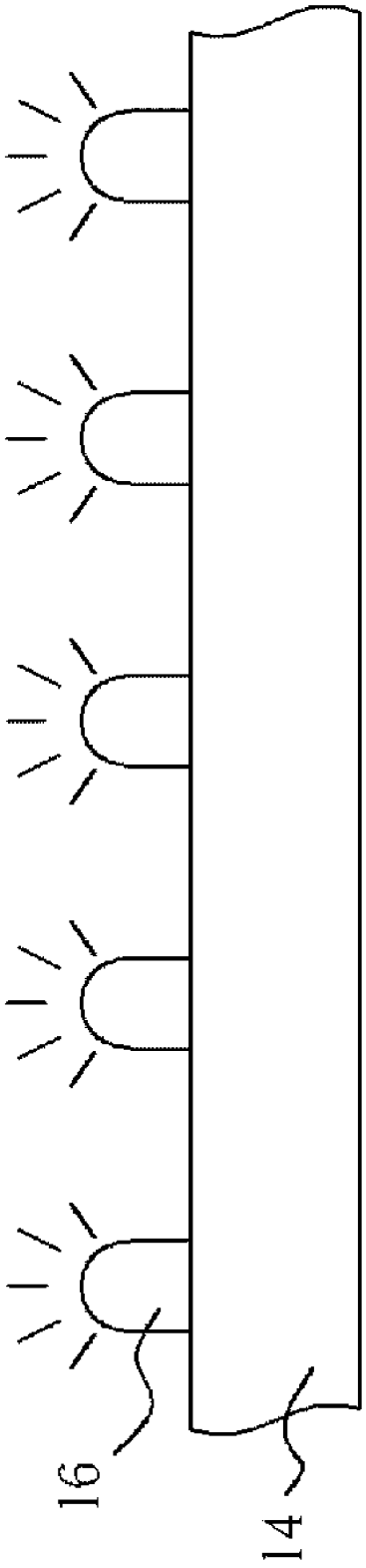


Fig. 2 Prior Art

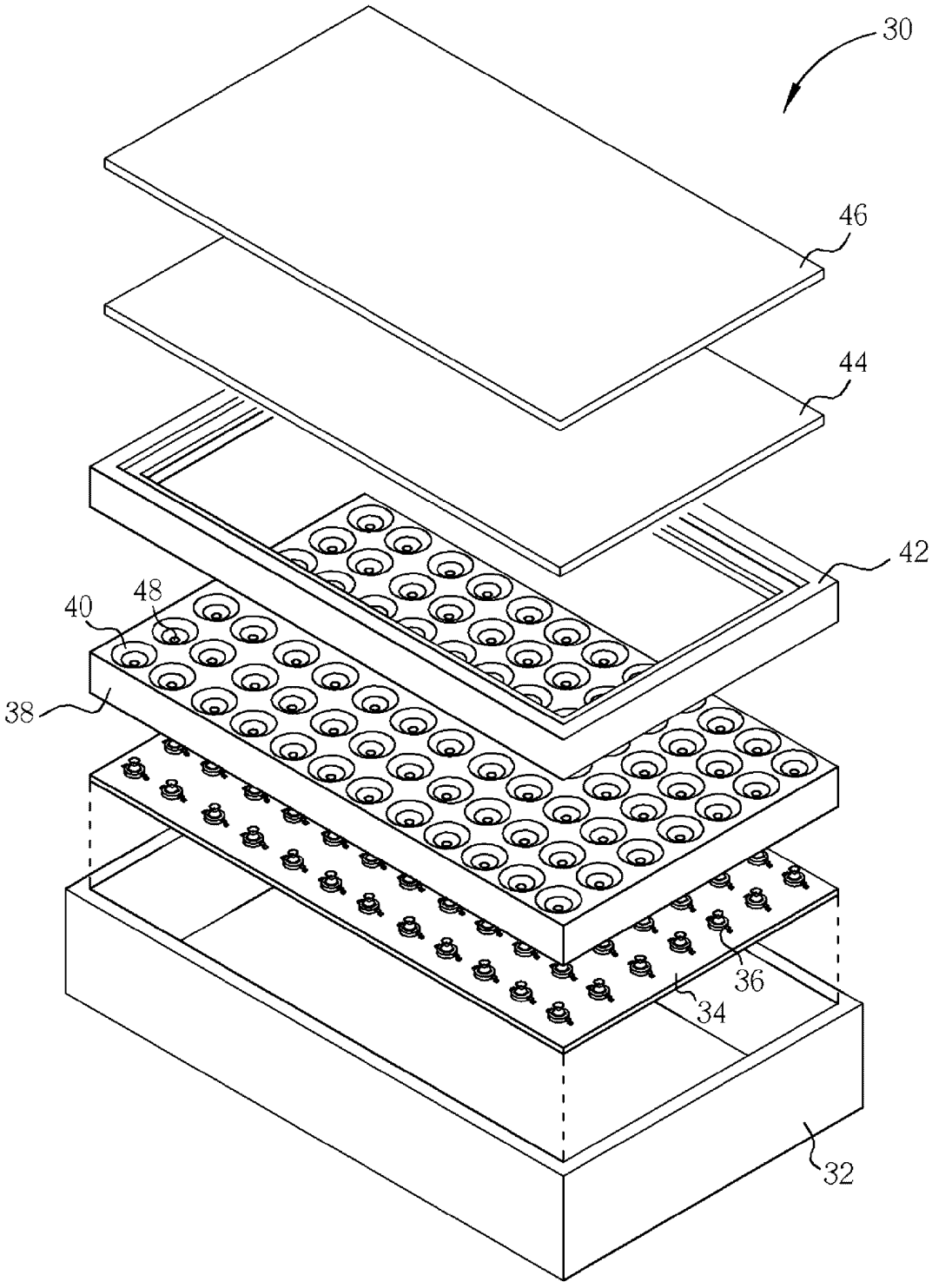


Fig. 3

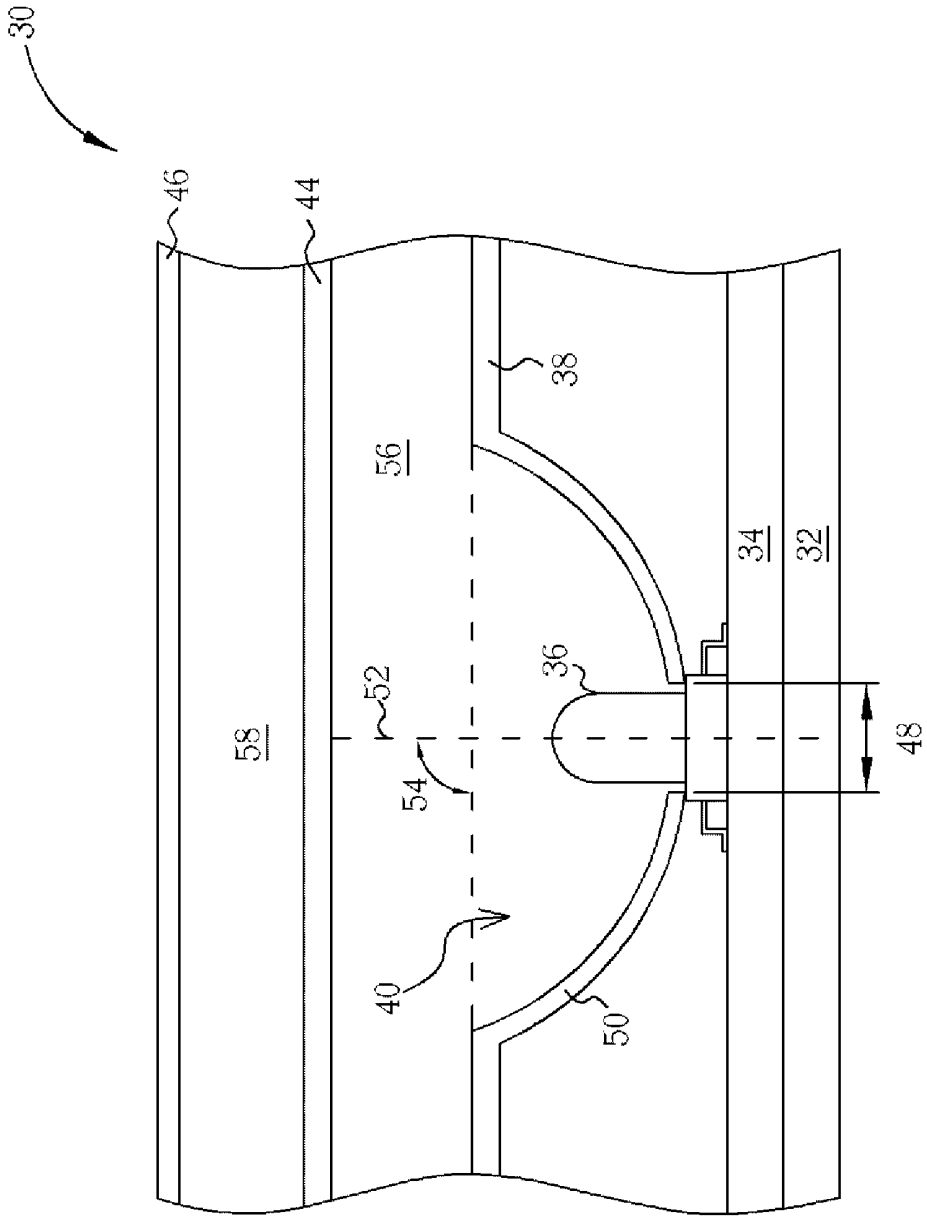


Fig. 4

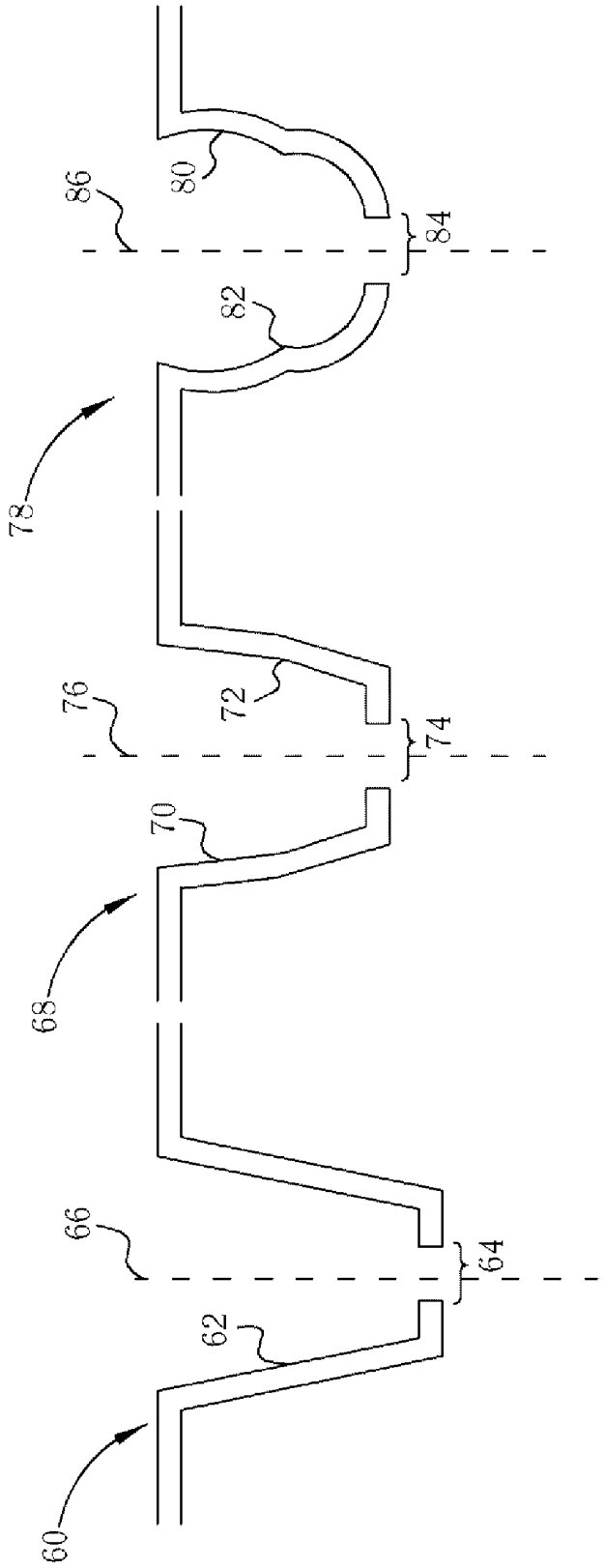


Fig. 5

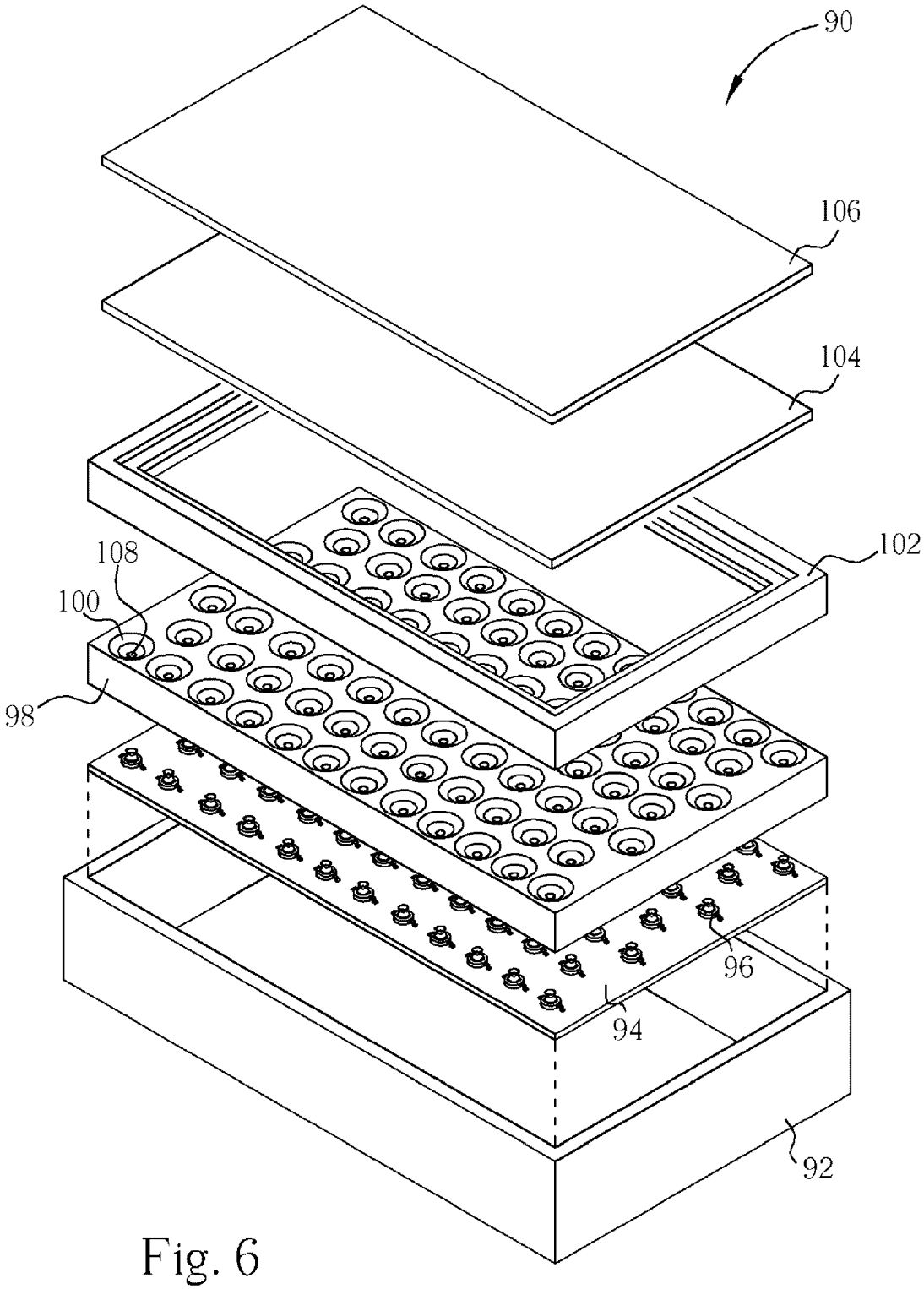


Fig. 6

BACKLIGHT MODULE OF LCD DEVICE

BACKGROUND OF INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a backlight module of an LCD device, and more particularly, to a backlight module of an LCD device, which utilizes a plurality of point light source generators as light sources and has a reduced thickness and improved optical performance.

[0003] 2. Description of the Prior Art

[0004] Liquid Crystal Displays (LCDs) are widely used in digital cameras, Personal Digital Assistants (PDAs), computer monitors, and flat panel televisions where the elimination of cathode ray tube (CRT) technology is desirable for several reasons. CRTs are characterized by large depth dimensions, undesirable weight, and fragility. Additionally, CRTs require a relatively high voltage power supply in order to sufficiently accelerate electron beams for displaying images.

[0005] In general, LCD devices have many advantages over CRT display devices in that they are thin and low in power consumption, etc. Therefore, LCD devices can effectively be substituted for CRT display devices and have been a matter of great interest in various industry fields.

[0006] In contrast to the CRT, the LCD device requires a light source, because liquid crystal is not a fluorescent material. A cold cathode fluorescent lamp (CCFL) or the like has been used as the light source of the LCD device. The lamp is included in a backlight module of the LCD device. However, the CCFL consists of mercury (Hg), which is an environmental pollutant. It is therefore desirable to replace the CCFL with a light emitting diode (LED).

[0007] Please refer to **FIG. 1**. **FIG. 1** illustrates a structure of an LED direct type backlight module **10** according to the prior art. An LED direct type backlight module **10** includes a back-up structure **12**, a printed circuit board **14**, which includes a plurality of LEDs **16**, situated in the back-up structure **12**, a front cover **18** disposed on the back-up structure **12**, a diffuser plate **20** installed on the front cover **18** for covering the printed circuit board **14**, in which an air space (not shown in **FIG. 1**) is formed between the diffuser plate **20** and the printed circuit board **14**, and a optical film **22** installed on the front cover **18** for covering the diffuser plate **20**, in which an air space (not shown in **FIG. 1**) is formed between the optical film **22** and the diffuser plate **20**.

[0008] Please refer to **FIG. 2**. **FIG. 2** is a section view along a-a' of the LED direct type backlight module **10** shown in **FIG. 1**. As shown in **FIG. 2**, the LEDs **16** are disposed on the printed circuit board **14** and use a surface of the printed circuit board **14** as a reflection surface. Therefore, the LED direct type backlight module **10** of the prior art utilizes a plane surface of the printed circuit board **14** to reflect lights generated by the LEDs **16**.

[0009] For good mixing of red, green, and blue light, however, the LED direct type backlight module **10** of the prior art must have an increased thickness. In some prior art, two diffuser plates are used to achieve the good mixing of red, green, and blue light, but this technique decreases the brightness of the backlight module. Furthermore, the brightness uniformity of the LED direct type backlight module **10** of the prior art is bad and an LED mura will occur.

SUMMARY OF INVENTION

[0010] It is therefore a primary objective of the present invention to provide a backlight module of an LCD device utilizing a plurality of point light source generators as light sources, and having a thinner thickness and better optical performance.

[0011] According to the present invention, a backlight module of an LCD device includes: a plurality of fillisters formed in a reflection sheet and each of the fillisters having a reflection surface and a symmetrical axis; a plurality of point light source generators set in the fillisters, wherein lights generated by the point light source generators are reflected by the reflection surfaces of the fillisters and the reflection sheet, and a profile of the point light source generators determines a shape of the fillisters; and at least one diffuser plate installed on the reflection sheet for scattering the lights generated by the point light source generators and reflected by the reflection surfaces of the fillisters and the reflection sheet, wherein an air space is formed between the diffuser plate and the reflection sheet.

[0012] It is an advantage of the present invention that the mura will not occur in the backlight module of the present invention. Additionally, the brightness and the brightness uniformity of the backlight module are improved and the thickness of the backlight module is reduced.

[0013] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0014] **FIG. 1** illustrates a structure of an LED direct type backlight module according to the prior art.

[0015] **FIG. 2** is a section view along a-a' of the LED direct type backlight module shown in **FIG. 1**.

[0016] **FIG. 3** is an exploded perspective diagram illustrating a backlight module of an LCD device according to a first preferred embodiment of the present invention.

[0017] **FIG. 4** is a section view of the LED direct type backlight module shown in **FIG. 3**.

[0018] **FIG. 5** shows a plurality of samples of the fillister according to the present invention.

[0019] **FIG. 6** is an exploded perspective diagram illustrating a backlight module of an LCD device according to a second preferred embodiment of the present invention.

DETAILED DESCRIPTION

[0020] Please refer to **FIG. 3**. **FIG. 3** is an exploded perspective diagram illustrating a backlight module **30** of an LCD device according to a first preferred embodiment of the present invention. As shown in **FIG. 3**, a backlight module **30** of an LCD device includes a back-up structure **32**, a printed circuit board **34**, a plurality of point light source generators **36** disposed on the printed circuit board **34**, a reflection sheet **38**, which has a plurality of fillisters **40**

formed in the reflection sheet **38**, a front cover **42**, at least one diffuser plate **44**, and at least one optical film **46**. The reflection sheet **38** is fabricated by plastic injection-molding or metal injection-molding and each of the fillisters **40** has an opening **48** in the bottom of the fillisters **40**. Furthermore, the fillisters **40** are arranged as an orthogonal matrix. However, the arrangement of the fillister shape reflectors **40** is not restricted to be an orthogonal matrix, and other arrangements may be applied according to the design of the backlight module **30**.

[**0021**] When assembling, the printed circuit board **34** is situated in the back-up structure **32**, the reflection sheet **38** covers the printed circuit board **34**, in which the point light source generators **36** are set in the fillisters **40** through the openings **48**, the front cover **42** is disposed on the reflection sheet **38**, the diffuser plate **44** is installed on the front cover **42** and covers the reflection sheet **38**, in which an air space is formed between the diffuser plate **44** an the reflection sheet **38**, and the optical film **46** is installed on the front cover **42** and covers the diffuser plate **44**, in which an air space is formed between the optical film **46** and the diffuser plate **44**.

[**0022**] In the first embodiment, the number and position of the point light source generators **36** correspond to the number and position of the openings **48** of the fillisters **40** such that each point light source generator **36** is set in each corresponding fillister **40** one by one, and the point light source generators **36** can all generate white light or generate red light, green light, and blue light individually according to the design of the backlight module **30**. In other embodiments, a point light source generator generating red light, a point light source generator generating green light, and a point light source generator generating blue light could be set together in each of the fillisters **40** for mixing the red, green, and blue lights to generate white light. A diffuser powder layer (not shown in **FIG. 3**) can cover the fillisters **40** for good mixing of the red, green, and blue lights.

[**0023**] Please refer to **FIG. 4**. **FIG. 4** is a section view of the LED direct type backlight module **30** shown in **FIG. 3**. As shown in **FIG. 4**, the printed circuit board **34** adheres to the back-up structure **32** by a glue (not shown in **FIG. 4**) with strong heat conduction, and heat produced by the printed circuit board **34** is radiated through the back-up structure **32**. Each of the fillisters **40** formed in the reflection sheet **38** further has a reflection surface **50**, and a symmetrical axis **52**. An angle **54** between the symmetrical axis **52** and the reflection sheet **38** is from 85 degree to 95 degree. Moreover, the reflection surface **50** is a parabolic reflection surface. The reflection surface **50** of the fillister **40** and the reflection sheet **38** utilize a mirror reflection, and the reflection surface **50** of the fillister **40** and a surface of the reflection sheet **38** are silver-reflecting surfaces, white-reflecting surfaces, or other mirror-like reflecting surfaces. The point light source generator **36**, for example, Light Emitting Diode (LED) such as side emitting LED or other similar light emitting devices for providing a stable light source to the backlight module **30**, is disposed on the printed circuit board **34** and set in the fillister **40** through the opening **48**, in which light generated by the point light source generator **36** is reflected by the reflection surface **50** of the fillister **40** and the reflection sheet **38**. The diffuser plate **44**, which may includes a plurality of scattering particles (not shown in **Fig. 4**) such as SiO_2 or TiO_2 for uniformly scattering the light generated by the point light source generator **36**, covers the reflection sheet **38** and is used for scattering lights generated by the point light source generator **36** and reflected by the reflection surface **50** of the fillister **40** and the reflection sheet **38**, and an air space **56** is formed between the diffuser plate **44** and the reflection sheet **38**. The optical film **46** covers the diffuser plate **44** and an air space **58** is formed between the optical film **46** and the diffuser plate **44**. It is to be understood that the backlight module **30** with one diffuser plate **44** is merely an exemplary embodiment, not a limitation. Depending on the requirements of the backlight module **30**, more than one diffuser plate **44** may be used.

[**0024**] Please refer to **FIG. 5**. **FIG. 5** shows a plurality of samples of the fillister according to the present invention. As shown in **FIG. 5**, a first sample of the fillister **60** has a taper reflection surface **62**, an opening **64**, and a symmetrical axis **66**, a second sample of the fillister **68** has a taper reflection surface **70** with a bending point **72**, an opening **74**, and a symmetrical axis **76**, and a third sample of the fillister **78** has a parabolic reflection surface **80** with a bending point **82**, an opening **84**, and a symmetrical axis **86**. It is noteworthy that a profile of the point light source generators **36** determines a shape of the fillisters.

[**0025**] Please refer to **FIG. 6**. **FIG. 6** is an exploded perspective diagram illustrating a backlight module **90** of an LCD device according to a second preferred embodiment of the present invention. The difference between the first preferred embodiment and the second preferred embodiment is that a plurality of fillisters **100** are arranged as a staggered matrix.

[**0026**] As shown in **FIG. 6**, a backlight module **90** of an LCD device includes a back-up structure **92**, a printed circuit board **94**, a plurality of point light source generators **96** disposed on the printed circuit board **94**, a reflection sheet **98**, which has a plurality of fillisters **100** formed in the reflection sheet **98**, a front cover **102**, at least one diffuser plate **104**, and at least one optical film **106**. The reflection sheet **98** is fabricated by plastic injection-molding or metal injection-molding and each of the fillisters **100** has an opening **108** in the bottom of the fillisters **100**. Furthermore, in the second preferred embodiment, the fillisters **100** are arranged as a staggered matrix.

[**0027**] Compared to the prior art, because of the specific reflection structure of the reflection sheet of the present invention, the lights generated by the point light source generators passing through the diffusing plate are capable of preventing the mura while achieving better brightness uniformity of the backlight module for the condition in which the brightness of the backlight module is not decreased. Furthermore, since the backlight module of the present invention does not need a thick region for mixing red, green, and blue lights, the backlight module is thinner than other backlight modules of the prior art.

[**0028**] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. A backlight module of an LCD device, comprisiA backlight module of an LCD device, comprising:

a plurality of fillisters formed in a reflection sheet and each of the fillisters having a reflection surface and a symmetrical axis;

a plurality of point light source generators set in the fillisters, wherein lights generated by the point light source generators are reflected by the reflection surfaces of the fillisters and the reflection sheet, and a profile of the point light source generators determines a shape of the fillisters; and

at least one diffuser plate covering the reflection sheet for scattering the lights generated by the point light source generators and reflected by the reflection surfaces of the fillisters and the reflection sheet, wherein an air space is formed between the diffuser plate and the reflection sheet.

2. The backlight module of an LCD device of claim 1, wherein the reflection surfaces of the fillisters are parabolic reflection surfaces.

3. The backlight module of an LCD device of claim 1, wherein an angle between the symmetrical axis and the reflection sheet is from 85 degree to 95 degree.

4. The backlight module of an LCD device of claim 1, wherein the reflection surfaces of the fillisters and the reflection sheet utilize a mirror reflection.

5. The backlight module of an LCD device of claim 1, wherein the reflection surfaces of the fillisters and a surface of the reflection sheet are silver-reflecting surfaces.

6. The backlight module of an LCD device of claim 1, wherein the reflection surfaces of the fillisters and a surface of the reflection sheet are white-reflecting surfaces.

7. The backlight module of an LCD device of claim 1, wherein the fillisters are arranged as an orthogonal matrix.

8. The backlight module of an LCD device of claim 1, wherein the fillisters are arranged as a staggered matrix.

9. The backlight module of an LCD device of claim 1, wherein the point light source generators are Light Emitting Diodes (LEDs).

10. The backlight module of an LCD device of claim 9, wherein the LEDs are side emitting LEDs.

11. The backlight module of an LCD device of claim 1, wherein a point light source generator generating white light is set in each of the fillisters.

12. The backlight module of an LCD device of claim 1, wherein a point light source generator generating red light, a point light source generator generating green light, and a point light source generator generating blue light are set together in each of the fillisters.

13. The backlight module of an LCD device of claim 12 further comprising a diffuser powder layer covering the fillisters for good mixing of the red, green, and blue lights.

14. The backlight module of an LCD device of claim 1, wherein a point light source generator generating red light, a point light source generator generating green light, and a point light source generator generating blue light are set in the fillisters individually.

15. The backlight module of an LCD device of claim 1 further comprising at least one optical film covering the diffuser plate, wherein an air space is formed between the optical film and the diffuser plate.

16. The backlight module of an LCD device of claim 1, wherein the diffuser plate further comprises a plurality of scattering particles for uniformly scattering the lights generated by the point light source generators.

17. A backlight module of an LCD device, comprising:

a back-up structure;

a printed circuit board situated in the back-up structure;

a plurality of point light source generators disposed on the printed circuit board;

a reflection sheet, having a plurality of fillisters formed in the reflection sheet, covering the printed circuit board and each of the fillisters having a reflection surface, an opening, and a symmetrical axis; and

at least one diffuser plate covering the reflection sheet, wherein an air space is formed between the diffuser plate and the reflection sheet;

wherein the point light source generators are set in the fillisters through the openings, lights generated by the point light source generators are reflected by the reflection surfaces of the fillisters and the reflection sheet, and a profile of the point light source generators determines a shape of the fillisters.

18. The backlight module of an LCD device of claim 17, wherein the printed circuit board adheres to the back-up structure by a glue with strong heat conduction, and heat produced by the printed circuit board is radiated through the back-up structure.

19. The backlight module of an LCD device of claim 17, wherein the reflection surfaces of the fillisters are parabolic reflection surfaces.

20. The backlight module of an LCD device of claim 17, wherein an angle between the symmetrical axis and the reflection sheet is from 85 degree to 95 degree.

21. The backlight module of an LCD device of claim 17, wherein the reflection surfaces of the fillisters and the reflection sheet utilize a mirror reflection.

22. The backlight module of an LCD device of claim 17, wherein the reflection surfaces of the fillisters and a surface of the reflection sheet are silver-reflecting surfaces.

23. The backlight module of an LCD device of claim 17, wherein the reflection surfaces of the fillisters and a surface of the reflection sheet are white-reflecting surfaces.

24. The backlight module of an LCD device of claim 17, wherein the fillisters are arranged as an orthogonal matrix.

25. The backlight module of an LCD device of claim 17, wherein the fillisters are arranged as a staggered matrix.

26. The backlight module of an LCD device of claim 17, wherein the point light source generators are Light Emitting Diodes (LEDs).

27. The backlight module of an LCD device of claim 26, wherein the LEDs are side emitting LEDs.

28. The backlight module of an LCD device of claim 17, wherein a point light source generator generating white light is set in each of the fillisters.

29. The backlight module of an LCD device of claim 17, wherein a point light source generator generating red light, a point light source generator generating green light, and a point light source generator generating blue light are set together in each of the fillisters.

30. The backlight module of an LCD device of claim 29 further comprising a diffuser powder layer covering the fillisters for good mixing of the red, green, and blue lights.

31. The backlight module of an LCD device of claim 17, wherein a point light source generator generating red light, a point light source generator generating green light, and a point light source generator generating blue light are set in the fillisters individually.

32. The backlight module of an LCD device of claim 17 further comprising at least one optical film covering the diffuser plate, wherein an air space is formed between the optical film and the diffuser plate.

33. The backlight module of an LCD device of claim 32 further comprising a front cover disposed on the reflection sheet, wherein the diffuser plate and the optical film is installed on the front cover.

34. The backlight module of an LCD device of claim 17, wherein the diffuser plate further comprises a plurality of scattering particles for uniformly scattering the lights generated by the point light source generators.

* * * * *

专利名称(译)	液晶显示装置的背光模块		
公开(公告)号	US20060215075A1	公开(公告)日	2006-09-28
申请号	US10/907183	申请日	2005-03-23
[标]申请(专利权)人(译)	黄池JEN 张之洞李		
申请(专利权)人(译)	黄池仁 张之洞李		
当前申请(专利权)人(译)	瀚宇彩晶股份有限公司.		
[标]发明人	HUANG CHI JEN CHANG CHIH LI		
发明人	HUANG, CHI-JEN CHANG, CHIH-LI		
IPC分类号	G02F1/1335		
CPC分类号	G02F1/133603 G02F1/133605 G02F1/133611		
外部链接	Espacenet USPTO		

摘要(译)

LCD装置的背光模块包括形成在反射片中的多个填充物，并且每个填充物具有反射表面和对称轴。设置在填充物中的多个点光源发生器，其中由点光源发生器产生的光被填充物和反射片的反射表面反射，并且点光源发生器的轮廓确定形状。 fillisters。至少一个安装在反射片上的漫射板，用于散射由点光源发生器产生并被填充物和反射片的反射表面反射的光，其中在漫射板和反射片之间形成空气空间。