



US 20040207996A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2004/0207996 A1**
Kao (43) **Pub. Date: Oct. 21, 2004**

(54) **LIQUID CRYSTAL DISPLAY AND LIGHT SOURCE DEVICE THEREOF**

(30) **Foreign Application Priority Data**

Apr. 18, 2003 (TW)..... 092109314

(76) **Inventor: Hung Chen Kao, Taipei (TW)**

Publication Classification

Correspondence Address:
LOWE HAUPTMAN GILMAN & BERNER, LLP
Suite 310
1700 Diagonal Road
Alexandria, VA 22314 (US)

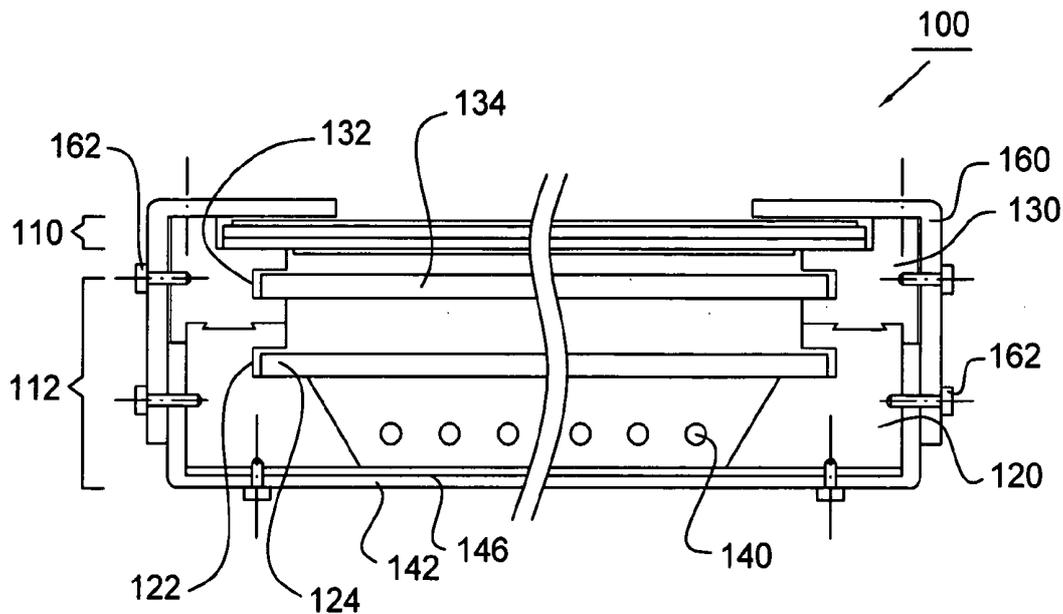
(51) **Int. Cl.⁷** **F21V 7/04**
(52) **U.S. Cl.** **362/31**

(57) **ABSTRACT**

A liquid crystal display comprises a liquid crystal panel for displaying images, a first frame, a second frame, and a first optical component. The first frame receives the liquid crystal panel. The second frame has a plurality of lamps for transmitting light to the liquid crystal panel. The first optical component is disposed on the first frame and between the second frame and the liquid crystal panel. The second frame is detachable from the first frame.

(21) **Appl. No.: 10/743,822**

(22) **Filed: Dec. 24, 2003**



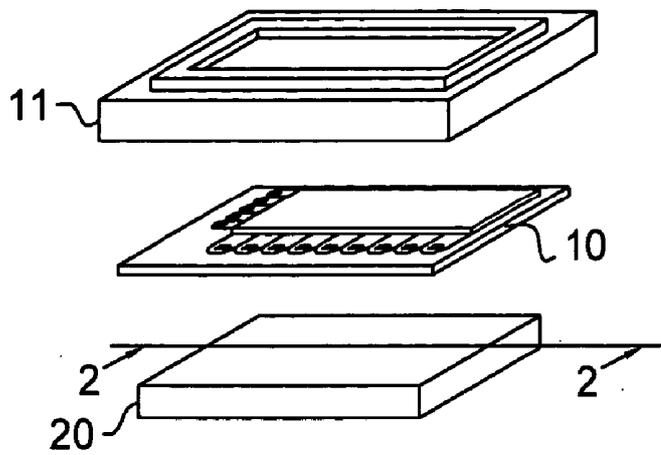


FIG. 1 (PRIOR ART)

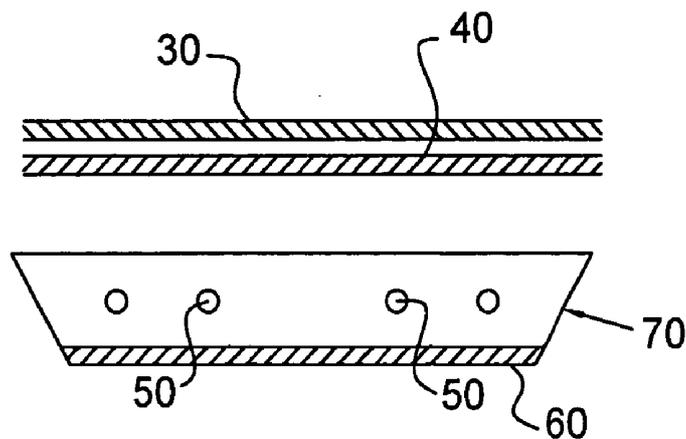


FIG. 2 (PRIOR ART)

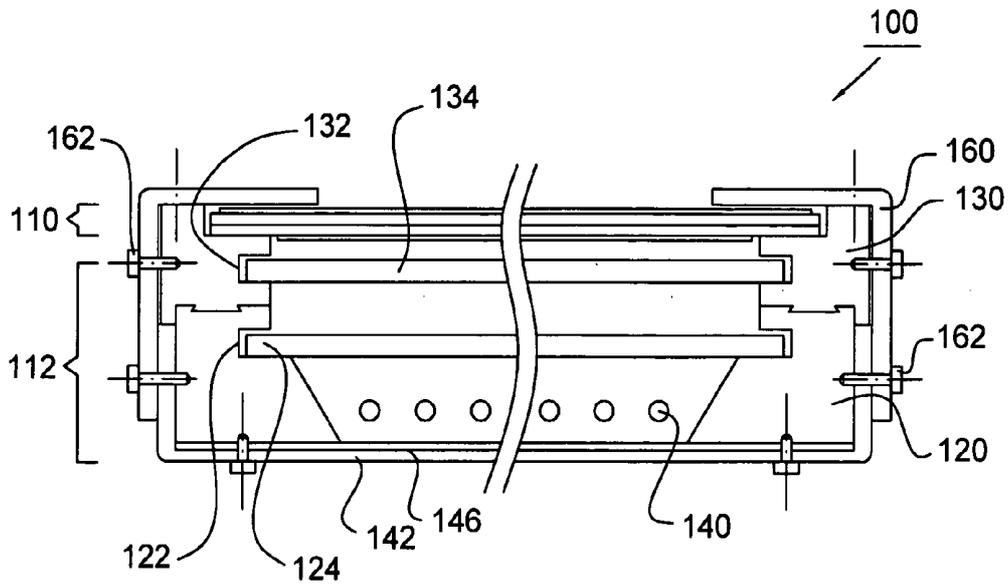


FIG. 3

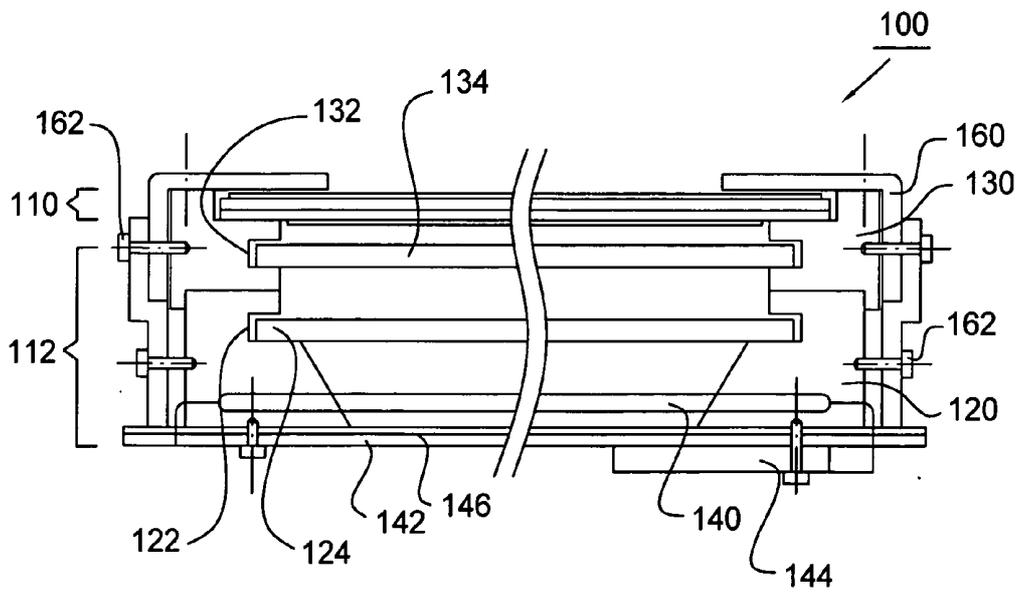


FIG. 4

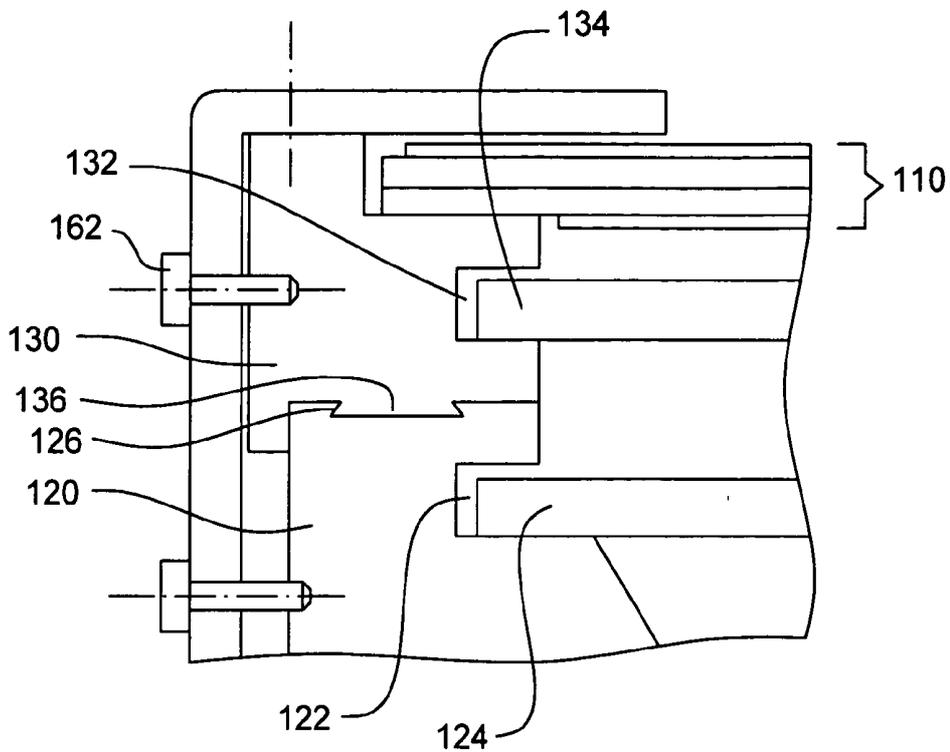


FIG. 5

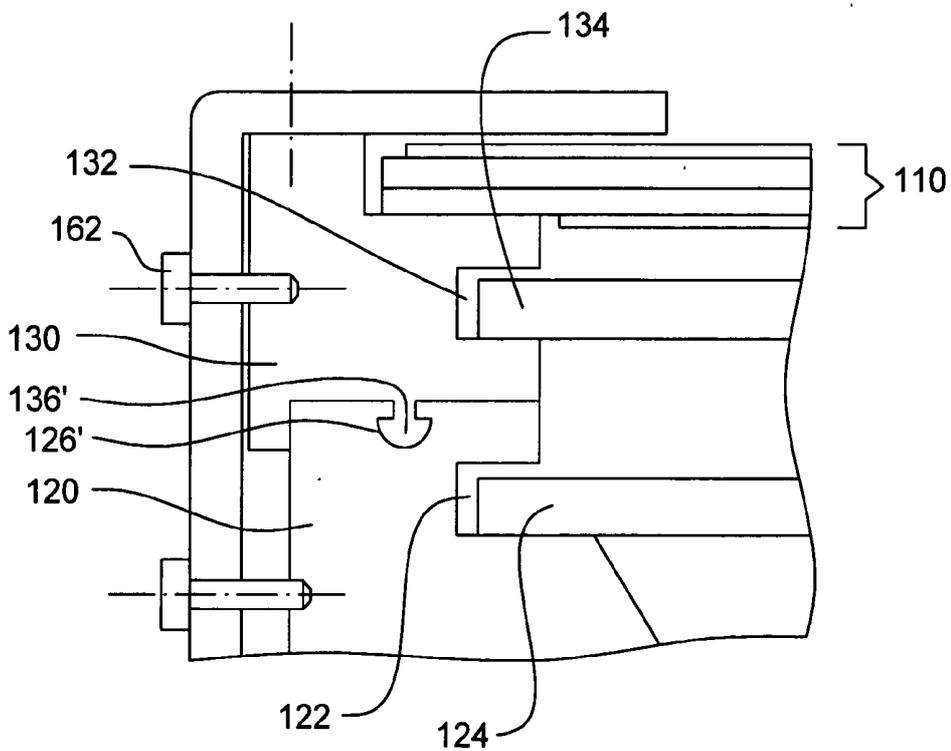


FIG. 6

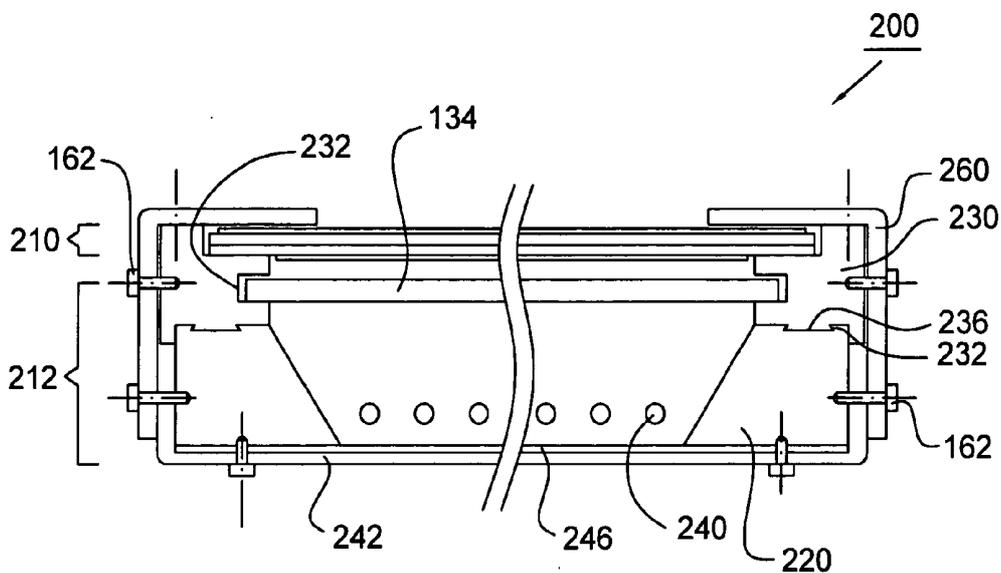


FIG. 7

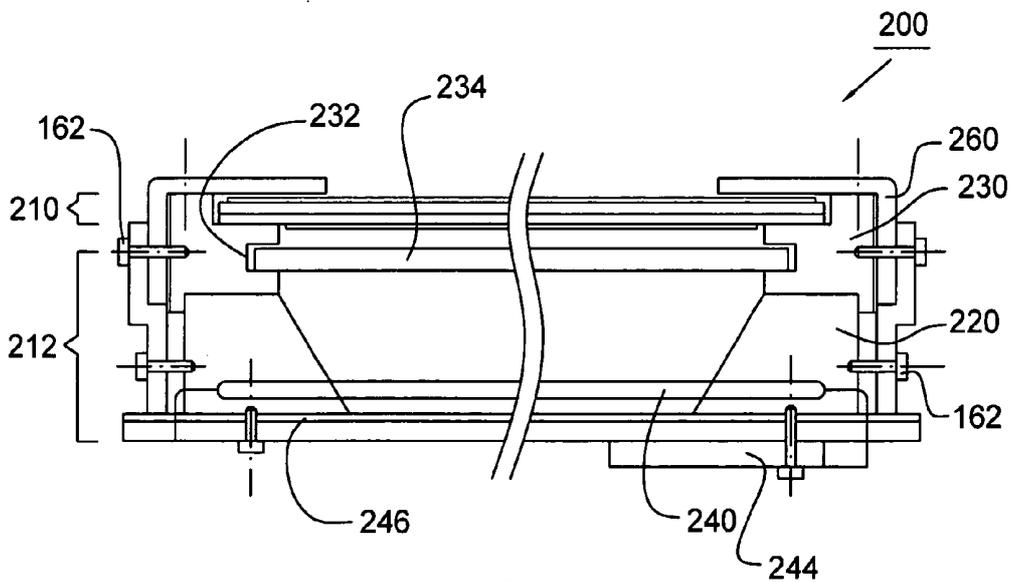


FIG. 8

LIQUID CRYSTAL DISPLAY AND LIGHT SOURCE DEVICE THEREOF

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Taiwan patent application serial No. 092109314, filed on Apr. 18, 2003, and the full disclosure thereof is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to a back light module of a liquid crystal display, and more particularly to a back light module of a liquid crystal display (LCD) having a housing which can be easily detached.

[0004] 2. Description of the Related Art

[0005] Due to the advance of electronic technology, especially for the popularity of portable electronic products, the requirements of light, compact and low-energy consuming display are gradually increasing. With the advantages of low-energy consuming, low-heat dissipation, light weight and non-luminescence display, liquid crystal displays (LCD) have been widely used in the electronic products and even have replaced the traditional CRT displays.

[0006] Referring to **FIG. 1**, it depicts a conventional liquid crystal display (LCD). In general, the liquid crystal display includes a liquid crystal panel **10** which has two substrates and liquid crystal material sealed therebetween, a back light module **20** disposed under the liquid crystal display panel **10**, and a front frame **11**.

[0007] The back light module **20** is used to distribute the light transmitted from a light source uniformly over the surface of the liquid crystal display panel **10**. There are several kinds of back light modules for the liquid crystal display, such as a direct back light type (or direct type) and an edge light type. For the liquid crystal display in large dimensions, the back light module of the direct type is widely used because of its easy installation and its low cost.

[0008] The back light module **20** of the direct type, as shown in **FIG. 2**, includes a housing **70** which has a reflective sheet **60** disposed on the bottom surface of the housing **70**, lamps **50**, such as a fluorescence cathode tube, disposed at the bottom portion of the housing **70**, a diffuser plate **40** disposed on the upper surface of the housing **70**, and a plurality of optical films **30**, such as a prism sheet and a diffuser sheet, disposed on the diffuser plate **40**. The lamps **50** are spaced apart from each other and disposed within the display area of the liquid crystal panel **10**, not shown. Since the light source, i.e. the lamps **50**, is a linear light source, the lamps **50** cannot provide light evenly illuminating the liquid crystal panel **10**. Therefore, the diffuser plate **40** and the optical films **30** have to be provided and disposed between the lamps **50** and the liquid crystal panel **10** so as to form a panel light source device having uniform luminance.

[0009] Many back light modules have been disclosed in the prior art, such as those disclosed in U.S. Pat. No. 6,407,781 B2 issued to Kitada on Jun. 18, 2002 and in U.S. Pat. No. 6,417,833 B1 issued to Takemoto et al. on Jul. 9, 2002, which are all incorporated herein by reference.

[0010] For the well-known technology, the lifetime of the lamp of the back light module is the shortest of all the parts or elements of the liquid crystal display. If the lamp malfunctions, the frame, the liquid crystal panel, the back light module frame, the optical film, and the diffusing sheet of the liquid crystal display have to be detached from the liquid crystal display to replace the lamp. This procedure, which is difficult and complex, must be carried out in the cleaning room, or the liquid crystal panel or the optical film will be contaminated and the liquid crystal display will be degraded. Further, the liquid crystal display in large dimensions will be unable to be serviced on site without the cleaning room.

[0011] Accordingly, there exists a need for a liquid crystal display having detachable lamps for facilitating the service and the repair.

SUMMARY OF THE INVENTION

[0012] It is an object of the present invention to provide a liquid crystal display having a detachable frame for receiving lamps, thereby facilitating the subsequent service and the repair.

[0013] In order to achieve the above object, the present invention provides a liquid crystal display which comprises a liquid crystal panel for displaying images, a first frame, a second frame, and a first optical component. The first frame receives the liquid crystal panel. The second frame has a plurality of lamps for transmitting light to the liquid crystal panel. The first optical component is disposed on the first frame and between the second frame and the liquid crystal panel. The second frame is detachable from the first frame.

[0014] The liquid crystal display according to the present invention is provided with a detachable frame, which can be referred to as a light source device or a light box, for receiving a plurality of lamps. While the lamp needs to be replaced, the frame or the light box can be detached from the liquid crystal display so as to obtain access to the lamps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawing.

[0016] **FIG. 1** is a schematic perspective exploded view of a liquid crystal display in the prior art.

[0017] **FIG. 2** is a schematic cross sectional view of a back light module of the direct type along the line 2-2 shown in **FIG. 1**.

[0018] **FIG. 3** is a schematic longitudinal cross sectional view of a liquid crystal display according to an embodiment of the present invention.

[0019] **FIG. 4** is a schematic transversal cross sectional view of the liquid crystal display shown in **FIG. 3**.

[0020] **FIG. 5** is a schematic partial enlarged cross sectional view of the liquid crystal display shown in **FIG. 3**.

[0021] **FIG. 6** is a schematic partial enlarged cross sectional view of a pair of a neck protrusion and a neck groove according to another embodiment of the present invention.

[0022] FIG. 7 is a schematic longitudinal cross sectional view of a liquid crystal display according to another embodiment of the present invention.

[0023] FIG. 8 is a schematic transversal cross sectional view of the liquid crystal display shown in FIG. 7.

DESCRIPTION OF THE EMBODIMENT

[0024] Referring to FIGS. 3 and 4, they depict a liquid crystal display 100 according to an embodiment of the present invention. The liquid crystal display 100 comprises a liquid crystal panel 110 for displaying images, a back light module 112 for transmitting light to the liquid crystal panel 110, and a front frame 160 for fixing the back light module 112 and the liquid crystal panel 110 together. The liquid crystal panel 110 includes two print circuit boards (PCBs), not shown, for transmitting the control signals and the driving signals to the liquid crystal panel 110.

[0025] The back light module 112 includes a first frame 130 and a second frame 120 both of which are substantially rectangular corresponding to and abutting the liquid crystal panel 110. The first frame 130 is provided with a first slot 132 therein for mounting a first optical component 134. It will be apparent to those skilled in the art that the first optical component 134 can comprise a plurality of optical films, such as a prism film and diffusing film, and a diffuser plate. The first optical component 134 is used for further evenly diffusing the light. For example, the prism sheet is commercially available from 3M™ Company of St. Paul Minn. under the trade name Brightness Enhancement Film series for gathering the light in the direction perpendicular thereto.

[0026] A housing 142 is attached on the second frame 120 for forming a cavity to receive a plurality of lamps 140. The inside of the housing 142 and the second frame 120 is covered with a reflector 146 for reflecting the light transmitted from the lamps 140. The second frame 120 is provided with a second slot 122 disposed therein for mounting a PMMA plate or a second optical component 124, such as a diffuser plate. An inverter 144 is connected to the lamps 140 for supplying the lamps 140 with electric power. Generally, the lamp 140 can be a cold cathode fluorescent lamp (CCFL).

[0027] As shown in FIG. 5, a pair of slidable snap devices are disposed between the second frame 120 and the first frame 130, and comprises a tenon or a neck protrusion 136 and a mortise or a neck groove 126. The neck protrusion 136 and the neck groove 126 are disposed on the corresponding sides of the first frame 130 and the second frame 120, respectively.

[0028] As shown in the drawing, the pair of the neck protrusion 136 and the neck groove 126 are dovetailed or frusta-triangular in shape. The neck protrusion 136 is inserted into and slidable within the neck groove 126. However, the neck protrusion 136 cannot be detached directly from the neck groove 126.

[0029] During assembly, the liquid crystal panel 110 and the first optical component 134 are attached to the first frame 130. The second optical component 124, the housing 142, and the lamps 140 are attached to the second frame 120. Then, the neck protrusion 136 of the first frame 130 is inserted into the neck groove 126 of the second frame 120, and slid to be in position. The front frame 160 is disposed

outside the second frame 120 and the first frame 130, and the second frame 120 and the first frame 130 can be fixed to the front frame 160 by a plurality of fasteners, such as bolts 162.

[0030] While the lamp of the liquid crystal display 100 malfunctions, an operator can unscrew the bolts 162, and slide out the second frame 120 in relation to the first frame 130 along the neck groove 126 and the neck protrusion 136 so as to detach the second frame 120 for replacing the lamps 140, and then complete the service or repair of the back light module 112 of the liquid crystal display 100. Since the liquid crystal panel 110 is substantially covered or sealed with the first optical component 134, the liquid crystal panel 110 will not be contaminated by the particles suspended in the atmosphere. It will be apparent to those skilled in the art that it is critical to prevent the contamination of the liquid crystal 110. Further, the second frame 120 and the first frame 130 can be made of plastic.

[0031] It will be apparent to those skilled in the art that the shape of the pair of the neck protrusion and the neck groove is not limited to illustrated dovetail or frusta-triangle. Other paired mechanism with neck can be used. Obviously, the neck protrusion can be disposed on the second frame and the neck groove can be disposed on the first frame.

[0032] Now referring to FIG. 6, it depicts a pair of slidable snap devices according to another embodiment of the present invention, which comprises a neck protrusion 136' and a neck groove 126'. The pair of the neck protrusion 136' and the neck groove 126' are provided with a hemispheric portion and a neck portion. The neck protrusion 136' also can be inserted into and slidable within the neck groove 126'.

[0033] Now referring to FIGS. 7 and 8, they depict a liquid crystal display 200 according to another embodiment of the present invention. The liquid crystal display 200 is generally similar to the liquid crystal display 100 wherein the similar elements are designated with the similar reference numerals. A second frame 220 of the liquid crystal display 200 is not provided with any optical component, diffuser plate or sheet, optical components 234 include all of the optical films which are installed into the liquid crystal display 200, and are mounted into a slot 232 of the first frame 230. In this arrangement, an operator can obtain further easy access to the lamps 240.

[0034] As indicated hereinabove, the liquid crystal display according to the present invention is provided with a detachable frame, which can be referred to as a light source device or a light box, for receiving a plurality of lamps. While the lamp needs to be replaced, the frame or the light box can be detached from the liquid crystal display so as to obtain access to the lamps.

[0035] For the purpose of description without any intent to limit the present invention, the terms "the neck protrusion" and "the neck groove," as being used herein, are intended to denote any protrusion and groove which are individually provided with a relatively narrow portion and which are slidable and snapped with each other. As described hereinabove, the neck protrusion can be a dovetailed or frusta-triangular in shape, and has a broad bottom portion and a narrow portion.

[0036] Obviously, the feature of the present invention is that a detachable light source device or light box is provided to facilitate the replacement of the lamp, and thus the pair of

the slidable snap members, i.e. the neck protrusion and the neck groove, are not essential. The neck protrusion and the neck groove are provided to further facilitate the assembly and the detachment of the liquid crystal display, but not to limit the present invention.

[0037] Although the invention has been explained in relation to its preferred embodiment, it is not used to limit the invention. It is to be understood that many other possible modifications and variations can be made by those skilled in the art without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A back light module for a liquid crystal display having a liquid crystal panel comprising:

- a first frame;
- a second frame detachable coupling with the first frame;
- a plurality of lamps disposed in the second frame for transmitting light; and
- a first optical component disposed on the first frame, wherein the first frame is disposed between the second frame and the liquid crystal panel.

2. The back light module as claimed in claim 1, further comprises:

- a neck protrusion disposed on one of the first frame and the second frame; and
- a neck groove paired with the neck protrusion and disposed on the other one of the first frame and the second frame;

wherein the first frame and the second frame are snapped with and slidable from each other by means of the neck protrusion and the neck groove.

3. The back light module as claimed in claim 2, wherein the neck protrusion and the neck groove are dovetailed in shape.

4. The back light module as claimed in claim 2, wherein each of the neck protrusion and the neck groove is provided with a hemispheric portion and a neck portion.

5. The back light module as claimed in claim 1, wherein the first optical component comprises a plurality of optical films and a diffuser plate.

6. The back light module as claimed in claim 5, wherein the optical films comprises a prism film.

7. The back light module as claimed in claim 5, wherein the optical films comprises a diffuser film.

8. The back light module as claimed in claim 1, wherein the first frame further comprises a first slot for receiving the first optical component.

9. The back light module as claimed in claim 1, wherein the second frame further comprises a second optical component.

10. The back light module as claimed in claim 9, wherein the second frame further comprises a second slot for receiving the second optical component.

11. The back light module as claimed in claim 9, wherein the second optical component comprises a diffuser plate.

12. A liquid crystal display comprising:

- a liquid crystal panel for displaying images;
- a first frame receiving the liquid crystal panel;
- a second frame detachable coupling with the first frame, and the second frame having a plurality of lamps for transmitting light to the liquid crystal panel; and
- a first optical component disposed on the first frame, wherein the first frame is disposed between the second frame and the liquid crystal panel.

13. The liquid crystal display as claimed in claim 12, further comprises:

- a neck protrusion disposed on one of the first frame and the second frame; and
- a neck groove paired with the neck protrusion and disposed on the other one of the first frame and the second frame;

wherein the first frame and the second frame are snapped with and slidable from each other by means of the neck protrusion and the neck groove.

14. The liquid crystal display as claimed in claim 13, wherein the neck protrusion and the neck groove are dovetailed in shape.

15. The liquid crystal display as claimed in claim 13, wherein each of the neck protrusion and the neck groove is provided with a hemispheric portion and a neck portion.

16. The liquid crystal display as claimed in claim 12, wherein the first optical component comprises a plurality of optical films and a diffuser plate.

17. The liquid crystal display as claimed in claim 12, wherein the first frame further comprises a first slot for receiving the first optical component.

18. The liquid crystal display as claimed in claim 12, wherein the second frame further comprises a second optical component.

19. The liquid crystal display as claimed in claim 18, wherein the second frame further comprises a second slot for receiving the second optical component.

* * * * *

专利名称(译)	液晶显示器及其光源装置		
公开(公告)号	US20040207996A1	公开(公告)日	2004-10-21
申请号	US10/743822	申请日	2003-12-24
[标]申请(专利权)人(译)	KAO洪辰		
申请(专利权)人(译)	KAO洪辰		
当前申请(专利权)人(译)	瀚宇彩晶股份有限公司.		
[标]发明人	KAO HUNG CHEN		
发明人	KAO, HUNG CHEN		
IPC分类号	G02F1/13357 F21V7/04		
CPC分类号	G02F1/133604 G02F2203/68 G02F2001/133317 G02F1/133608		
优先权	092109314 2003-04-18 TW		
其他公开文献	US6979114		
外部链接	Espacenet USPTO		

摘要(译)

液晶显示器包括用于显示图像的液晶面板，第一框架，第二框架和第一光学部件。第一帧接收液晶面板。第二框架具有多个灯，用于将光传输到液晶面板。第一光学元件设置在第一框架上以及第二框架和液晶面板之间。第二框架可从第一框架拆卸。

