



United States Patent [19]

Hira et al.

[11] Patent Number: **5,961,198**

[45] Date of Patent: **Oct. 5, 1999**

[54] **LIQUID CRYSTAL DISPLAY DEVICE AND METHOD OF MANUFACTURING BACKLIGHTING LIGHT GUIDE PANEL THEREFOR**

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[73] Assignee: **Hitachi, Ltd.**, Tokyo, Japan

[21] Appl. No.: **08/791,513**

[22] Filed: **Jan. 30, 1997**

[30] **Foreign Application Priority Data**

Feb. 2, 1996 [JP] Japan 8-017335

[51] **Int. Cl.⁶** **F21V 7/04; G02F 1/1335**

[52] **U.S. Cl.** **362/31; 362/561; 349/65**

[58] **Field of Search** **362/31, 32; 349/65**

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,079,675	1/1992	Nakayama	362/31
5,377,084	12/1994	Kojima et al.	362/31
5,386,347	1/1995	Matsumoto	362/31
5,396,406	3/1995	Ketchpel	362/31
5,408,387	4/1995	Murase et al.	362/31
5,408,388	4/1995	Kobayashi et al.	362/31
5,420,761	5/1995	DuNah et al.	362/31

5,450,292	9/1995	Yokoyama et al.	362/31
5,461,547	10/1995	Ciupke et al.	362/31
5,485,291	1/1996	Qiao et al.	362/31
5,485,354	1/1996	Ciupke et al.	362/31
5,521,796	5/1996	Osakada et al.	362/31
5,575,549	11/1996	Ishikawa et al.	362/31
5,584,556	12/1996	Yokoyama et al.	362/31
5,608,837	3/1997	Tai et al.	362/31
5,649,754	7/1997	Matsumoto	362/31

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[57] **ABSTRACT**

A light guide panel and liquid crystal display device including a liquid crystal cell array, a light guide panel or plate disposed on a rear surface of the liquid crystal cell array, and a light source disposed at a lateral side of the light guide panel or plate. The light guide panel or plate has a light incident surface on which light rays emitted from the light source are incident, a light-transmissive surface through which the incident light rays exit the light guide panel or plate toward the liquid crystal cell array, and a plurality of reflecting slant portions for directing the incident light rays toward the light-transmissive surface, wherein the reflecting slant portions are constituted by convexes or concaves which are substantially rectangular in plan view and substantially trapezoidal in sectional view.

8 Claims, 18 Drawing Sheets

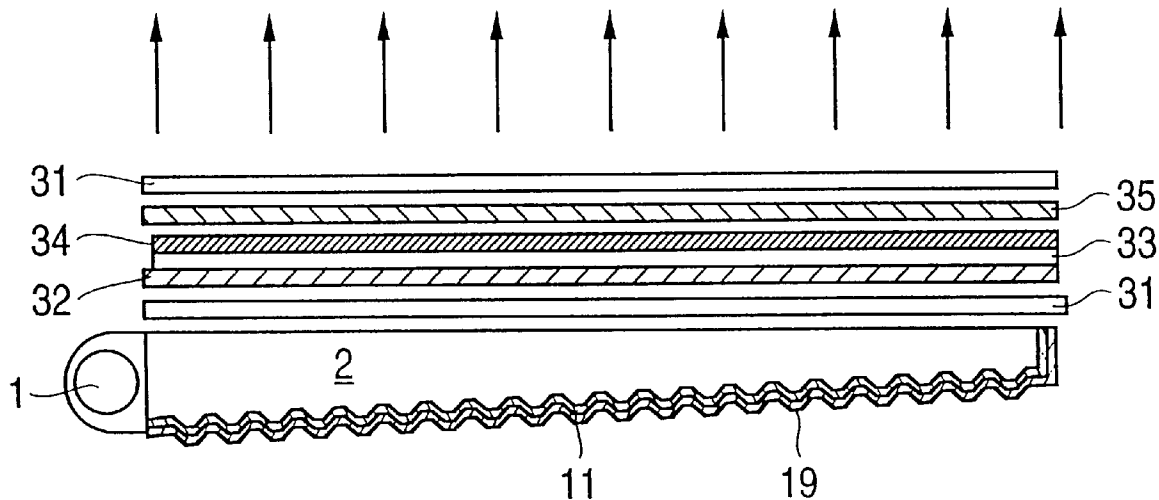


FIG. 1

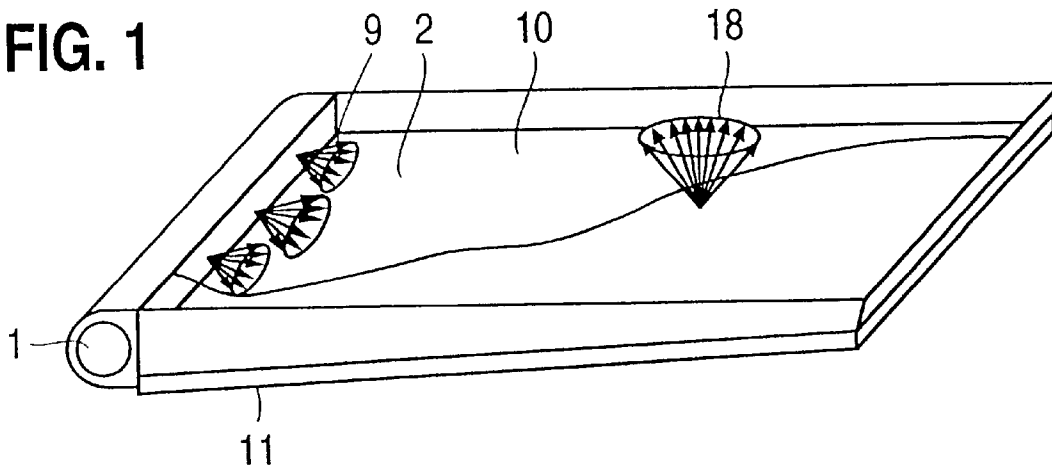


FIG. 2

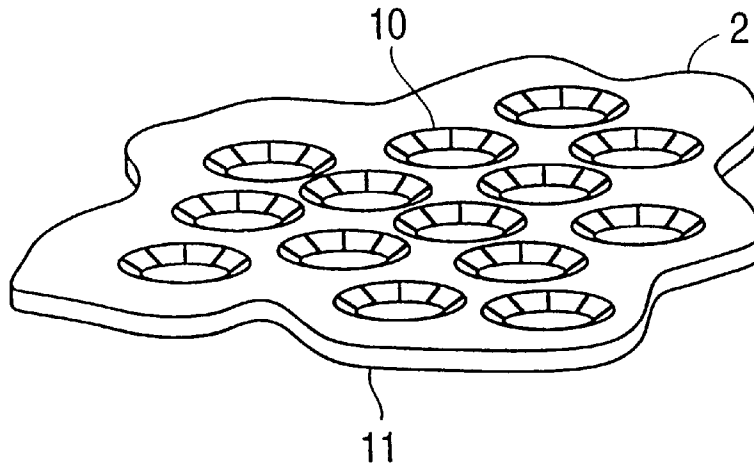


FIG. 3
PRIOR ART

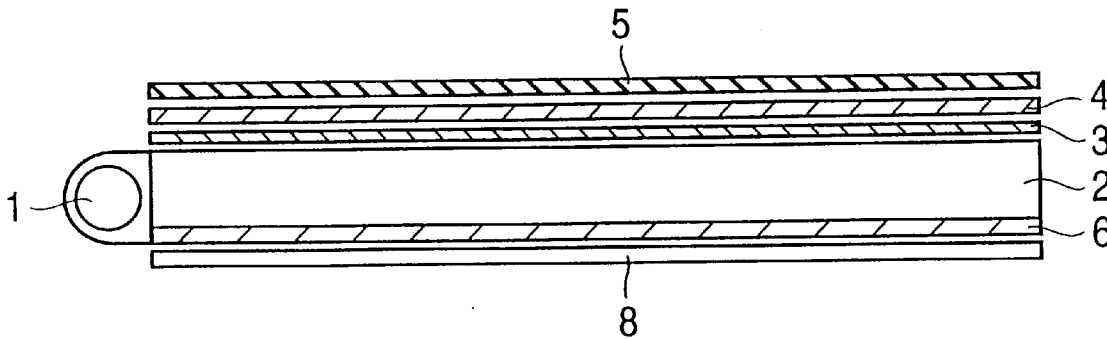


FIG.4
PRIOR ART

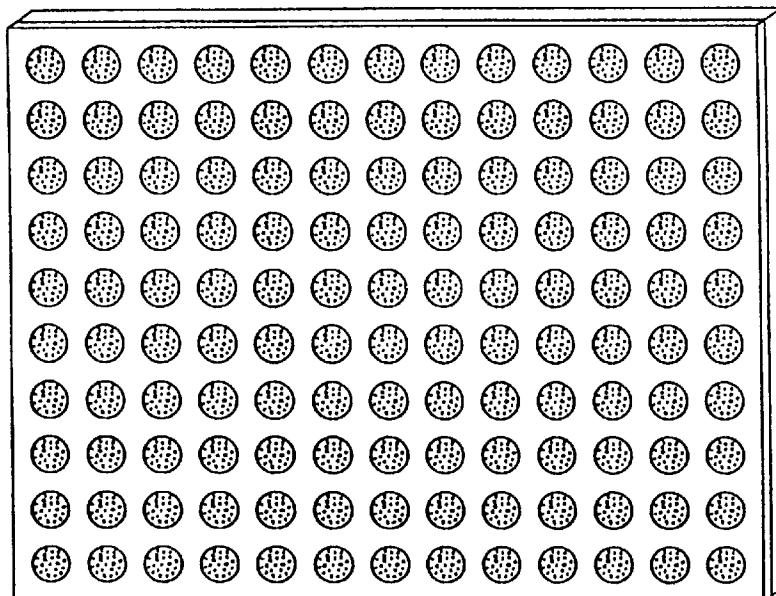


FIG. 5

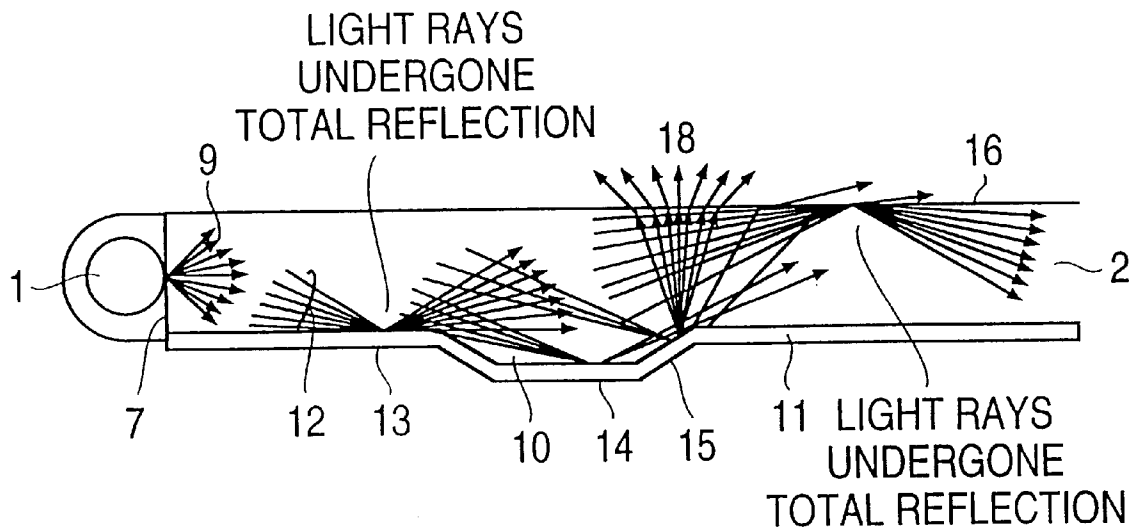


FIG. 6

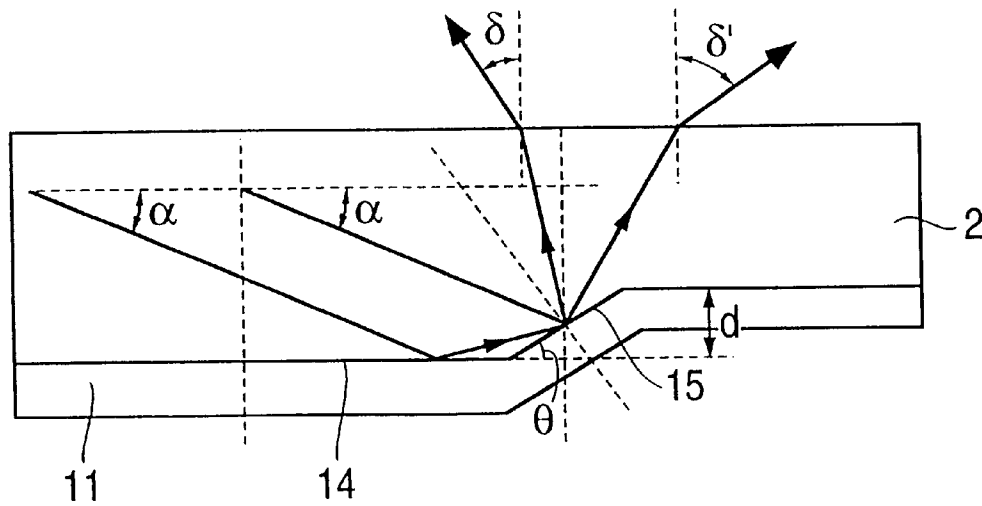


FIG. 7

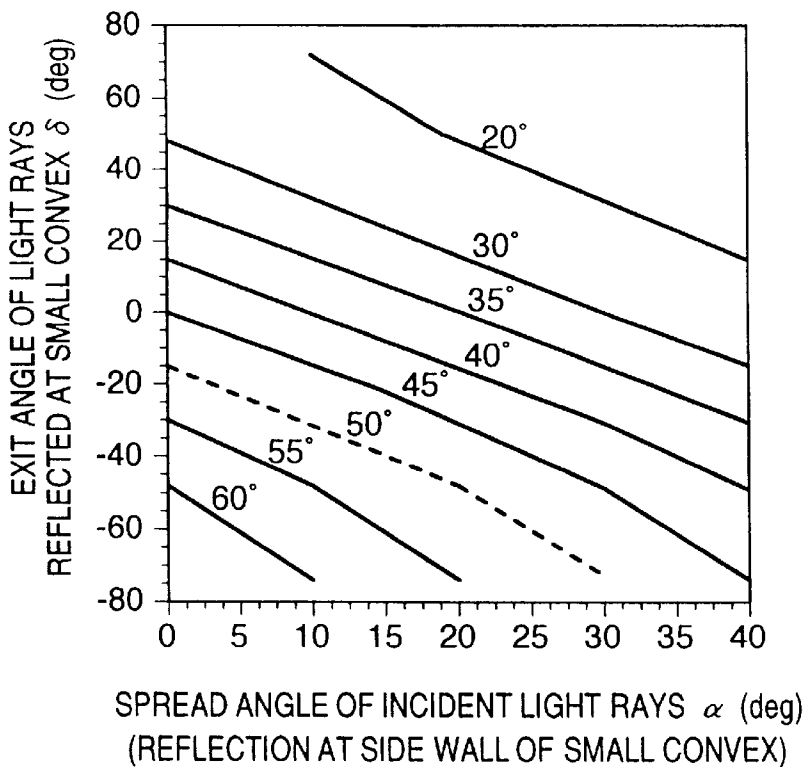
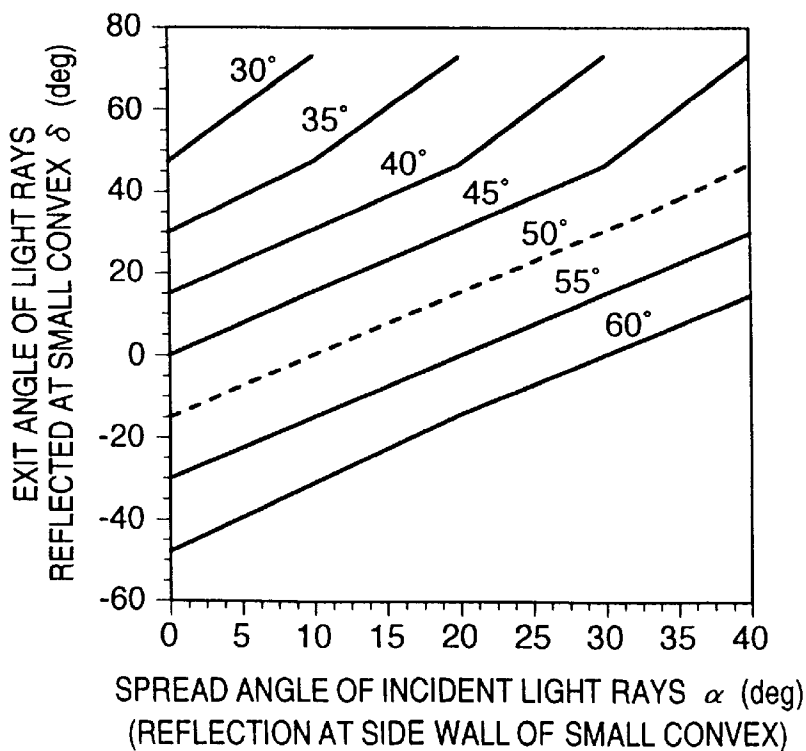


FIG. 8



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