



United States Patent [19]

Suzuki et al.

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[54] **OPTICAL FILM AND LIQUID CRYSTAL DISPLAY DEVICE USING THE FILM**

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[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: **121,657**

[22] Filed: **Sep. 14, 1993**

[30] **Foreign Application Priority Data**

Sep. 16, 1992 [JP] Japan 4-246225

[51] **Int. Cl.⁶** **G02F 1/1343**

[52] **U.S. Cl.** **349/112; 349/62**

[58] **Field of Search** 359/69, 48, 49, 359/50, 42, 599; 362/31, 330, 333; 385/146, 901

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Primary Examiner—William L. Sikes

Assistant Examiner—James A. Dudek

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[57] **ABSTRACT**

The luminance within the viewing angle of an LCD device is increased by using an optical film of transparent material. The film has a first surface having a wave structure including a plurality of isosceles triangle prisms arranged side-by-side, and a second surface having an optically rough structure for performing diffuse transmission. The film may also have a first surface having a structure including a plurality of quadrangular prisms arranged side-by-side, and a second surface having an optically rough structure for performing diffuse transmission.

7 Claims, 8 Drawing Sheets

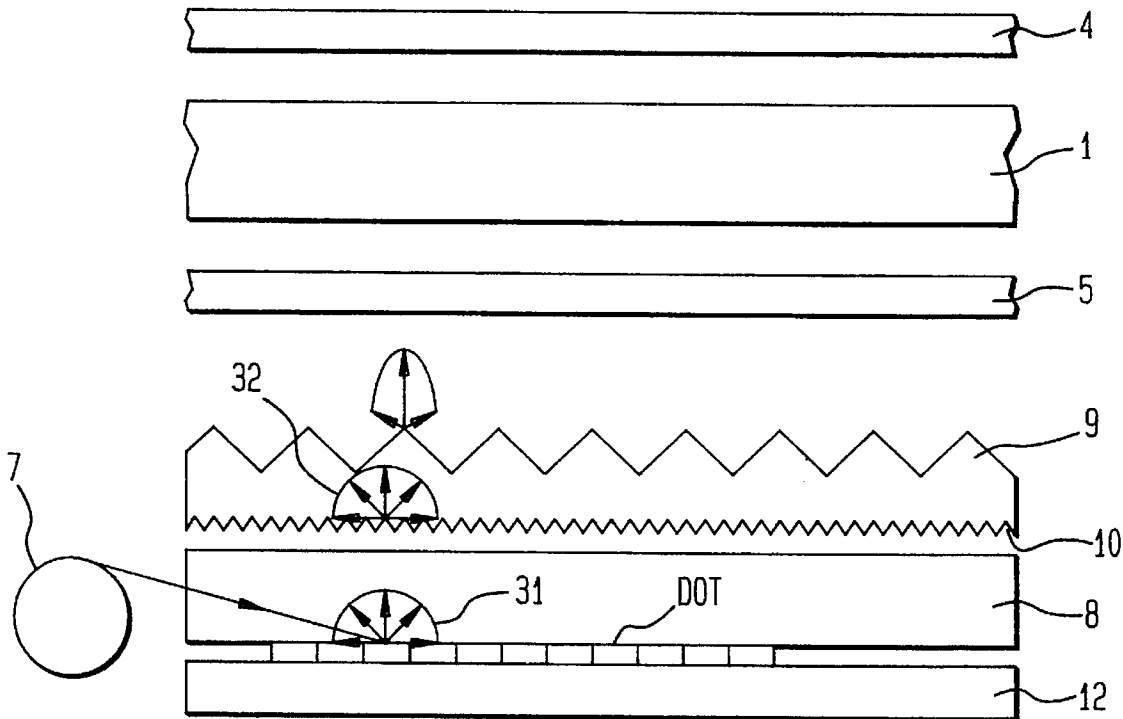


FIG. 1

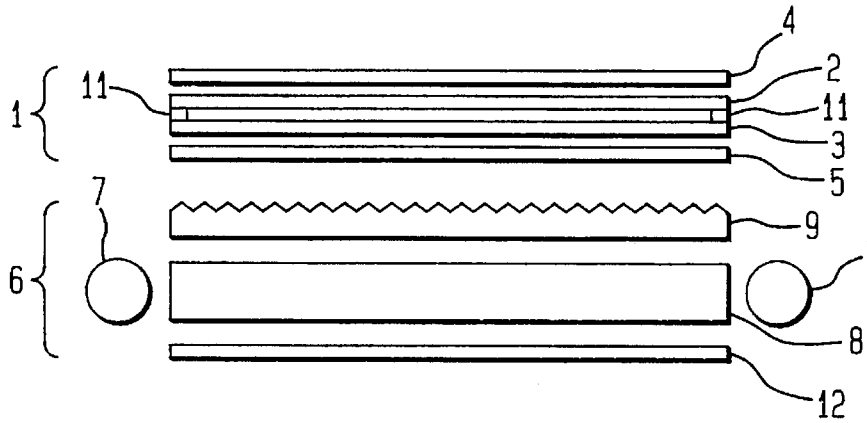


FIG. 2

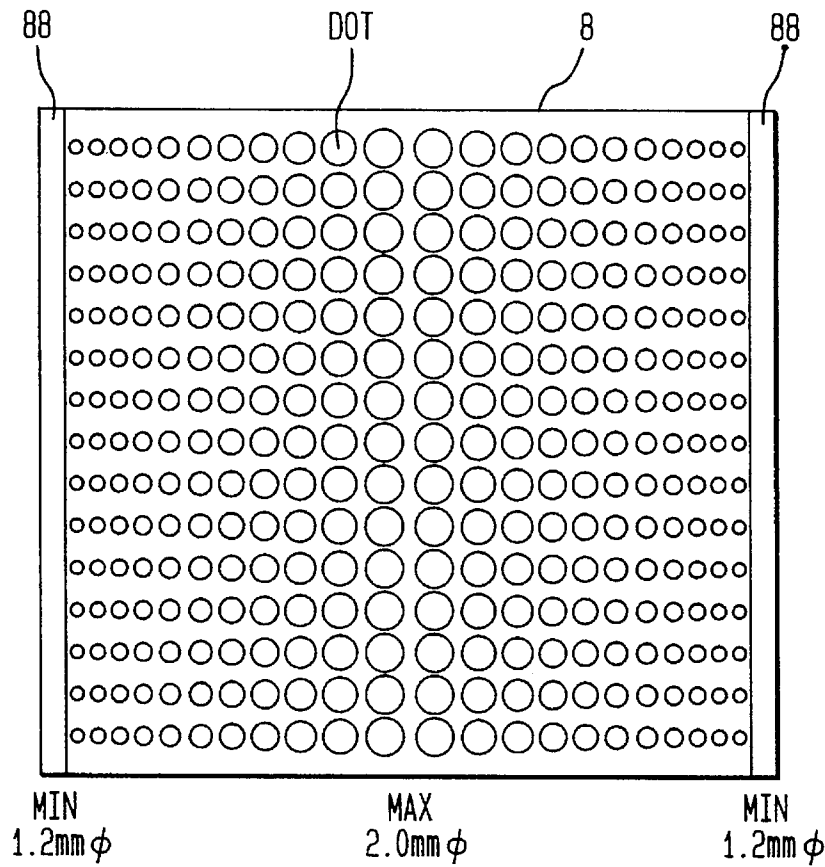


FIG. 3

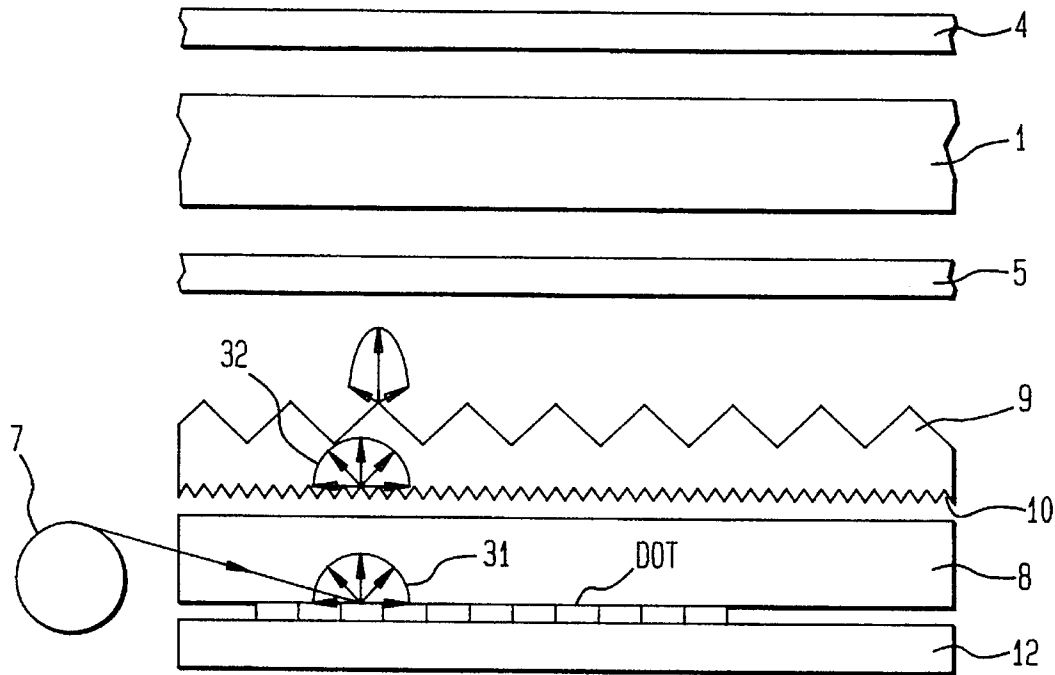


FIG. 4

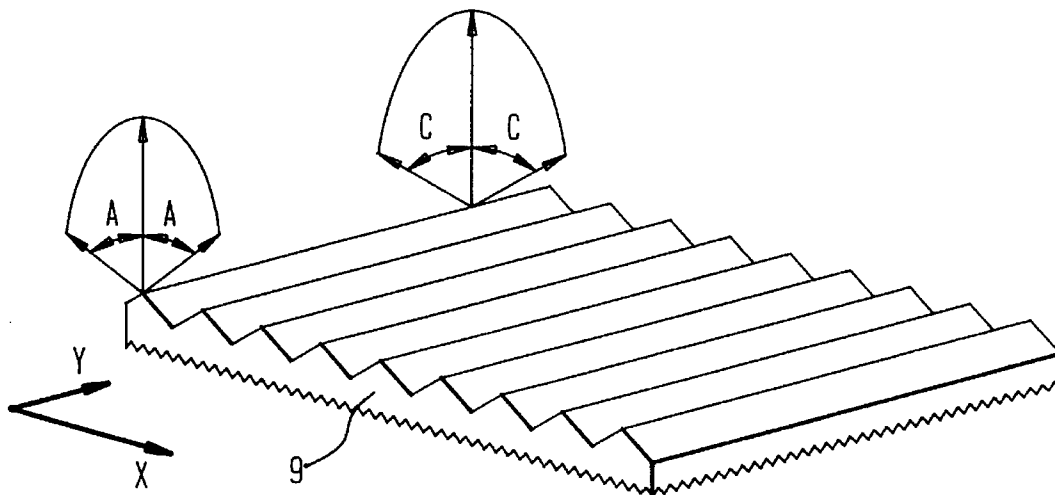


FIG. 5

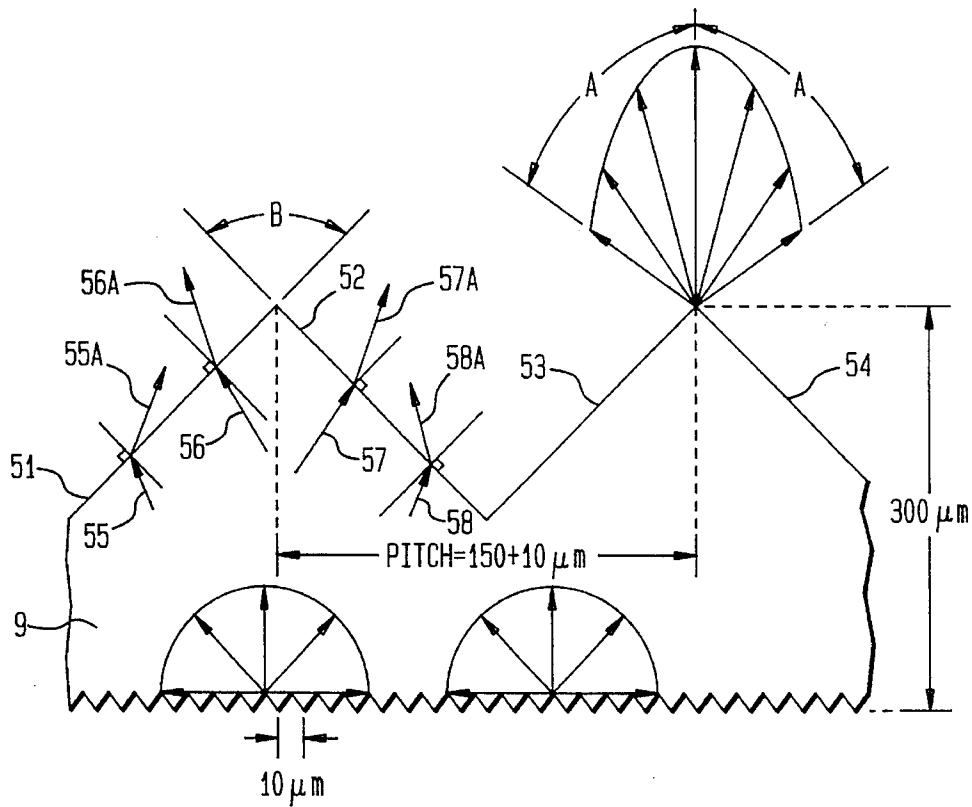


FIG. 14

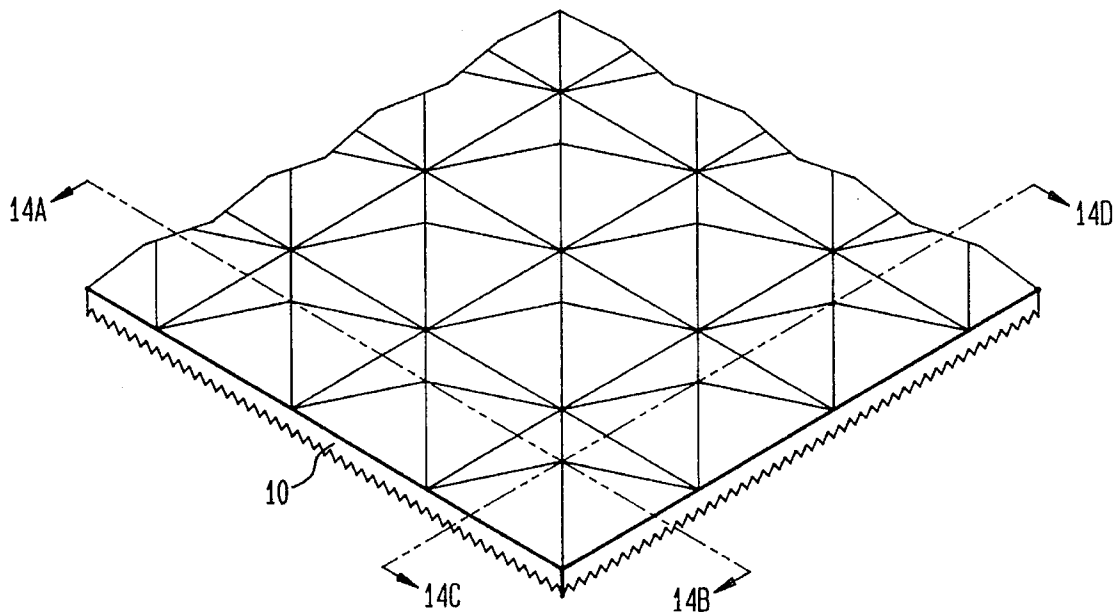


FIG. 6

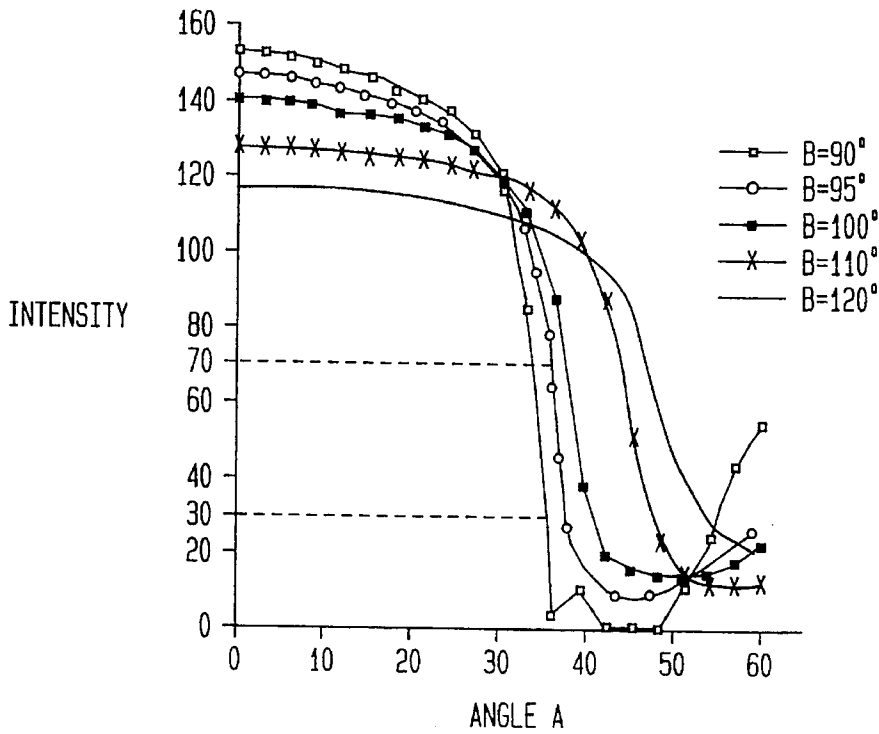
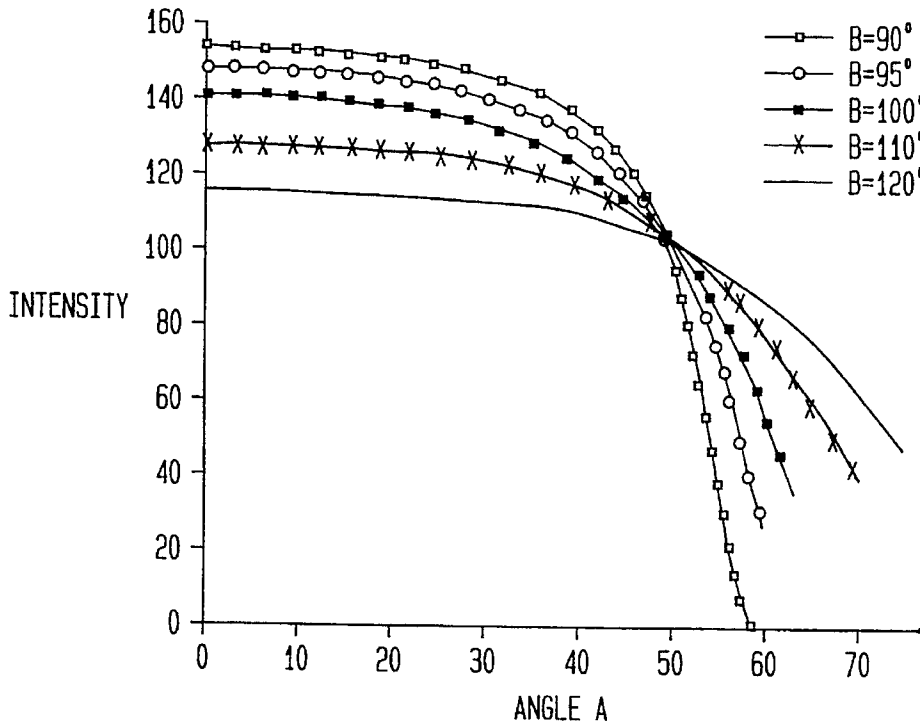


FIG. 7



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