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# United States Patent [19]

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Nishio et al.

[45] Date of Patent: **Jan. 28, 1997**

- [54] **FILM LENS AND A SURFACE LIGHT SOURCE USING THE SAME**
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[73] Assignee: **Dai Nippon Printing Co., Ltd.**, Japan

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[21] Appl. No.: **215,789**

[22] Filed: **Mar. 22, 1994**

### [30] Foreign Application Priority Data

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 Nov. 29, 1993 [JP] Japan ..... 5-323214

[51] Int. Cl.<sup>6</sup> ..... **G02F 1/13**

[52] U.S. Cl. .... **349/57; 362/31; 362/32; 385/147; 349/62**

[58] Field of Search ..... 359/261, 263,  
 359/291, 572, 589, 366, 642, 36, 40, 49,  
 69, 51, 619; 362/31, 32, 26, 27, 330, 329;  
 385/147

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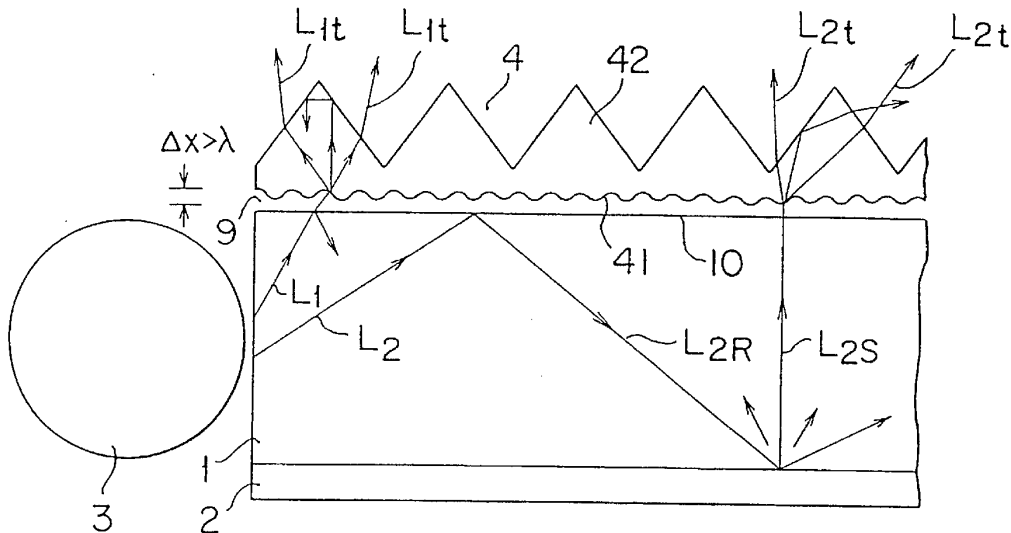
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### [57] ABSTRACT

A film lens comprises a light transmitting base having one side and an opposite side, a plurality of concave or convex unit lenses formed on the one side of the light transmitting base, and a plurality of projections formed on the opposite side of the light transmitting base and having a profile height not smaller than the wavelength of a source light and not greater than 100 μm. In this arrangement, when the film lens is placed on a smooth surface of a light guide plate of a surface light source of the edge-light type, the projections on the reverse side of the light transmitting base can secure a gap with a width not smaller than the wavelength of the source light between the film lens and the light guide plate. Thus, the source light can be uniformly distributed without hindrance throughout the light guide plate as it is totally reflected by the surface of the guide plate. In the surface light source using the film lens, moreover, the lens can provide a uniform luminance in a desired angular range, and a uniform luminance distribution can be obtained for the whole surface without concentration in the vicinity of the light source.

**6 Claims, 11 Drawing Sheets**



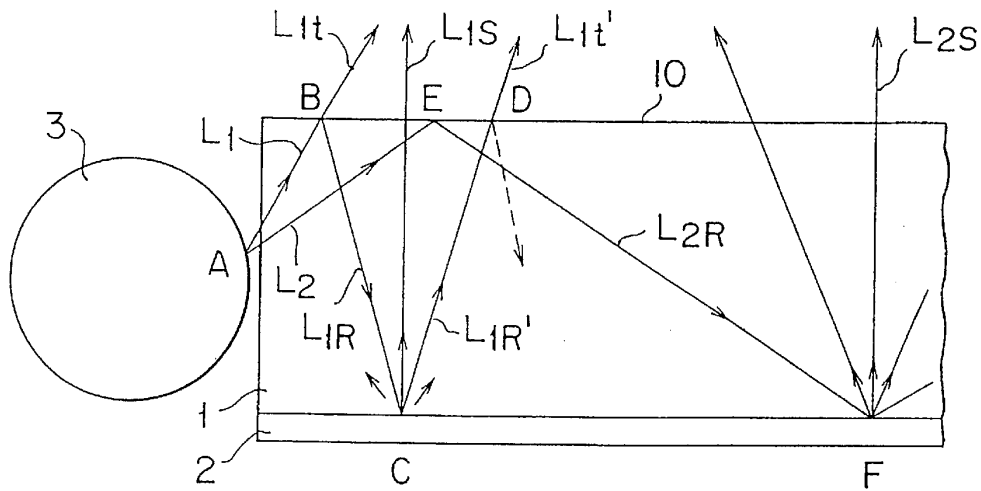


FIG. 1 PRIOR ART

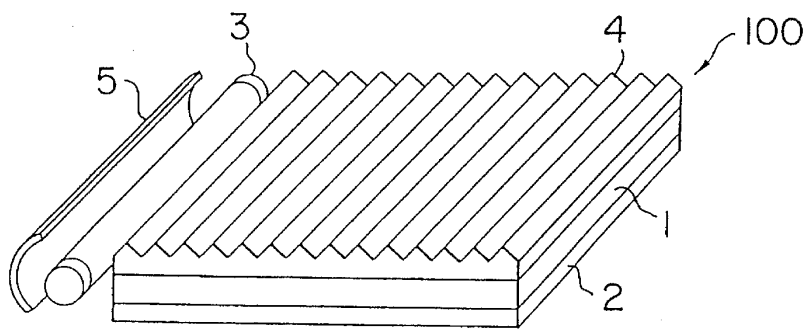


FIG. 2 PRIOR ART

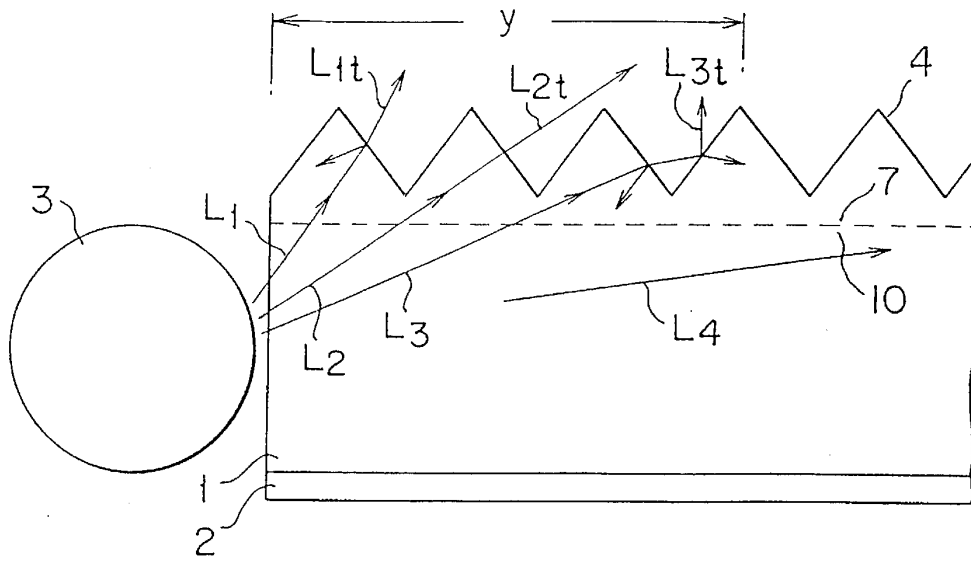


FIG. 3 PRIOR ART

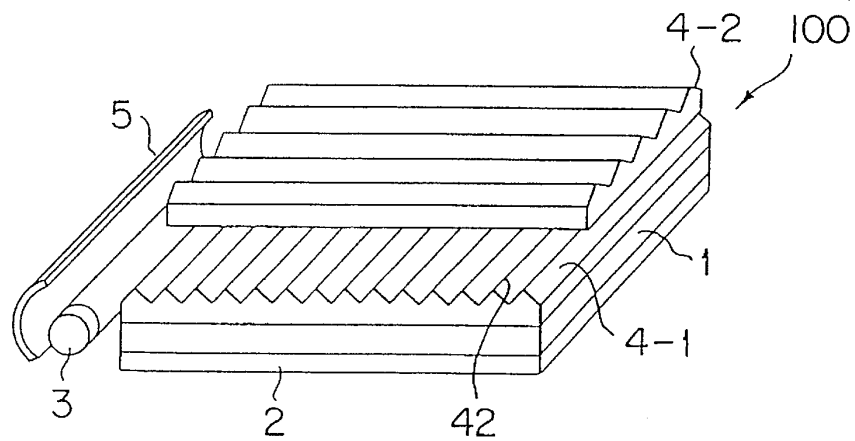


FIG. 4 PRIOR ART

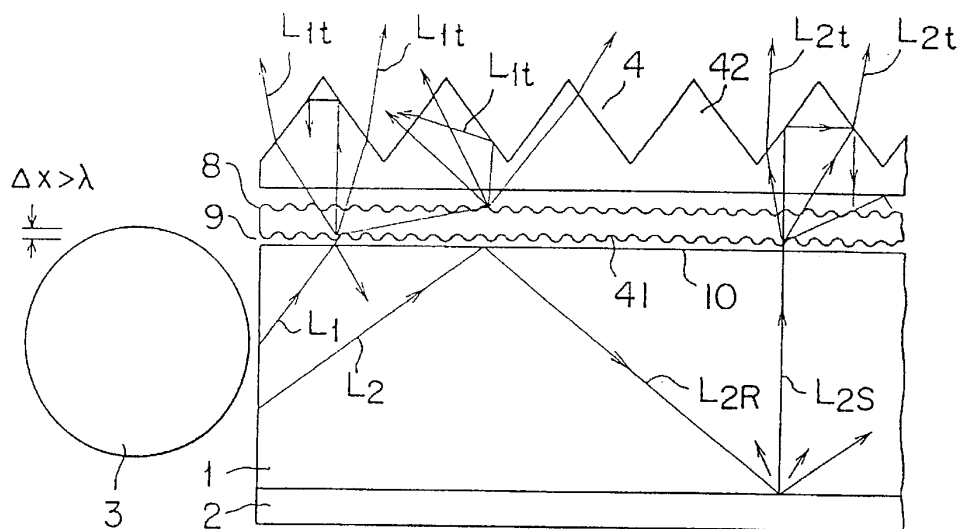


FIG. 5

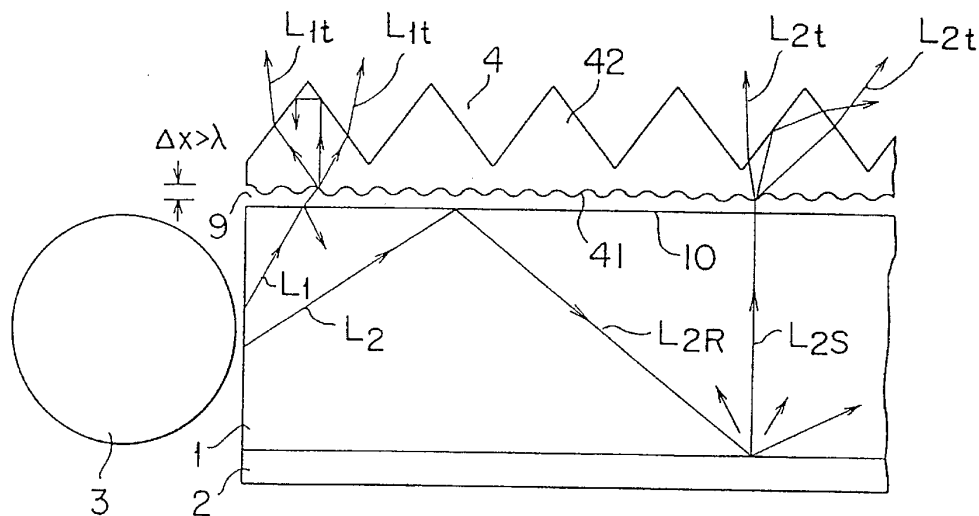


FIG. 6

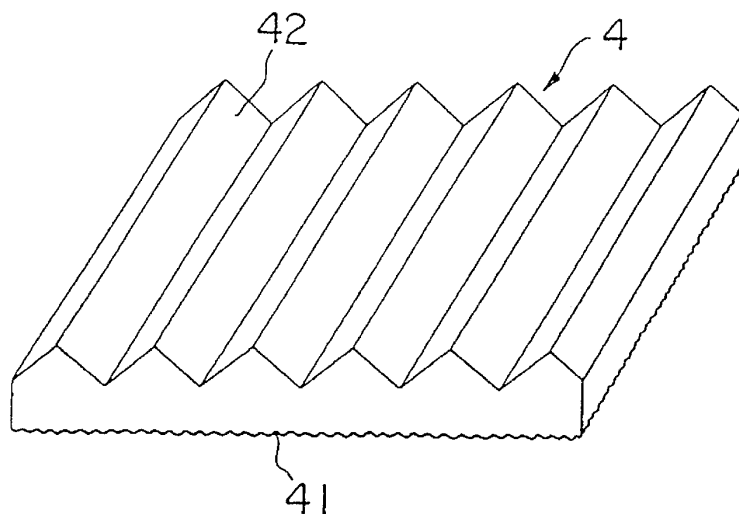


FIG. 7

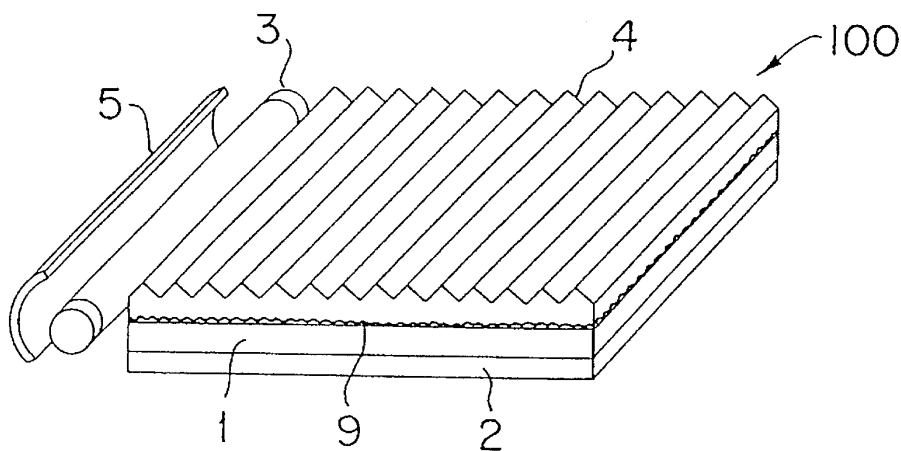


FIG. 8

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