



[54] FLAT LIGHT SOURCE USING LIGHT-DIFFUSING SHEET WITH PROJECTIONS THEREON

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[73] Assignee: Dai Nippon Printing Co., Ltd., Japan

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[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

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[21] Appl. No.: 08/619,623

[57] ABSTRACT

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A flat light source used as back-lighting for a liquid crystal display device includes an optically conductive plate (1) having a light reflecting layer (2), and a light source (3). A light-diffusing sheet (8) is provided outside the optically conductive plate (1) opposite to the light reflecting layer (2). A lens sheet (4) is provided outside the light-diffusing sheet (8), with a transmission type of display element (6) provided on the outer side of the lens sheet (4). The light-diffusing sheet (8) is formed of a transparent material free from light-diffusing agent particles and has minute irregularities (41) formed at random on the front surface thereof. The irregularities are of a surface roughness that is at least the wavelength of the light from the light source, but is no more than 100 μm. When the percentage of the cumulative frequency distribution of the heights of the minute irregularities are plotted along the Y-axis and the heights of these minute irregularities are plotted along the X-axis, the cumulative frequency distribution curve has a convex portion oriented towards the lower side of the coordinates and the average value of the heights of the minute irregularities is greater than the median value thereof. Thus, a flat light source is provided which emits highly luminant light uniformly within a predetermined angular range, and which has no local differences in intensity over the surface thereof.

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[30] Foreign Application Priority Data

Aug. 12, 1994 [JP] Japan 6-210694

[51] Int. Cl.⁶ F21V 7/04

[52] U.S. Cl. 362/31; 362/551

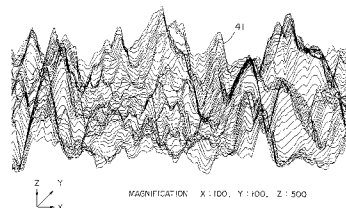
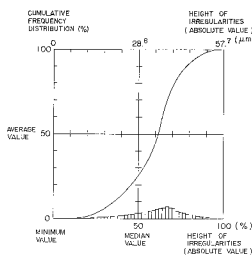
[58] Field of Search 362/26, 31, 551

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11 Claims, 20 Drawing Sheets



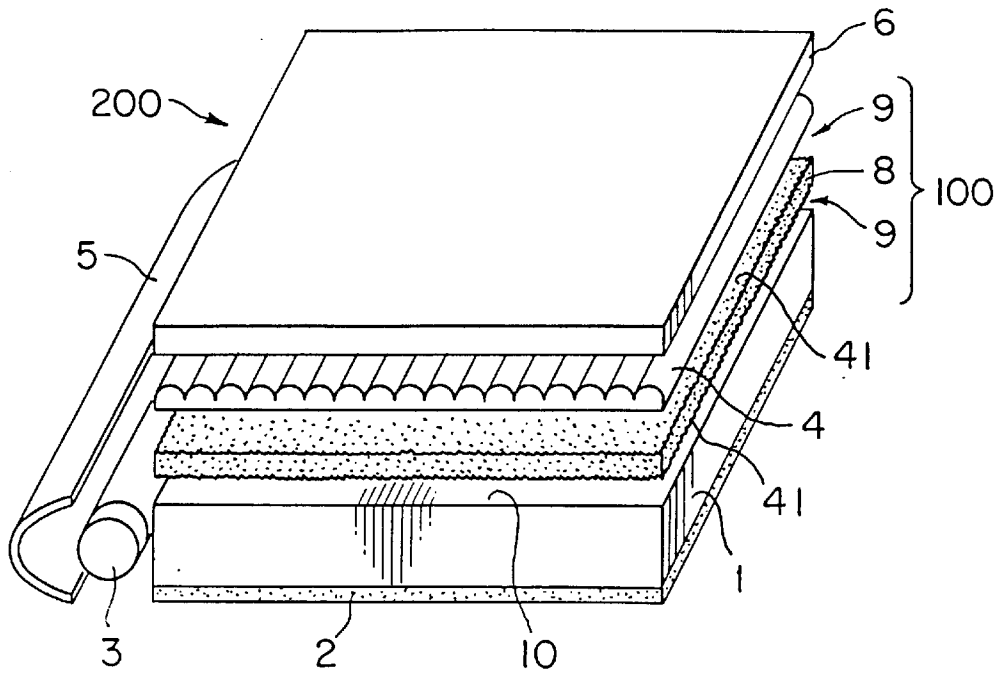


FIG. 1

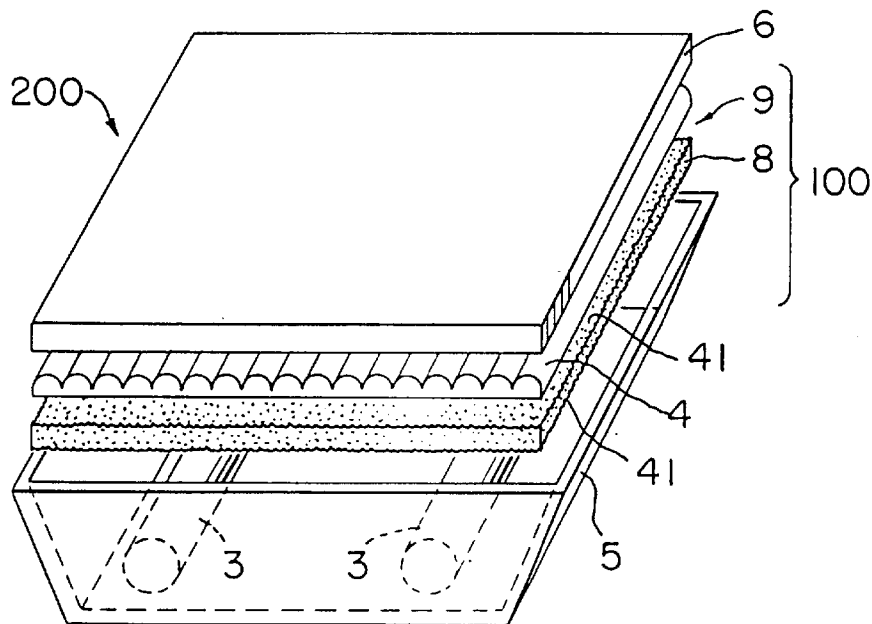


FIG. 2

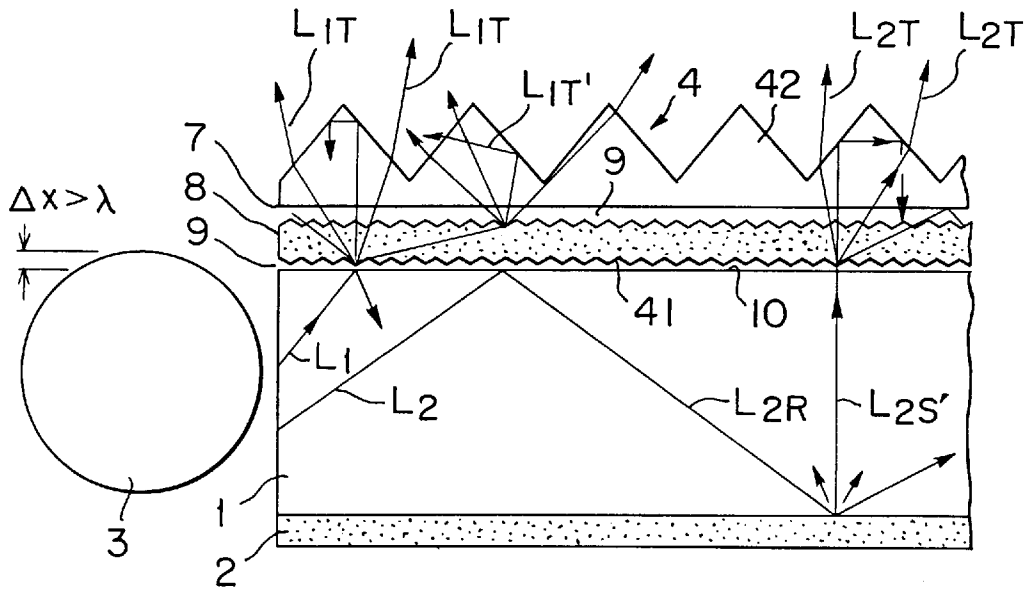


FIG. 3

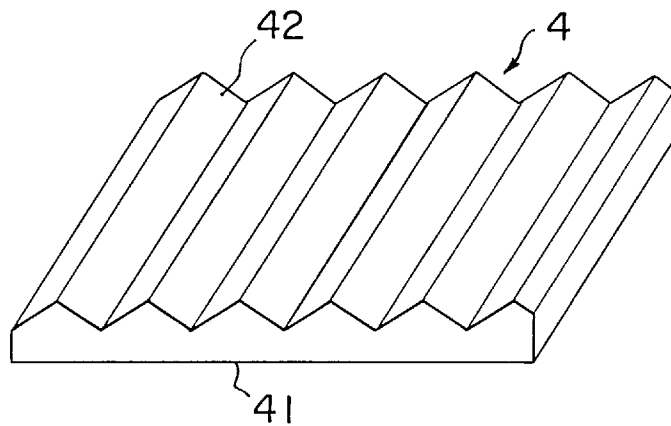


FIG. 4

FIG. 5

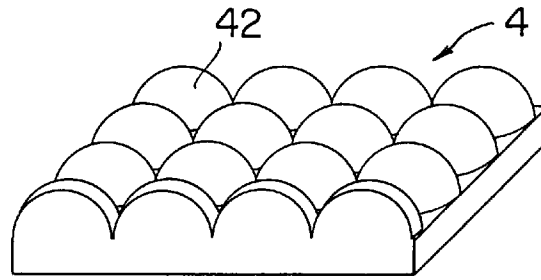


FIG. 6

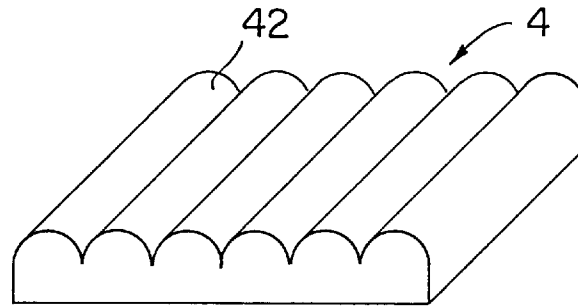


FIG. 7

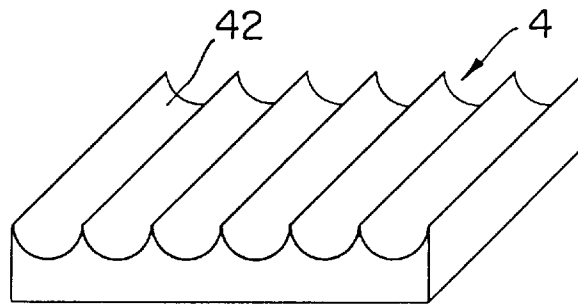
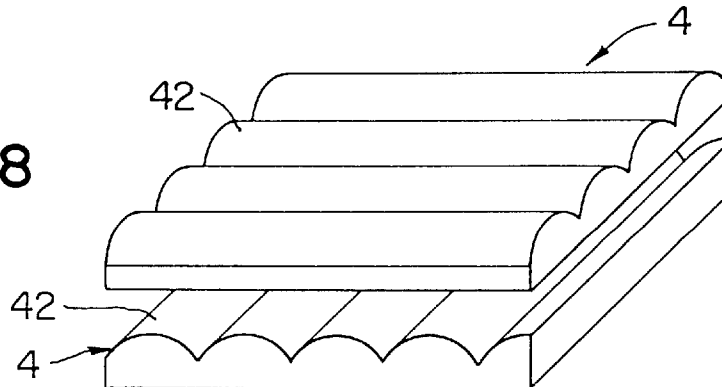


FIG. 8



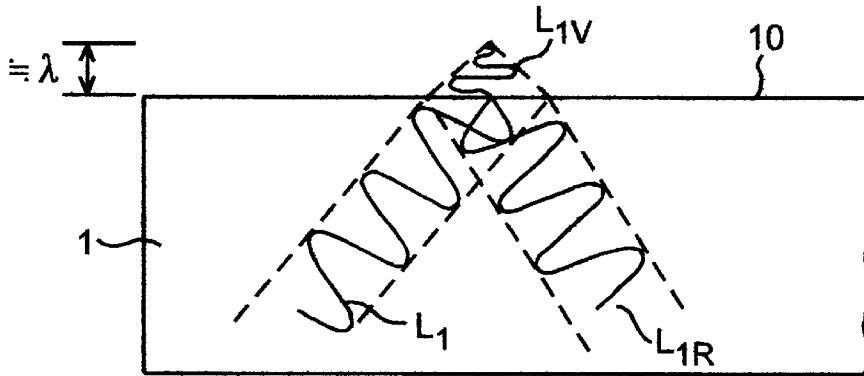


FIG. 9

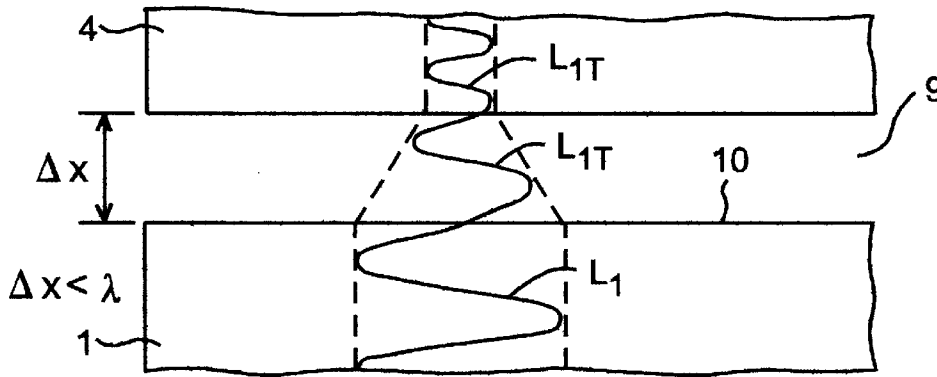


FIG. 10

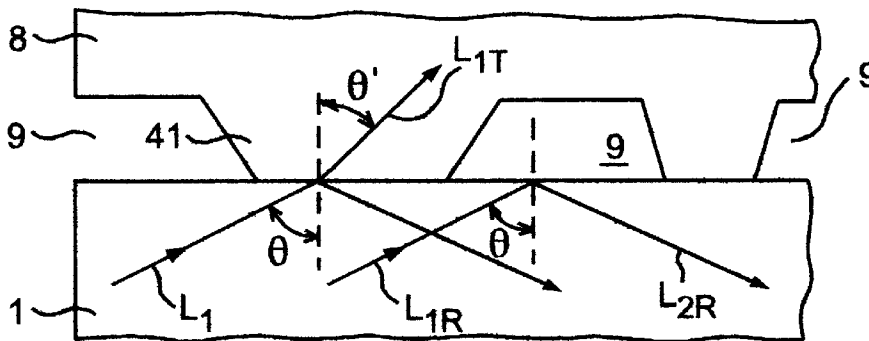


FIG. 11

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