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(54) [Title of the Invention] BACKLIGHT APPARATUS FOR  
LIQUID CRYSTAL DISPLAY ELEMENT

(57) [Abstract]

[Object] An object is to provide a thin LCD backlight apparatus whose luminance does not vary from one area to another, thereby realizing uniform illumination.

[Construction] The apparatus includes a molded resin LED lamp 10, in which plural LEDs are connected in series, a light conductor 11, which is provided at a light emitting side of the LED lamp 10, and a reflector 12, which surrounds the light conductor 11 with the lamp 10. The front surface of the light conductor 11 is a crimp-textured surface 11a formed by surface texturing. Recessed optical paths 11b, each of which extends in a light propagation direction and has a triangular shape in cross section, are formed in the

reverse surface of the light conductor 11.

[Operation] Light emitted from the LED lamp 10 is guided partly through the recessed optical paths 11b to every nook and corner of the light conductor 11, and is diffused into multiple directions by the reflector 12 and the crimp-textured surface 11a.

[Claim]

[Claim 1] A backlight apparatus for a liquid crystal display element, comprising:

a light source that includes plural light emitting elements connected in a line;

a flat light conductor for directing light emitted from the light source, said light conductor being provided at a light emitting side of the light source and having a light emission surface as a front surface; and

a reflector that is provided behind a reverse surface of the conductor;

wherein the front surface of the light conductor is a crimp-textured surface, and

wherein many recessed optical paths extending in a light propagation direction are formed in the reverse surface.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] The present invention relates to a backlight apparatus for a liquid crystal display element that requires an illuminating light source. More particularly, the invention relates to a sidelight-type backlight apparatus that directs light of a light source to a light emission surface in a lateral direction (parallel direction).

[0002]

[Description of the Related Art] A liquid crystal display (LCD) backlight apparatus is widely used as an illuminating light source for an LCD built in various kinds of equipment such as an electronic calculator, a digital watch/clock, a personal computer, a personal word processor, and the like. A sidelight backlight apparatus, which includes a light source made up of plural light emitting elements [e.g., light emitting diodes (LED)] connected at regular intervals, and a light conductor (light guiding plate) provided at a light emitting side of the light source, is known as a type of such a backlight apparatus. In a sidelight backlight apparatus, typically, the front/top of a light conductor functions as a light emission surface, and other surfaces (back and sides) function as reflection surfaces. In such a backlight apparatus, light emitted from a light source is diffused in and by a light conductor and is finally outputted in multiple directions from a light emission surface. To increase efficiency in light diffusion, in some apparatuses, the inside of a light emission surface is crimp (pear's skin) textured, or a light-transmissive diffusion sheet is on the outside of the light emission surface.

[0003]

[Problems to be Solved by the Invention] In a backlight apparatus according to prior art described above, since the

intensity of LED light decreases with distance from a light source, though it is bright at an area near the light source, luminance decreases in proportion to the distance. To overcome this relationship, a known apparatus offers illumination with greater uniformity by diffusing light by means of a reflector (reflection plate). However, the problem of differences in the level of lightness/darkness between the center area of a light emission surface and the peripheral area thereof (darker at the peripheral area) has not been solved yet.

[0004]

One known approach for obtaining uniform illumination is to increase the intensity of illumination by increasing the number of LEDs or raising a voltage applied to LEDs. However, if this approach is taken, it will not only increase the amount of heat generated by the light source but also accelerate the deterioration of the light source. Another known solution is to provide partitions, etc., in a light conductor or a reflector for obtaining uniform and sharp illumination. However, such a structure is more complex, and significantly decreases light transmittance.

[0005]

The thickness of prior-art backlight apparatuses is within a range from 2.5 to 6.0 mm. In the art, it is difficult to reduce a thickness to 2.0 mm or less. The

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