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United States Patent [19]

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Borchardt

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- [54] **BACKLIT DISPLAY WITH ENHANCED VIEWING PROPERTIES**
- [75] Inventor: **Jerry L. Borchardt**, Maple Grove, Minn.
- [73] Assignee: **Honeywell Inc.**, Minneapolis, Minn.
- [21] Appl. No.: **130,084**
- [22] Filed: **Sep. 30, 1993**
- [51] Int. Cl.⁶ **F21V 13/00**
- [52] U.S. Cl. **362/31; 362/26; 362/27; 362/30; 362/331**
- [58] Field of Search **362/800, 26, 30, 27, 362/31, 331, 332, 333; 40/546**

3M/Optical Systems, "Right Angle Backlighting Technology Design Aid", 15 pages.
 "Brightness Enhancement Film", 10 pages.
 3M product brochure 75-0500-0403-7, "Brightness Enhancement Film (BEF)", 2 pages (1993).
 3M, "Diffusion Film", 6 pages.
 3M product brochure 75-0500-0563-8, "Light Diffusing Film", 2 pages (1993).

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[57] ABSTRACT

A high aspect ratio, backlit liquid crystal display in which light from opposing rows of light emitting diodes is projected into the ends of a thin optical cavity. The optical cavity is bounded by one major wall of which the interior surface is specularly reflective and an opposing major wall including a layer of transparent material having an interior surface formed with an array of regularly spaced, fine, triangular prisms which tend to collimate light received from the cavity and project it outwardly perpendicular to the major wall. A diffusion layer overlays the layer of transparent material, and a brightness enhancing film overlays the diffusion layer and functions to convert diffuse illumination received through the diffusion layer into directed illumination predominantly falling within the a viewing space bounded by predetermined angles.

[56] References Cited

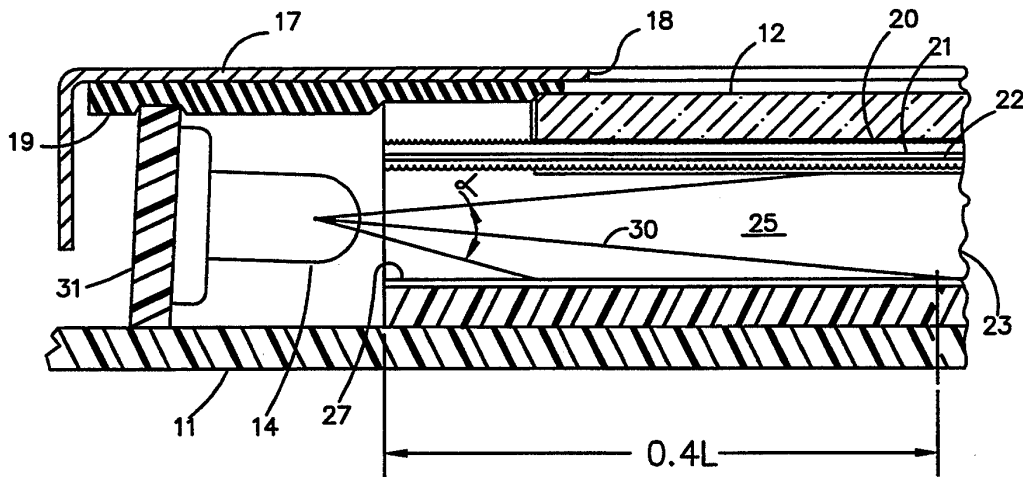
U.S. PATENT DOCUMENTS

4,714,983	12/1987	Lang	362/27
4,874,228	10/1989	Aho et al.	
4,922,384	5/1990	Torrence	362/31
4,984,144	1/1991	Cobb, Jr. et al.	
4,994,941	2/1991	Wen	362/26
5,054,885	10/1991	Melby	
5,070,431	12/1991	Kitazawa et al.	362/26 X
5,190,370	3/1993	Miller et al.	
5,272,601	12/1993	McKillip	362/27

OTHER PUBLICATIONS

R. McCartney, et al., "S7-7 Directional Diffuser Lens Array for Backlit LCD's", Japan Display '92, pp. 259-262.

10 Claims, 4 Drawing Sheets



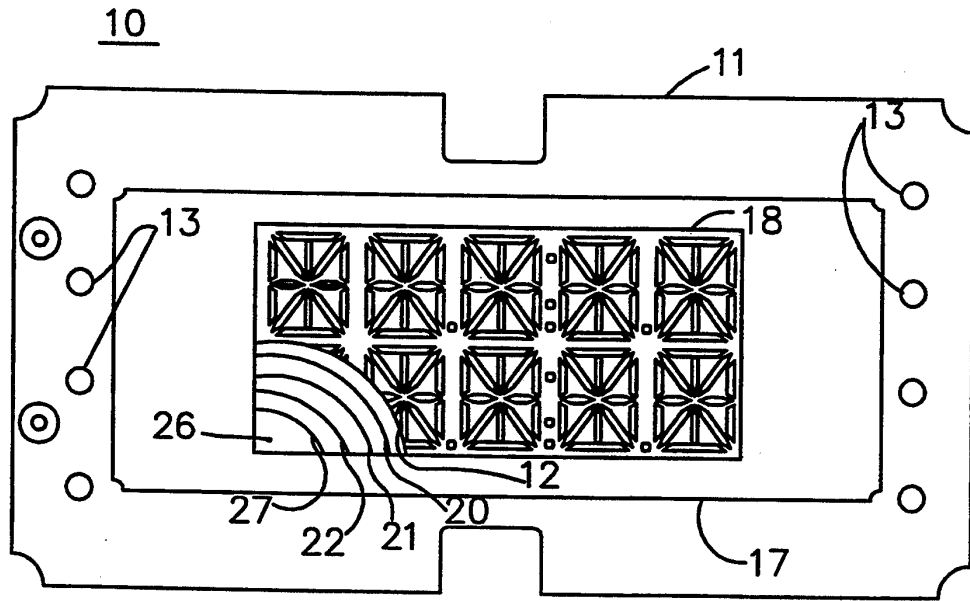


Fig. 1

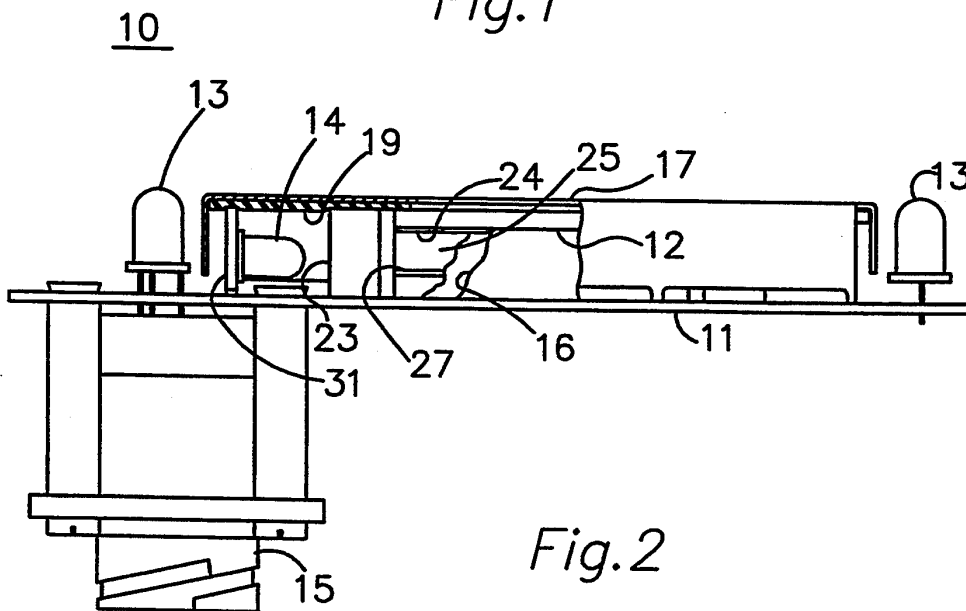


Fig. 2

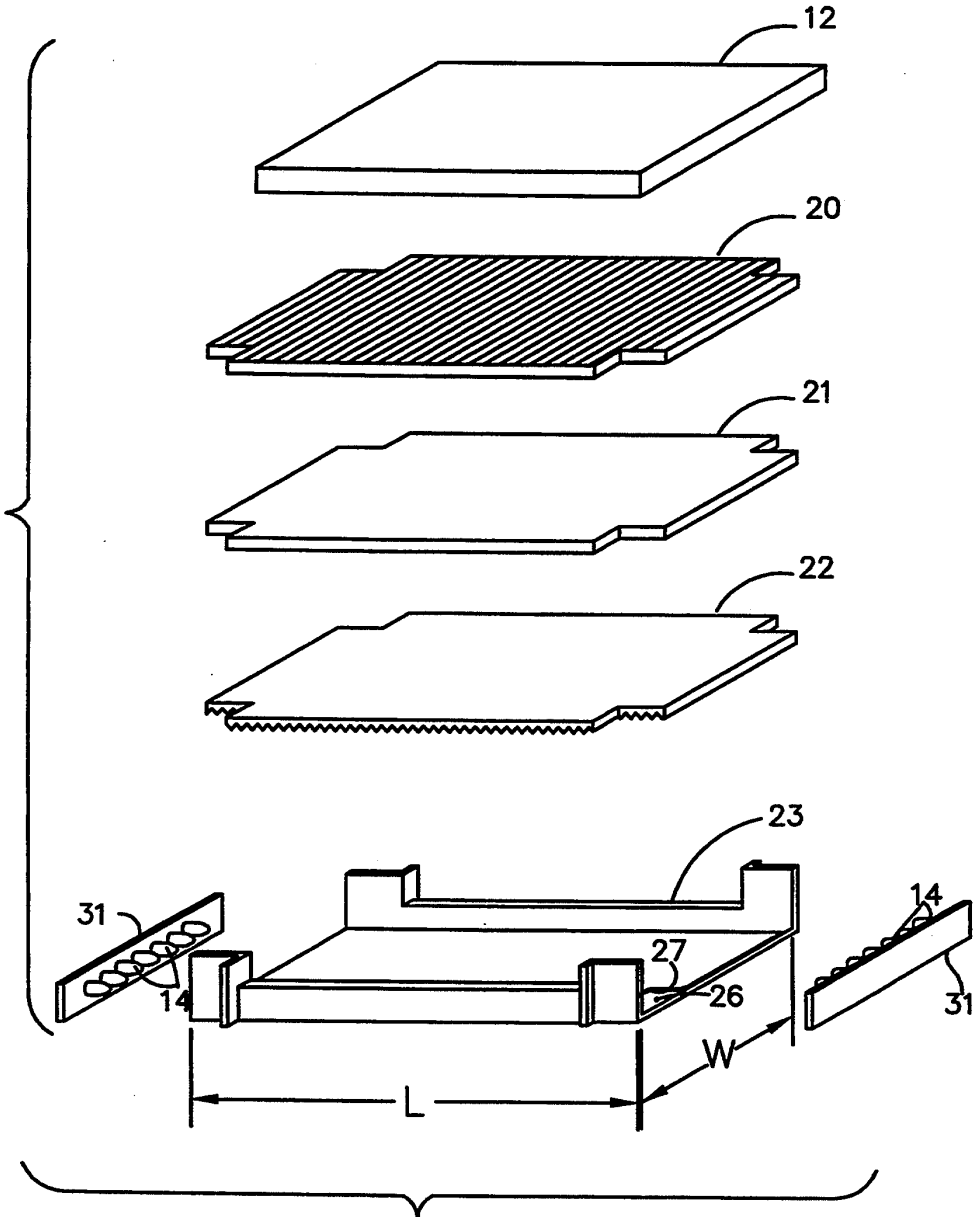


Fig. 3

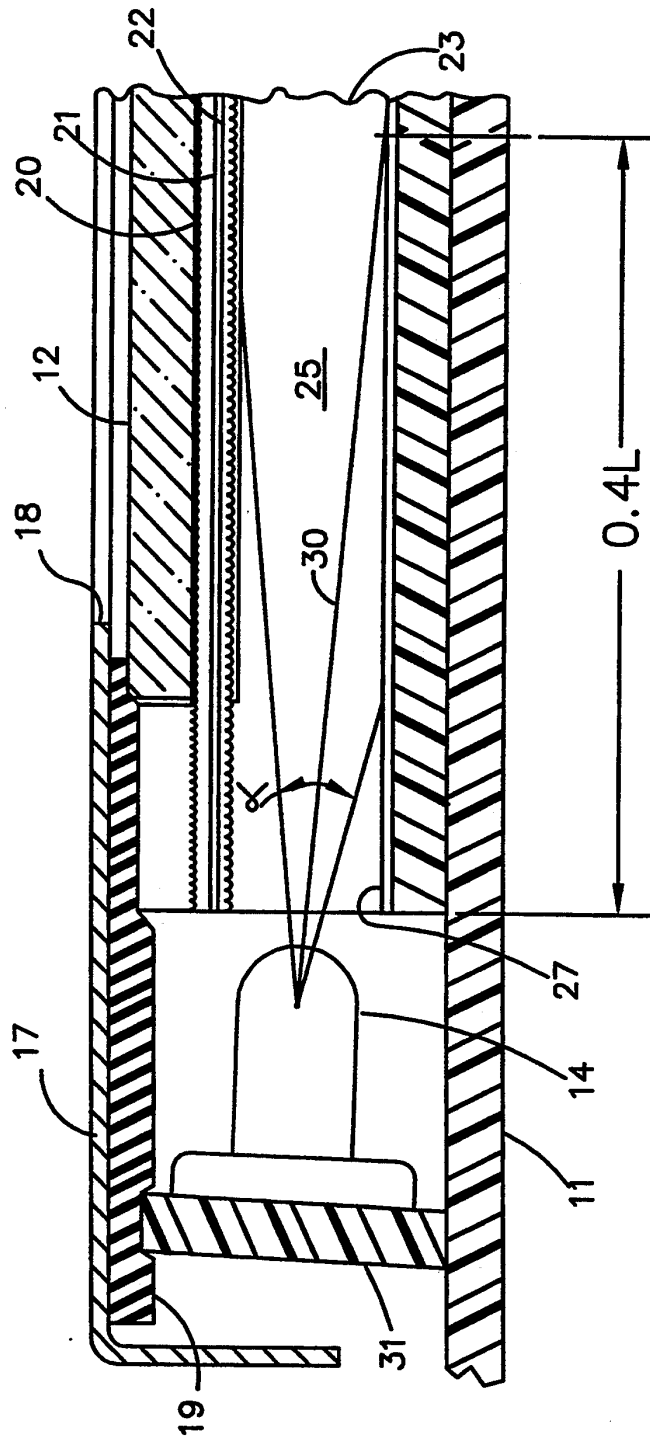


Fig. 4

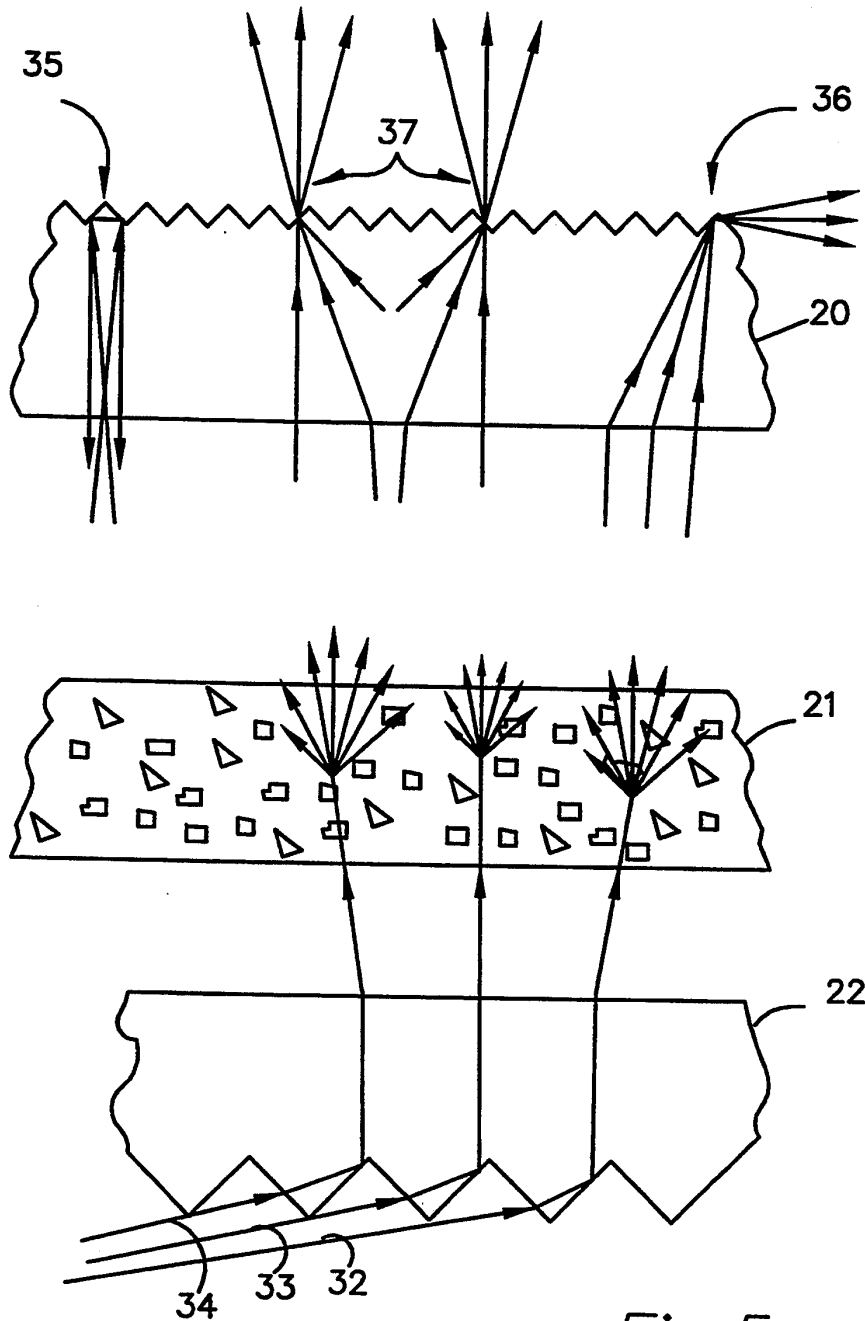


Fig. 5.

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