US005138472A

United States Patent [19]

Jones et al.

[11] Patent Number: 5,138,472

[45] Date of Patent: Aug. 11, 1992

[54] DISPLAY HAVING LIGHT SCATTERING CENTERS

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[21] Appl. No.: **653,563**

[22] Filed: **Feb. 11, 1991**

[51] **Int. Cl.**[5] **G02F 1/13**

[52] **U.S. Cl.** **359/52**; 359/51; 359/69

[58] **Field of Search** ..... 350/339 D, 347 V; 359/51, 69, 52, 98

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,905,682	9/1975	Meyerhofer	350/160 LC
3,984,176	10/1976	Hirai et al.	350/345
4,435,047	3/1984	Fergason	350/334
4,591,233	5/1986	Fergason	350/334
4,606,611	8/1986	Fergason	350/350 R
4,616,903	10/1986	Fergason	350/347 V
4,648,691	3/1987	Oguchi et al.	350/338
4,671,618	6/1987	Wu et al.	350/350 R
4,673,255	6/1987	West et al.	350/350 R
4,685,771	8/1987	West et al.	350/347 V
4,688,900	8/1987	Doane et al.	350/351
4,707,080	11/1987	Fergason	350/334
4,832,458	5/1989	Fergason et al.	350/338
5,088,807	2/1992	Waters et al.	359/51

FOREIGN PATENT DOCUMENTS

0326248A2	8/1989	European Pat. Off. .	
0005996	1/1978	Japan	350/339 D
WO90/03593	4/1990	PCT Int'l Appl. .	

OTHER PUBLICATIONS

Haas, "Scattering Electro-Optic Cells," Xerox Disclosure Journal, vol. 3, No. 5, Sep./Oct. 1978, pp. 333-334.

J. Applied Phys. 62(9); Angular discrimination of light transmission through polymer-dispersed liquid-crystal films; Wu et al.; pp. 3925-3931 (1987).

The Physics and Chemistry of Liquid Crystal Devices; IBM Research Library; pp. 190-194 (1979).

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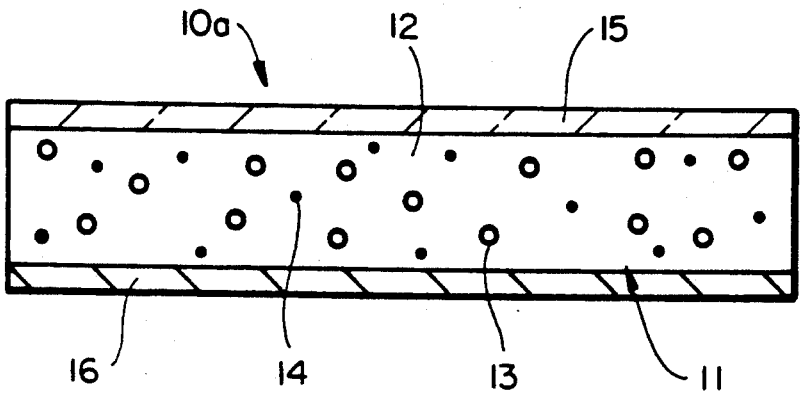
[57] **ABSTRACT**

A display having (a) a first electrode; (b) a second electrode; (c) a display medium positioned between the first and second electrodes, which display medium is switchable between a first state in which incident light is at least one of scattered and absorbed and a second state in which the amount of such scattering and/or absorption is reduced; and (d) scattering centers disposed in front of the second electrode for scattering incident light with a scattering half angle of between about 2 and about 40 degrees when the display medium is in its second state, while permitting at least 10% of the incident light to be transmitted.

15 Claims, 5 Drawing Sheets