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Sheridon

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[54] **MULTITHRESHOLD ADDRESSING OF A TWISTING BALL DISPLAY**

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[58] **Field of Search** 345/85, 84, 107, 345/95

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,126,854	11/1978	Sheridon	340/373
4,143,103	3/1979	Sheridon	264/4
4,261,653	4/1981	Goodrich	350/362
4,268,413	5/1981	Dabisch	252/408
4,299,880	11/1981	Arens	428/304
4,374,889	2/1983	Arens	428/207
4,418,098	11/1983	Maistrovich	427/161
4,438,160	3/1984	Ishikawa et al.	427/214
4,500,172	2/1985	Gagnon et al.	350/331
4,688,900	8/1987	Doane et al.	350/347
4,695,528	9/1987	Dabisch et al.	430/290
4,729,687	3/1988	Arens	401/198
4,810,431	3/1989	Leidner	264/15
4,837,071	6/1989	Tagoku et al.	428/195
4,877,253	10/1989	Arens	273/240
4,890,902	1/1990	Doane et al.	350/347
4,919,521	4/1990	Tada et al.	350/362
4,948,232	8/1990	Lange et al.	350/334
4,991,941	2/1991	Kalmanash	350/347
4,994,204	2/1991	Doane et al.	252/299.01
5,075,186	12/1991	Sheridon	430/47
5,155,607	10/1992	Inoue et al.	359/51
5,157,011	10/1992	Okabe et al.	503/201
5,189,658	2/1993	Moses	369/100
5,219,820	6/1993	Morohoshi et al.	503/204
5,249,000	9/1993	Okabe et al.	346/151
5,251,048	10/1993	Doane et al.	359/51
5,262,098	11/1993	Crowley et al.	264/8
5,262,374	11/1993	Okabe et al.	503/201
5,274,460	12/1993	Yamada et al.	358/296
5,315,418	5/1994	Sprague et al.	359/41
5,344,594	9/1994	Sheridon	264/4
5,354,598	10/1994	Arens	428/195
5,363,222	11/1994	Ledebuhr	359/40
5,383,008	1/1995	Sheridon	355/256
5,384,067	1/1995	Doane et al.	252/299
5,389,426	2/1995	Arens et al.	428/195
5,389,945	2/1995	Sheridon	345/85
5,397,503	3/1995	Yuasa et al.	252/299.01
5,432,526	7/1995	Hyatt	345/87
5,432,534	7/1995	Maruyama et al.	347/172
5,469,020	11/1995	Herrick	313/511

OTHER PUBLICATIONS

Lawrence L. Lee, "A Magnetic Particles Display," *IEEE Transactions on Electron Devices*, vol. ED–22, No. 9, Sep. 1975, pp. 758–765.

(List continued on next page.)

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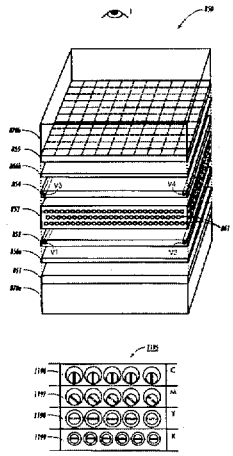
[57] **ABSTRACT**

A multithreshold electrical twisting ball display device. The device is composed of electrically and optically anisotropic spheroidal balls of at least two different rotation thresholds, disposed in an elastomer substrate, together with an addressing electrode assembly. The addressing electrode assembly allows a preferred region of the substrate to be selected in which at least one ball of the first set and at least one ball of the second set are disposed, and first and second electric field to be applied to the preferred region thus selected, each of the first and second electric fields extending throughout the preferred region. The first field facilitates a contemporaneous rotation of balls of both the first and second sets rotatably disposed in the preferred region. The second electric field facilitates a rotation of balls of the second set rotatably disposed in the preferred region, without facilitating a rotation of any ball of the first set rotatably disposed in the preferred region. Also disclosed are the substrate material and electrode assembly for the device, and a method of using the device.

26 Claims, 32 Drawing Sheets