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(54) **DIFFUSE MULTILAYER OPTICAL ASSEMBLY**

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(58) **Field of Classification Search** 349/96, 349/61–71, 98; 428/1.1, 1.3, 1.31
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,655,263	A	4/1972	Hoffman et al.
4,074,004	A	2/1978	Bateson et al.
4,415,509	A	11/1983	Toyooka et al.
4,737,559	A	4/1988	Kellen et al.
5,112,722	A	5/1992	Tsujino et al.
5,162,087	A	11/1992	Fukuzawa et al.
5,269,977	A	12/1993	Nakahashi et al.
5,540,978	A	7/1996	Schrenk
5,592,047	A	1/1997	Park et al.
5,751,388	A	5/1998	Larson
5,753,362	A	5/1998	Kawase et al.
5,793,456	A	8/1998	Broer et al.
5,825,543	A	10/1998	Ouderkirk et al.
5,867,316	A	2/1999	Carlson et al.
5,882,774	A	3/1999	Jonza et al.
5,914,560	A	6/1999	Winsor
6,042,945	A	3/2000	Maekawa
6,057,961	A	5/2000	Allen et al.
6,080,467	A	6/2000	Weber et al.
6,111,696	A	8/2000	Allen et al.
6,111,697	A	8/2000	Merrill et al.
6,122,103	A	9/2000	Perkins et al.
6,153,289	A	11/2000	Murray
6,163,351	A	12/2000	Nakayama
6,163,651	A *	12/2000	Washisu et al. 396/55

(Continued)

FOREIGN PATENT DOCUMENTS

CN	1104325	6/1995

(Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 60/690992, entitled "Diffuse Multilayer Optical Article", filed on Jun. 15, 2005.

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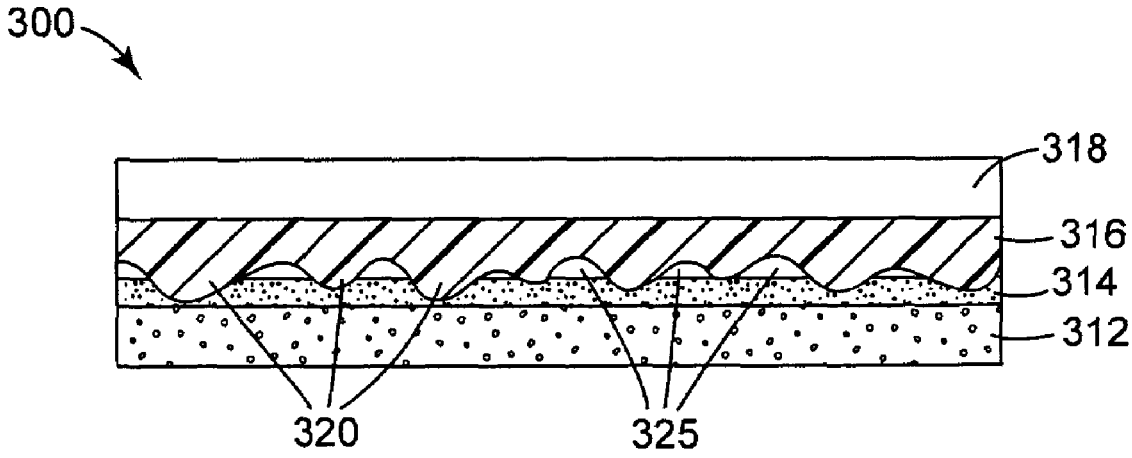
(57) **ABSTRACT**

An optical assembly includes a light diffusing layer attached to a reflective polarizing layer. An intermediate region between the light diffusing layer and the reflective polarizing layer includes an intermediate structure that defines voids between the light diffusing layer and the reflective polarizing layer.

13 Claims, 2 Drawing Sheets