



US007777832B2

(12) **United States Patent**
Richard et al.

(10) **Patent No.:** **US 7,777,832 B2**
(45) **Date of Patent:** **Aug. 17, 2010**

(54) **MULTI-FUNCTION ENHANCEMENT FILM**

5,076,668 A 12/1991 Dalisa
5,128,783 A 7/1992 Abileah
5,146,415 A 9/1992 Faris
5,161,041 A 11/1992 Abileah
5,190,370 A 3/1993 Miller
5,247,390 A 9/1993 Hed
5,268,782 A 12/1993 Wenz et al.

(75) Inventors: **James T. Richard**, Lake Elmo, MN (US); **Clinton L. Jones**, Somerset, WI (US)

(73) Assignee: **3M Innovative Properties Company**, Saint Paul, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 894 days.

(Continued)

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **11/283,307**

DE 3407431 8/1985

(22) Filed: **Nov. 18, 2005**

(65) **Prior Publication Data**

US 2007/0115407 A1 May 24, 2007

(Continued)

OTHER PUBLICATIONS

(51) **Int. Cl.**
G02F 1/1335 (2006.01)

US 2001/0013282 A1, 08/2001, LaBelle et al. (withdrawn)

(52) **U.S. Cl.** **349/64**; 349/112; 349/62;
349/61

Primary Examiner—Hoan C Nguyen

(58) **Field of Classification Search** 349/60–62,
349/112; 385/146; 362/246, 335, 558
See application file for complete search history.

(57) **ABSTRACT**

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 3,531,358 A 9/1970 Rost et al.
- 3,754,813 A 8/1973 DePalma
- 3,765,281 A 10/1973 Wolfe
- 3,788,171 A 1/1974 Hoadley
- 3,851,093 A 11/1974 Sunstein
- RE29,091 E 12/1976 DePalma
- 4,542,449 A 9/1985 Whitehead
- 4,576,850 A 3/1986 Martens
- 4,791,540 A 12/1988 Dreyer, Jr.
- 4,804,253 A 2/1989 Stewart
- 4,906,070 A 3/1990 Cobb, Jr.
- 4,971,719 A 11/1990 Vaz et al.
- 4,984,144 A 1/1991 Cobb, Jr. et al.
- 5,005,108 A 4/1991 Pristash

A light management unit is described for attachment to a display module, especially suited for an LCD TV or LCD monitor. The light management unit includes a directionally recycling layer including a structured side and a planar side where the structured side includes prism structures. The light management unit also includes a reflective polarizer positioned on the planar side of the directionally recycling layer. The light management unit also includes a diffusion structure incorporated into either the directionally recycling layer or between the directional recycling layer and the reflective polarizer. The diffusion structure causes a level of diffusion that is sufficient to prevent the appearance of colored bands when a viewer positioned along a line of sight that is perpendicular to the direction of the prism structures views the light management unit, illuminated from below, at an oblique angle from a vertical axis.

22 Claims, 6 Drawing Sheets

