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(54) **DISPLAY SYSTEM COMPRISING A SCREEN COMPRISING AN ARRAY OF THREE-DIMENSIONAL SCATTERING PATTERNS**

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(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,140,972 B2 *	9/2015	Pelletier	.....	G02B 27/0172
9,229,310 B2 *	1/2016	Pelletier	.....	G02B 5/021
2005/0206854 A1	9/2005	Katase		
2007/0217005 A1 *	9/2007	Novet	.....	G03B 21/60 359/459
2008/0094705 A1 *	4/2008	Burkum	.....	G03B 21/60 359/487.05
2010/0067107 A1 *	3/2010	Akiyama	.....	G03B 21/60 359/459
2013/0050814 A1 *	2/2013	Jeon	.....	G03B 21/60 359/449

(Continued)

FOREIGN PATENT DOCUMENTS

FR	2 986 624 A1	8/2013
WO	WO 2005/043233 A2	5/2005
WO	WO 2013/046858 A1	4/2013

OTHER PUBLICATIONS

French Search Report for French Counterpart Application No. FR 1302896, 7 pgs. (Sep. 3, 2014).

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(57) **ABSTRACT**

The general field of the invention is that of display systems comprising an image projector and an associated display screen, the said display system being designed to be used by an observer situated at a given location, the said display screen comprising two transparent and substantially parallel faces, the said display screen comprising, on at least one of its transparent faces, a plurality of regularly distributed light-scattering patterns. The image projector according to the invention illuminating the screen under a plurality of angles of incidence determined by the position and the size of the display screen, the said angles of incidence being centered on a mean angle of incidence, the scattering patterns comprise at least one scattering surface oriented in such a manner as to diffuse the light rays having at least the mean angle of incidence in one or more directions corresponding to the said given location of the observer. Several embodiments are described.

6 Claims, 4 Drawing Sheets

