



US010439088B2

(12) **United States Patent**
Vasylyev

(10) **Patent No.:** **US 10,439,088 B2**

(45) **Date of Patent:** **Oct. 8, 2019**

(54) **LIGHT CONVERTING SYSTEM
EMPLOYING PLANAR LIGHT TRAPPING
AND LIGHT ABSORBING STRUCTURES**

(71) Applicant: **Sergiy Vasylyev**, Elk Grove, CA (US)

(72) Inventor: **Sergiy Vasylyev**, Elk Grove, CA (US)

(73) Assignee: **SVV TECHNOLOGY
INNOVATIONS, INC.**, Sacramento,
CA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/297,499**

(22) Filed: **Mar. 8, 2019**

(65) **Prior Publication Data**

US 2019/0207049 A1 Jul. 4, 2019

Related U.S. Application Data

(60) Division of application No. 15/442,645, filed on Feb.
25, 2017, now Pat. No. 10,269,999, which is a
continuation of application No. 14/222,588, filed on
Mar. 22, 2014, now abandoned, which is a
continuation of application No. 13/181,482, filed on
Jul. 12, 2011, now Pat. No. 8,735,791.

(Continued)

(51) **Int. Cl.**

H01L 27/00 (2006.01)
H01L 31/054 (2014.01)
G01J 1/04 (2006.01)
G01J 5/08 (2006.01)
G02B 5/02 (2006.01)
H01L 31/0232 (2014.01)
H01L 31/0525 (2014.01)
G02B 19/00 (2006.01)

(52) **U.S. Cl.**

CPC **H01L 31/0547** (2014.12); **G01J 1/0407**
(2013.01); **G01J 5/0853** (2013.01); **G02B**
5/0231 (2013.01); **G02B 5/0294** (2013.01);
G02B 19/0028 (2013.01); **H01L 31/02327**
(2013.01); **H01L 31/0525** (2013.01); **H01L**
31/0543 (2014.12); **Y02E 10/52** (2013.01)

(58) **Field of Classification Search**

CPC H01L 31/0525; H01L 31/02327; H01L
31/0543; H01L 31/0547
USPC 250/216, 203.1, 203.3, 203.4; 136/246,
136/256, 259; 385/33, 36
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

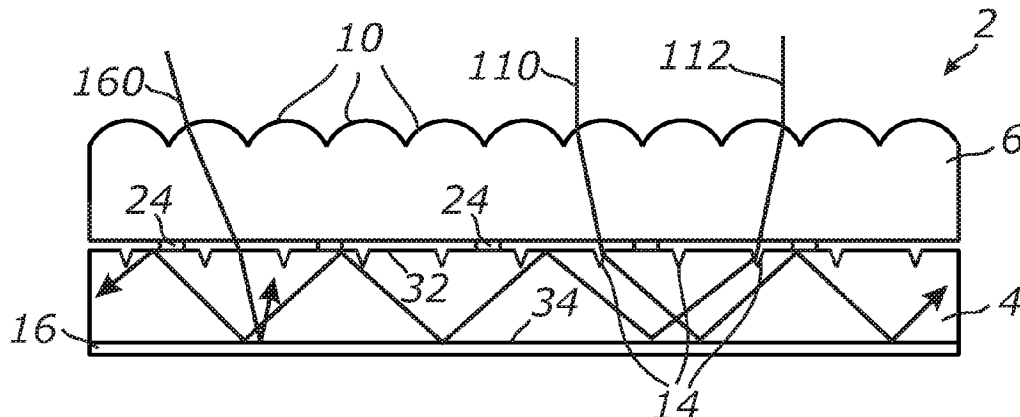
4,920,039 A * 4/1990 Fotland G09F 19/14
359/619
6,274,860 B1 8/2001 Rosenberg
(Continued)

Primary Examiner — Kevin K Pyo

(57) **ABSTRACT**

A light converting optical system employing a planar light trapping optical structure illuminated by a monochromatic light source. The light trapping optical structure includes a photoresponsive layer including semiconductor quantum dots. The photoresponsive layer is configured at a relatively low thickness and located between opposing broad-area surfaces that confine and redistribute light within the structure and cause multiple transverse propagation of unabsorbed light through the photoresponsive layer to enhance absorption. The light trapping optical structure further incorporates various microstructured surfaces including light-distributing surface relief features such as linear microlenses, prismatic surface relief features and/or linear grooves.

26 Claims, 7 Drawing Sheets



US 10,439,088 B2

Page 2

Related U.S. Application Data

- (60) Provisional application No. 61/402,061, filed on Aug. 21, 2010, provisional application No. 61/399,552, filed on Jul. 13, 2010.

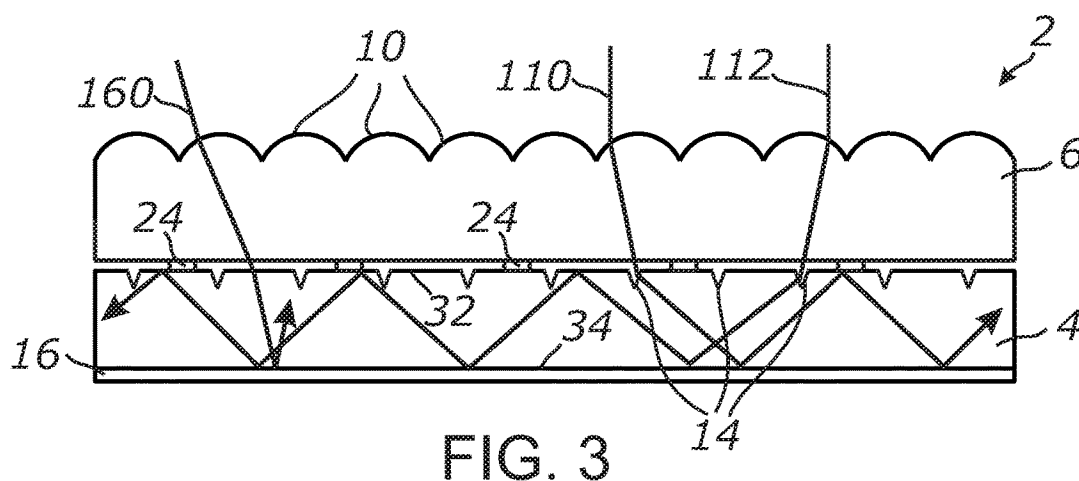
References Cited

(56)

U.S. PATENT DOCUMENTS

6,333,458	B1	12/2001	Forrest et al.	
6,440,769	B2	8/2002	Peumans et al.	
7,672,549	B2	3/2010	Ghosh et al.	
7,817,885	B1	10/2010	Moore et al.	
10,269,999	B2 *	4/2019	Vasylyev	G01J 1/0407
2004/0103938	A1	6/2004	Rider	
2008/0264483	A1	10/2008	Keshner et al.	
2008/0295882	A1	12/2008	Stephens et al.	
2009/0067784	A1	3/2009	Ghosh et al.	
2009/0126792	A1	5/2009	Gruhlke et al.	
2010/0186798	A1	7/2010	Tourmen et al.	
2010/0278480	A1	11/2010	Vasylyev	
2011/0226332	A1	9/2011	Ford et al.	
2012/0012741	A1	1/2012	Vasylyev	

* cited by examiner



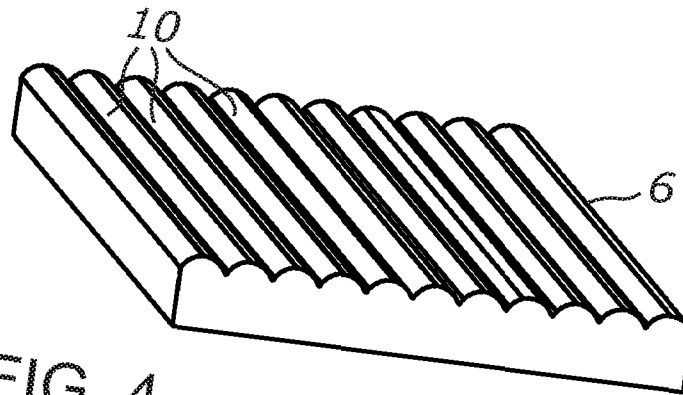


FIG. 4

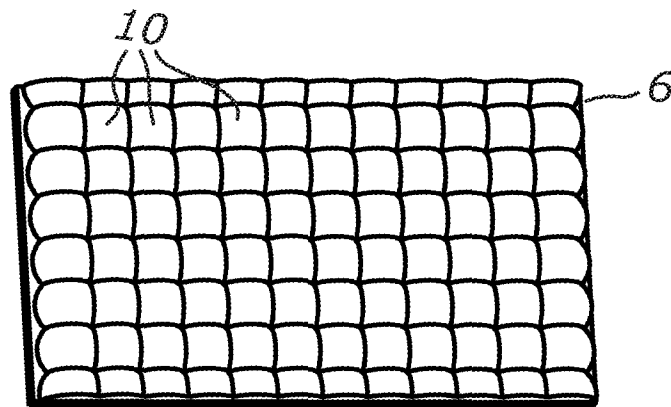


FIG. 5

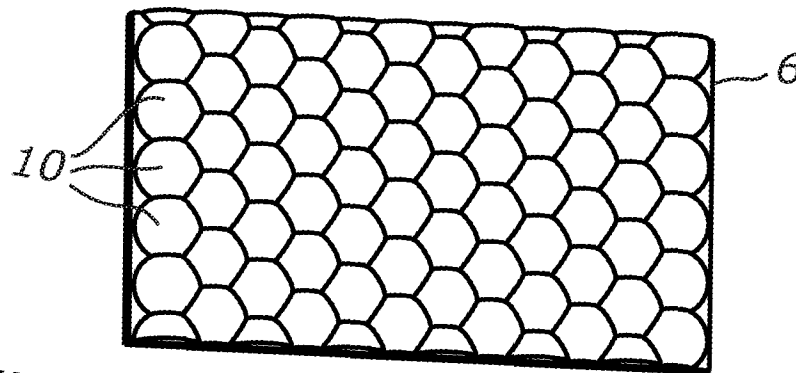
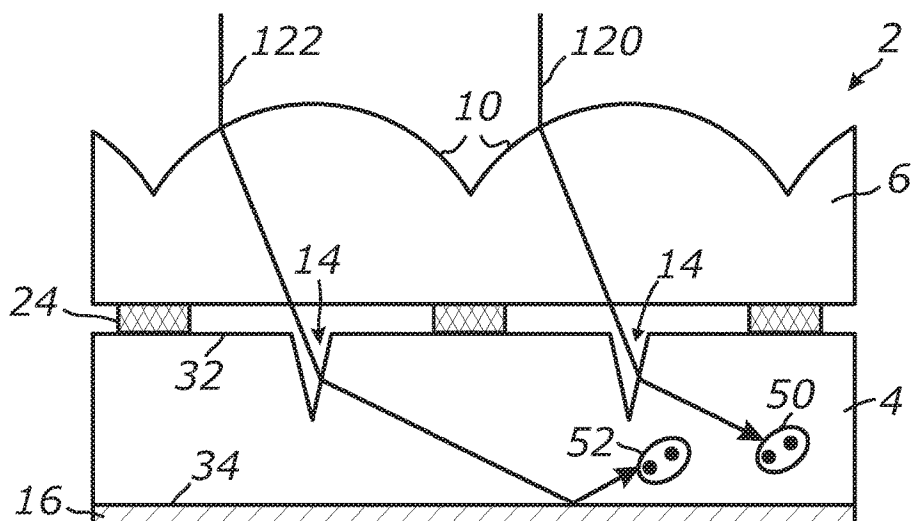
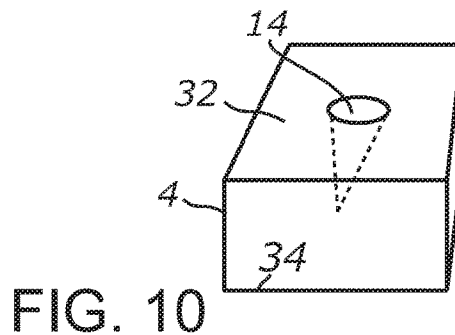
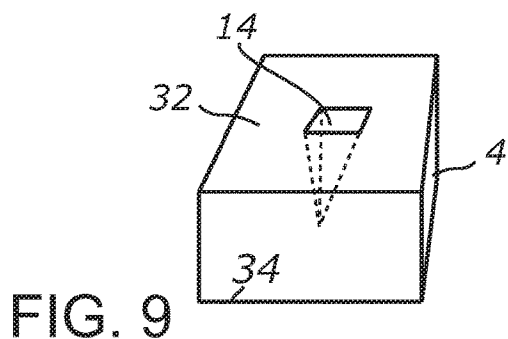
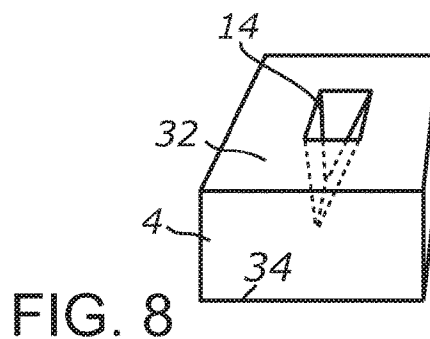
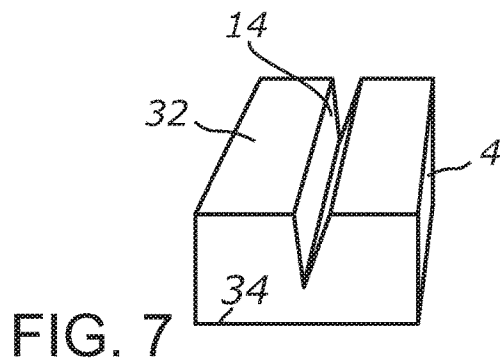


FIG. 6



Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.