



US010439089B2

(12) **United States Patent**
Vasylyev

(10) **Patent No.:** **US 10,439,089 B2**

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

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

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(*) 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.: **16/368,272**

(22) Filed: **Mar. 28, 2019**

(65) **Prior Publication Data**

US 2019/0221699 A1 Jul. 18, 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.

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

(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; 385/33,
385/36; 136/246, 256, 259

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,274,860 B1 8/2001 Rosenberg
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.

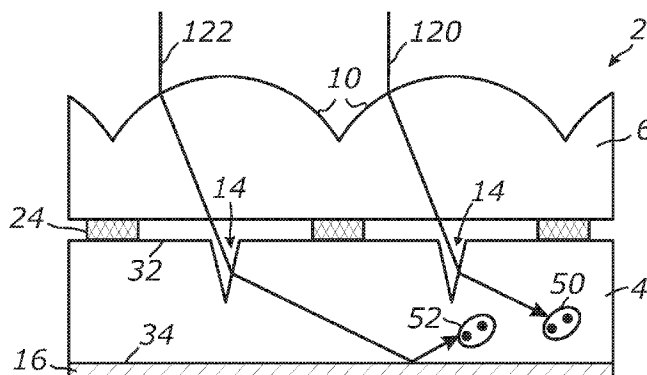
(Continued)

Primary Examiner — Kevin K Pyo

(57) **ABSTRACT**

A light converting optical system employing a planar light trapping optical structure illuminated by a source of monochromatic light. 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 light trapping structure and cause multiple transverse propagation of light through the photoresponsive layer to enhance absorption. The light trapping optical structure further incorporates optical elements configured for injecting light into the light trapping structure.

20 Claims, 7 Drawing Sheets



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(56)

References Cited

U.S. PATENT DOCUMENTS

7,817,885	B1	10/2010	Vloore 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	
2013/0028565	A1 *	1/2013	Moore	H01L 31/0547 385/129

* cited by examiner



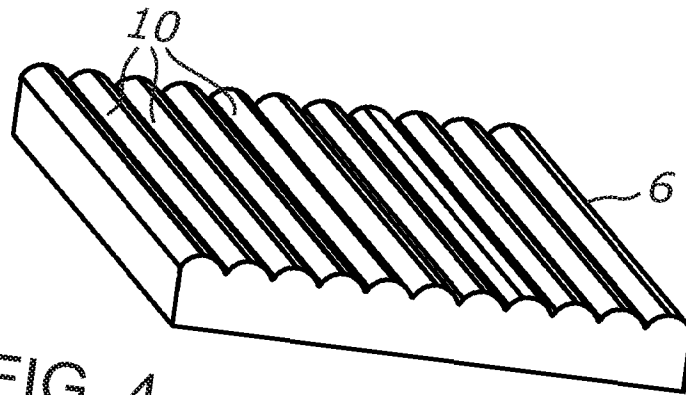


FIG. 4

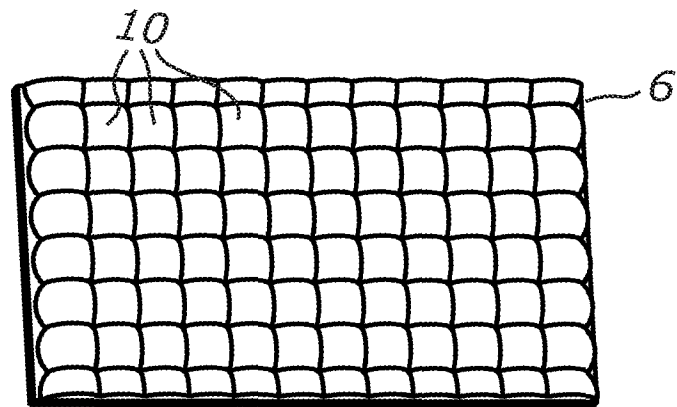


FIG. 5

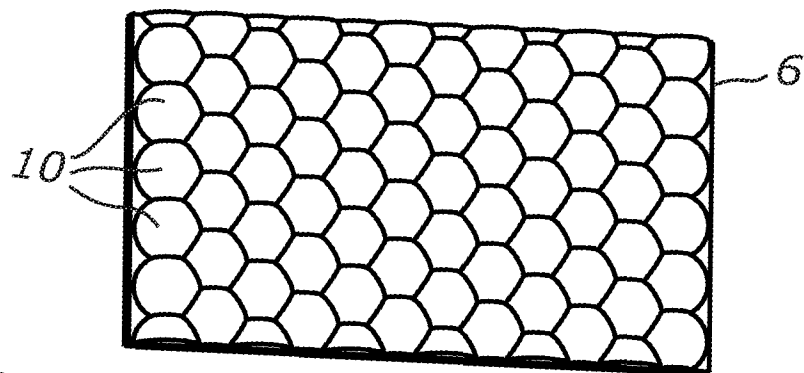
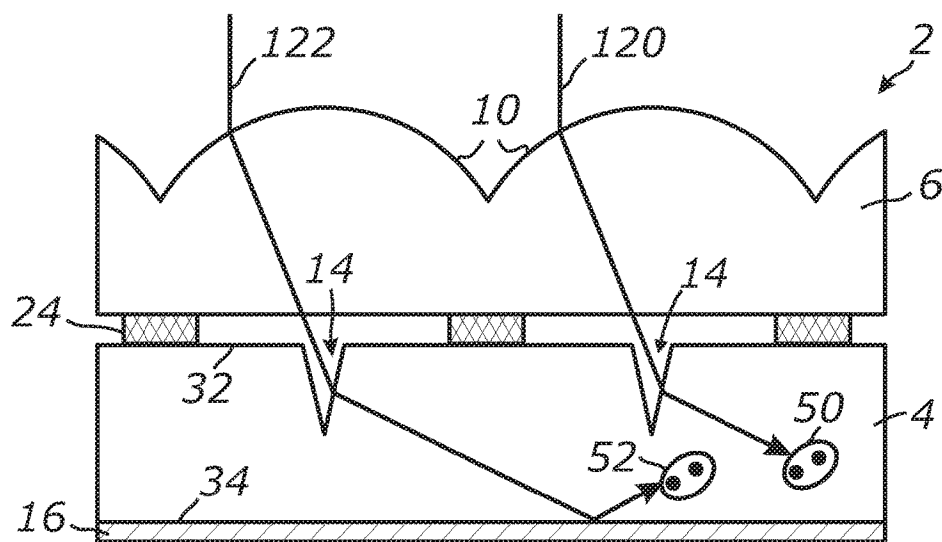
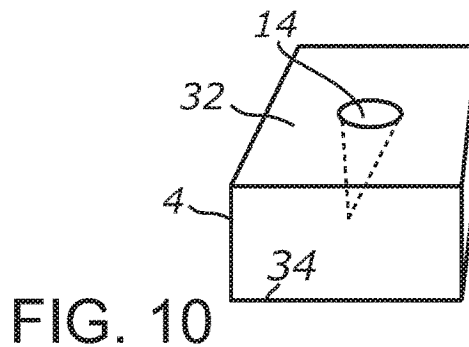
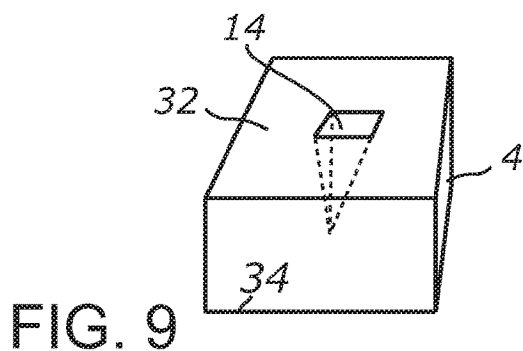
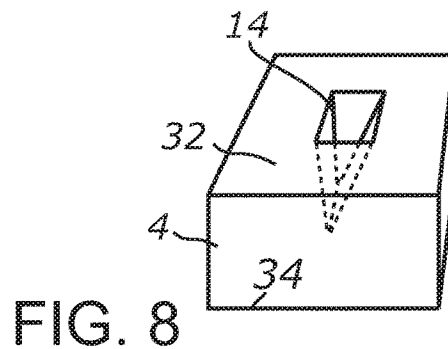
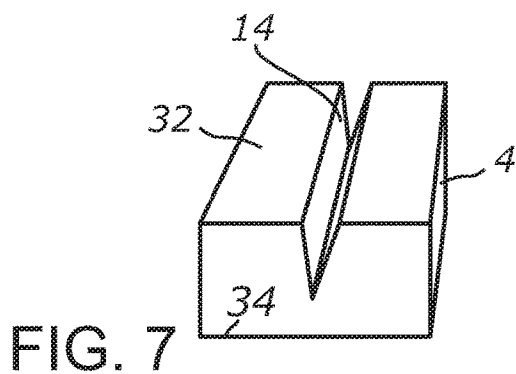


FIG. 6



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