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Vasylyev

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(54) **LIGHT TRAPPING OPTICAL STRUCTURES EMPLOYING LIGHT CONVERTING AND LIGHT GUIDING LAYERS**

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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 263 days.

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Related U.S. Application Data

(63) 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 31/02327; H01L 31/0525; H01L 31/0543; H01L 31/0547
 USPC 250/203.1, 203.3, 203.4, 216; 136/246, 136/256, 259; 385/33, 36
 See application file for complete search history.

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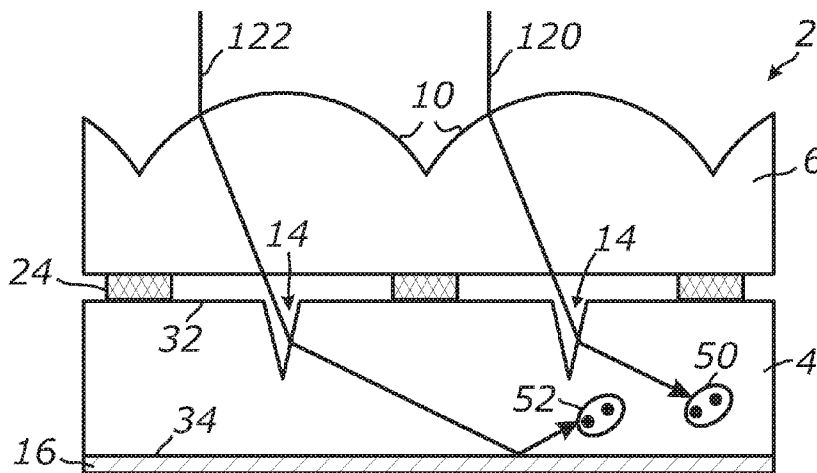
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Primary Examiner — Kevin K Pyo

(57) **ABSTRACT**

A light converting optical system employing a planar light trapping optical structure. The light trapping optical structure includes a monochromatic light source, a light guiding layer, a lenticular lens array incorporating a plurality of linear cylindrical microlenses, a broad-area reflective surface, and a generally planar photoresponsive layer located between the lens array and the reflective surface. The photoresponsive layer is configured at a sufficiently low thickness to transmit at least a portion of incident light without absorption in a single pass. A portion of the unabsorbed light is trapped within the light trapping optical structure and redirected back to the photoresponsive layer.

13 Claims, 7 Drawing Sheets



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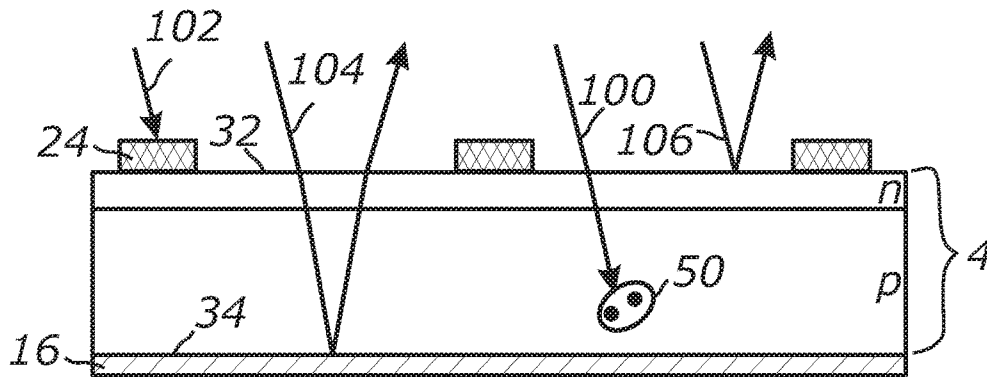


FIG. 1
(PRIOR ART)

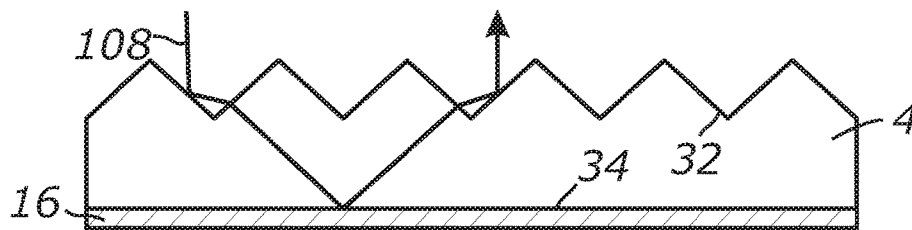


FIG. 2
(PRIOR ART)

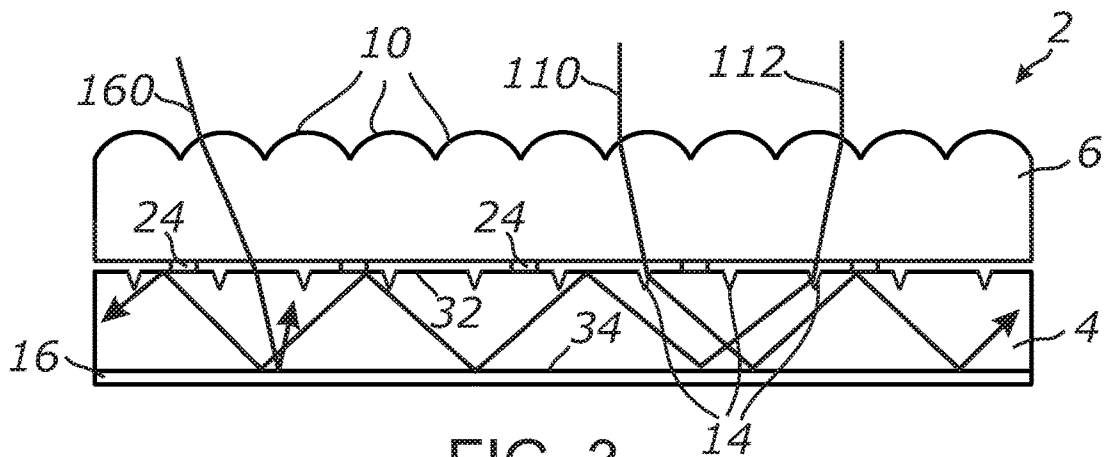


FIG. 3

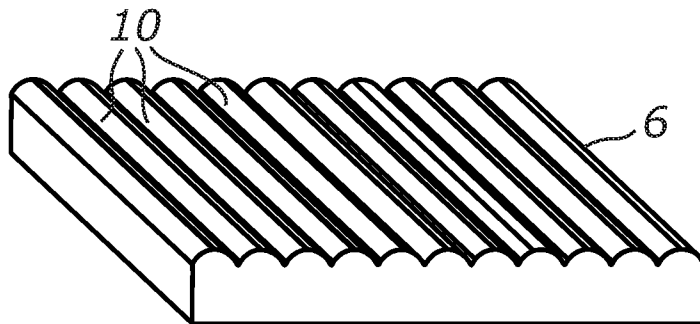


FIG. 4

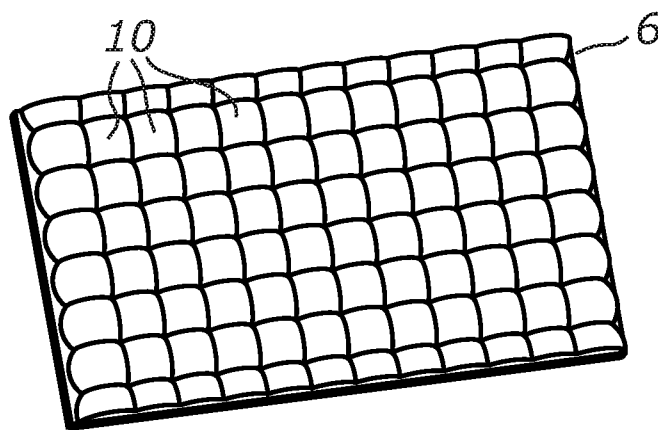


FIG. 5

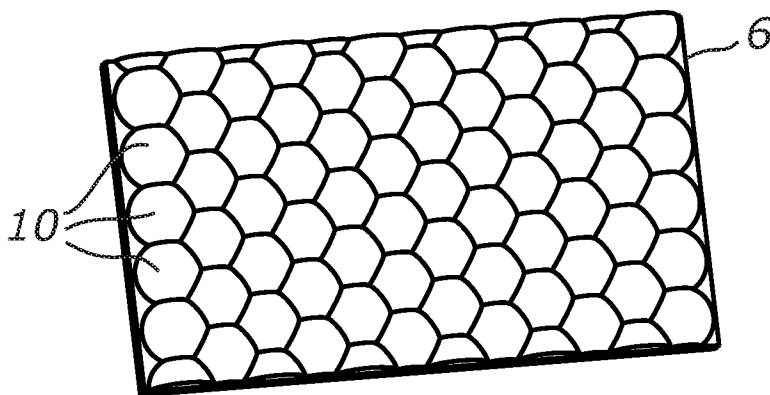


FIG. 6

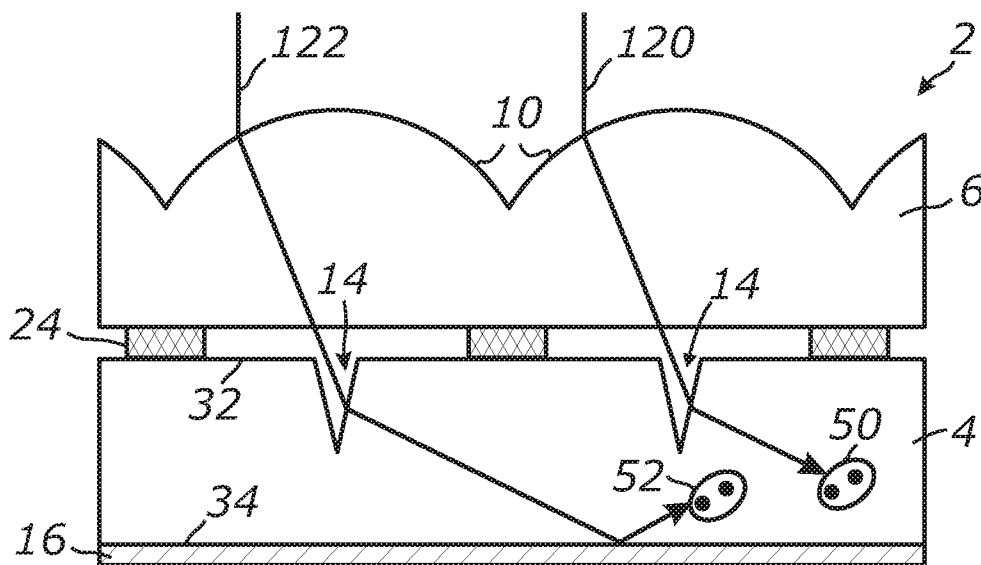
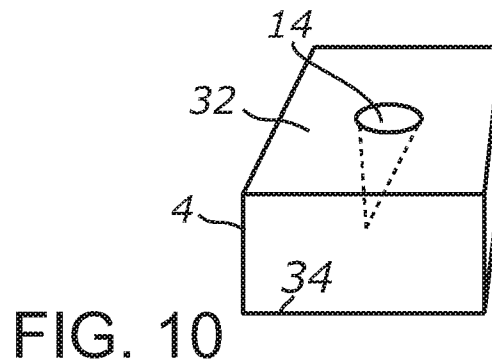
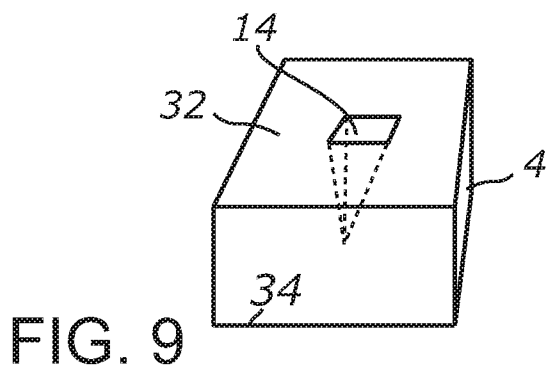
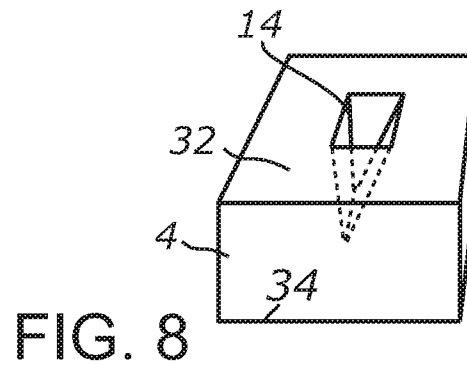
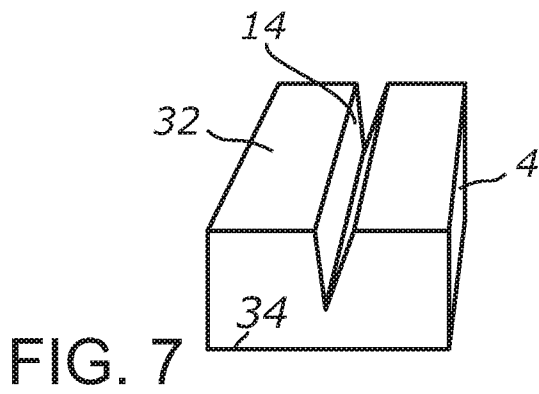


FIG. 11

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