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(54) **OPTO-ACOUSTIC TRANSDUCER AND COVER GLASS**

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(58) **Field of Classification Search**
CPC G01H 9/00; H04R 23/008
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,636,076 A * 1/1987 Pettigrew G01D 5/38 356/499
2004/0130728 A1* 7/2004 Degertekin G01B 11/026 356/505
2015/0145084 A1* 5/2015 Chang H01L 27/14621 257/432

* cited by examiner

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(57) **ABSTRACT**

An opto-acoustic transducer may include a light source, a substrate, a top layer, an interstitial layer, a lens, and a detector array. The light source may generate light beams. The substrate may reflect the light beams generated by the light source. The top layer may modulate responsive to an acoustical wave impingent thereupon and may reflect the light beams generated by the light source. The interstitial layer may be between the substrate and the top layer and may include a cavity which acts as an optical collector. The lens may propagate the light beams reflected by the substrate and the light beams reflected by the top layer. The detector array may reconstruct the acoustical wave impingent on the top layer based on the light beams propagated by the lens.

14 Claims, 5 Drawing Sheets