United States Patent [19]

Gardner et al.

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[54] **HIGH EFFICIENCY LAMP OR LIGHT ACCEPTER**

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[52] **U.S. Cl.** **357/17; 357/72; 357/74**

[58] **Field of Search** 357/17, 72, 74; 250/552

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[57] **ABSTRACT**

A lamp has a reflective cup with a light emitting device in the bottom of the cup. A transparent material having an index of refraction n fills the cup and extends to a hemispherical surface with radius R and an equator parallel to the opening of the cup. The reflective walls of the cup project substantially all of the light within a cutoff cone having an included half angle equal to the Brewster's angle of the transparent material. The center of the hemispherical lens surface is spaced from the rim of the opening of the cup a distance R/n. Thus, the opening of the cup is the locus of aplanatic points of the equator if the hemisphere. Most rays from within the cup are incident on the hemispherical lens surface at no more than the complement of the Brewster's angle. Thus, minimal light losses occur at the interface between the transparent medium and air. An aplanatic image is formed outside the hemispherical lens of a virtual source comprising a hemispherical surface extending through the rim of the cup opening. Such optics may also be used for a light accepting device. These principles may also be applicable to a an elongated cavity with a semicylindrical lens of radius R and edges spaced from the edge of the cavity a distance R/n.

24 Claims, 2 Drawing Sheets