



US007390116B2

(12) **United States Patent**  
**Jain**

(10) **Patent No.:** **US 7,390,116 B2**  
(45) **Date of Patent:** **Jun. 24, 2008**

(54) **HIGH-BRIGHTNESS, COMPACT ILLUMINATOR WITH INTEGRATED OPTICAL ELEMENTS**

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(75) Inventor: **Kanti Jain**, Hawthorne, NY (US)

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\* cited by examiner

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 148 days.

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(21) Appl. No.: **10/830,607**

(57) **ABSTRACT**

(22) Filed: **Apr. 23, 2004**

(65) **Prior Publication Data**

US 2005/0237764 A1 Oct. 27, 2005

(51) **Int. Cl.**  
**G02B 6/00** (2006.01)  
**F21V 7/00** (2006.01)

A compact, high-brightness, integrated illuminator in which collection of light from a point-arc source is maximized by a multi-curvature reflector section configuration of elliptical reflector and segmented spherical retroreflector directing all light rays into a well-defined numerical aperture. The invention also integrates a homogenizer and other optical elements with the multi-curvature reflector section, constructs any or all of these components in a single block of optical material, or, alternatively, constructs these components with molded hollow reflective cavities fabricated in metal or plastic blocks. Cooling is provided by internal fluid channels within the block.

(52) **U.S. Cl.** ..... **362/551; 362/347**

(58) **Field of Classification Search** ..... 362/551, 362/555, 341, 347, 245  
See application file for complete search history.

**8 Claims, 11 Drawing Sheets**

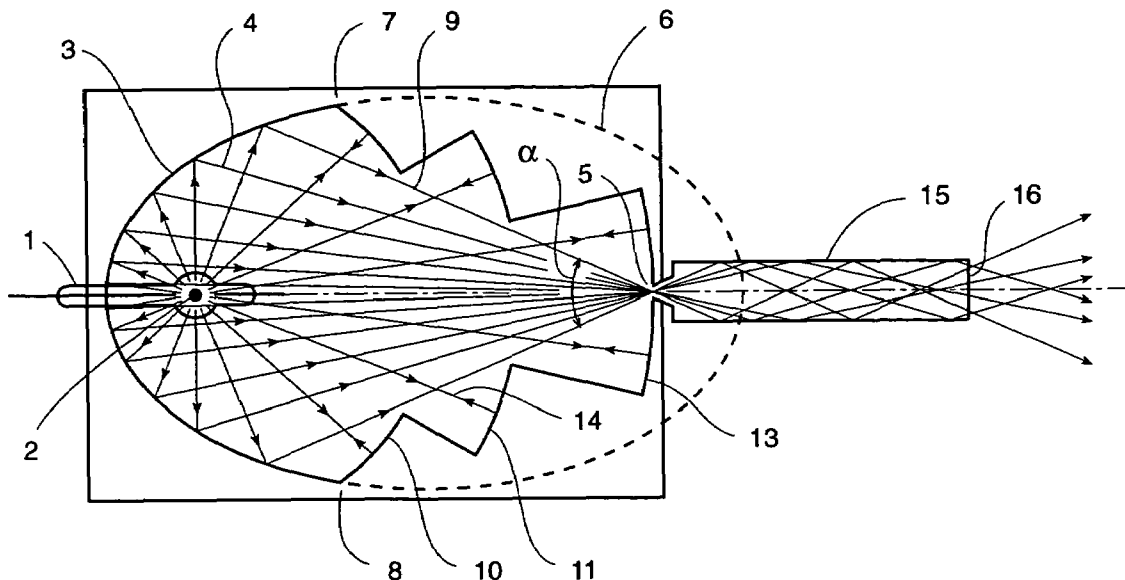


Fig. 1

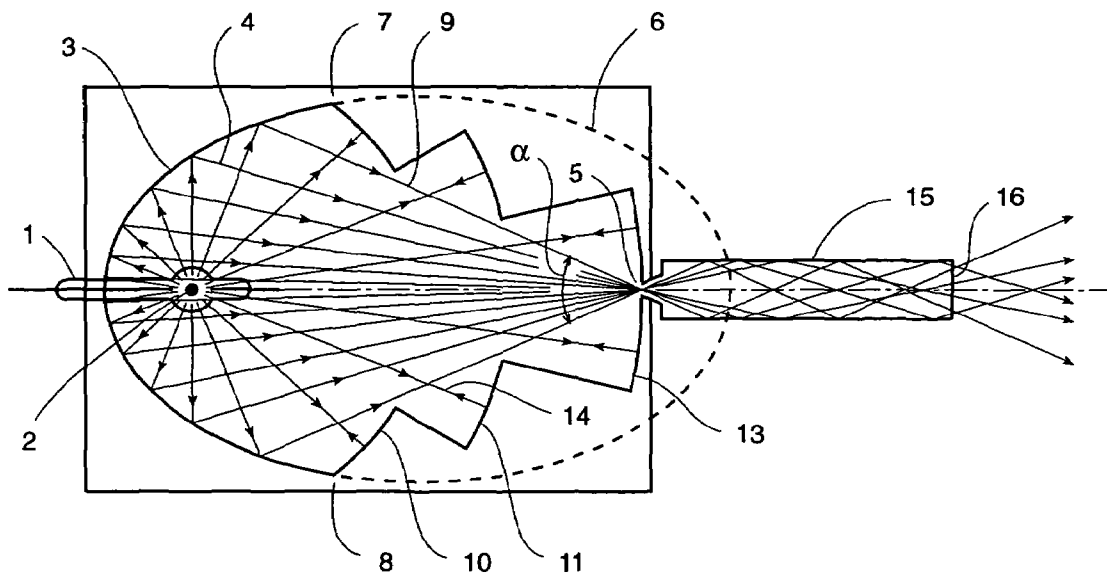
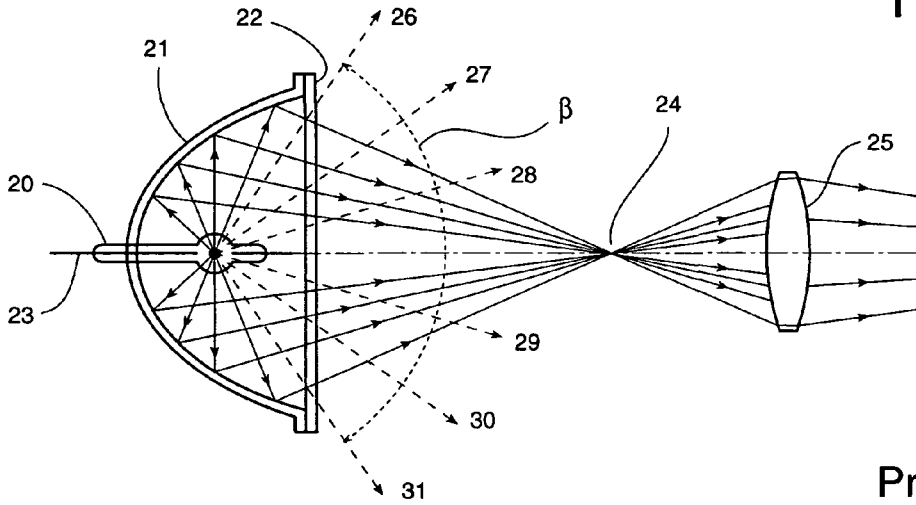
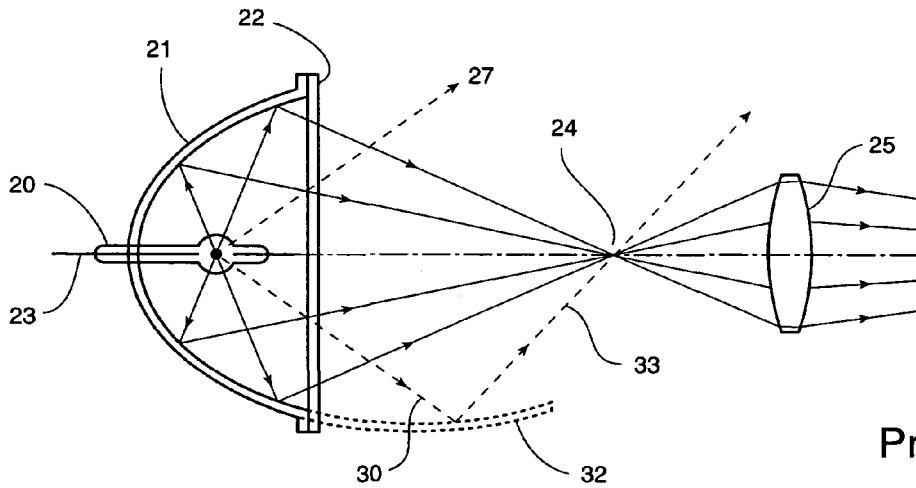


Fig. 2



Prior Art

Fig. 3



Prior Art

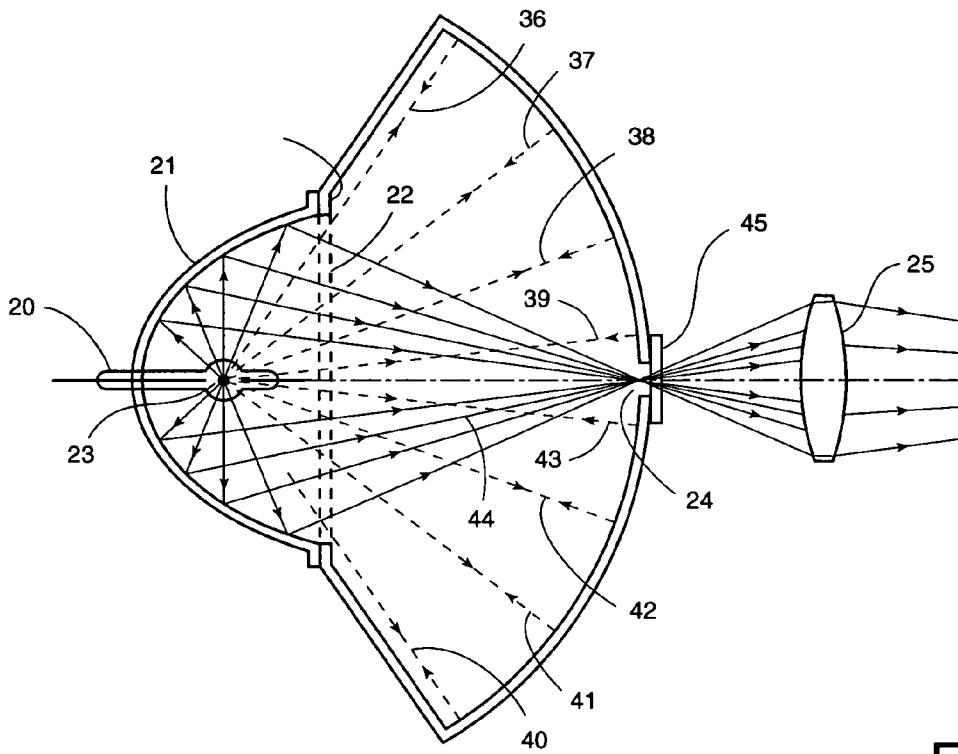


Fig. 4

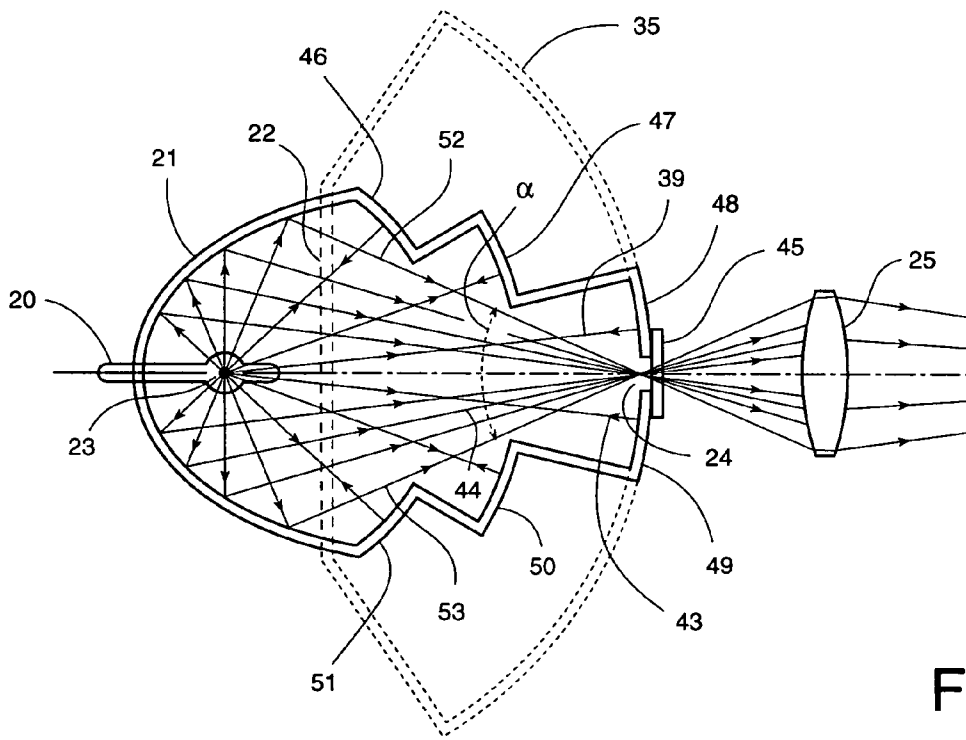


Fig. 5

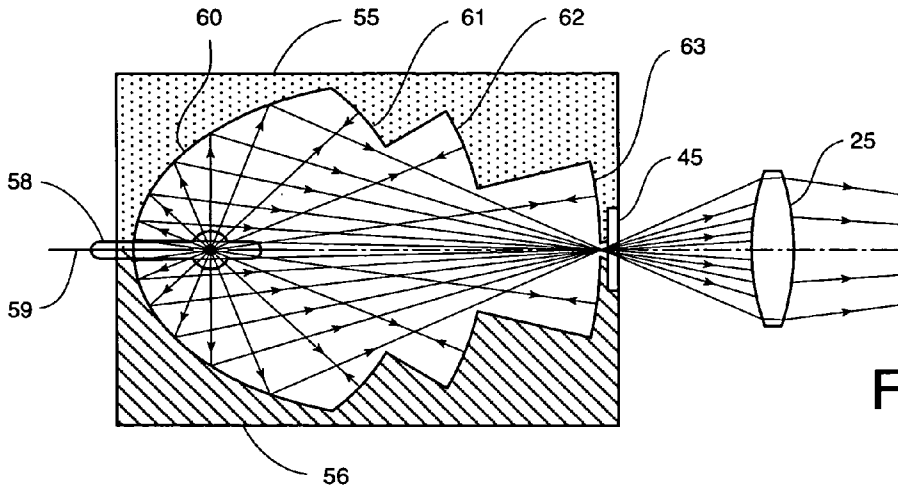


Fig. 6

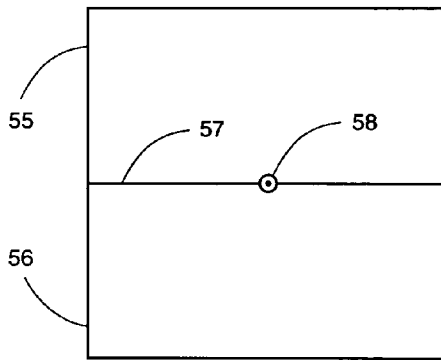


Fig. 7

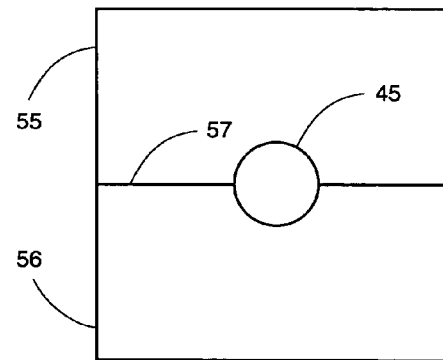


Fig. 8

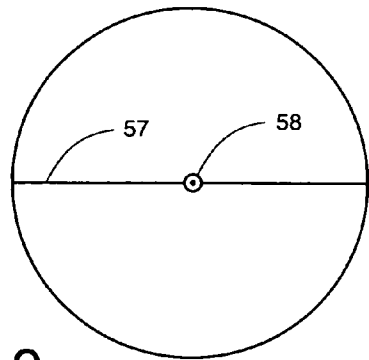


Fig. 9

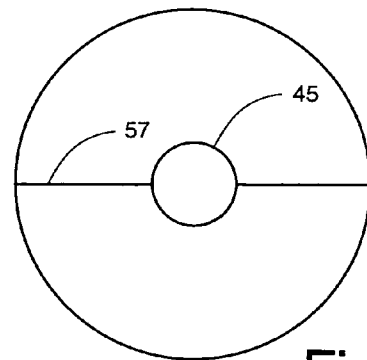


Fig. 10

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