



US007404637B2

(12) **United States Patent**
Miller et al.

(10) **Patent No.:** **US 7,404,637 B2**
(45) **Date of Patent:** ***Jul. 29, 2008**

(54) **SYSTEM AND METHOD FOR INCREASING THE DEPTH OF FOCUS OF THE HUMAN EYE**

(75) Inventors: **David Miller**, Brookline, MA (US);
Ernesto Blanco, Belmont, MA (US)

(73) Assignee: **Boston Innovative Optics, Inc.**, Irvine, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/417,927**

(22) Filed: **May 3, 2006**

(65) **Prior Publication Data**

US 2006/0274267 A1 Dec. 7, 2006

Related U.S. Application Data

(60) Continuation of application No. 11/284,791, filed on Nov. 22, 2005, which is a division of application No. 10/729,200, filed on Dec. 5, 2003, now Pat. No. 6,966,648, which is a division of application No. 10/384,957, filed on Mar. 10, 2003, now Pat. No. 6,874,886, which is a division of application No. 09/516,258, filed on Feb. 29, 2000, now Pat. No. 6,554,424.

(60) Provisional application No. 60/138,110, filed on Jun. 7, 1999, provisional application No. 60/122,001, filed on Mar. 1, 1999, provisional application No. 60/124,345, filed on Mar. 15, 1999.

(51) **Int. Cl.**
G02C 7/10 (2006.01)
A61F 2/16 (2006.01)

(52) **U.S. Cl.** **351/163**; 351/165; 623/6.17; 623/6.31

(58) **Field of Classification Search** 351/163, 351/165; 623/6.17, 6.3, 6.31
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

564,518 A 7/1896 Heilborn

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 457 553 A2 11/1991

(Continued)

OTHER PUBLICATIONS

“Research on the Multi-Range Lens,” Wesley, N.K., pp. 18-24.

(Continued)

Primary Examiner—Jordan M Schwartz

(74) *Attorney, Agent, or Firm*—Knobbe Martens Olson & Bear LLP

(57) **ABSTRACT**

A method and apparatus for increasing the depth of focus of the human eye is comprised of a lens body, an optic in the lens body configured to produce light interference, and a pinhole-like optical aperture substantially in the center of the optic. The optic may be configured to produce light scattering or composed of a light reflective material. Alternatively, the optic may increase the depth of focus via a combination of light interference, light scattering, light reflection and/or light absorption. The optic may also be configured as a series of concentric circles, a weave, a pattern of particles, or a pattern of curvatures. One method involves screening a patient for an ophthalmic lens using a pinhole screening device in the lens to increase the patient’s depth of focus. Another method comprises surgically implanting a mask in the patient’s eye to increase the depth of focus.

30 Claims, 7 Drawing Sheets

