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Simonov et al.

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(54) **ADJUSTABLE CHIRAL OPHTHALMIC LENS**

USPC 623/6.11, 6.32
See application file for complete search history.

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 82 days.

3,305,294 A 2/1967 Alvarez
3,583,790 A 6/1971 Baker

(Continued)

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AU 2002219861 A8 7/2002
DE 10241208 A1 3/2004

(Continued)

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FOREIGN PATENT DOCUMENTS

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OTHER PUBLICATIONS

Bernet et al., Adjustable refractive power from diffractive moiré elements, *Applied Optics*, Jul. 2008, 3722-3730, 47-21.

(Continued)

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(57) **ABSTRACT**

The present invention relates to an adjustable ophthalmic lens comprising at least one optical element comprising a combination of at least two optical surfaces wherein both optical surfaces are chiral optical surfaces adapted to provide chiral modulation of the light beam, the combination of the chiral optical surfaces is adapted to provide at least one adjustable focus and the combination of the chiral optical surfaces is adapted such that the focal distance of the adjustable foci depends on the mutual position of the chiral optical surfaces. These chiral optical surfaces result in a chiral modulation of the light beam. Combinations of chiral optical surfaces are applied to obtain adjustable optical powers in single-focus ophthalmic lenses and multiple-focus ophthalmic lenses.

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