

## INTRAOCULAR LENS AND TELESCOPE WITH MATING FASTENERS

### FIELD OF THE INVENTION

The present invention relates generally to intraocular lens (IOL) implants and particularly to an intraocular lens and telescope constructed with mating mechanical fasteners.

### BACKGROUND OF THE INVENTION

Intraocular inserts comprising telescopes are known. European Published Patent Application EP-A-212616 describes an intraocular lens that includes an anterior convex lens and a posterior concave lens. The contour of the lens can be selectively changed by varying the amount of fluid therein in order to change its refractive power. The lens is intended solely as a replacement for the natural lens of the eye.

U.S. Pat. No. 4,074,368 also describes an intraocular lens that includes an anterior convex lens and a posterior concave lens with high magnification proposed for the relief of conditions such as macular degeneration and diabetic retinopathy. The lens has many relatively low power lens surfaces arranged in a relatively long lens assembly which extends, when implanted, through almost the entire depth of the eye, from the pupil nearly to the retina. Implanting such a lens would necessitate major surgery. Moreover, the proposed lens does not provide a replacement for the natural lens for a wide field of view.

French Published Patent Application 2,666,735 describes an implant that includes a lens-shaped optical portion and a fastening assembly for securing the implant in the eye. The optical portion includes at least one closed internal cavity which contains a fluid or vacuum, forming a refraction chamber changing the optical properties of the lens.

Applicant/assignee's U.S. Pat. Nos. 5,354,335 and 5,391,202, the disclosures of which are incorporated herein by reference, describe intraocular inserts with a positive (converging) lens facing the anterior side of the eye and a negative (diverging) lens facing the posterior side, the two lenses forming a Galilean telescopic system. In U.S. Pat. No. 5,354,335, the lenses are assembled in a body member, the positive lens being generally flush with the anterior face of the body member. The negative lens may either be flush with the posterior face of the body member, or may project posteriorly therefrom. The body member anterior and/or posterior faces may be convex. In U.S. Pat. No. 5,391,202, the positive lens projects anteriorly from the anterior face of the body member which is preferably a soft lens constructed from a material such as a silicone. In U.S. patent application Ser. No. 08/882,972, the disclosure of which is incorporated herein by reference, the present applicant/assignee discloses a further intraocular implant comprising a telescope body having an anterior end and a posterior end and including one or more windows sealed to the telescope body at the anterior end and/or the posterior end. There are at least two lenses disposed within the telescope body intermediate the anterior and posterior ends. The lenses may be a so-called reverse Galilean telescope, i.e., a negative lens faces the anterior side of the eye while a positive lens faces the posterior side of the eye. One of the features of the system is that the lenses are doublet lenses. The windows may be formed without optical power, or alternatively, may comprise a prism.

In U.S. patent application Ser. No. 08/882,973, the disclosure of which is incorporated herein by reference, the present applicant/assignee discloses yet another intraocular implant comprising a telescope (either Galilean or reverse

Galilean) which extends through at least a portion of a lens capsule of the eye and forwardly thereof toward the anterior side of the eye, the telescope not penetrating the vitreous of the eye. The intraocular lens implant is supported within the lens capsule by loops, in the absence of a lens within the lens capsule. One of the features of the system is that the telescope may be tilted such that light from outside the eye is focused by the telescope on a low resolution but operative section of the retina. Other optional features of the system include one or more lenses having a graded index of refraction, holographic (diffusing) lenses, and/or doublet lenses which help prevent chromatic aberrations. The patent application also discloses a method for manufacturing an intraocular insert telescope employing laser fusing to join the lenses to the telescope body. Alternatively or additionally, the method employs glass particles having a low temperature melting point as a joining medium.

None of the prior art, however, provides a solution to the following problem. Galilean telescopic IOL's are designed to correct problems stemming from central field defects, such as those caused by macular degeneration (e.g., atrophic or exudative), chorioretinitis of the macula, central serous chorioretinopathy, or ischemia, for example. Reverse Galilean telescopic IOL's are designed to correct problems stemming from peripheral field defects, such as those caused by retinitis pigmentosa, primary or metastatic central nervous system tumors or glaucoma, for example. The majority of cases of central or peripheral field defects manifest themselves only after cataracts or other disorders which warrant implantation of an IOL. Thus, usually the need for a telescope or telescopic IOL arises after a regular IOL has already been implanted. It is difficult and possibly damaging to remove the regular IOL after years of service and implant in its place a telescopic IOL.

### SUMMARY OF THE INVENTION

The present invention seeks to provide an improved telescopic lens system extending from an IOL which solves the above mentioned problem. A system is provided whereby a "regular" IOL can be implanted and a telescope added thereto afterwards without need for removing the IOL from the eye. The primary purpose of the present invention is to allow attachment of the telescope to the lens after months or years of service. However, the present invention also provides a novel system for initially installing the IOL together with the telescope, in two convenient steps: first the lens and then the telescope.

Specifically, the present invention provides an intraocular lens and telescope constructed with mating mechanical fasteners. After implantation in the eye, the telescope is quickly and simply fastened to the lens.

There is thus provided in accordance with a preferred embodiment of the present invention an intraocular lens implant including an intraocular lens, a telescope, and at least one mechanical fastener that fixedly attaches the telescope to the lens.

In accordance with a preferred embodiment of the present invention at least one of the lens and the telescope is integrally formed with the at least one mechanical fastener.

Additionally in accordance with a preferred embodiment of the present invention the lens is formed with a female fastener which mates with a corresponding male fastener formed on the telescope. Alternatively in accordance with another preferred embodiment of the present invention the lens is formed with a male fastener which mates with a corresponding female fastener formed on the telescope.