BIFOCAL INTRAOCULAR LENS STRUCTURE AND SPECTACLE ACTUATION FRAME

BACKGROUND OF THE INVENTION

The invention relates to intraocular lens structures, that is, to structures designed and adapted for surgical implantation in an eye, in place of a cataracted natural lens.

Surgical implantation of an artificial lens, in place of a cataracted natural lens, is rapidly becoming an accepted procedure, offering the user the advantage of wide-angle vision and avoidance of the cumbersome strong-lens spectacles that have traditionally been the burden for those who have had a cataract removed. The surgeon has a great variety of lens-implant styles from which to chose, but to my knowledge all such lens-implants to date contemplate but a single focal length of the implant. It is therefore necessary for the user to provide himself with such spectacles as may enable him to correct his vision for any range outside the capability of his fixed-focus implant.

BRIEF STATEMENT OF THE INVENTION

It is an object of the invention to provide improved intraocular lens structure enabling multiple-focus operation within the eye.

A specific object is to provide structure enabling implantation of at least two lenses within a given eye, with selective availability of one to the exclusion of the other of said lenses, to achieve different focal circumstances appropriate to different ranges of desired-object viewing.

Another specific object is to provide structure enabling implantation of an intraocular optical element which is selectively movable into and out of the viewing or pupillary axis of the eye.

A further specific object is to provide externally operable actuator means for selectively positioning an installed intraocular lens into and out of the optical axis of the eye.

A general object is to achieve the above object with relatively simple and low-mass structure which can be surgically manipulated and correctly installed, using present techniques.

The invention achieves the foregoing objects and certain further features by providing haptic-supported frame structure for stabilized mounting in one of the chambers of an eye, and an auxiliary lens or other optical element has movably guided coaction with the frame structure, whereby in one selectively available position the auxiliary element is substantially aligned with the viewing axis of the eye, and in another selectively available position the auxiliary element is substantially out of the bundle of rays used for normal viewing. In the forms to be described, the movable auxiliary element is pivotally suspended and is magnetically actuable from one to the other of its two possible positions. And the forms to be described illustrate various combinations with posterior-chamber mounting, anterior-chamber mounting and trans-iris mounting of the movable element.

DETAILED DESCRIPTION

The invention will be illustratively described in detail, in conjunction with the accompanying drawings, in which:

FIG. 1 is a front-elevation view of intraocular lens structure of the invention;

FIG. 2 is a side-elevation view of the structure of FIG. 1, certain parts being partly broken-away and in vertical section, generally along the line 2—2 of FIG. 1;

FIGS. 3, 4 and 5 are views taken at successive optical-axis locations in the structure of FIGS. 1 and 2, namely, as indicated at 3—3, 4—4 and 5—5, respectively, in FIG. 2;

FIGS. 6 and 7 are views corresponding to FIGS. 1 and 2 to illustrate another embodiment, the section plane of FIG. 7 being generally at the line 7—7 of FIG. 6;

FIGS. 8 and 9 are views also corresponding to FIGS. 1 and 2, but illustrating a third embodiment, the section plane of FIG. 9 being generally at the line 9—9 of FIG. 8;

FIGS. 10 and 11 are further views corresponding to FIGS. 1 and 2, to illustrate a fourth embodiment, the section plane of FIG. 11 being generally at the line 11—11 of FIG. 10; and

FIGS. 12 and 13 are simplified views in perspective to illustrate a non-invasive actuating means for intraocular ocular implants as described for the various embodiments.

Referring initially to FIGS. 1 to 5, the invention is shown in application to a conventional intraocular lens 10 having compliant haptic formations 11-11' adapted particularly for stabilizing contact with the inner wall of the posterior chamber of an eye. The lens 10 may be molded, turned and polished plastic, inert to body fluids, methyl methacrylate being acceptably usable, and the haptic elements may suitably be of polypropylene. Surgical implantation procedure for posterior lens 10 and its haptics may be conventional, via a dilated iris, as will be understood.

In accordance with a feature of the invention, a second optical element, such as another lens 12, is movably supported with respect to the relatively fixed structure of posterior lens 10 and its haptics. More specifically, a frame member 13, which provides pivotal reference for movable lens 12, has a central opening 14 deriving axially forward cantilevered support from the posterior lens 10 via plural trans-iris posts 15, equally spaced about the optical axis Y of lens 10. The forward offset provided by posts 15 will be understood to be sufficient to position frame member 13 within the anterior chamber and with sufficient relief from the iris to allow normal mobility of the iris, i.e., normal dilation with respect to its constricted condition, suggested by phantom outline 16 in FIG. 3.

The movable lens element 12 may be of material and finish as described for lens 10, and it is shown with an integrally formed pivot arm 17 and with a pivot pin 18 engaged in a suitable bearing aperture in frame member 13. A second frame member 20 with a central aperture 21 is connected to frame member 13 via spaced lugs 22-23-24, and in such forwardly offset relation to member 13 as to establish positively guided retention of movable lens 12 by and between frame members 13-20, the opposite ends of pivot pin 18 being located in bearing apertures, as at 25 in frame member 20. It is convenient to provide a laterally extending formation 26 in frame member 13, and 27 in frame member 20, so that lugs 23—24 may connect members 13—20 on opposite sides of the pivot axis and so that lug 24 may serve as a stop, to locate the off-axis position of movable lens 12, as best seen in FIG. 4.