ACCOMMODATING INTRAOCULAR LENS AND METHOD OF IMPLANTING AND USING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to intraocular lenses, and pertains more particularly to a focusable intraocular lens which is substituted for a defective (usually cataractous) natural lens of a human eye.

2. Description of the Prior Art

Various nonfocusable or nonaccommodating intraocular lenses have been devised and rather extensively utilized. One such lens is disclosed in U.S. Pat. No. 4,466,705, issued on Aug. 21, 1984 to Paul E. Michelson for "FLUID LENS." In this instance, a semipermeable sheath having anterior and posterior portions, which portions are joined at their peripheral edges, contain therein a body of liquid. The interior of the sheath is kept full of liquid by osmosis, the liquid in this way determining the refractive power of the lens. The refractive power, however, is not variable.

Lenses of hard plastic have also been devised and used. As an example, reference may be made to U.S. Pat. No. 4,328,595 granted on May 11, 1982 to John H. Sheets for "INTRAOCULAR LENS." This patent depicts a typical plano-convex hard plastic lens that is held in place by means of spring loops. It is of the non-accommodating or non-focusing type in that the lens is simply implanted after the natural lens capsule has been removed.

A more complex and sophisticated system is described in U.S. Pat. No. 4,373,218 issued on Feb. 15, 1983 to Ronald A. Schachar for "VARIABLE POWER INTRAOCULAR LENS AND METHOD OF IMPLANTING INTO THE POSTERIOR CHAMBER" in which the optical characteristics are determined by varying the amount of fluid contained in an expansible sac in one instance, or by means of a controlled voltage in another instance where the contents of the sac constitute a liquid crystal material.

In still another patent, this being U.S. Pat. No. 4,253,199 granted on Mar. 3, 1981 to Anton Banko for "SURGICAL METHOD AND APPARATUS FOR IMPLANTS FOR THE EYE," the natural eye lens is removed along with the anterior portion of the natural capsule. In this situation, the implant capsule is comprised of peripherally sealed pieces or walls that are connected to the ciliary body by means of sutures. The ciliary body provides the muscular action in order to produce different degrees of accommodation.

None of the above patented arrangements, or others known to me, envisage the retention of the biologically provided capsule or bag belonging to a human eye, and replacing the natural lens that has become defective for some reason with a readily deformable lens in which the anterior and posterior walls thereof are normally biased outwardly in a bulging relation with respect to each other, but which can be flattened or caused to move closer together by the natural capsule that has been left within the eye and also the muscle-acting zonules that nature has provided and which also are left within the eye so that they can exert a tensional pull on the natural capsule with the consequence that an artificial lens can be flattened so as to change the refractive index thereof.

SUMMARY OF THE INVENTION

Accordingly, a general object of my invention is to provide an artificial lens that will simulate the action of a natural lens. In this regard, an aim is to retain the biologically provided capsular bag and insert therein my accommodating intraocular lens so that the muscular action normally provided by the zonules connected to the natural capsule will exert a tensional pull outwardly so that the walls of the capsular bag will contract and thus flatten the walls of my substitute intraocular lens.

A more specific object of my invention is to provide an accommodating intraocular lens that will normally be biased into a more spherical or bulging shape with portions of the anterior and posterior walls spaced farther apart along the optical axis of the lens so as to correct for near vision and to enable the lens to be flattened more for distance vision.

Associated with the preceding object is the advantage that my invention permits the choice and employment of several different types of biasing mechanisms. thereby enabling the biasing action to be more closely correlated with the gentle muscular forces that are applied to the natural lens capsule. For instance, the biasing action may be provided by the lens members themselves, if the proper material and thickness are selected, or by supplemental spring-like devices.

Another object is to provide a two-piece intraocular lens, in which the two lens members can be readily assembled without having to resort to heat or sonic sealing procedures. More specifically, my invention lends itself to being easily assembled within the natural lens capsule after removal of the person's biological lens.

Still another object is to incorporate some of the refraction power of the assembled lens in either or both of the lens members by reason of the radii of curvature imparted to the outer and inner surfaces thereof.

A further object of the invention is to provide an accommodating intraocular lens that can be readily implanted. In this regard, my invention allows the surgeon to utilize known incising techniques in order to provide access to the natural lens contained within the biologically provided capsular bag, then permitting the removal of the natural lens, and then inserting or implanting my accommodating intraocular lens, preferably in two stages, within the cavity of the capsule that has originally contained the natural lens therein. If desired, the anterior portion of the natural capsule can then be sutured so as to retain permanently a lens structured in accordance with my invention.

Yet another object is to provide an accommodating or focusable intraocular lens that is not only relatively inexpensive to manufacture or fabricate, but can be relatively easily implanted. In this way, the cost of the overall operation is kept to a minimum.

Briefly, my invention contemplates the provision of a two-piece intraocular lens having focusing or accommodating capabilities that is comprised of a pair of flexible plastic walls or lens members that are configured so as to be readily secured together adjacent their edges so that the lens members can be flexed to change the distance therebetween. In this way, the distance between the lens members, as measured along the optical axis of the lens, can be either increased or decreased to permit the eye to focus on either nearby or distant objects. It is planned that the flexible walls or lens members be nor-