The parameters of the 4-sector lens of FIG. 4*a* are used in the lens of FIG. 4*b* except that the lens of FIG. 4*b* is arbitrarily divided into eight (8) sectors. As the number of discrete sectors increases, with each sector area decreasing, the continuous shading configuration of the type illustrated in FIG. 7, described below, is approached.

Shading the regions so that the amplitudes of their light transmissions follow a Bessel function theoretically results in an infinite depth of field. However, in practical designs using a Bessel function algorithm, the resulting lens will have a finite depth of field due to the finite size of the lens or pupil.

Other geometries than the ones of FIGS. 2 and 3 may be employed to effect concentric regions of differing transparency. For example, as shown in FIG. 5, tinted inwardly directed angularly displaced wedges 19 provide a digital approximation of the concentric regions of transparency of the lens of FIG. 2, similar in effect to the lens of FIG. 3 yet permitting the tinting to be applied in larger continuous zones than the scattered zones of the lens of FIG. 3. This geometry can be advantageous in obtaining the high degree of control over regional transparency that the digital technique of FIG. 3 permits while realizing economies in fabrication.

The geometry of the lens shading need not necessarily be a circular one. Rectangular systems may be used as in the case of the lens illustrated in FIG. 6. There, the adjacent shaded regions are parallel. The lens of FIG. 6 may be shaded to enhance depth of focus over the field of view by increasing transparency of the shaded regions 21 along a direction transverse to them from opposite edges of the lens toward the center. This arrangement can be used to enhance depth of focus in the vertical field of view without affecting relative changes in depth of focus across the lateral field of view.

Lenses following the teachings of the invention need not be subdivided into discrete zones. Continuous shading over the entire lens may be employed. For example, in the lens of FIG. 7, the density of the shading is continuous, that is, it increases radially over entire lens surface which constitutes a single zone.

With lenses constructed in accordance with the heretofore described invention, the energy in the caustic zone is very low in comparison with known prior art designs. With conventional lenses that rely on power variation, there is no capability for achieving zero power in the caustic region. The lenses of the invention permit the caustic region to approach zero power and the lenses can achieve true wide depth of focus without blur.

It is to be appreciated that the foregoing is a description of seven preferred embodiments of the invention to which variations and modifications may be made without departing from the spirit and scope of the invention. For example, other geometric patterns and relative densities of shading may be applied in accordance with other mathematical functions having Fourier transforms consistent with enhanced depth of focus.

What is claimed is:

1. A lens adapted to be worn on, or implanted in, the eye comprising a substrate having a surface with a plurality of regions of at least partial transparency, at least one of said regions having a degree of transparency greater than another of said regions more distant from the center of said lens than said one region for enabling viewing with an extended depth of focus.

2. A lens according to claim **1** wherein said first and second regions are concentrically displaced.

3. A lens according to claim **1** wherein said first and second regions are in parallel disposition.

4. A lens according to claim **1** wherein said first and second regions are radially displaced.

5. A lens according to claim **1** wherein said first and second regions are angularly displaced.

6. A lens according to claim **1** wherein the transparency of said regions varies as a mathematical function of their distance from a predetermined origin.

7. A lens according to claim **6** where said mathematical function is a Gaussian distribution.

8. A lens according to claim **6** where said mathematical function is a Bessel function.

9. A lens according to claim **1** wherein said substrate comprises a tint applied to at least one of said regions to attenuate its transparency.

10. A lens according to claim **9** wherein the transparency of said tint is variable as a function of the light incident upon it.

11. A lens according to claim **1** wherein said substrate is contoured so that at least one of said regions has diopter power the absolute value of which is greater than zero.

12. A method of increasing depth of focus for a lens adapted to be worn on, or implanted in, the eye comprising rendering the transparency of at least one of a plurality of regions of at least partial transparency of said lens greater than the transparency of another of said regions more distant from the center of said lens than said one region.

13. A method of increasing depth of focus for a lens according to claim **12** wherein the transparencies of concentrically displaced regions are rendered different.

14. A method of increasing depth of focus for a lens according to claim **12** wherein the transparencies of parallel displaced regions are rendered different.

15. A method of increasing depth of focus for a lens according to claim **12** wherein the transparencies of radially displaced regions are rendered different.

16. A method of increasing depth of focus for a lens according to claim **12** wherein the relative transparencies of said regions are rendered to vary as a mathematical function of their distance from a predetermined origin.

17. A method of increasing depth of focus for a lens according to claim **16** wherein said mathematical function is a Gaussian distribution.

18. A method of increasing depth of focus for a lens according to claim **16** wherein said mathematical function is a Bessel function.

19. A method of increasing depth of focus for a lens according to claim **12** further comprising tinting said one region to a different transparency than said another region.

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