CLAIMS

1. An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

a curved front surface and a curved back surface, wherein the front surface and the back surface are configured to bound at least a portion of one chamber;

a dielectric layer proximate to at least one of the curved front surface and the curved back surface, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

an energy source embedded in the variable optic insert in at least a region comprising a non-optical zone; and

a layer containing liquid crystal material positioned within the at least one chamber, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence.

2. The ophthalmic lens device of Claim 1 wherein the index of refraction across at least the first portion of the optic insert has a parabolic dependence on a radial dimension.

3. The ophthalmic lens device of Claim 2 wherein an optical effect of the layer containing liquid crystal material is supplemented by an effect of the thickness of the dielectric layer when an electric field is applied across the layer containing liquid crystal material.

4. The ophthalmic lens device of Claim 3 wherein the lens is a contact lens.

5. The ophthalmic lens device of Claim 4 further comprising:

a first layer of electrode material proximate to the curved back surface; and

a second layer of electrode material proximate to the curved front surface.

6. The ophthalmic lens device of Claim 5 wherein at least a portion of the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.

7. The ophthalmic lens device of Claim 6 wherein the variable optic insert alters a focal characteristic of the lens.

8. The ophthalmic lens device of Claim 7 further comprising an electrical circuit, wherein the electrical circuit controls a flow of electrical energy from the energy source to the first and second electrode layers.

9. The ophthalmic lens device of claim 8 wherein the electrical circuit comprises a processor.

10. An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

a curved first front surface and a curved first back surface wherein the first front surface and the first back surface are configured to bound at least a portion of a first chamber;

a curved second front surface and a curved second back surface wherein the second front surface and the second back surface are configured to bound at least a portion of a second chamber;

a dielectric layer proximate to at least one of the curved first front surface and the curved first back surface, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

at least one layer containing liquid crystal material positioned within the at least one chamber, wherein the at least one layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence; and

an energy source embedded in the insert in at least a region comprising a non-optical zone.

11. The ophthalmic lens device of Claim 10 wherein the index of refraction across at least the first portion of the optic insert has a parabolic dependence on a radial dimension.

12. The ophthalmic lens device of Claim 11 wherein an optical effect of the layer containing liquid crystal material is supplemented by an effect of the thickness of the dielectric layer when an electric field is applied across the layer containing liquid crystal material.

13. The ophthalmic lens device of Claim 10 wherein the lens is a contact lens.

14. The ophthalmic lens device of Claim 13 further comprising:

a first layer of electrode material proximate to the first curved back surface; and

a second layer of electrode material proximate to the curved first front surface.

15. The ophthalmic lens device of Claim 14 wherein the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.

16. The ophthalmic lens device of Claim 15 wherein the variable optic insert alters a focal characteristic of the lens.

17. The ophthalmic lens device of Claim 16 further comprising an electrical circuit, wherein the electrical circuit controls a flow of electrical energy from the energy source to the first and second electrode layers.

18. The ophthalmic lens device of claim 17 wherein the electrical circuit comprises a processor.

19. A contact lens device with a variable optic insert positioned within at least a portion of an optical zone of the contact lens device, wherein the variable optic insert comprises:

a curved first front surface and a curved first back surface wherein the first front surface and the first back surface are configured to form at least a first chamber;

a first layer of electrode material proximate to the curved first front surface;

a second layer of electrode material proximate to the curved first back surface;

a dielectric layer proximate to at least one of the curved first front surface and the curved first back surface, wherein the dielectric layer varies in thickness at least within the portion within the optical zone;

a first layer containing liquid crystal material positioned within the first chamber, wherein the first layer includes regions of liquid crystal material aligned in a first pattern wherein a first index of refraction across at least a first portion of the variable optic insert varies with a first radial dependence, and wherein the first layer containing liquid crystal material varies its first index of refraction affecting a first ray of light traversing the first layer containing liquid crystal material when a first electric potential is applied across the first layer of electrode material and the second layer of electrode material;

a curved second front surface and a curved second back surface wherein the second front surface and the second back surface are configured to form at least a second chamber;

a third layer of electrode material proximate to the curved second front surface;

a fourth layer of electrode material proximate to the curved second back surface;

a second layer containing liquid crystal material positioned within the second chamber, wherein the second layer includes regions of liquid crystal material aligned in a second pattern wherein a second index of refraction across at least a second portion of the variable optic insert varies with a second radial dependence, and wherein the second layer containing liquid crystal material varies its second index of refraction affecting a second ray of light traversing the second layer containing liquid crystal material when a second electric potential is applied across the third layer of electrode material and the fourth layer of electrode material;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

an electrical circuit comprising a processor, wherein the electrical circuit controls a flow of electrical energy from the energy source to one or more of the first, second, third or fourth electrode layers; and

wherein the variable optic insert alters a focal characteristic of the contact lens device.

20. A contact lens device with a variable optic insert positioned within at least a portion of an optical zone of the contact lens device, wherein the variable optic insert comprises:

a layer containing liquid crystal material positioned within the variable optic insert, wherein the layer includes regions of liquid crystal material aligned in

a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence;

a dielectric layer proximate to the layer containing liquid crystal material, wherein the dielectric layer varies in thickness at least within the portion within the optical zone; and

wherein at least a first surface of the layer containing liquid crystal material is curved.

21. An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

an insert front curve piece and an insert back curve piece, wherein a back surface of the front curve piece has a first curvature and a front surface of the back curve piece has a second curvature;

a dielectric layer proximate to at least one of the front curve piece and the back curve piece, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

a layer containing liquid crystal material, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence.

22. The ophthalmic lens device of Claim 21 wherein the index of refraction across at least the first portion of the optic insert has a parabolic dependence on a radial dimension.

23. The ophthalmic lens device of Claim 22 wherein an optical effect of the layer containing liquid crystal material is supplemented by an effect of the thickness of the dielectric layer when an electric field is applied across the layer containing liquid crystal material.

24. The ophthalmic lens device of Claim 23 wherein the first curvature is different from the second curvature.

25. The ophthalmic lens device of Claim 24 wherein the lens is a contact lens.

26. The ophthalmic lens device of Claim 25 further comprising:
a first layer of electrode material proximate to the back surface of the front curve piece; and
a second layer of electrode material proximate to the front surface of the back curve piece.

27. The ophthalmic lens device of Claim 26 wherein the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.

28. The ophthalmic lens device of Claim 27 wherein the variable optic insert alters a focal characteristic of the lens.

29. The ophthalmic lens device of Claim 28 further comprising an electrical circuit, wherein the electrical circuit controls a flow of electrical energy from the energy source to the first and second electrode layers.

30. The ophthalmic lens device of claim 29 wherein the electrical circuit comprises a processor.

31. An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

an insert front curve piece, at least a first intermediate curve piece and an insert back curve piece, wherein a back surface of the front curve piece has a first curvature and a front surface of the first intermediate curve piece has a second curvature;

a dielectric layer proximate to at least one of the front curve piece and the intermediate curve piece, wherein the dielectric layer varies in thickness at least within the portion within the optical zone;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

the variable optic insert comprising a layer containing liquid crystal material, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence.

32. The ophthalmic lens device of Claim 31 wherein the index of refraction across at least the first portion of the optic insert has a parabolic dependence on a radial dimension.

33. The ophthalmic lens device of Claim 32 wherein the first curvature is different from the second curvature.

34. The ophthalmic lens device of Claim 31 wherein the lens is a contact lens.

35. The ophthalmic lens device of Claim 34 further comprising:

a first layer of electrode material proximate to the front curve piece; and

a second layer of electrode material proximate to one or more of the intermediate curve piece and the back curve piece.

36. The ophthalmic lens device of Claim 34 further comprising:

a first layer of electrode material proximate to the front curve piece; and

a second layer of electrode material proximate to the intermediate curve piece.

37. The ophthalmic lens device of Claim 36 wherein the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.

38. The ophthalmic lens device of Claim 37 wherein the variable optic insert alters a focal characteristic of the lens.

39. The ophthalmic lens device of Claim 38 further comprising an electrical circuit, wherein the electrical circuit controls a flow of electrical energy from the energy source to the first and second electrode layers.

40. The ophthalmic lens device of claim 39 wherein the electrical circuit comprises a processor.

CLAIMS

1.An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

a curved front surface and a curved back surface, wherein the front surface and the back surface are configured to bound at least a portion of one chamber;

a dielectric layer proximate to at least one of the curved front surface and the curved back surface, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

an energy source embedded in the variable optic insert in at least a region comprising a non-optical zone; and

a layer containing liquid crystal material positioned within the at least one chamber, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence and wherein the layer containing liquid crystal material is a polymerizable mixture.

2.The device according to Claim 1, wherein the monomer(s) used to form the polymer matrix may itself contain attached liquid crystal portions.

3.The device according to Claim 2, wherein polymerization is initiated by actinic radiation shone onto the mixture.

4.The device according to Claim 3, wherein the lens is a contact lens.

5.The device ~~of~~ according to Claim 4, further comprising:

a first layer of electrode material proximate to the curved back surface; and

a second layer of electrode material proximate to the curved front surface wherein the electrodes are formed into a helix from the centre of the lens to the periphery.

6.The device according to Claim 1, wherein the variable optic insert further comprises a polarizing element.

7.The device according to Claim 1, wherein the curved front surface and a curved back surface possess differing radii of curvature.

8.An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

a curved first front surface and a curved first back surface wherein the first front surface and the first back surface are configured to bound at least a portion of a first chamber;

a curved second front surface and a curved second back surface wherein the second front surface and the second back surface are configured to bound at least a portion of a second chamber;

a dielectric layer proximate to at least one of the curved first front surface and the curved first back surface, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

at least one layer containing liquid crystal material positioned within the at least one chamber, wherein the at least one layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence; and

an energy source embedded in the insert in at least a region comprising a non-optical zone and wherein the layer containing liquid crystal material is a polymerizable mixture.

9.The device according to Claim 8, wherein the monomer(s) used to form the polymer matrix may itself contain attached liquid crystal portions.

10.The device according to Claim 9, wherein polymerization is initiated by actinic radiation shone onto the mixture.

11.The device according to Claim 8, wherein the lens is a contact lens.

12.The device according to Claim 11, further comprising:

a first layer of electrode material proximate to the first curved back surface; and

a second layer of electrode material proximate to the curved first front surface

wherein the electrodes are formed into a helix from the centre of the lens to the periphery.

13.The device according to Claim 8, wherein the variable optic insert further comprises a polarizing element.

14.The device according to Claim 13, wherein the curved front surface and a curved back surface possess differing radii of curvature.

15.A contact lens device with a variable optic insert positioned within at least a portion of an optical zone of the contact lens device, wherein the variable optic insert comprises:

a curved first front surface and a curved first back surface wherein the first front surface and the first back surface are configured to form at least a first chamber;

a first layer of electrode material proximate to the curved first front surface;

a second layer of electrode material proximate to the curved first back surface;

a dielectric layer proximate to at least one of the curved first front surface and the curved first back surface, wherein the dielectric layer varies in thickness at least within the portion within the optical zone;

a first layer containing liquid crystal material positioned within the first chamber, wherein the first layer includes regions of liquid crystal material aligned in a first pattern wherein a first index of refraction across at least a first portion of the variable optic insert varies with a first radial dependence, and wherein the first layer containing liquid crystal

material varies its first index of refraction affecting a first ray of light traversing the first layer containing liquid crystal material when a first electric potential is applied across the first layer of electrode material and the second layer of electrode material;

a curved second front surface and a curved second back surface wherein the second front surface and the second back surface are configured to form at least a second chamber;

a third layer of electrode material proximate to the curved second front surface;

a fourth layer of electrode material proximate to the curved second back surface;

a second layer containing liquid crystal material positioned within the second chamber, wherein the second layer includes regions of liquid crystal material aligned in a second pattern wherein a second index of refraction across at least a second portion of the variable optic insert varies with a second radial dependence, and wherein the second layer containing liquid crystal material varies its second index of refraction affecting a second ray of light traversing the second layer containing liquid crystal material when a second electric potential is applied across the third layer of electrode material and the fourth layer of electrode material;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

an electrical circuit comprising a processor, wherein the electrical circuit controls a flow of electrical energy from the energy source to one or more of the first, second, third or fourth electrode layers; and

wherein the variable optic insert alters a focal characteristic of the contact lens device and wherein a layer containing liquid crystal material is a polymerizable mixture.

16.A contact lens device with a variable optic insert positioned within at least a portion of an optical zone of the contact lens device, wherein the variable optic insert comprises:

a layer containing liquid crystal material positioned within the variable optic insert, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein

an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence;

a dielectric layer proximate to the layer containing liquid crystal material, wherein the dielectric layer varies in thickness at least within the portion within the optical zone; and

wherein at least a first surface of the layer containing liquid crystal material is curved and wherein the layer containing liquid crystal material is a polymerizable mixture.

17.An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

an insert front curve piece and an insert back curve piece, wherein a back surface of the front curve piece has a first curvature and a front surface of the back curve piece has a second curvature;

a dielectric layer proximate to at least one of the front curve piece and the back curve piece, wherein a thickness of the dielectric layer varies at least within the portion within the optical zone;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

a layer containing liquid crystal material, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence and wherein the layer containing liquid crystal material is a polymerizable mixture.

18.The device according to Claim 17, wherein the monomer(s) used to form the polymer matrix may itself contain attached liquid crystal portions.

19.The device according to Claim 18, wherein polymerization is initiated by actinic radiation shone onto the mixture.

20.The device according to Claim 19, wherein the first curvature is different from the second curvature in the sense that the first curvature and second curvature possess differing radii of curvature.

21.The device according to Claim 20, wherein the lens is a contact lens.

22.The device according to Claim 21, further comprising:

a first layer of electrode material proximate to the back surface of the front curve piece; and

a second layer of electrode material proximate to the front surface of the back curve piece.

23.The device according to Claim 22, wherein the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.

24.The device Claim 23, wherein the variable optic insert alters a focal characteristic of the lens.

25.An ophthalmic lens device with a variable optic insert positioned within at least a portion of an optical zone of the ophthalmic lens device, wherein the variable optic insert comprises:

an insert front curve piece, at least a first intermediate curve piece and an insert back curve piece, wherein a back surface of the front curve piece has a first curvature and a front surface of the first intermediate curve piece has a second curvature;

a dielectric layer proximate to at least one of the front curve piece and the intermediate curve piece, wherein the dielectric layer varies in thickness at least within the portion within the optical zone;

an energy source embedded in the insert in at least a region comprising a non-optical zone; and

the variable optic insert comprising a layer containing liquid crystal material, wherein the layer includes regions of liquid crystal material aligned in a pattern wherein an index of refraction across at least a first portion of the variable optic insert varies with a radial dependence and wherein the layer containing liquid crystal material is a polymerizable mixture.

26.The device according to Claim 25, wherein the monomer(s) used to form the polymer matrix may itself contain attached liquid crystal portions.

27.The device ~~of~~ according to Claim 26, wherein the first curvature is different from the second curvature.

28.The device according to Claim 25, wherein the lens is a contact lens.

29.The device according to Claim 28, further comprising:

a first layer of electrode material proximate to the front curve piece; and

a second layer of electrode material proximate to one or more of the intermediate curve piece and the back curve piece.

30.The device according to Claim 28, further comprising:

a first layer of electrode material proximate to the front curve piece; and

a second layer of electrode material proximate to the intermediate curve piece.

31.The device according to Claim 30, wherein the layer containing liquid crystal material varies its index of refraction affecting a ray of light traversing the layer containing liquid crystal material when an electric potential is applied across the first layer of electrode material and the second layer of electrode material.