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;

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 across at least a first portion of the variable optic insert that varies with a cycloidal pattern.

2. The ophthalmic lens device of Claim 1 wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

3. The ophthalmic lens device of Claim 1 wherein the layer containing liquid crystal material and varying with the cycloidal pattern assumes a curved shape.

4. The ophthalmic lens device of Claim 3 wherein the lens includes a polarizing component.

5. The ophthalmic lens device of Claim 3 additionally 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 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 across at least a first portion of the variable optic insert that varies with a cycloidal pattern; 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 locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

12. The ophthalmic lens device of Claim 11 wherein the layer containing liquid crystal material that varies with the cycloidal pattern assumes a curved shape.

13. The ophthalmic lens device of Claim 12 wherein the lens includes a polarizing component.

14. The ophthalmic lens device of Claim 12 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. 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 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 first layer containing liquid crystal material positioned within the first chamber, wherein the layer includes regions of liquid crystal material aligned in a pattern across at least a first portion of the variable optic insert that varies with a cycloidal pattern, and wherein the first layer containing liquid crystal material varies its first index of refraction affecting a ray of light traversing the first 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;

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 filters out a circular polarization component of incident light;

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 ophthalmic lens device.

20. 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 layer containing liquid crystal material positioned within the variable optic insert, wherein the layer includes regions of liquid crystal material aligned in a pattern across at least a first portion of the variable optic insert that varies with a cycloidal pattern; 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:

a front curve piece and a 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 ;

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 wherein the layer

includes regions of liquid crystal material aligned in a pattern across at least a first portion of the variable optic insert that varies with a cycloidal pattern.

22. The ophthalmic lens device of Claim 21 wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

23. The ophthalmic lens device of Claim 22 wherein the layer containing liquid crystal material that varies with the cycloidal pattern assumes a curved shape.

24. The ophthalmic lens device of Claim 23 wherein the first curvature is approximately the same as the second curvature.

25. The ophthalmic lens device of Claim 24 wherein the lens includes a polarizing component.

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:

a front curve piece, at least a first intermediate curve piece and a 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 ;

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 across at least a first portion of the variable optic insert that varies with a cycloidal pattern.

32. The ophthalmic lens device of Claim 31 wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a 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 approximately the same as the second curvature.

34. The ophthalmic lens device of Claim 33 wherein the lens includes a polarizing component.

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;
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 across at least a first portion of the variable optic insert that varies in a repeating a cycloidal pattern.

2. The device as claimed in Claim 1, wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

3. The device as claimed in Claim 1, wherein the layer containing liquid crystal material and varying with the cycloidal pattern assumes a curved shape.

4. The device as claimed in Claim 3, wherein the lens includes a polarizing component.

5. The device as claimed in Claim 3, additionally 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 device as claimed in 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 device as claimed in Claim 6, wherein the variable optic insert alters a focal characteristic of the lens.

8. The device as claimed in 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. 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 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 across at least a first portion of the variable optic insert that varies with a repeating cycloidal pattern; and
an energy source embedded in the insert in at least a region comprising a non-optical zone.

10. The device as claimed in Claim 9, wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

11. The device as claimed in Claim 10, wherein the layer containing liquid crystal material that varies with the cycloidal pattern assumes a curved shape.

12. The device as claimed in Claim 11, wherein the lens includes a polarizing component.

13. The device as claimed in 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.

14. The device as claimed in Claim 13,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.

15. The device as claimed in Claim 14, wherein the variable optic insert alters a focal characteristic of the lens.

16. The device as claimed in Claim 15, 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.

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:
a front curve piece and a 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 ;
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 the layer includes regions of liquid crystal material aligned in a pattern across at least a first portion of the variable optic insert that varies with a repeating cycloidal pattern.

18. The device as claimed in Claim 17, wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

19. The device as claimed in Claim 18, wherein the layer containing liquid crystal material

that varies with the cycloidal pattern assumes a curved shape.

20. The device as claimed in ~~of~~ Claim 19, wherein the first curvature is approximately the same as the second curvature.

21. The device as claimed in ~~of~~ Claim 20, wherein the lens includes a polarizing component.

22. The device as claimed in 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 as claimed in 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 as claimed in Claim 23, wherein the variable optic insert alters a focal characteristic of the lens.

25. The device as claimed in Claim 24, 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.

26. 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 front curve piece, at least a first intermediate curve piece and a 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 ;
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 across at least a first portion of the variable optic insert that varies with a repeating cycloidal pattern.

27. The device as claimed in Claim 26, wherein locations of orientations in liquid crystal orientation aligning with a radial axis across at least a first portion of the optic insert has a parabolic dependence on a radial dimension.

28. The device as claimed in Claim 27, wherein the first curvature is approximately the same as the second curvature.

29. The device as claimed in Claim 28, wherein the lens includes a polarizing component.

30. The device as claimed in Claim 29, 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.

31. The device as claimed in Claim 29, 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.

32. The device as claimed in Claim 31, 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.

33. The device as claimed in Claim 32, wherein the variable optic insert alters a focal characteristic of the lens.

34. The device as claimed in Claim 33, 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.

35. The device as claimed in Claim 8, 16, 25 or Claim 34, wherein the electrical circuit comprises a processor.