Parts of a Patent

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  - Summary
  - Drawing Description
  - Description
  - Operation - Main and alternative embodiments
  - Conclusion
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- Abstract

Specification - Background

- Short description of the state of the general field the inventions pertains to.
- Describes the problems to be solved.
- Describes prior art (i.e. what's already out there to address this problem.
- Criticism of relevant prior art.

Specification - Background

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VARIABLE ANAMORPHIC LENS AND METHOD FOR CONSTRUCTING LENS

This invention relates to lenses and more particularly relates to a variable power lens which provides variable cylindrical lens power and cylindrical lens rotation.

For cylindrical lens systems two descriptive specifications are required for their use. First, the desired cylinder power must be chosen. Secondly, the cylindrical lens must be rotated to its desired orientation. When this has been done, the desired difference in magnification of an image in each of two perpendicular directions is achieved.

General Description of the Invention

Start of Background

Specification - Background

When anamorphic lens systems are used, they are commonly used in combination with spherical optics. A common example of this is the phoropter or refractor used by ophthalmologists. When cylindrical lenses are conventionally used in combination with spherical optics, change of the effective focal length of the combined optics results.

This change of focal length of combined optics can best be understood by remembering that spherical objects can be emulated by crossing at 90° cylinder lenses of equal power. When a cylinder is used as an anamorphic insert in a spherical lens system, the effective total cylindrical component of the combined optics is changed. Change of the average spherical optic focal length results. For example, inserting a positive cylinder lens into a configuration of spherical optics having positive power will produce increased lens power on the average for the combination.

More background, but starts to show the limitations of existing cylindrical systems.

What is SEP of a cylindrical lens?

Specification - Background

In addition to changing the effective spherical power of optics used in combination with anamorphic optics, the desired rotation of a cylinder is often hard to determine, especially where the diopter power of the cylinder correction is small. An example of this is the difficulty opticians commonly experience in determining the rotational alignment of an astigmatic correction to a patient's eye when the astigmatic correction is of extreme low diopter power. In essence the rotational alignment precision becomes dependent on the strength of the cylinder.

More limitationsof existing cylindrical systems.

Typically, axis becomes poorly defined as astigmatism goes to zero.

Specification - Prior Art

It is known to generate astigmatism by use of a variable power lens. Such a lens is disclosed in U.S. Pat. No. 3,305,294, issued Feb. 21, 1967, entitled "TWO ELEMENT VARIABLE POWER SPHERICAL LENS," to Luis W. Alvarez and U.S. Pat. No. 3,507,565, issued Apr. 21, 1970, entitled "VARIABLE POWER LENS AND SYSTEM" to Luis W. Alvarez and William E. Humphrey.

Again, prior art is anything that exists or has been described that pertains to the new invention. It must be disclosed, if it is known. The key to novelty inthe patent is to show the new invention solves a problem better than the prior art or solves a problem that the prior art cannot solve.

Utility & Novelty

Specification - Prior Art

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It will be understood that the cylinder optics there obtainable have many similar disadvantages to conventional cylindrical optics. It is necessary that the lens element or elements be rotated to achieve desired cylinder angular alignment. Difficulty in determining cylinder rotation alignment at low diopter cylinder power remains.

Again, prior art is anything that exists or has been described that pertains to the new invention. It must be disclosed, if it is known. The key to novelty inthe patent is to show the new invention solves a problem better than the prior art or solves a problem that the prior art cannot solve.

Utility & Novelty

Specification - Summary

- Describes how your invention addresses the previously stated problem.
- Describes why your invention is useful.
- Positive aspects of the invention (relative to criticisms of prior art).

Specification - Summary

An anamorphic lens is disclosed which generates variable cylinder lens power and variable cylinder lens rotation over incremental viewpoints chosen through its surface. Cylinder power and rotation is a function of the displacement distance and angle of a viewpoint segment on the lens from a neutral viewpoint segment on the lens.

$$t = A\,[(r^3/3)\cos 3\theta]$$

WHERE:

t is optical thickness as described hereinabove;

A is a constant representative of the rate of lens power variation over the lens surface as described hereinabove;

r and *θ* are polar coordinates of a particular element of area.

An object of this invention is to set forth a single lens element constructed in accordance with the above equational limitations which element provides at preselected incremental viewpoints along its surface predictable cylindrical lens effects of desired power and desired axial rotation.

Basically, what the invention does.

$$Z_3^3(\rho,\theta) = \sqrt{8}\rho^3\cos 3\theta$$

Specification - Summary

An advantage of this predictability of the cylindrical power and cylindrical rotational axis is that the displacement of a view segment through the lens relative to a neutral segment of view through the lens can be radially equated to power and angularly equated to cylinder rotation.

Another advantage of the single lens element is that it generates a cylinder correction of positive cylinder at a preselected angular alignment and a negative cylinder of equal power normal to the positive cylinder. Hence, the average focal length of spherical optic used in combination with the lens element remains unchanged.

Advantages over prior art

The cylinder power and axis is directly related to where you look through the lens.

SEP = 0

12 other advantages to make sure the patent examiner is fully aware of the benefits of the lens.

Specification - Drawing Description

FIG. 1*a* is an enlarged perspective view of the lens element of this invention with broken lines shown defining sections through the lens to illustrate the shape of the lens element;

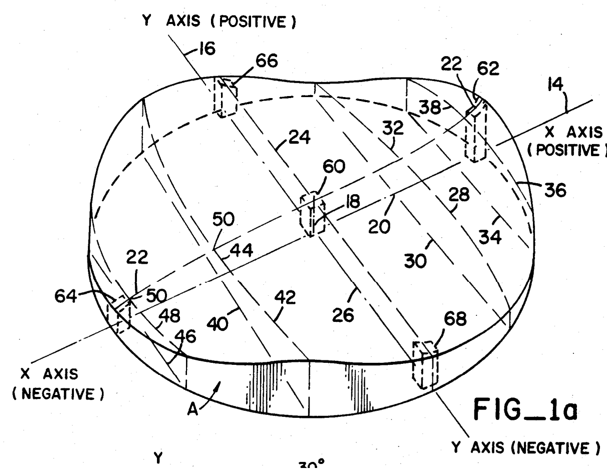


FIG_1a

Specification - Drawing Description

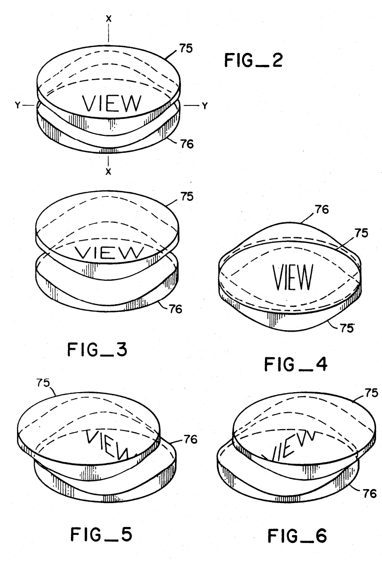
FIG. 2 illustrates two lens elements of FIG. 1 on a reduced scale shown in perspective, the lens elements confronted one to another at their surfaces of compound curvatures, the overlapped lenses here being overlapped in a neutral position to have no anamorphic effect when looking through the lens elements onto the written word "VIEW";

FIG. 3 illustrates the lenses of FIG. 2 with the upper lens being displaced rearwardly and the view through the overlapped lens elements showing the word "VIEW" anamorphically expanded horizontally and compressed vertically;

FIG. 4 illustrates the lens elements of FIG. 2 with the top lens element displaced forwardly relative to the lower element and the view through the overlapped lens elements showing the word "VIEW" anamorphically compressed horizontally and expanded vertically;

FIG. 5 illustrates the lens elements of FIG. 2 with the upward element displaced to the left of the lower element and the view through the overlapped lens elements showing the word "VIEW" anamorphically elongated along one diagonal and compressed on the opposite diagonal;

FIG. 6 illustrates the lens elements of FIG. 2 with the upper lens element displaced towards the right and the view through the overlapped lens elements showing the word "VIEW" anamorphically compressed along one diagonal and expanded along the opposite diagonal;



Specification - Description & Embodiments

- Thoroughly describes the theory and process for the invention.
- Describes figures in full detail and the function of the labeled items.
- Describes the preferred embodiment (i.e. what's the best way to make the invention).
- Describes alternative embodiments.
- A person "reasonbly skilled in the art" must be able to make or implement the invention based on this description.

- Column 5 Line 29 through Column 14 Line 58 devoted to this description.

Specification - Conclusion

- Summarizes utility and novelty of the device.
- Summarizes advantages of the invention over prior art.
- Statement that the invention is not limited to the physical form shown in the description.

> **It should be appreciated that numerous departures from the specifics of the disclosure illustrated here can be made by those skilled in the optic art without departing from the spirit and scope of this invention.**

Claims

- Precise statements about the invention.
- Regardless of what is stated in the description, only the concepts within the Claims are protected by law.
- Claims should be as broad as possible to prevent competition from working around the patent.
- Claims then should specify ranges and/or materials to be more specific.
- Claims are sometimes repeated several times with different wording to prevent misinterpretation.

Claims

What is claimed is:

1. A lens element comprising: transparent optical media having first and second optical interfaces with said transparent media disposed between said interfaces, the thickness of said optical media between said optical interfaces including a variation of effective optical thickness measured substantially orthogonal to an x, y Cartesian coordinate axis system disposed substantially parallel to said interfaces, said effective optical thickness variation defined by the terms:

$$A\,[(x^3/3) - xy^2]$$

wherein:

x represents displacement on a Cartesian coordinate system substantially parallel to said optic axis;
y represents displacement on a Cartesian coordinate system wherein said y axis is substantially normal to said x axis in said plane; and
A is a constant representing the lens power variation.

Claim broadly describes lens element. Blocks anybody from making lenses with thickness variation described by the mathematical formula.

Independent Claim (i.e. stands on its own)

Claims

2. A lens element comprising: transparent optical media having first and second optical interfaces with said transparent media disposed between said interfaces; the thickness of said optical media between said optical interfaces including a variation of effective optical thickness measured substantially orthogonal to a polar axis coordinate system disposed in a plane substantially parallel to said interfaces; said effective optical thickness variation defined by the terms:

$$(Ar^3/3)\ \mathrm{Cos}\ 3\theta$$

where:

r is the radius of displacement in the polar coordinate system;
θ is the angle of displacement in the polar coordinate system from a preselected 0 angular displacement; and
A is a constant representing lens power variation per unit translation along the surface.

Same thing as claim 1, but now in polar coordinate system.

Repitition allows avoiding possible ambiguities in meaning.

Independent Claim

Claims

3. A lens system comprising: first and second lenses arranged in tandem one behind the other along an optic axis; each lens having first and second optical interfaces disposed sub-stantially normal to said optic axis with a transparent lens media disposed between said interfaces, the thickness of said optical media of each of said lenses including a variation of effective optical thickness measured substantially orthogonal to an x, y Cartesian coordinate axis system disposed substantially normal to the optic axis, said effective optical thickness variation for said first lens element defined by the terms:

$$(+)\ A\ [(x^3/3) - xy^2]$$

said effective optical thickness variation for said second lens element defined by the terms:

$$(-)\ A\ [(x^3/3) - xy^2]$$

wherein:

x represents displacement on a Cartesian coordinate system substantially normal to said optic axis;
y represents displacement on a Cartesian coordinate system wherein said y axis is substantially normal to said x axis in said plane; and
A is a constant representing the lens power variation per unit translation over a lens surface.

This is an independent claim that covers using two of these lenses, with equal and opposite powers, in conjunction.

Claims

4. The lens system according to claim **3** and including means for moving said first lens relative to said second lens orthogonally with respect to said optic axis.

This is a Dependent Claim, since it encompasses everything in Independent Claim 3, as well as the concept of moving one of the lenses with respect to the other.

Claims

5. A lens system comprising: first and second lenses arranged in tandem one behind the other along an optic axis; each lens having first and second optical interfaces disposed substantially normal to said optic axis with a transparent lens media disposed between said interfaces, the thickness of said optical media of each of said lenses including a variation of effective optical thickness measured substantially orthogonal to a polar coordinate system disposed substantially normal to the optic axis, said effective optical thickness variation for said first means defined by the terms:

$$(+)\ (Ar^3/3)\ \mathrm{Cos}\ 3\theta$$

said effective optical thickness variation for said second lens element defined by the terms:

$$(-)\ (Ar^3/3)\ \mathrm{Cos}\ 3\theta$$

wherein:

r is the radius of displacement of the polar coordinate system,

θ is the angle of displacement of the polar coordinate system from a preselected 0 angular displacement; and

A is a constant representing a lens power variation per unit of translation.

Repeat of Claim 3 in polar coordinates.

Claims

6. An opthamological device comprising: at least one lens having first and second optical interfaces with transparent lens media therebetween, the maximum lens thickness variation being less than one-half the lens diameter, said lens having a thickness t parallel to an optic axis passing through said optical interfaces substantially normal thereto, said thickness substantially defined by the terms:

$$A\,[(x^3/3) - xy^2\,] + Bx^2 + Cxy + Dy^2 + Ex + Fy + G$$

wherein:

- *x* and *y* represent points on a rectangular coordinate system described substantially normal to said optic axis;
- *A* is a constant representing the rate of lens power variation across the surface;
- *B* is a coefficient representing a contribution to rates of prism power variation across the surface;
- *C* is a coefficient representing a contribution to rates of prism power variation across the surface;
- *D* is a coefficient representing a contribution to rates of prism power variation across the surface;
- *E* is a coefficient representing a contribution to rates of thickness variation across the surface;
- *F* is a coefficient representing a contribution to rates of thickness variation across the surface; and,
- *G* is a constant representing lens thickness at an optic axis intersecting the *x*, *y* axis.

* * * * *

This claim covers superimposing the basic lens on to an arbitrary spherocylinder lens.

Covers a way of getting around the patent.