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(71) Applicant: **AKKOLENS INTERNATIONAL B.V.** [NL/NL]; Overaseweg 9, NL-4836 BA Breda (NL).

(72) Inventors: **SIMONOV, Aleksey Nikolaevich**; Hopmanstraat 20, NL-2497 DV 's-Gravenhage (NL). **ROMBACH, Michiel Christiaan**; Overaseweg 9, NL-4836 BA Breda (NL).

(74) Agent: **VAN OEFFELT, Abraham**; Patentwerk B.V., P.O. Box 1514, NL-5200 BN 's-Hertogenbosch (NL).

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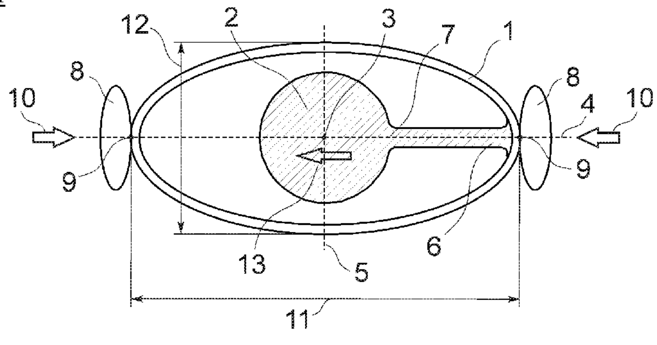
(54) **Title**: OBLONG SHAPED ACCOMMODATING INTRAOCULAR LENS

Fig. 1



(57) **Abstract**: Accommodating intraocular lens construction with an oblong flexible haptic (1) which change shape such that the ratio of the length of the chief axis (4) and the length of the transverse axis (5) decreases when the driving means are active. The haptic provides movement of optic (2) in a direction parallel or, alternatively, perpendicular to the direction of movement of the driving means. The variable lens is a single multifocal lens or, alternatively, a combination of at least two optical elements providing different optical powers at different relative positions of the optical elements in a direction perpendicular to the optical axis (3). Movement can be lateral shift or rotation of at least one optical element.

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Oblong shaped accommodating intraocular lens

The present invention disclosed in this document relates to an accommodating intraocular lens construction to restore the ability of the human eye to accommodate. The construction includes at least one lens for variable optical power (also: variable lens) comprising at least one optical element, for example, a single multifocal lens, or, alternatively, the construction includes at least one lens for variable optical power comprising at least two optical element, for example, a variable lens comprising two optical elements with one cubic optical surface each of which at least one element moves, in a plane largely perpendicular to the optical axis, with moving meaning shifting, or, alternatively, rotating, or, alternatively, a movement which is a combination of said shift and rotation. The construction also includes a flexible oblong haptic (also: haptic), the mechanical construction in which the optical elements are fitted, which positions the construction in the eye and which transfers movements from driving means to at least one of the optical elements. The haptic is an oblong shaped flexible haptic adapted to change shape such that the ratio of the length of the chief axis (the longest axis, as in the longest axis of an oval) and the length of the transverse axis (as in the short axis of said oval) of said haptic decreases when the driving means are active with said ratio of lengths increasing when the driving means are inactive.

The term oblong means, in the context of the present document: being elongated in one direction, usually as a deviation from a square, a rectangle or a circle, and thus having the chief axis approximately the same size as the transverse axis, bur generally with the long axis considerably longer than the transverse axis. An oval shape will be put forward in the present document as an example. However, the invention can include any oblong shape including any shape which can be derived from an oblong shape, such as a lozenge shape, a shape according to a parallogram, a rectangle or any other shape derived from any of said shapes. Splitting an oblong shaped haptic along the chief axis results in two, half-oblong, sections (also: chief sections), with a central point where the transverse axis intersects such chief section. A split of the oblong shape along the transverse axis results also in two, half-oblong sections (also: transverse sections), with a central point where the chief axis intersects such transverse section.
The haptic is connected to the rim of one of the optical elements at a first point where the transverse axis of the haptic intersects with the haptic (or, in alternative terms, the

rim is connected at the central point of a chief section), and, that the haptic is connected to the rim of the other optical element at the second point where the transverse axis of the haptic intersects with the haptic, opposite the first point (or, in alternative terms, the rim is connected at the central point of the other chief section). Such connection can be achieved by various means including glueing or repolymerization or by moulding. The optical elements and haptic can be moulded in a single procedure. Alternatively, the optical element can be fitted to the haptic by a form-fitting connection during manufacturing or after manufacturing, for example during surgery or even during surgery, in the eye.

The haptic is coupled to a first section of driving means at the first point where the chief axis of the haptic intersects with the haptic (or, in alternative terms, at the central point of a transverse section) and the haptic is coupled to the driving means at the second point where the chief axis of the haptic intersects with the haptic, opposite the first point (in alternative terms, the central point of the other transverse section). In such construction the haptic provides movement of at least one optical element in a direction perpendicular to the direction of movement of the driving means.

So, the accommodating intraocular lens construction comprises a variable lens comprising a combination of at least one optical element adapted to provide different optical powers at different relative positions of at least one optical element in a plane perpendicular to the optical axis, and, at least one haptic connected at, at least one, optics connection point, to the rim of the optical element, with each optical element comprising one optics connection point, and, the haptic coupled at, at least one driving connection point, to, at least one, driving means, and, with the haptic adapted to position the optical element in the eye, and, with the haptic adapted to provide translation of movement of driving means, in a direction perpendicular to the optical axis, into movement of at least one optical element in a direction perpendicular to the optical axis, with the lens construction comprises one single oblong flexible haptic which is adapted to change shape when the driving means are active such that the ratio of the length of the chief axis and the length of the transverse axis of said haptic decreases when the driving means are active with said ratio increasing when the driving means are inactive.

The lens construction can comprise at least one combination of connection points which combination comprises at least one optics connection point and at least one driving connection point, both connected to the haptic at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the chief axis.
Alternatively, the lens construction can comprise at least one combination of connection points which combination comprises at least one optics connection point at the point where the transverse axis of the haptic transverses the haptic, and, at least one driving connection point at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the transverse axis.

The flexible oblong haptic is generally, but not necessarily, fitted with at least two anchors to support positioning of the construction and/or to support efficient transfer of movement from driving means to the optical elements. The design of such anchors depends on the overall design of the intraocular lens and its specifications. For example, the anchors can be adapted for driving of the construction by ciliary mass directly, as set forth in, for example, WO2011062486.
Anchors, firstly, support positioning of the construction in the eye, which is the traditional function of such anchors in monofocal, non-accommodating, intraocular lenses. For such positioning function the anchor can be fitted with flanges, grooves or hooks. In the accommodating lens disclosed in the present document the anchors, secondly, also support transfer of movement from driving means to the haptic and, subsequently, transfer of movement to at least one the optical element. Such driving means can be, for example, the ciliary muscle of the eye. So, an anchor can have, for example, a stretched shape to transfer movement from the ciliary muscle directly. This adaptation can include, for example, a groove which encloses the ciliary mass for efficient positioning of the construction and efficient transfer of movement from the muscle to the haptic and, subsequently, transfer movement to at least one optical element.

Alternatively, such anchor can have, for example, a shape adapted to transfer movement from the capsular bag or ciliary muscle to the haptic which, subsequently, transfers movement to at least one optical element.

The lens construction comprises a haptic which is adapted to urge the optical element back to a resting position when the driving means are inactive. Such driving force can be generated by, for example, the inherent elasticity of the haptic. The flexible oblong haptic is constructed such that forces exerted onto it at result in movement of the haptic in only the plane perpendicular to the optical axis. Such forces should not result in undesired contortions of the haptic, for example, in torsion. Such restricted movement of the haptic can be achieved by, for example, by a haptic thicker in the direction of the optical axis compared to the direction perpendicular to the optical axis.

Figure 1 depicts a front view of an oblong lens construction with a single lens. The lens construction comprises the oblong haptic, 1, and, in this example, a single optical element, 2, for example, a single multifocal lens, centrally positioned at the cross-point of the optical axis, 3, the chief axis, 4, and transverse axis, 5. The haptic is connected at the optic connection point, 6, where the chief axis of the haptic intersects with the haptic, to the rim, 7, of the optical element. Anchors, 8, are connected to the driving connection points, 9, on the chief axis. Compression, 10, of the haptic along the chief axis results in a decrease in length of the chief axis, 11, and increase in length of the transverse axis, 12, a shift, 13, of the optical element along the optical axis.

Figure 2 depicts a front view of an oblong lens construction with two optical elements. The lens construction comprises the oblong haptic, 1, and, in this example, two optical elements, 14, 15, which, in combination, form a lens of variable power of which the power depends on the relative position of the elements in a plane perpendicular to the optical axis, for example, a variable lens with two cubic elements, which elements are centrally positioned at the cross-point of the optical axis, 3, the chief axis, 4, and transverse axis, 5. The haptic is connected at the optic connection point, 16, 17, where the transverse axis of the haptic intersects with the haptic, to the rims, 7, of the optical elements. Anchors, 8, are connected to the driving connection points, 9, on the chief axis. Compression, 10, of the haptic along the chief axis results in a decrease in length of the chief axis, 11, and increase in length of the transverse axis, 12, a shift, 18, 19, of both optical elements along the transverse axis. For other features of the lens construction refer also to other Figures.

Figure 3 depicts a side view of an oblong lens construction with two optical elements. The lens construction in side view shows the, shifting, optical elements, 14, 15, each with a cubic optical surface, 20, the optical axis, 3, and chief axis, 4, and the transverse axis, 5. The haptic is connected at the haptic connection points, 16, 17, to the rim of the optical elements, by, in this example, a form-fitting connection, 21, 22. For other features of the lens construction refer also to earlier Figures.

Figure 4 depicts a front view of an oblong lens construction with two optical elements and rotating optical elements. The lens construction can comprise two optical elements, 23, 24, which provide variable focus by relative rotation movement, 25, of the elements around a central axis, 26, which axis also connects the elements, with the optics connection points, 27, 28, and driving connection points, 29 and 30, in this example with the optics connection points linked to elongated connection components, 31, 32, to provide leverage for rotation of the optical elements. For other features of the lens construction refer also to earlier Figures.

Figure 5 depicts a front view of an oblong lens construction with two optical elements and fanning optical elements. The lens construction can comprise two optical elements, 23, 24, which provide variable focus by relative fanning movement, 33, of the elements around an axis, 34, close to the rim of the optical elements which axis also connects the elements, with the optics connection points, 27, 28, and driving connection points, 29 and 30, in this example with the optics connection points linked to elongated connection components, 31, 32, to provide leverage for fanning of the optical elements. For other features of the lens construction refer also to earlier Figures.

Figure 6 depicts a side view of an oblong lens construction with two optical elements and variable monofocality. Variable lenses can be variable monofocal. In this example the light beam, 35, is focused by two, cubic, optical elements, 36, 37, which provide variation in focal distance, 38, by lateral shift, 39, over the distance 40-41, which focuses the light beam by the extreme focal powers of the variable lens at, 42, 43, determined by the specifications of the optical elements, e.g. the peak-to-valley amplitudes,44, 45, of the cubic surfaces of the optical surfaces and the range of shift, 40-41, of the optical elements. An additional lens of fixed optical power, 46, to correct refractive error of the eye is added to the variable lens. For other features of the lens construction refer also to earlier Figures.

Figure 7 depicts a side view of an oblong lens construction with two optical elements and variable multifocality. Variable lenses can also be variable multifocal, which is, for accommodating lenses, a novel concept. In this example two, chiral, optical elements, 47, 48, provide variation in focal distances of two foci by rotation of at least one such optical element over an angle, 49, 50, with, at the large angle, the incoming light beam, 35, focused at two corresponding focal spots, 51 and 52, moving in tandem, 53, 54, along the optical axis, 3, from the first extreme positions, 55, to the second extreme position, 56, at decreasing angle of rotation of the elements. The range of focal spots is dependent on the specifics of the optical elements and the range of rotation. A fixed optical power, 57, to correct for refractive error of the eye is added one of the optical elements. For other features of the lens construction refer also to earlier Figures.

The lens construction can comprise a single optical element which element is a multifocal lens to provide different optical powers at different relative positions in a plane perpendicular to the optical axis, for example, a bifocal lens. Alternatively, the lens construction can comprise a combination of at least two optical elements which combination provides different optical powers at different relative positions of said optical elements in a plane perpendicular to the optical axis. The variable lens can thus be a combination of at least two optical elements which provides different optical powers at different relative positions of the optical elements by movement of at least one optical element in a direction perpendicular to the optical axis. Such movement can be a lateral shift, a rotation, or any other combination of movements of at least one of the optical elements in a plane perpendicular to the optical axis. Free-form optical surfaces, surfaces with no rotational symmetry, can achieve such variable lenses, with at least one such free-form surface included in each optical element.

Firstly, such free-form surfaces can include a cubic free-form component according to $t = A (xy^2 + 1/3\, x^3)$ with t the lens thickness of the optical element in the direction of the optical axis, x the coordinate in the direction of the motion of the optical elements, y the coordinate in the direction perpendicular to the optical axis and to the x-direction and A a constant. Such variable lens with shifting optics was first disclosed in US-A3,305,294 and US-A3,583,790 and developed for use in accommodating intraocular lenses in, for example, US2008/0046076, US2009/0024214, US2009/0062912, and combined with additional free-form optics in WO2008/071760, all of which documents are included in the present document by reference. To these documents is referred for detailed descriptions of such cubic surfaces, of said formula and derivates thereof.

Secondly, such free-form surfaces can include a chiral free-form component, for example a parabolic screw according to $z = Ar^2\alpha$. The two chiral optical surfaces are of opposite chirality, alternatively, right-handed or left-handed, but not necessarily of equal steepness. The preferred embodiment includes chiral optical surfaces with a shape according to $z = Ar^2\alpha$ within the circular pupil of the eye, with z the surface sag, r the radial coordinate, α the polar angle in the plane of the surface, and A the mask steepness, or, in alternative coordinates, according to $\vartheta(r,\alpha) = Ar^2\alpha$, defined in a pupil of a unit radius, with r the radial coordinate and, in this notation, α the polar angle in the transverse plane. The chiral optical surface includes a central point of origin and a radial transition zone which is not chiral. So, alternatively, a chiral optical surface can be composed which does not include said point of origin nor the transition zone. An adapted cubic surface can be chiral optical surfaces to be included in lenses disclosed in the present document, or, alternatively, any other chiral surfaces can be chiral optical surfaces to be included in lenses disclosed in the present document. Note also that combinations of chiral optical surfaces with different degrees of steepness, of opposite sign, will provide combinations of discrete multifocality and of continuous multifocality, which combinations, albeit complex combinations, can be adapted to fit complex requirements of particular eyes.

More than two chiral surfaces distributed over at least two optical elements can be adapted to provide an adjustable continuous multifocal lens in which the dimensions of the range of sharpness can be varied in a fixed combination with the degree of sharpness, for example from a limited range in the direction of the optical axis in combination with a relative high degree of sharpness to an extended range along the optical axis in combination with a relative low degree of sharpness, or, in alternative terms, extension of range in the direction of the optical axis, the Z-direction will result in extension of range in the direction of the X or Y axis or in a direction of a combination thereof.

Variable lenses comprising two cubic surfaces generally provide a single focal spot of which the position along the optical axis depends on the relative position, distance of shift, of the optical elements (also: variable monofocality). However, variable lenses comprising two chiral surfaces, for example two parabolic screw type surfaces can provide multiple focal spots, for example, two spots, of which the positions along the optical axis depend on the relative position, meaning relative angle of rotation, of the optical elements, chiral surfaces (also: variable multifocality). Such variable multifocality for intraocular lenses is a novel concept first disclosed in the present document and the application of such multivariable lenses is not restricted to the intraocular lens constructions set forth in the present document.

So, the lens construction can comprises a combination of at least two optical elements which combination is adapted to provide different optical powers at different relative positions of said optical elements in a plane perpendicular to the optical axis, for example, a least two optical elements which combination provides different optical powers by shift in a plane perpendicular to the optical axis, which combination, for example, comprises at least two cubic optical surfaces with one such cubic surface fitted to each optical element, as in, for example, US2008046076 and WO2011062486 and US2009062912, or, alternatively, the lens construction can comprises a combination of at least two optical elements which combination is adapted to provide different optical powers by rotation in a plane perpendicular to the optical axis, with the lens construction comprising, for example, a combination of two optical elements which combination comprises at least two largely chiral optical surfaces with one such chiral surface fitted to each optical element as first set forth in, for example, WO2011102719.

The lens construction can be positioned in the capsular bag of the eye, or, alternatively, in the sulcus of the eye. Accommodating lenses are, generally, driven by the ciliary muscle of the eye, either by the muscle directly or by the muscle via the capsular bag from which the natural lens was removed during surgery. Such accommodating lens construction can be implanted in the sulcus of the eye or in the capsular bag of the eye. Implant in the iris, in the pupil of the eye, is a third option.

The driving force of the lens can be generated by a natural component of the eye, for example the ciliary muscle of the eye. However, the driving force can also be generated by an additional component of the lens construction, for example, a micro-electro-mechanical, MEMS, component. Such component can, for example, amplify a relatively small movement of a natural component of the eye into a relatively large movement of at least one optical element. The anchor has to be adapted to transfer movement from the MEMS actuator to the haptic and, subsequently, transfer movement to at least one optical element.

The lens construction can comprise a haptic which is driven by a natural component of the eye, for example, the ciliary muscle of the eye. Alternatively, the lens construction can comprise a haptic which is driven by an artificial component in the eye, for example, a micro-electro-mechanical-system component

Intraocular lenses are implanted in the human eye to correct for optical disorders. Such disorders can be fixed optical disorders, for example presbyopia, hyperopia and myopia of the eye. The accommodating intraocular lens constructions as disclosed in the present document can be fitted with additional optical surfaces to correct for such and other fixed optical disorders.
Loss of accommodation of the eye is a variable disorder of the eye. The construction disclosed in the present document restores accommodation of the eye. So, the lens construction can be adapted for implant in the human eye to correct for an optical disorder of the eye, which can be a variable optical disorder of the eye, for example accommodation, or, alternatively, the optical disorder is a fixed optical disorder of the eye, for example, presbyopia.

Prior art. The direction of the force which drives the lens construction is parallel to the direction in which at least one of the optical elements moves in all prior art disclosing the use of cubic, optical elements in intraocular lenses and the haptics include one rigid haptic connected to the first sector at the rim of an optical element and a flexible haptic connected to a, different, second sector opposite the first sector (as in prior art US2008/0046076, US2009/0024214, US2009/0062912, WO2008/071760 and related documents). US2011112638 also discloses an intraocular lens with two cubic surfaces, but here the movement is driven by forces in the eye in a direction parallel to the direction of optical axis. In the present invention the optical elements shift in a direction perpendicular to the direction of the force which drives the lens construction. The haptics include only a single flexible haptic connected to a single spot the optical element. Therefore, the inventions in the aforementioned prior art related to cubic optical elements differ from the invention in the present document.

An accommodating intraocular lens with shifting progressive power optics was disclosed in US4994082 (1991), which (see the third embodiment of US4994082, Fig. 5 and Fig. 6), describes two triangular fittings with each three haptics of which two haptics slidingly engage the optical element by a groove and flange construction and one haptic attached to the lens, which haptic is less flexible compared to said two other haptics. The lens construction is designed such that contraction of the ciliary muscle of the eye translates into an inward flex of the one, less flexible, haptic which pushes the lens into a 120^{o} angle formed by the two other, more flexible, haptics. At relaxation of the muscle the two, more flexible, haptics push the less back to its starting position. So, the prior art invention US4994082 differs from the present invention in that US4994082 employs two progressive power lenses (the present invention employs two cubic surfaces which, only in combination, form a variable lens) three haptics with different elasticity parameters (the present invention includes a single haptic) arranged in a triangular construction (the present invention is an oblong construction), in that the driving haptic moves inward, towards the optical axis when driving means are active (in the present invention the haptic moves outward, away from the optical axis when driving means are active).

So, in summary, the present document doscloses an accommodating intraocular lens construction to replace the natural lens of the human eye, with the construction comprising a variable lens comprising a combination of at least one optical element adapted to provide different optical powers at different relative positions of at least one optical element in a plane perpendicular to the optical axis, and at least one haptic connected at, at least one, optics connection point, to the rim of the optical element, with each optical element comprising at least one optics connection point, and, the haptic coupled at, at least one driving connection point, to, at least one, driving means, and, with the haptic adapted to position the optical element in the eye, and, with the haptic adapted to provide translation of movement of driving means, in a direction perpendicular to the optical axis, into movement of at least one optical element in a direction perpendicular to the optical axis, with the lens construction comprising at least one single oblong flexible haptic which is adapted to change shape when the driving means are active such that the ratio of the length of the chief axis and the length of the transverse axis of said haptic decreases when the driving means are active with said ratio increasing when the driving means are inactive, with either the lens construction comprising at least one combination of connection points which combination comprises at least one optics connection point and at least one driving connection point, both connected to the haptic at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the chief axis, or, alternatively, the lens construction comprising at least one combination of connection points which combination comprises at least one optics connection point at the point where the transverse axis of the haptic transverses the haptic, and, at least one driving connection point at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the transverse axis, with the lens construction generally, comprising a haptic adapted to urge the optical element back to a resting position when the driving means are inactive, and which lens construction can comprise either a single optical element which element is a multifocal lens, providing at least two distinct foci, which lens is adapted to provide different optical powers at different relative positions in a plane perpendicular to the optical axis, which multifocal can be a bifocal lens providing two distinct foci, or, alternatively, the lens construction comprising a combination of at least two optical elements which combination is adapted to provide different optical powers at different relative positions of said optical elements in a plane perpendicular to the optical axis which combination is adapted to provide different optical powers by shift in a plane perpendicular to the optical axis or by rotation in a plane perpendicular to the optical axis with the combination comprising at least two cubic optical surfaces with one such cubic surface fitted to each optical element, or, alternatively, comprising a combination of two optical elements which combination comprises at least two largely chiral optical surfaces with one such chiral surface fitted to each optical element, which lens construction can be adapted for positioning in the capsular bag of the eye, or, alternatively, be adapted for positioning in the sulcus of the eye and which lens construction can be adapted to be driven by a natural component of the eye, for example, the ciliary muscle of the eye or which lens construction can be driven by an artificial component in the eye, for example a micro-electro-mechanical-system component adapted to drive the lens construction, and which lens construction is adapted for implant in the human eye to correct for an optical disorder of the eye, which disorder can include at least one variable optical disorder of the eye, for example accommodation or variable astigmatism or the optical disorder is a fixed optical disorder of the eye, for example presbyopia or the lens is adapted to provide correction of any combination of variable and fixed disorders of the eye.

Claims

1. Accommodating intraocular lens construction to replace the natural lens of the human eye, with the construction comprising:

- a variable lens comprising a combination of at least one optical element adapted to provide different optical powers at different relative positions of at least one optical element in a plane perpendicular to the optical axis,
- at least one haptic connected at, at least one, optics connection point, to the rim of the optical element, with each optical element comprising at least one optics connection point, and, the haptic coupled at, at least one driving connection point, to, at least one, driving means, and, with the haptic adapted to position the optical element in the eye, and, with the haptic adapted to provide translation of movement of driving means, in a direction perpendicular to the optical axis, into movement of at least one optical element in a direction perpendicular to the optical axis, **characterized in that** the lens construction comprises at least one single oblong flexible haptic which is adapted to change shape when the driving means are active such that the ratio of the length of the chief axis and the length of the transverse axis of said haptic decreases when the driving means are active with said ratio increasing when the driving means are inactive.

2. Lens construction according to claim 1, **characterized in that** the lens construction comprises at least one combination of connection points which combination comprises at least one optics connection point and at least one driving connection point, both connected to the haptic at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the chief axis.

3. Lens construction according to claim 1, **characterized in that** the lens construction comprises at least one combination of connection points which combination comprises at least one optics connection point at the point where the transverse axis of the haptic transverses the haptic, and, at least one driving connection point at the point where the chief axis of the haptic transverses the haptic with said combination adapted to provide translation of movement of driving means along the chief axis into movement of at least one optical element along the transverse axis.

4. Lens construction according to any of the claims 1-3, **characterized in that** the lens construction comprises a haptic adapted to urge the optical element back to a resting position when the driving means are inactive.

5. Lens construction according to any of the claims 1-4, **characterized in that** the lens construction comprises a single optical element which element is a multifocal lens, providing at least two distinct foci, which lens is adapted to provide different optical powers at different relative positions in a plane perpendicular to the optical axis.

6. Lens construction according to claim 5, **characterized in that** the multifocal lens is a bifocal lens providing two distinct foci.

7. Lens construction according to any of the claims 1-4, **characterized in that** the lens construction comprises a combination of at least two optical elements which combination is adapted to provide different optical powers at different relative positions of said optical elements in a plane perpendicular to the optical axis.

8. Lens construction according to claim 7, **characterized in that** the lens construction comprises a combination of at least two optical elements which combination is adapted to provide different optical powers by shift in a plane perpendicular to the optical axis.

9. Lens construction according to claim 7, **characterized in that** the lens construction comprises a combination of at least two optical elements which combination is adapted to provide different optical powers by rotation in a plane perpendicular to the optical axis.

10. Lens construction according to any of the claims 7-9, **characterized in that** the lens construction comprises a combination of two optical elements which combination comprises at least two cubic optical surfaces with one such cubic surface fitted to each optical element.

11. Lens construction according to any of the claims 7-9, **characterized in that** the lens construction comprises a combination of two optical elements which combination

comprises at least two largely chiral optical surfaces with one such chiral surface fitted to each optical element.

12. Lens construction according to any of the claims 1-11, **characterized in that** the lens construction is adapted for positioning in the capsular bag of the eye.

13. Lens construction according to any of the claims 1-11, **characterized in that** the lens construction is adapted for positioning in the sulcus of the eye.

14. Lens construction according any of the claims 1-13, **characterized in that** the lens construction is adapted to be driven by a natural component of the eye.

15. Lens construction according to claim 14, **characterized in that** the natural component of the eye is the ciliary muscle of the eye.

16. Lens construction according to any of the claims 1-15, **characterized in that** the lens construction is adapted to be driven by an artificial component in the eye.

17. Lens construction according to claim 16, **characterized in that** the artificial component in the eye is a micro-electro-mechanical-system component adapted to drive the lens construction.

18. Lens construction according to any of the claims 1-17, **characterized in that** the lens construction is adapted for implant in the human eye to correct for an optical disorder of the eye.

19. Lens construction according to claim 18, **characterized in that** the optical disorder is a variable optical disorder of the eye.

20. Lens construction according to claim 18, **characterized in that** the variable optical disorder of the eye is accommodation.

21. Lens construction according to claim 18, **characterized in that** the optical disorder is a fixed optical disorder of the eye.

22. Lens construction according to claim 18, **characterized in that** the fixed optical disorder is presbyopia.

23. Lens construction according to claim 18, **characterized in that** the fixed optical disorder is presbyopia.

24. Lens according to claim 18, **characterized in that** the lens is adapted to provide correction of any combination of disorders according to claims 19-23.

Fig. 1

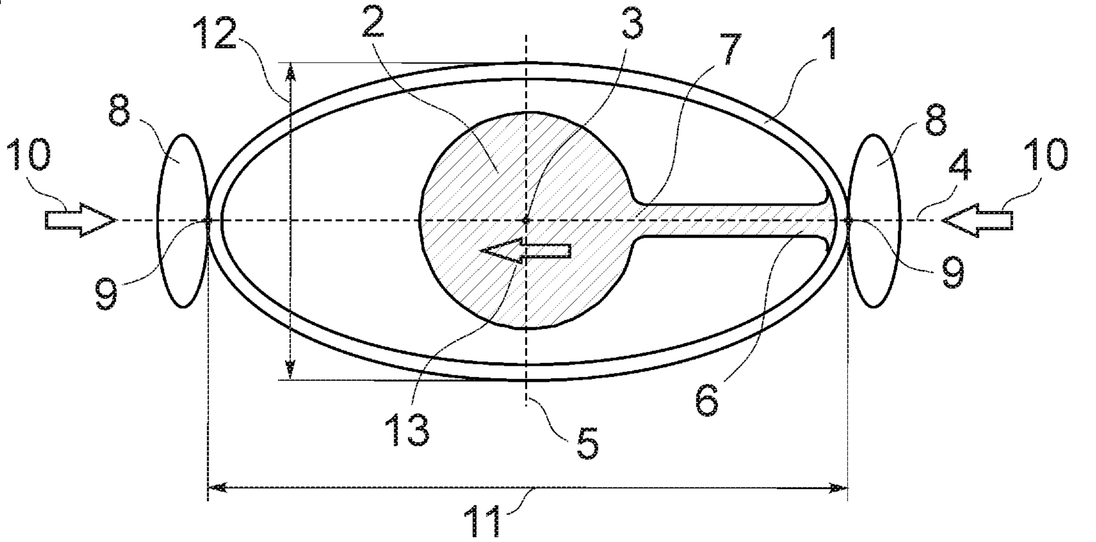
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Fig. 2

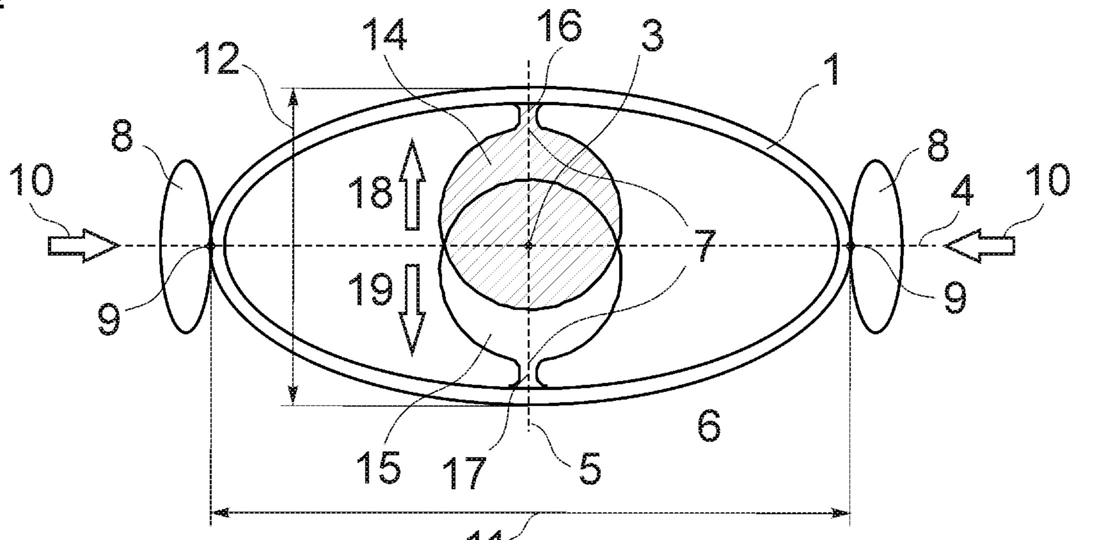
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Fig. 3

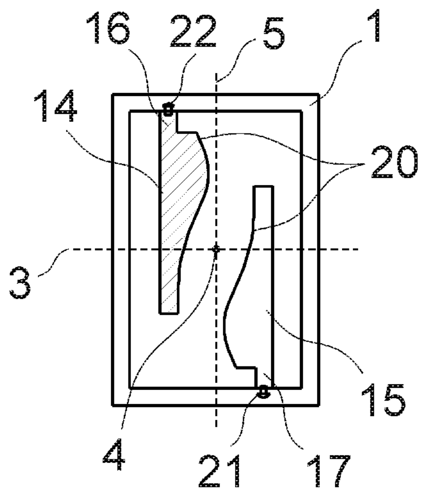


Fig. 4

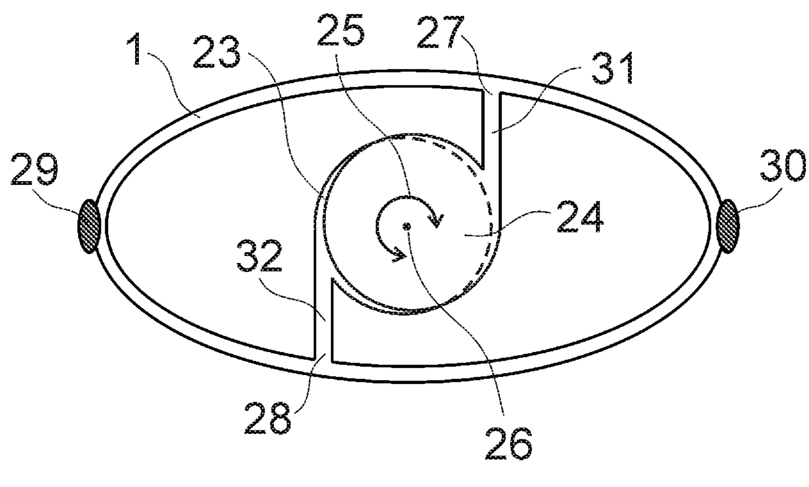


Fig. 5

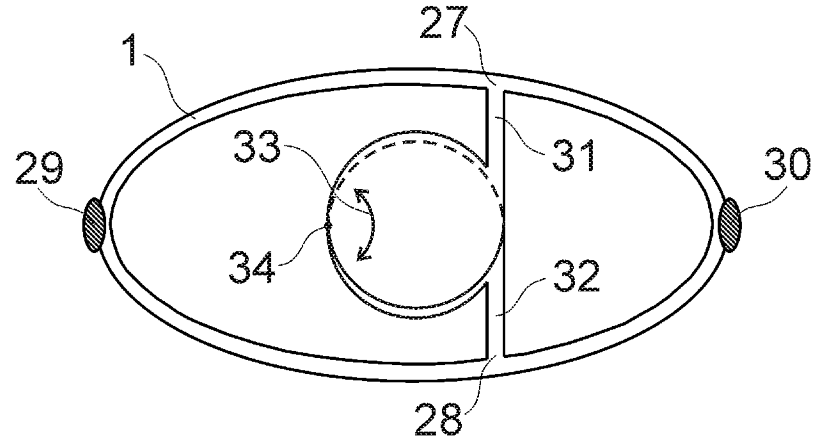


Fig. 6

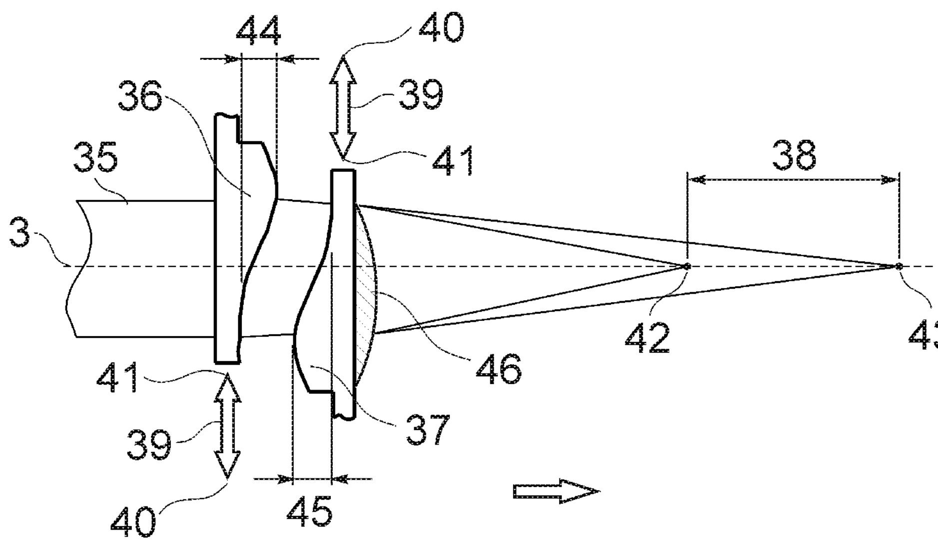
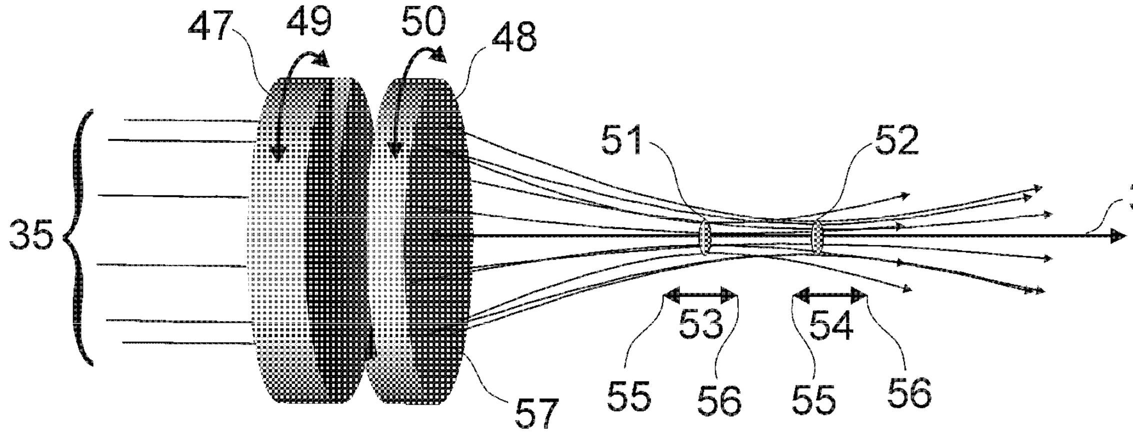


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050718

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F2/16
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/105843 A1 (AKKOLENS INT BV [NL]; SIMONOV ALEKSEY NIKOLAEVICH [NL]; ROMBACH MICHIE) 9 August 2012 (2012-08-09)	1-9, 12-24
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Y	page 2, line 37 - page 4, line 15 page 7, line 13 - page 9, line 8 page 11, line 24 - page 12, line 23 page 13, line 6 - line 25 page 15, line 5 - page 18, line 36 page 19, line 4 - line 21 page 19, line 22 - page 21, line 23; figures 3,4,6,7,10,14,15,17,18,20	10,11

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 January 2014	17/01/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Lega, A

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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