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(54) **Title**: SPECTACLES WITH LIGHT SOURCES FOR ILLUMINATING AN OBJECT OBSERVED THROUGH THE LENS AND RELATED EARPIECES

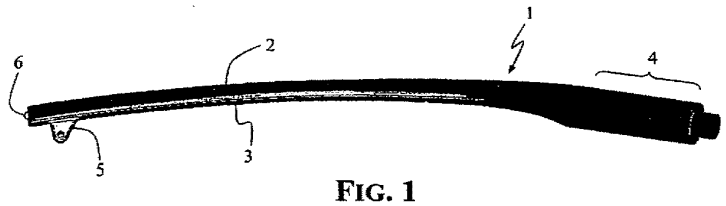


FIG. 1

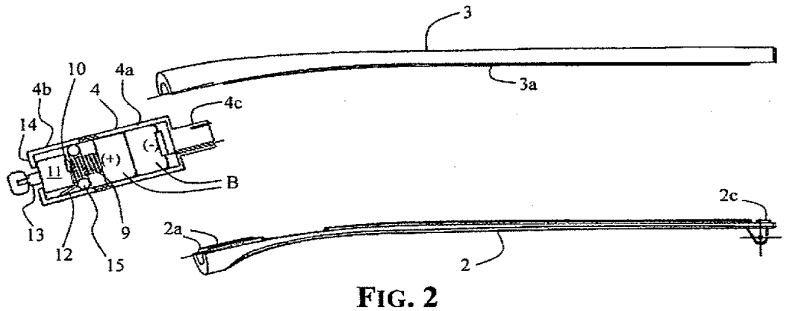


FIG. 2

(57) **Abstract**: Earpieces (1) for spectacles integrating a light source (6, 16) at its front end have at their free distal end a pre-constituted detachable module (4) containing at least a powering battery (B), a switch (11) and electrical connecting means to said light source (6, 16) and having a certain cross section and an end surface, through an opening (14) of which a control stem (13) of the switch projects. A pair of electrical supply wires (17, 18) of the light source run inside a slender front and proximal part of the earpiece, the cross section of which gradually increases as far as matching the enlarged cross section of the detachable distal end module (4). The front and proximal part of the earpiece may have a box-like structure composed of two channel cross section elements (2, 3) joined together for defining at least a conduit along which run the electrical supply wires (17, 18). Alternatively, the earpiece (1) is made in monolithic form defining in a distal part of enlarged cross section (Ia) a cavity adapted to receive a pre-constituted plug-in module (4) containing said battery (B), switch (11) and electrical connecting means (17b, 18b, partly enveloped by an end shell (Ib), through an opening (14) of which the control stem (13) of the switch projects.

Luxottica Ex. 1003 (3 of 3)
IPR Petition USP 8,905,541

"SPECTACLES WITH LIGHT SOURCES FOR ILLUMINATING AN OBJECT OBSERVED THROUGH THE LENS AND RELATED EARPIECES"

The present invention relates in general to spectacles with light sources for illuminating an object observed through the lens and in particular to earpieces of a spectacles frame incorporating a lighting device.

Endowing common spectacles of battery powered devices for illuminating an object observed through the lens is a practice that has been proposed and developed for a long time and that benefits from the availability of efficient LED type (acronym for Light Emitting Diode) light sources, which beside a high conversion efficiency of electrical energy to a light energy have far smaller sizes compared to the size of a classic miniature lamp. This is documented by the wealth of publications that describe different approaches and solutions to the problem of making spectacles frame with built in light sources.

CN 20061032873 discloses spectacles with LED incorporated in the front frame and in the earpieces.

CN 2906672YY discloses spectacles with LEDs incorporated in the front frame with earpieces, a part of which hinged to the front mask is hollow and accommodates a LED and related electrical hardware including a slider switch. The other part of the earpiece that plugs into the first part contains a powering battery.

GB-2411009 discloses spectacles with lighting LEDs installed at the front end of the earpieces as well as on the central bridge piece of the front frame of the spectacle. The earpieces contain a battery and a switch for turning on /off the LEDs and a jack or inductor coil for recharging the battery.

US-2003-086053 discloses lighting LED modules that may be mounted onto the earpieces of the spectacles.

WO 2007/008062 A1 discloses spectacles with light sources. A button type powering battery is introduced inside a slot cavity defined within the thickness of the earpiece that also includes a slider switch for turning on and off the battery powered LED. The LED are installed at the front end of the earpieces or in the front mask of the spectacles, in the latter case by realizing isolated sliding contacts within the connecting hinge.

These proposal and approaches have so far not been favored by the market because of a persistently poor ergonomicity and because the inevitable additional weight of the powering battery, being them rechargeable or primary batteries, of the LED and of the relative switches and other components of the electrical circuit makes tiresome to wear the spectacles for a long period of time because the increased weight bears for a substantial part of it on the nose of the bearer.

The miniaturized slider switches that is normally incorporated in the earpiece is difficult to locate and operate by relying on tactile sense while wearing the spectacles. The enlarging of the earpieces as far as necessary to accommodate the powering battery, the switch and the electrical hardware and connecting wing to the front LED, makes the general aspect of the worn eyeglasses not so pleasant. Fabrication of the earpieces and the realization at their interior of the electrical powering circuit of one or more LEDs is according to the known approaches rather laborious and costly.

It is a first object of the present invention to provide spectacles integrating light sources for illuminating an object observed through the lens with enhanced ergonomic characteristics and practicalness of use.

It is a further objective of this invention to provide spectacle earpieces integrating a light source and related powering circuit though preserving for the front and proximal part of their extension the aspect of common earpieces even of particularly slender cross section.

According to a first aspect of the present invention, a single light source is incorporated or mounted at the front end of the earpiece while the powering battery of the light source and a switch are accommodated in a terminal distal portion of the earpiece, substantially beyond the point of rest of the earpiece on the ear of the wearer of the spectacles, of enlarged cross section compared to the cross section of the front and proximal part of the earpiece. The extra weight of the powering module is born mainly by the ears, practically relieving from it the more sensible nose of the bearer.

According to another aspect of the present invention, turning on and off the light source is effected through a switch, the control stem of which projects from the end surface of the earpiece, to be immediately felt by the finger of the bearer and easily operated.

A further aspect of the present invention consists in that the connecting wires of the frontally installed light source to the electrical powering circuit components housed at the farther or distal end of the earpiece, run inside part of the earpiece having a box-like hollow structure composed by two channel cross section elements or semi-earpiece joined together.

The invention is defined in the annexed claims.

Figure 1 is a photographic rendering of an earpiece for spectacles integrating a light source of the present invention.

Figure 2 is an exploded view of an earpiece according to first exemplary embodiment.

Figures 3 and 4 are views showing respectively the two channel cross section semi-earpieces that compose the front and proximal part of the earpiece of Figure 2, coupled to a distal cartridge-shaped part of the earpiece containing the electrical powering devices.

Figure 5 shows enlarged details of the earpiece of the preceding figures.

Figure 6 is a schematic view of an earpiece made according to an alternative exemplary embodiment.

Figure 7 shows the other side of the earpiece of the Figure 6.

Figure 8 is an exploded view showing the way electrical contacts between a separable powering module and a two-wire connecting line to the front light source are established.

Figure 9 is an electrical diagram of the circuit incorporated in the earpiece of Figures 6-8.

Figures 10 and 11 are photographic renderings of a pair of spectacles with earpieces of Figures 1-5.

Figure from 1 to 5 illustrate a first exemplary embodiment of an earpiece for spectacles integrating a light source according to the present invention.

According to this first embodiment, the front and a proximal part of the earpiece 1 has a box-like structure resulting by joining channel cross section relatively slender semi-earpieces 2 and 3 and a distal part 4 of enlarged cross section compared to the front and proximal part of the earpiece.

From the external surface of the semi-earpiece 3 extends, in the example shown, a holed wing 5 which will eventually be engaged in a common fastening hinge of the earpiece to a front frame of the spectacles (not depicted in the Figure).

A light source is accommodated and retained in a front end recess defined by coupling together two channel-cross section semi-earpieces 2 and 3. Of the light source, typically a LED, in Figure 1 is observable only the terminal lens 6.

In the exploded view of Figure 2, the two channel cross section semi-earpieces 2 and 3 may be better observed and so is the geometry of the coupling perimeters provided with moldings 2a and 2b and 2c that are destined to engage themselves in specularly formed channels or recesses formed along the coupling perimeter of

the other semi-earpiece 3, which has a median longitudinal stiffening rib 3a the crest molding of which engages in a corresponding longitudinal recess formed along the crest of a corresponding longitudinal median rib formed in the first semi-earpiece 2, such that upon coupling together the two pieces, the inner space of the so-defined box-like structure is longitudinally divided, for a good portion of the length of the earpiece, in two distinct channels. Moreover, the median longitudinal ribs present along both channel cross section semi-earpieces 2 and 3 confer to the resulting hollow body an enhanced rigidity.

As may be observed, the distal end portion of the two semi-earpieces 2 and 3 is shaped such to confer to the distal end of this part of the earpiece of box-like structure a cross section that gradually increases as far as matching without any substantial discontinuity the enlarged cylindrical cross section of the distal part of the earpiece 4 which, in the illustrated example, comprises a cylindrical cartridge of aluminum or other light weight electrically conducting metallic material composed by telescopically screwing together two parts: respectfully a coupling end part 4a and an end or closing part 4b.

The coupling end part 4a has a central tail 4c transversed by a hole 7 for receiving a blocking pin passed across the tailed portion 4c, after having introduced it inside an end receptacle defined by the two semi-earpieces 2 and 3 joined together and at least the wall of one or of both the two semi-earpieces, according to common assembling practices.

The cartridge 4 contains at least one, in the depicted example two, button type batteries B in series held by a metal spring 9 that establishes also the electrical connection between the positive terminal (+) of the series of two batteries B to a first lead 10 of a push-button switch 11, a second lead 12 of which is bent in order to establishing electrical contact with the metal cartridge 4 itself. The control stem 13 of the switch emerges through an opening of the end face 14 of the distal cartridge part 4 of the earpiece 1.

A common O-ring 15 stops and sustains in position the switch 11.

Figures 3 and 4 show the end cartridge 4 respectfully associated to one and to the other of the two semi-earpieces 2 and 3 that compose the box-like front and proximal part of the earpiece.

In Figure 4 that shows the terminal cartridge 4 and the semi-earpiece 3 may be observed the front end LED 16, held between the tongued ends of the two semi-earpieces, and the pair of connecting wires respectively running in the two channels defined in the interior of the box-like structure of the earpiece. The wire 17 connects the respective lead of the LED 16 to the metallic bulk of the cylindrical cartridge 4 that is short circuited through the switch 11 to the positive pole of the series of two button batteries B by the bent lead 12. The other wire 18, optionally provided with an isolating sleeve, passes through a longitudinal hole purposely formed in the tail 4c and establish an electric contact with the negative pole of the series of batteries B.

Details of the electrical paths may be better observed in the enlarged view of Figure 5.

Figures 6, 7 and 8 are schematic views in transparency of an earpiece of the present invention according to an alternative embodiment employing a single button battery B and a switch 11 of the so-called slider type instead of a push button switch of the prior embodiment and further implementing a different way of establishing the electrical connection between the powering and control elements contained at the free or distal end of the earpiece and a LED incorporated at the front end of the earpiece.

According to this alternative embodiment, the earpiece 1 of thermoplastic material may be formed in a mold in a substantially "monolithic" form, such to incorporate in the molded resin the front LED (which of course will only be partially encapsulated in the molded resin), a pair of conducting wires 17 and 18 for the powering of the LED 16 and two semi contacts 17a and 18a, to which the ends of the two wires 17 and 18 are connected. The semi contacts 17a and 18a are

partially embedded in the resin at the bottom of the cavity of a hollow portion of enlarged cross section 1a of the molded earpiece.

A plug-in part 4 that is eventually inserted in side the cavity of the hollow portion 1a of the molded resin earpiece is a pre-constituted assembly or module, the portion of which that is received into the end cavity of the molded earpiece has on its lead surface two semi contacts 17b and 18b that establish electric contacts with the respective partially embedded terminations 17a and 18a of the pair of conducting wires incorporated in the molded resin. A secure electrical contact between the two pairs of semi contacts 17a-17b and 18a-18b, may be ensured by making the pair of semi contacts 17a and 18a of termination of the respective wires 17 and 18 incorporated in the molded resin of a ferromagnetic metallic material and the pair of semi contacts 17b and 18b with permanent magnets of an electrical conducting material. The magnetic attraction force beside ensuring a stable electrical contact also retains the pre-assembled module 4 once it is pushed fully inside the end cavity of the molded earpiece.

The pre-constituted end module 4 adapted to be at least partly received inside the end cavity of the molded earpiece houses a button battery B, the negative pole (-) of which is connected to the semi-contact 18b. The positive pole (+) is connected to the common lead of a slider switch 11, while the "output" lead 12 of the switch 11 is electrically connected to the semi-contact 17b on the lead surface of the plug-in module 4 pushed inside in the cavity, as shown in Figure 9.

A shell 1b of the same plastic material with which is formed the molded front and proximal part of the earpiece 11 encapsulates the switch 11, the relative connecting leads or pins 10 and 12 and the plastic housing of the battery B and of the semi contacts 17b and 18b, letting protrude through a narrow slot 14 present on the terminal surface of the shell 1b, the control stem 13 of the slider switch 11.

Alternatively, a secure electrical contact between the semi contacts pairs 17a-17b and 18a-18b, may be ensured by making the pair of semi contacts 17b and 18b in the form of mobile metallic buttons with biasing springs, installed in respective

cavities of the plastic housing of the battery. In this case, the retention of the module 4 plugged inside the end cavity of the molded front and proximal parts of the earpiece, may be ensured by common snap-action moldings or tonguings that are forcibly engaged exploiting the elastic memory of the cooperating geometric details formed in the molded material of which is made at least one of the two joinable parts, according to common practices of pre-arrangement of lockable features in separable parts of an assembled piece.

Figures 10 and 11 are photographic rendering of spectacles of the present invention employing earpieces according to the embodiment of Figure 1-5.

As will be obvious to an informed reader, the battery or series of batteries used as sources of electrical energy for powering the light source, typically a LED, may be primary batteries, replaceable upon exhaustion, or alternatively they may be rechargeable batteries.

In the latter case, it may be contemplated the presence in the earpiece of a common jack for connection to an external battery charger or an embedded coil (secondary of an air transformer) and relative battery charging circuit powerable in a "contactless" fashion by an external device having a coil (primary of an air transformer) driven at high frequency mutually coupled to the embedded coil, according to common practices of contactless recharging of an embedded rechargeable battery of the earpiece.

CLAIMS

1. Spectacles with light sources, connected in a powering circuit comprising a battery and an on/off switch, for illuminating an object observed through the lens of the spectacles, having earpieces hingedly connected to a front frame, characterized in that

each earpiece has at its free distal end a pre-constituted detachable module containing said battery, said switch and electrical connecting means of a certain cross sectional size and having an end surface, through an opening of which a control stem of the switch projects;

a pair of electrical supply wires of at least one light source present at the front end of the earpiece run inside a front and proximal part of the earpiece having a cross section that gradually increases as far as matching the cross section of said detachable distal end module.

2. The spectacles according to claim 1, wherein said earpieces have a box-like structure comprising two channel cross section semi-earpieces joined together defining at least a conduit inside which runs said pair of electrical supply wires of a LED held at the front end of the earpiece.

3. The spectacles according to claim 2, wherein said two channel cross section semi-earpieces joined together to constitute said front and proximal part of the earpiece have a slender cross section than the cross section of said detachable distal end module of the earpiece.

4. The spectacles according to claim 3, wherein said module is a metallic cartridge composed by a first half cartridge having a tail insertable inside a distal cavity of said box-like structure part of the earpiece formed by two semi-earpieces joined together and by a second half cartridge screwed to said first half cartridge and having an opening through its end surface through which a control stem of the switch projects;

said pre-constituted detachable cartridge containing said switch, powering battery and electrical connection means to said pair of electric supply wires of said LED.

5. The spectacles according to claim 1, wherein

said earpieces are made in a monolithic form defining in a distal part of enlarged cross section a cavity adapted to receive a pre-constituted plug-in module containing said battery, switch and electrical connecting means, partly enveloped by an end shell, through an opening of which the control stem of the switch projects;

said electrical connection means comprising a pair of semi contacts adapted to contact respective semi contacts of termination of said pair of supply wires, of the light source partly embedded in the material of the formed monolithic earpiece at the bottom of said cavity.

6. The spectacles according to claim 5, wherein the electrical contact between said semi contact pairs is ensured by biasing springs acting on semi contacts present on the lead surface of said plugged-in module introduced a blocked inside said cavity.

7. The spectacles according to claim 5, wherein the electrical contact between said semi contact pairs is ensured by making said pair of terminations semi contacts with a ferromagnetic metallic material and said pair of semi contacts present on the lead surface of said plugged-in module with two permanent magnets of an elastically conducting material.

8. An earpiece for spectacles integrating a light source at its front end having at its free distal end a pre-constituted detachable module containing at least a powering battery, a switch and electrical connecting means to said light source and having a certain cross sectional size and an end surface, through an opening of which a control stem of said switch projects;

a pair of electrical supply wires of said light source present at the front end of the earpiece run inside a front and proximal part of the earpiece having a cross section that gradually increases as far as matching the cross section of said detachable distal end module.

9. The earpiece according to claim 8, characterized in that said front and proximal part has a box-like structure composed of two channel cross section elements joined together for defining at least a conduit inside which runs said pair of electrical supply wires of a LED held at the front end of the earpiece.

10. The earpiece according to claim 9, wherein said two channel cross section elements joined together to constitute said front and proximal part of the earpiece have a slender cross section than the cross section of said detachable distal end module of the earpiece.

11. The earpiece according to claim 10, wherein said module is a metallic cartridge composed by a first half cartridge having a tail insertable inside a distal cavity of said box-like structure part of the earpiece formed by two elements joined together and by a second half cartridge screwed to said first half cartridge and having an opening through its end surface through which a control stem of the switch projects;

said pre-constituted detachable cartridge containing said switch, powering battery and electrical connection means to said pair of electric supply wires of said LED.

12. The earpiece according to claim 8, characterized in that

it is made in a monolithic form defining in a distal part of enlarged cross section a cavity adapted to receive a pre-constituted plug-in module containing said battery, switch and electrical connecting means, partly enveloped by an end shell, through an opening of which the control stem of the switch projects;

said electrical connection means comprising a pair of semi contacts adapted

to contact respective semi contacts of termination of said pair of supply wires, of the light source partly embedded in the material of the formed monolithic earpiece at the bottom of said cavity.

13. The earpiece according to claim 12, wherein electrical contact between said semi contact pairs is ensured by biasing springs acting on movably held semi contacts present on the lead surface of said plugged-in module introduced and blocked inside said cavity.

14. The earpiece according to claim 12, wherein the electrical contact between said semi contact pairs is ensured by making said pair of terminations semi contacts of a ferromagnetic metallic material and said pair of semi contacts present on the lead surface of said plugged-in module with two permanent magnets of an electrically conducting material.

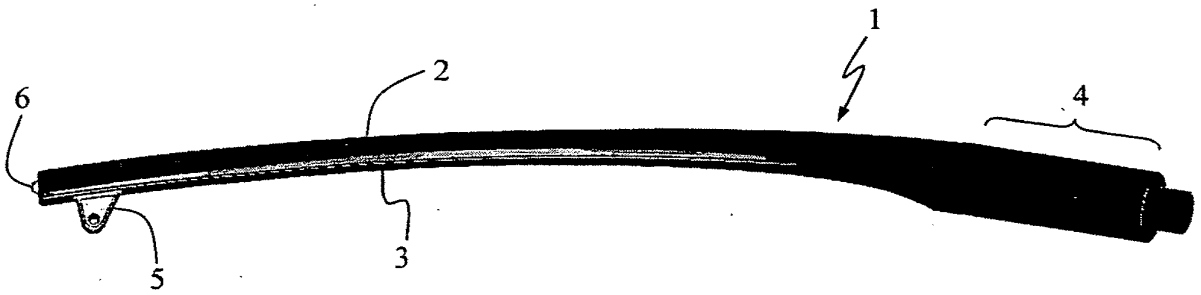


FIG. 1

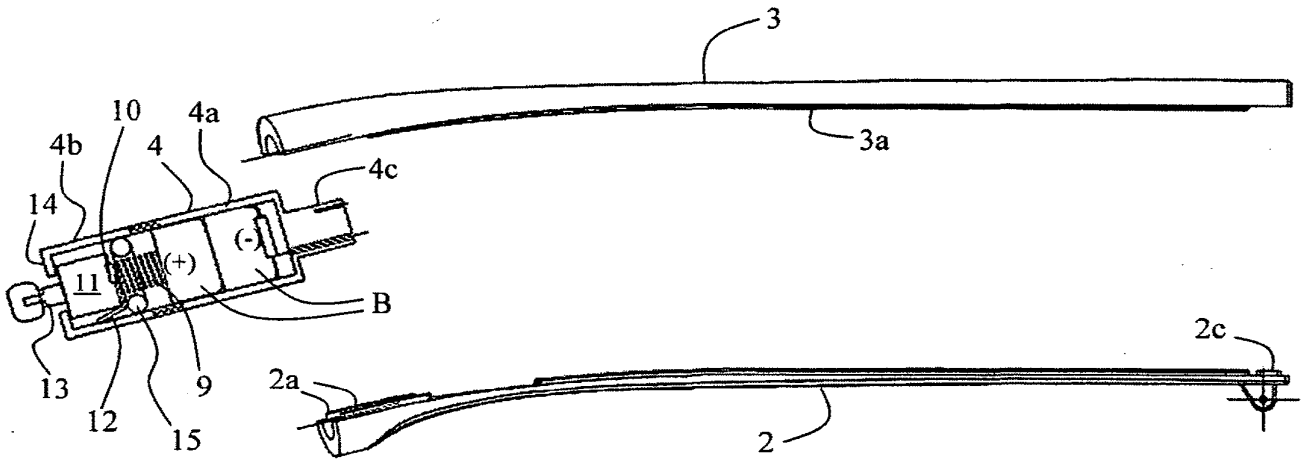


FIG. 2

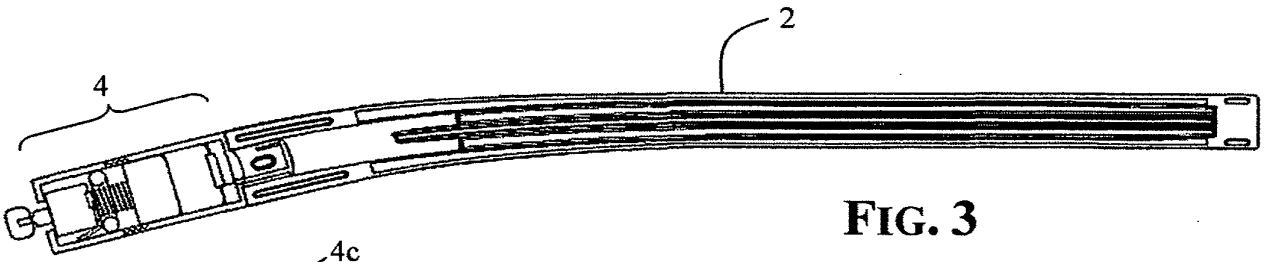


FIG. 3

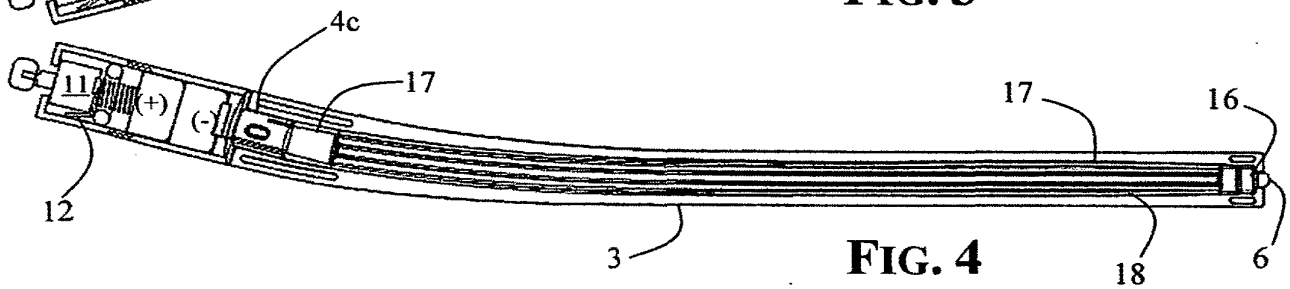


FIG. 4

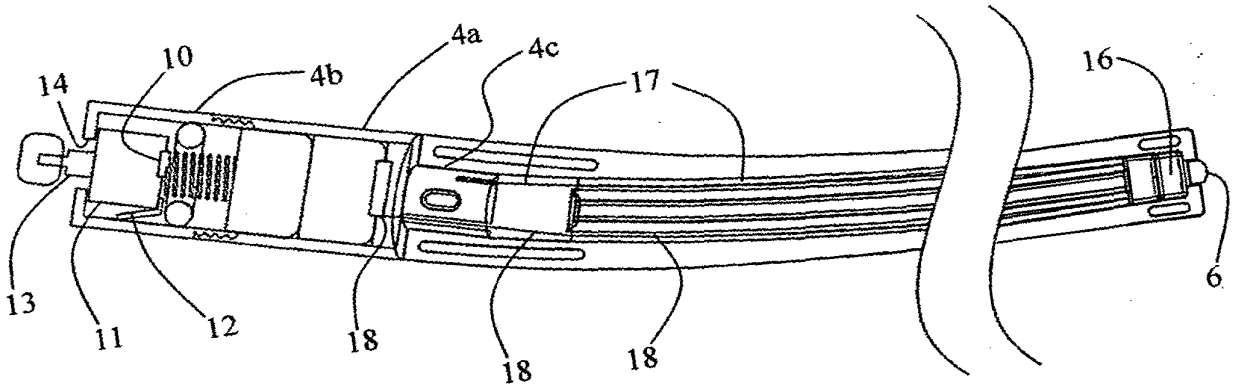


FIG. 5

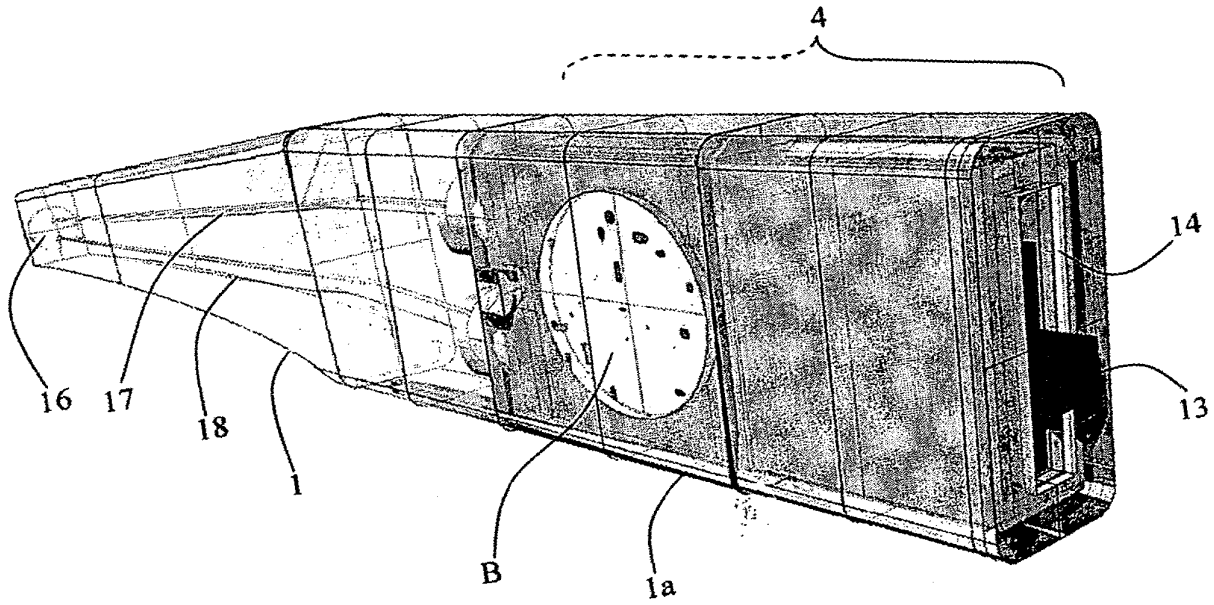


FIG. 6

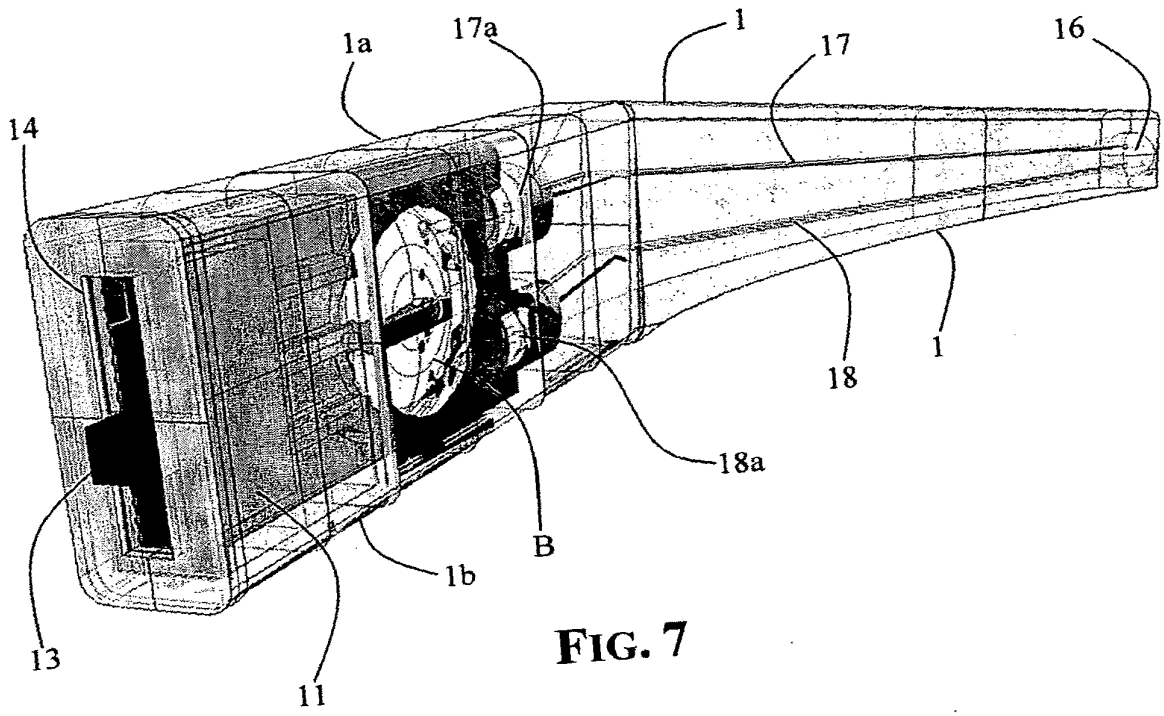


FIG. 7

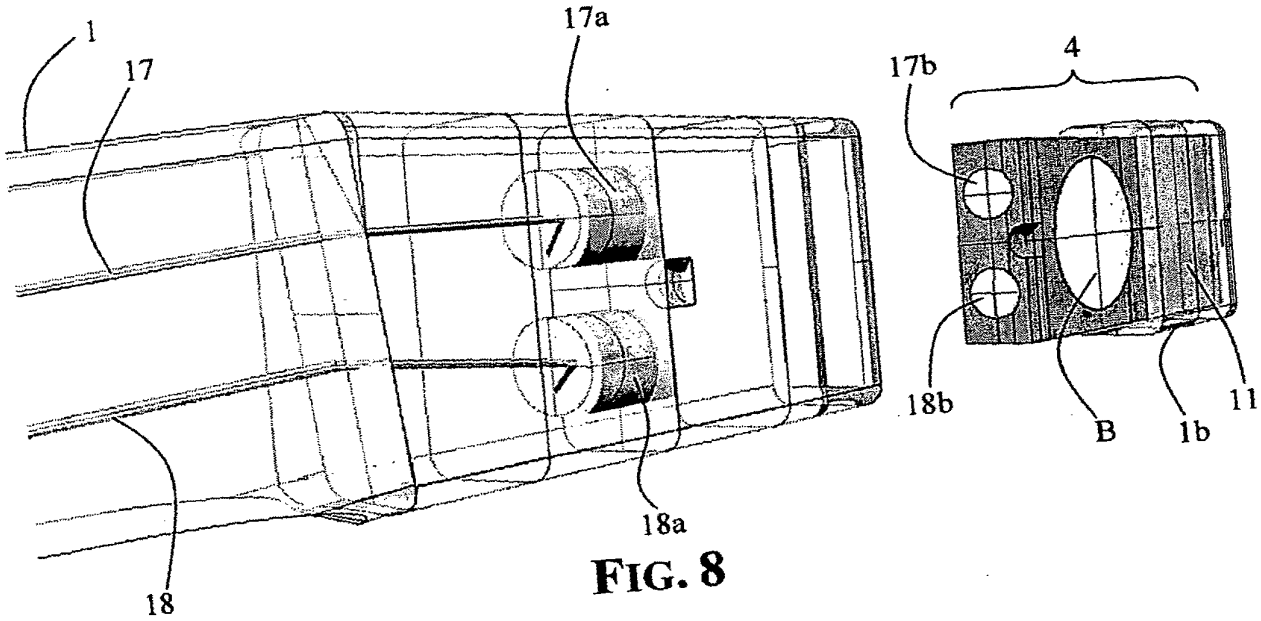


FIG. 8

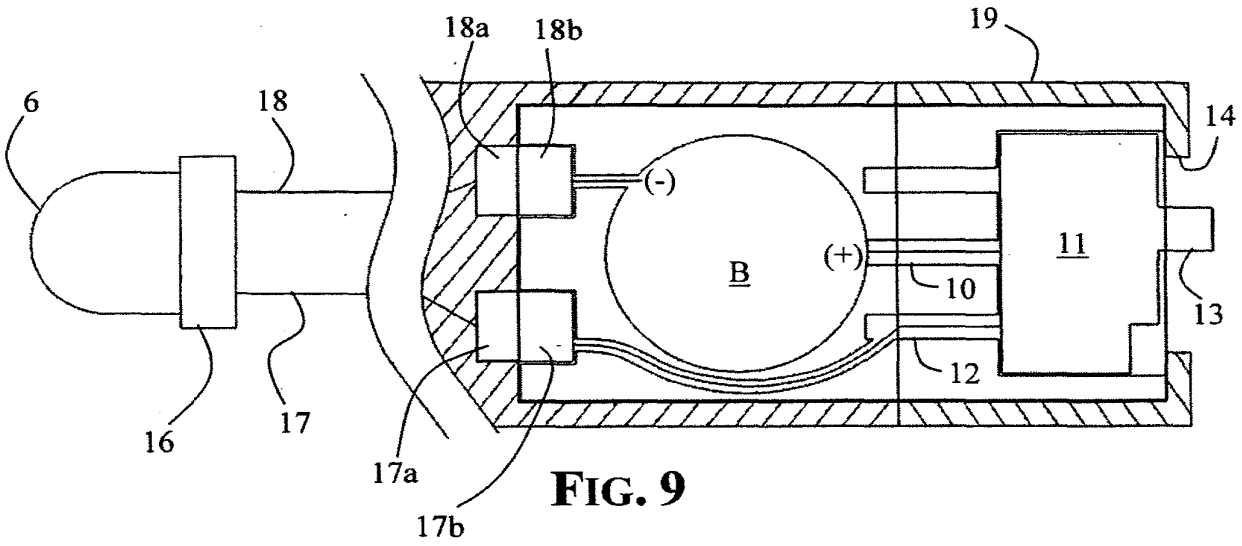


FIG. 9

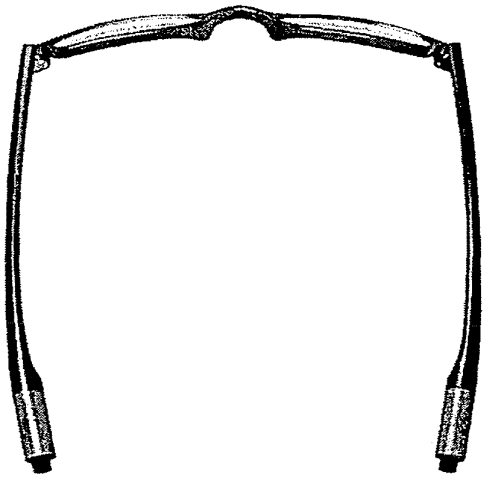


FIG. 10

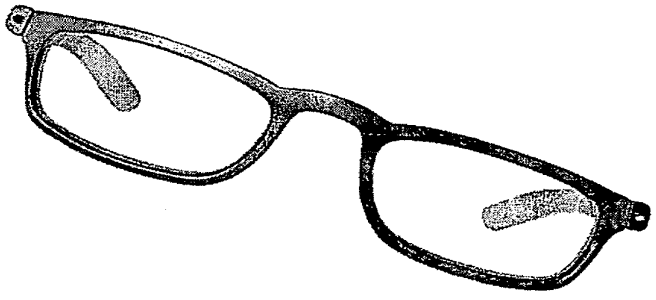


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2008/000069

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02C11/04

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)
G02C

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2007/008062 A (SPEEKENBRINK ADRIANUS [NL]) 18 January 2007 (2007-01-18) figures 2,4D page 4, lines 5-9,15,16,19,20	1,5,6,8, 12,13 1-3,5,6, 8-10,12, 13
Y	US 2007/046887 A1 (HOWELL THOMAS A [US] ET AL) 1 March 2007 (2007-03-01) figure 13B paragraphs [0071], [0079], [0080], [0083], [0087], [0088], [0170], [0176]	1,5,6,8, 12,13
Y	US 2007/200998 A1 (SCHRIMMER MICHAEL L [US] ET AL) 30 August 2007 (2007-08-30) figures 1-4 paragraph [0029]	2,3,9,10

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

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 September 2008	02/12/2008

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2008/000069

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2006 015334 A1 (LEE CHING-HUI [TW]) 11 October 2007 (2007-10-11) figures 5,6 paragraphs [0016] - [0024]	1,5,8,12
A	DE 101 17 446 A1 (OPTIK SOMMER [DE]) 17 October 2002 (2002-10-17) the whole document	1,5,8,12
A	GB 2 127 254 A (HEANEY JAMES) 4 April 1984 (1984-04-04) the whole document	1,5,8,12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IT2008/000069

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search reportcovers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-3, 5, 6, 8-10, 12, 13

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1 - 3, 5, 6, 8 - 10, 12, 13

Detachable module linked via spring connection to wires in earpiece

1.1. claims: 1, 8

A spectacles temple with a light source in the front part, a battery and a switch in the distal part; the battery and the switch are in a detachable module.

1.2. claims: 2, 3, 9, 10

The front and proximal part of temple is made with two parts which form a conduit for the wires.

1.3. claims: 5, 12

The front and proximal part of temple is one monolithic part.

1.4. claims: 6, 13

The electrical connection to the detachable module is done with biasing springs.

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2. claims: 4, 11

The detachable module is split in two half cartridges screwed into one another.

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3. claims: 7, 14

The electrical connection to the detachable module is done with magnets.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IT2008/000069

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007008062 A	18-01-2007	NL 1029496 C1	15-01-2007
US 2007046887 A1	01-03-2007	NONE	
US 2007200998 A1	30-08-2007	NONE	
DE 102006015334 A1	11-10-2007	NONE	
DE 10117446 A1	17-10-2002	NONE	
GB 2127254 A	04-04-1984	NONE	

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(74) Agent: **SCHAFFER, Robert, D.**; Pearl Cohen Zedek Latzer, LLP, 1500 Broadway, 12th Floor, New York, NY 10036 (US).

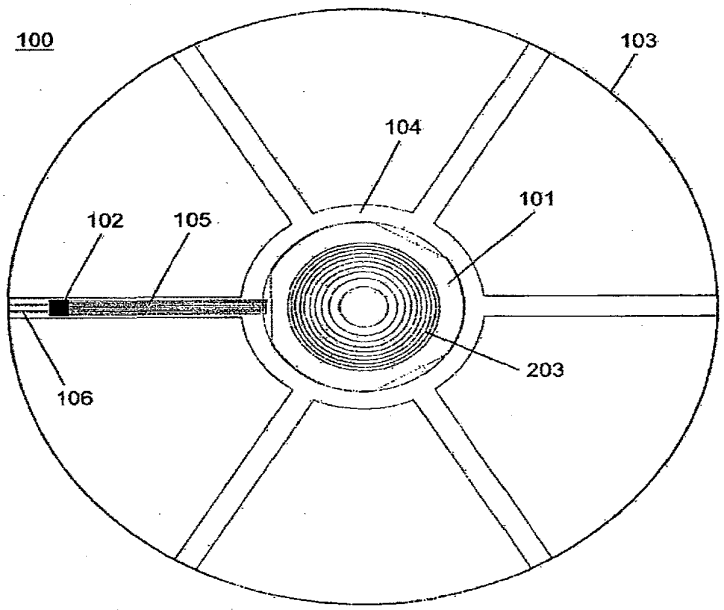
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRONIC ADAPTER FOR ELECTRO-ACTIVE SPECTACLE LENSES



(57) Abstract: An adapter for a spectacle frame is disclosed which is configured for enabling the spectacle frame to operate and control electro-active lenses housed therein. In particular the spectacle frame may allow electro-active lenses housed therein to focus and be controlled both automatically and manually with heretofore unrealized results.

WO 2008/002388 A2

ELECTRONIC ADAPTER FOR ELECTRO-ACTIVE SPECTACLE LENSES

Inventors: Ronald D. Blum, Joshua N. Haddock, and Dwight P. Duston

CROSS REFERENCE TO RELATED APPLICATIONS

[001] This application claims the benefit of Provisional Application U.S. Serial No. 60/815,870, filed on June 23, 2006 (and entitled Electronic Adapter For Electro-Active Spectacle Lenses That Enables Near Universal Frame Compatibility) which is incorporated in its entirety herein by reference

BACKGROUND OF THE INVENTION

Field of the Invention

[002] The present invention generally relates to an adapter for a spectacle frame housing electro-active lenses. Specifically, this invention relates to an adapter configured for enabling a spectacle frame to operate and control electro-active lenses housed therein without the need to either uniquely design and manufacture the spectacle frame or to perform undue modifications of an existing spectacle frame. In particular, the spectacle frame may allow electro-active lenses housed therein to focus and be controlled both automatically and manually with heretofore unrealized results.

Description of the Related Art

[003] With the invention of electro-active spectacle lenses that provide dynamic changes in focus there is a desire to engineer these lenses such that they can be compatible with most, if not all, pre-existing spectacle frame designs. To accomplish such a task, all of the components required to operate the electro-active functionality must be incorporated either internally or externally to the body of the lens so that the lens can be mounted into any unmodified spectacle frame and still be both aesthetically acceptable and fully functional.

[004] Historically, the optical industry has been structured in such a way that the patient selects his or her eyewear based largely on aesthetics that relate to frame comfort and appearance. Generally the frames are the first item selected in picking out prescription eyeware. Lenses, including tints, coatings, and optical design are usually picked second. Given the significant number of available frame styles, sizes, and colors, the manner in which the industry has historically functioned, and the desire of the consumer or patient to have a vast selection of frames to choose from, there is a desire to provide a means and system for near universal compatibility between the new electro-active lenses and existing frame designs.

[005] Accordingly, there is now provided with this invention an improved spectacle frame adapted for housing electro-active lenses that effectively overcomes the aforementioned difficulties and longstanding problems inherent in the art. These problems have been solved in a simple, convenient, and highly effective way by which to control electro-active lenses.

SUMMARY OF THE INVENTION

[006] According to one aspect of the invention, an adapter for an electro-active lens is disclosed, wherein the electro-active lens is housed in a spectacle frame and the electro-active lens has a first set of electrical contacts. The adapter is a separate element from the electro-active lens and has a second set of electrical contacts for providing an electrical signal to the electro-active lens through the first set of electrical contacts.

[007] As will be appreciated by those persons skilled in the art, a major advantage provided by the present invention is enabling a spectacle frame to operate and control electro-active lenses housed therein without the need to either uniquely design and manufacture the spectacle frame or to perform undue modifications of an existing spectacle frame. The spectacle frame may allow electro-active lenses housed therein to focus and be controlled both automatically and manually with heretofore unrealized results. Additional objects of the present invention will become apparent from the following description.

[008] The method and apparatus of the present invention will be better understood by reference to the following detailed discussion of specific embodiments and the attached figures which illustrate and exemplify such embodiments.

DESCRIPTION OF THE DRAWINGS

[009] A specific embodiment of the present invention will be described with reference to the following drawings, wherein:

[0010] Figure 1 is a diagrammatic representation of an example of an electro-active lens and its drive components.

[0011] Figure 2A is a front view of a spectacle frame housing the adapter of the present invention.

[0012] Figure 2B is a top view of a spectacle frame housing the adapter of the present invention.

[0013] Figure 3A is a top view of the left temporal side of an embodiment of the electro-active spectacle lens of the present invention.

[0014] Figure 3B is a top view of the top left temporal side of an embodiment of the adapter of the present invention.

[0015] Figure 3C is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0016] Figure 3D is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0017] Figure 3E is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0018] Figure 3F is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0019] Figure 3G is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0020] Figure 3H is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0021] Figure 3I is a top view of the left temporal side of another embodiment of the electro-active spectacle lens of the present invention.

[0022] Figure 3J is a top view of the top left temporal side of another embodiment of the adapter of the present invention.

[0023] Figure 4 is a front view of an embodiment of the right side of the electro-active spectacle lens and adapter of the present invention.

[0024] Figure 5 is a front view of another embodiment of the right side of the electro-active spectacle lens and adapter of the present invention.

[0025] Figure 6 is a front view of another embodiment of the right side of the electro-active spectacle lens and adapter of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] The following preferred embodiment as exemplified by the drawings is illustrative of the invention and is not intended to limit the invention as encompassed by the claims of this application.

[0027] As shown in FIG. 1, as in all embodiments of the present invention, the electro-active spectacle lenses **100** contain an electro-active lens element **101** and drive electronics, including one or more focus sensors **102**, all of which are embedded within the body of a lens **103** that act to correct refractive errors of the eye not associated with presbyopia. The drive electronics are contained within a driver. The driver may also include all necessary control components for providing the appropriate electrical signal for providing the proper optical power in the electro-active lens. The body of the lens may be either a finished blank (two optical quality surfaces) or a semi-finished blank (one optical quality surface). The focus sensors, drive electronics, and

electro-active lens element may be typically attached to the anterior and/or posterior surface of a flexible but transparent star shaped substrate **104** where electrical connection is made via thin film transparent electrical leads **105** (such as, by way of example only, indium tin oxide, ITO). These thin film transparent electrical leads include connections **106** for an electrical power source. These thin film transparent electrical leads may also include connections for digital or analog signal transfer. In certain other embodiments, the power source and signal connections may be of a different design where they are connected to the flexible substrate but contain non thin-film conductors, such as, by way of example only, fine gauge metal wire. This alternative design is such that the connection does not significantly interfere with the user's vision or the aesthetics of the lens. These power source and signal connections as well as the focus sensors and drive electronics are placed near the edge of the lens, near where the frame eye-wire and temple connect, such that when the lens is fitted within the frame, the power source, drive electronics, and focus sensors do not interfere with the vision of the user. Alternatively, the drive components may be placed distal from the electro-active lenses either in the spectacle frame, the temples, or in the adapter of the present invention.

[0028] In an embodiment of the invention shown in FIG. 2, the electro-active lens **201** with electro-active region **203** is edged (cut to the shape of the spectacle frame) using techniques well known in the art. The process of edging the lens acts to either partially or fully expose the electrical leads that connect to the power source. This edged lens is then combined with an electrical adapter **202** that, as shown in FIG 3B, may contain one or more electrical power sources **305**, one or more electrical switches to provide manual control of the lenses to the user **306**, and one or more sensors **307** that acts to detect the presence of the user (determine if spectacles are being worn). As an alternative design, the sensor 307 may also include the drive electronics **102** for the electro-active lens. The sensor 307 may also sense if the frame is opened. This adapter has electrical contacts **308** that correspond to the power source and signal electrical contacts in the lens **106** such that when the adapter is placed between the spectacle lens and the eye wire of the spectacle frame, the pressure associated with securing the lens within the frame acts to make positive electrical contact between the lens and the adapter as well as physically secure the adapter to the spectacles. Components within the adapter are connected electrically by means of internal wiring **309**. Power sources included within the adapter may be, by way of example only, disposable zinc-air batteries or rechargeable Li-ion or Li-polymer batteries. Manual switches included within the adapter may be, by way of example only, pressure switches, capacitive touch switches or optical proximity switches. Sensors to determine if the spectacles are being worn may be, by way of example only, optical proximity switches or accelerometers which, if activated, instruct the drive electronics to operate the focus sensors

within the body of the lens. In this embodiment each of the lenses would be identical and would each require an individual adapter. The driver may provide an electrical signal for generating the appropriate amount of optical power in each of the electro-active lenses. The driver may also include a focusing sensor for determining the appropriate signal for the electro-active lenses.

[0029] As also shown in FIGS. 3A-3J, the use of such an adapter **202** may require, in certain embodiments, other machining steps in addition to edging where, by way of example only, one or more of a slot, groove, or notch **301** is machined into the body of the lens **201** such that robust physical and electrical connection is made between the frame, lens, and adapter. As the adapter would be placed near to where the frame eye-wire and temple connect, such a machining step may allow the adapter to be located on the posterior surface of the lens **302** and be mostly hidden from view by the temple hinge. Such a placement would be advantageous for preserving the aesthetic quality of the spectacles. It is preferable that the edge profile of the adapter **303** match that of the lens **304** such that a secure fit is guaranteed between the frame, lens, and adapter.

[0030] Embodiments of the adapter of the present invention may contain any of a combination of components. For example, as shown in FIG. 3B, the adapter may have an on/off switch, a power source, and a sensor for sensing the presence of the user. Alternatively, as shown in FIG. 3C, the adapter may only have a power source. Alternatively, as shown in FIG. 3D, the adapter may only have an on/off switch. Alternatively, as shown in FIG. 3E, the adapter may only have a sensor for sensing the presence of the user. As shown in FIG. 3F, the adapter may have an on/off switch, and a sensor for sensing the presence of the user. As shown in FIG. 3G, the adapter may have an on/off switch, and a power source. As shown in FIG. 3H, the adapter may have a power source and a sensor for sensing the presence of the user.

[0031] As further illustrated in FIGS. 3I and 3J, the electrical connection made between the frame, lens, and adapter may include a physical connection in which mating elements between the lens and the adapter are screwed to one another. As shown, the adapter may include screw threads 311 which secure into mating threads 310 in the lens. Of course, as is well known in the art, such physical connections can further include a wide variety of equivalents, for example, a bayonet-type connection, a detent, snap-like connection and etc. As is also well known in the art, the electrical connection may be made with a wide variety of electrical mating elements, for example, male/female connectors, plugs, sockets, pins, and the like.

[0032] The adapter may be positioned so that it simultaneously contacts the lens and the frame or, alternatively, it may be positioned so that it only contacts the lens and does not contact the frame. The adapter may be positioned so that it is located under and above the surface of the

lens when it is in contact therewith. The adapter may be further positioned so that it is located near a periphery of the surface of the lens when it is in contact therewith.

[0033] One issue with the above embodiments is that each lens operates independently from the other. Therefore, the possibility exists that under certain operational conditions one lens may be triggered to operate while the other is not. To eliminate this problem a means for synchronizing the operation of the two lenses must be devised such that when one of the two lenses is activated, the other will be activated by default In another embodiment of the invention the electrical adapters of the two lenses are connected by means of discrete signal conduit such as, by way of example only, one or more of a small gauge metal wire or optical fiber. Such signal conduits could be hidden in the gap between the frame eye wire and the lens as well as behind the bridge that joins the two lenses.

[0034] In another embodiment the two lenses are synchronized by means of a wireless optical connection designed to transmit data across the bridge as shown in FIG. 4. In this embodiment an infrared optical transceiver unit **401** is tethered to each adapter **202** by means of a flex circuit **402**, which may be hidden between the superior eye-wire of the frame and the edged electro-active spectacle lens **201**. The transceiver unit is preferred to be located at the location of where the superior vertical distance of each eye-wire allows for the best, unhindered optical communication between the IR transceivers. As with the adapter, an additional machining step may be required where, by way of example only, one or more of a slot, groove, or notch **403** is machined into the body of the lens such that a robust physical connection is made between the transceiver unit and the spectacles. Furthermore, such machining steps would allow the transceiver unit to be mounted to either the anterior or posterior surface of the lens.

[0035] In another embodiment the two lenses are synchronized by means of a wireless, radio frequency (RF) communication system as shown in FIG. 5. In this embodiment the electrical adapter **202** contains circuitry for an RF transceiver that is tethered to a flex circuit antenna **501** (for example only). This flex circuit antenna may be hidden between the frame eye wire and the edged spectacle lens **201**.

[0036] In another embodiment the two lenses are synchronized by means of inductive coupling as shown in FIG. 6. In this embodiment the electrical adapter **202** contains circuitry for a pulsed current source that is tethered to multiple-turn coils of an electrical conductor made using flex circuit **601** (for example only). These flex circuit coils may be hidden between the frame eye wire and the edged spectacle lens. In this approach, current pulses in the coils of lens 1 generates a magnetic field which, by way of Faraday's law of induction, generates a current in the coils of lens 2, which is then be detected by the circuitry of the electrical adapter of lens 2. In this manner communication between the two lenses is enabled.

[0037] In another embodiment, the two lenses may be synchronized by means of ultrasonic signals transmitted over free space. In this embodiment the electrical adapter contains circuitry for an ultrasonic transceiver. Such an approach is advantageous in that no additional components are required to be tethered to the electrical adapter.

[0038] In yet another embodiment, the two lenses may be synchronized by means of vibrations transmitted through the spectacle frame. In this embodiment the electrical adapter contains a vibration transducer and detector that makes physical contact to the frame when the lenses, adapters, and frames are assembled. Transducers and detectors of vibrations may be made from, by way of example only, piezoelectric materials. Such an approach is advantageous in that no additional components are required to be tethered to the electrical adapter.

[0039] In order to simplify any of the above embodiments, only one lens could be outfitted with one or more focus sensors and a synchronization transmitter while the other lens would not include any focus sensors and only a synchronization receiver. In such an embodiment the lens with the focus sensor(s) would operate as the "master" while the other lens would operate as the "slave" and only operate when directed by the master. Such a one-way communication system would reduce power consumption (by eliminating synchronization transmitters and a focus sensors) and simplify synchronization, but at the expense of eliminating redundancy in the focus sensors.

[0040] Although the particular embodiments shown and described above will prove to be useful in many applications in the spectacle art and the electro-active lens art to which the present invention pertains, further modifications of the present invention will occur to persons skilled in the art. All such modifications are deemed to be within the scope and spirit of the present invention as defined by the appended claims.

CLAIMS

What is claimed is:

1 An adapter for an electro-active lens, wherein the electro-active lens is housed in a spectacle frame and the electro-active lens has a first set of electrical contacts, wherein said adapter is a separate element from the electro-active lens, and wherein said adapter has a second set of electrical contacts for providing an electrical signal to the electro-active lens through said first set of electrical contacts.

2 The adapter of Claim 1, further comprising a power source operatively connected to said second set of contacts.

3. The adapter of Claim 2, further comprising a manually operable on/off switch connected to said power source.

4. The adapter of Claim 1, further comprising a sensor operatively connected to said second set of electrical contacts, wherein said sensor is for detecting if the electro-active lens is to be provided with the signal.

5. The adapter of Claim 1, further comprising a driver operatively connected to said second set of electrical contacts, wherein said signal is for generating a predetermined optical add power to the electro-active lens.

6. The adapter of Claim 1, wherein said first set of electrical contacts and said second set of electrical contacts further comprise electrical mating elements.

7 The adapter of Claim 4, wherein said sensor senses the presence of the user.

8. The adapter of Claim 7, wherein said sensor senses if the frame is opened

9. The adapter of Claim 5, wherein said driver provides said signal for generating the appropriate amount of optical power in the electro-active lens.

10. The adapter of Claim 5, wherein said driver further comprises a focusing sensor for determining the appropriate signal for the electro-active lenses.

11. The adapter of Claim 1, further comprising a synchronizing means operatively connected to the adapter for controlling one lens based upon the control of another lens.

12. The adapter of Claim 11, wherein said synchronizing means comprises infrared optical transmission signals.

13. The adapter of Claim 11, wherein said synchronizing means comprises RF transmission signals.

14. The adapter of Claim 11, wherein said synchronizing means comprises an inductive coupling.

15. The adapter of Claim 11, wherein said synchronizing means comprises a flexible circuit extending through the spectacle frame.

16. The adapter of Claim 11, wherein said synchronizing means comprises ultrasonic transmission signals.
17. The adapter of Claim 11, wherein said synchronizing means comprises vibration transmission signals.
18. The adapter of Claim 17, wherein said synchronizing means comprises piezoelectric materials.
19. The adapter of Claim 1, wherein the adapter is for simultaneously contacting the lens and the frame.
20. The adapter of Claim 1, wherein the adapter is for contacting the lens without contacting the frame.
21. The adapter of Claim 1, wherein the adapter is located under and above the surface of the lens when in contact therewith.
22 The adapter of Claim 1, wherein the lens has a surface and adapter is located near the periphery of said surface when in contact with the lens.

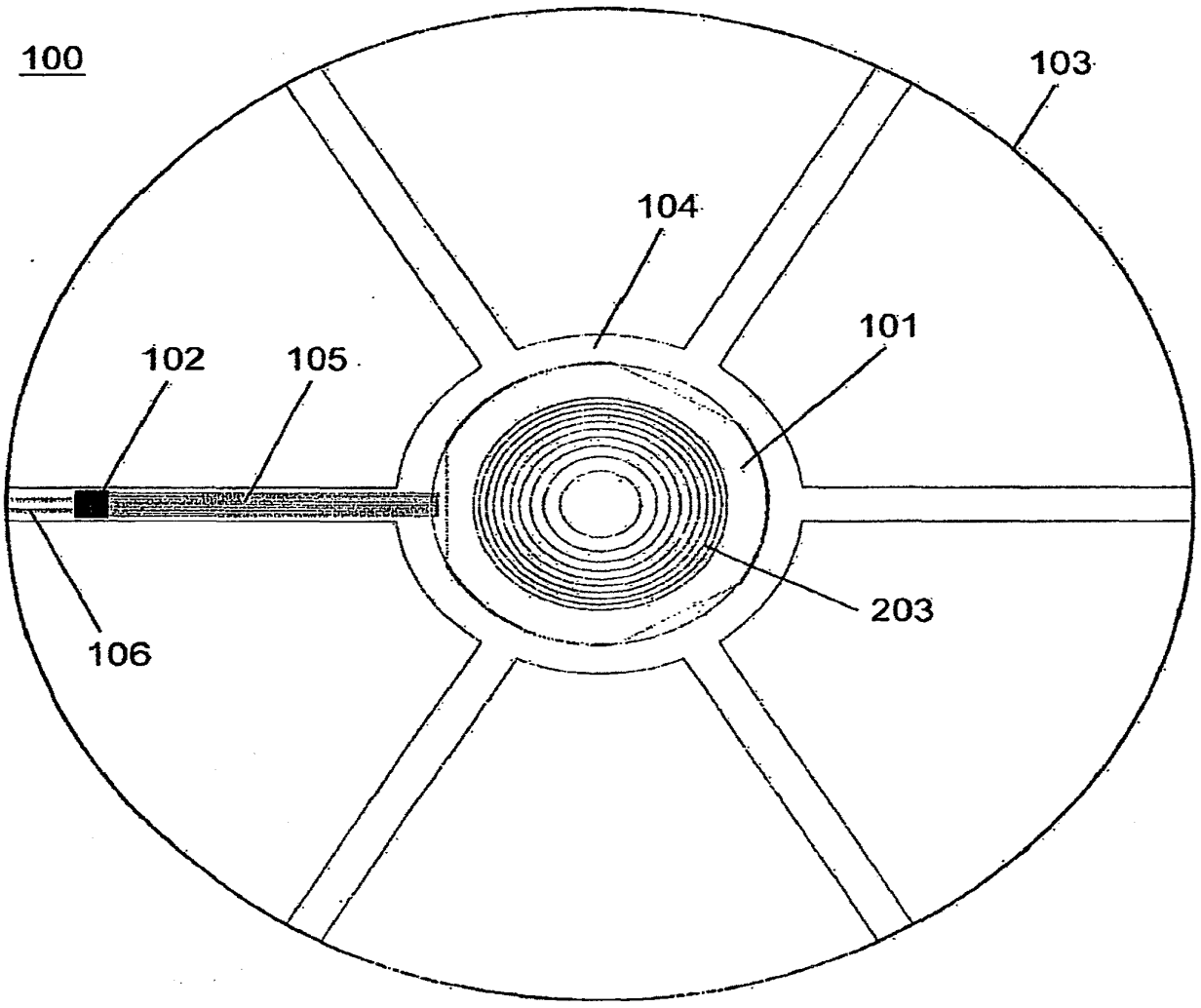


FIG. 1

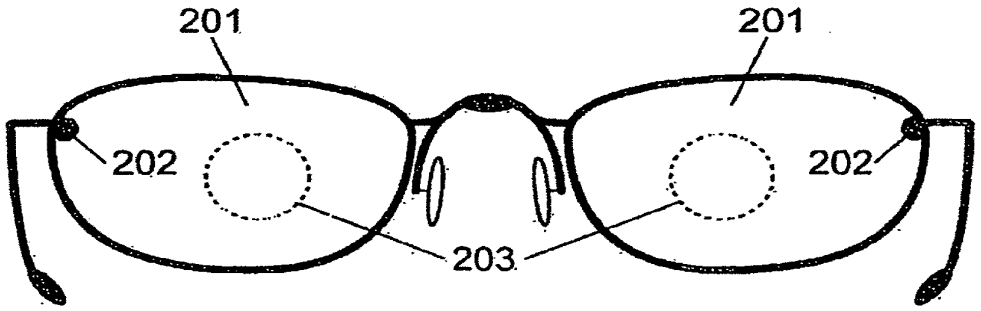


FIG. 2A

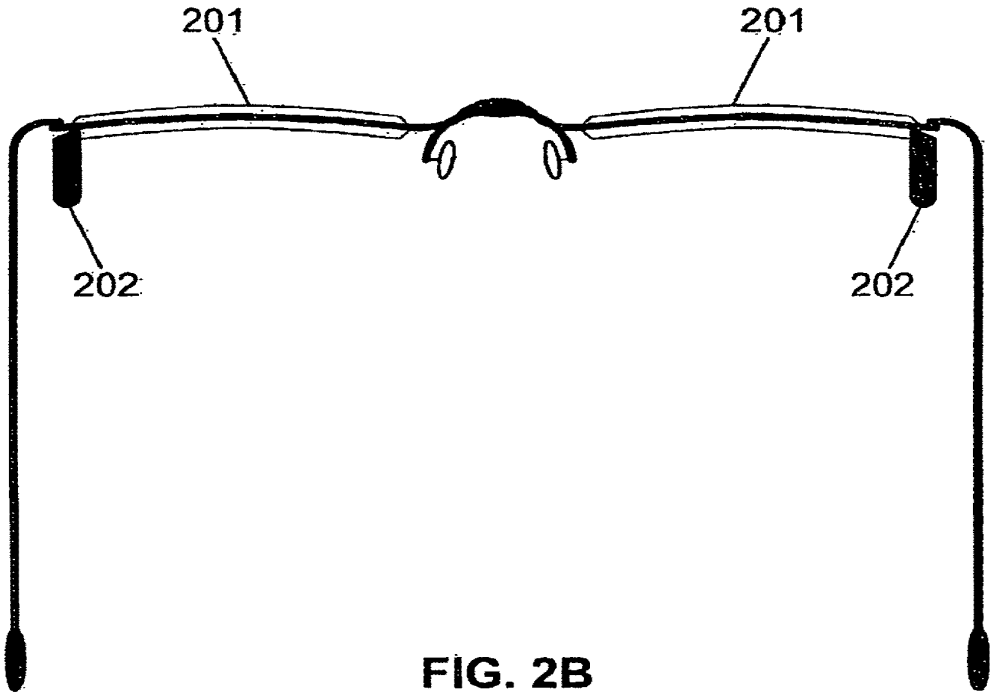


FIG. 2B

FIG. 3A

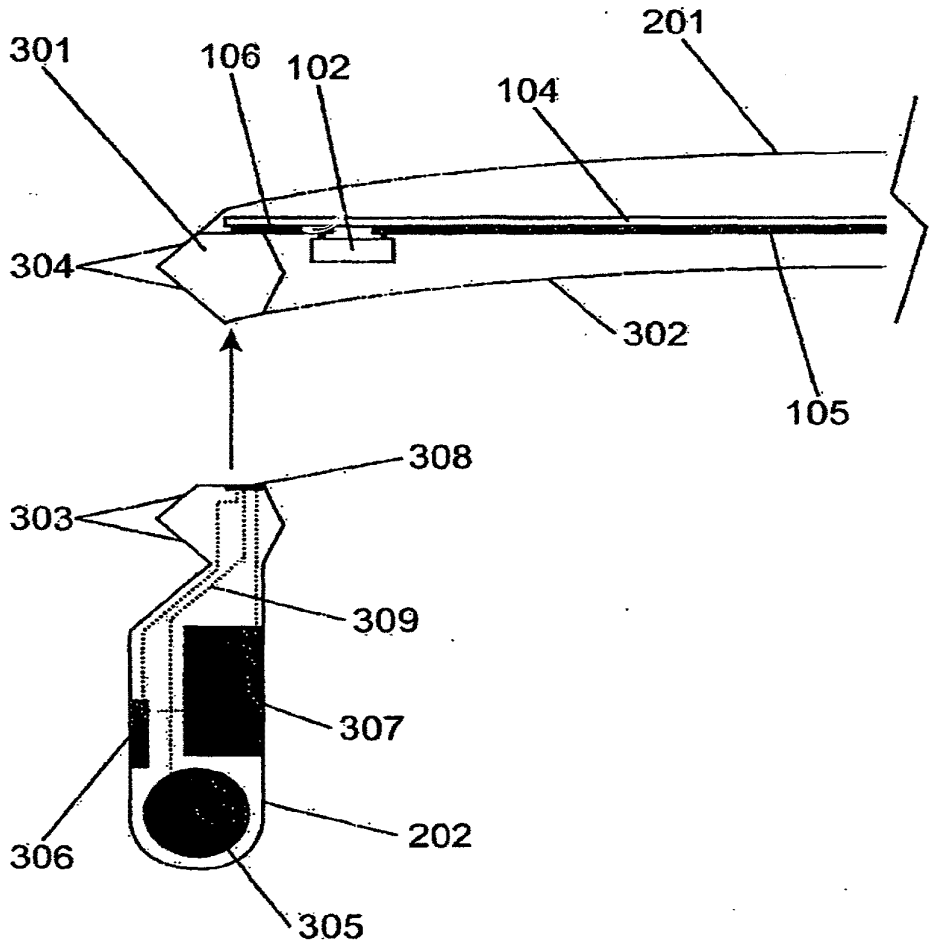


FIG. 3B

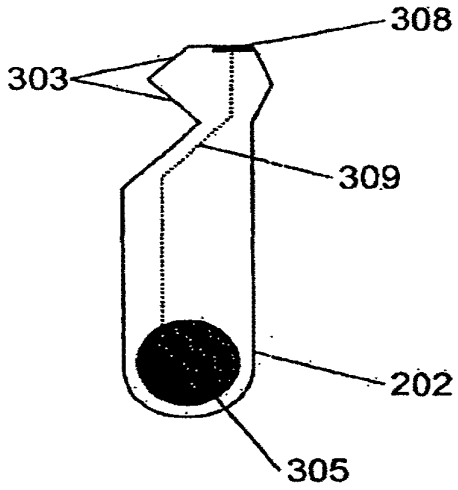


FIG. 3C

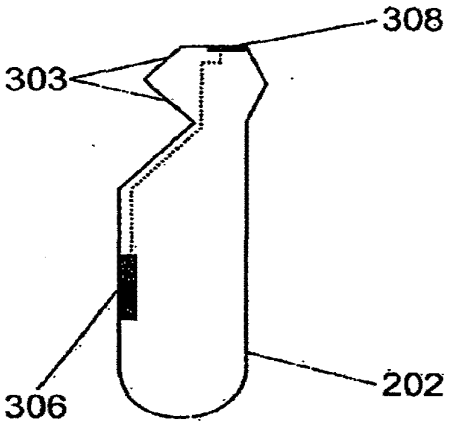


FIG. 3D

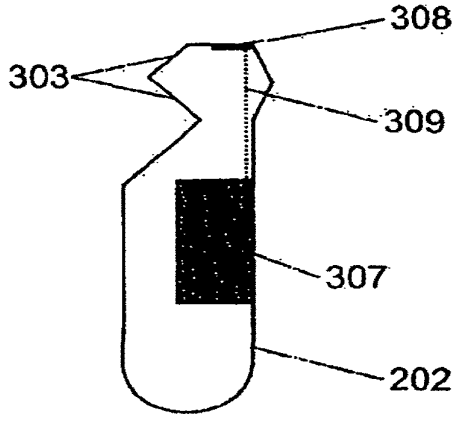


FIG. 3E

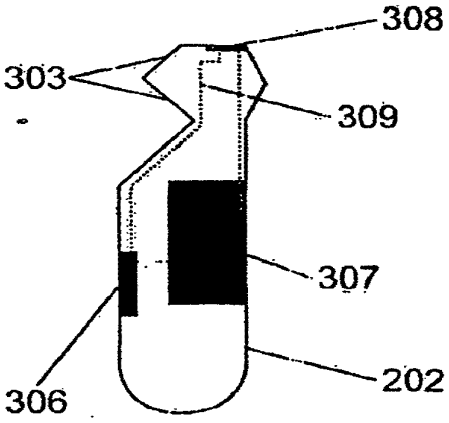


FIG. 3F

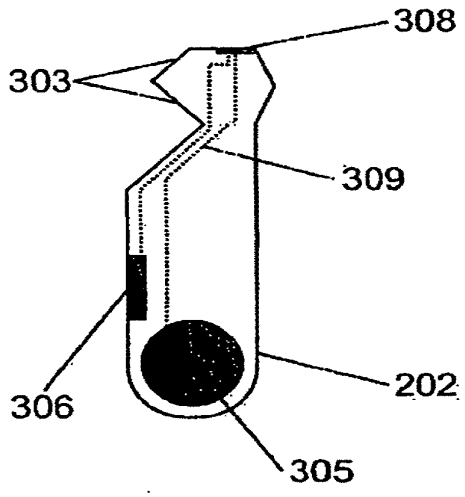


FIG. 3G

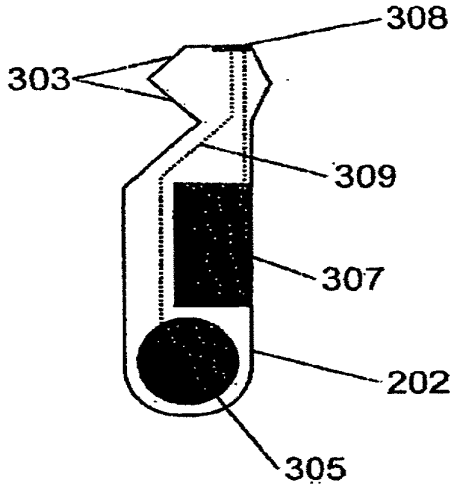


FIG. 3H

FIG. 3I

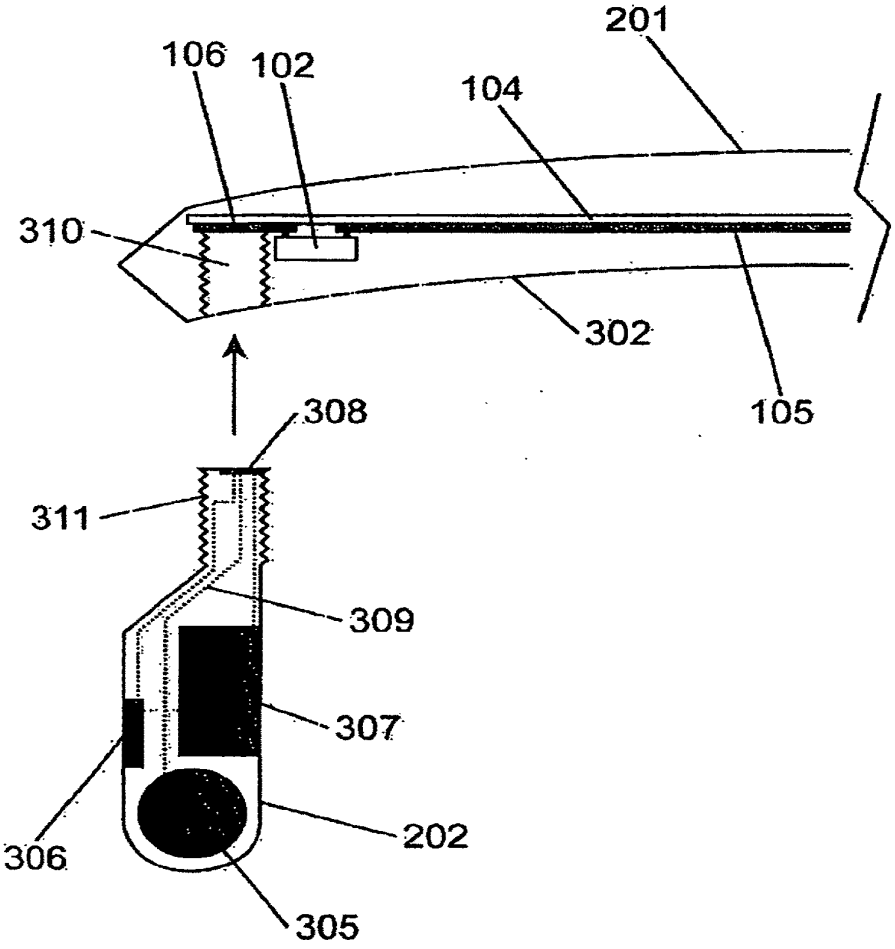


FIG. 3J

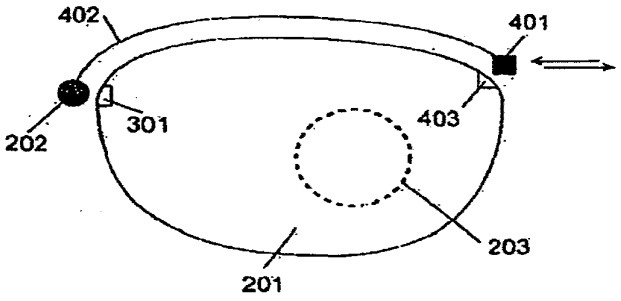


FIG. 4

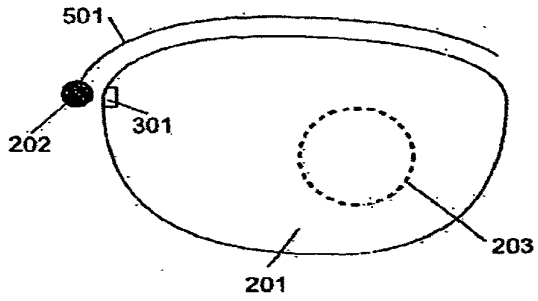


FIG. 5

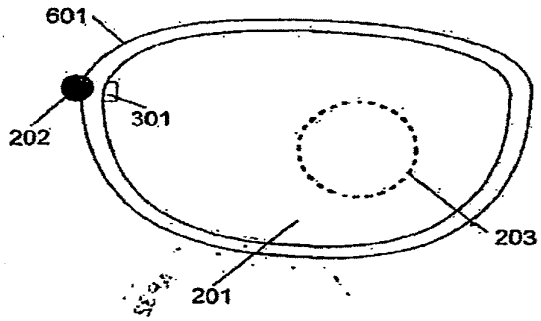


FIG. 6

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
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(25) Filing Language: English

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(30) Priority Data:
60/815,870 23 June 2006 (23.06.2006) US

(71) Applicant *(for all designated States except US)*: **PIXELOPTICS, INC.** [US/US]; 2840 Hershberger Road, Suite A, Roanoke, VA 24017 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **BLUM, Ronald, D.** [US/US]; 5320 Silver Fox Road, Roanoke, VA 24018 (US). **HADDOCK, Joshua, N.** [US/US]; 17 Church Avenue Sw, Apt. 202, Roanoke, VA 24011 (US). **DUSTON, Dwight, P.** [US/US]; 59 Fairlane, Laguna Niguel, CA 92677 (US).

(74) Agent: **SCHAFFER, Robert, D.**; Pearl Cohen Zedek Latzer, LLP, 1500 Broadway, 12th Floor, New York, NY 10036 (US).

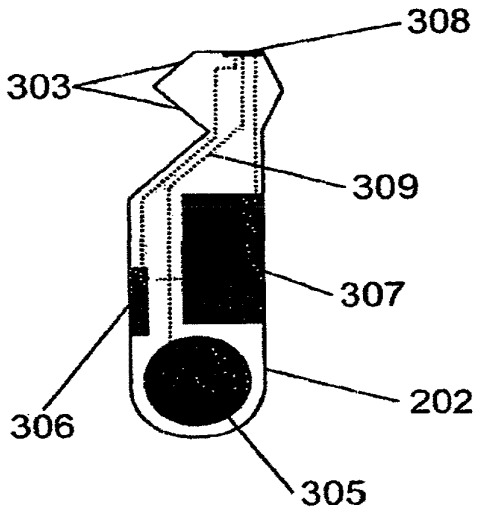
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
2 May 2008

(54) Title: ELECTRONIC ADAPTER FOR ELECTRO-ACTIVE SPECTACLE LENSES



(57) Abstract: An adapter (202) for a spectacle frame (104) is disclosed which is configured for enabling the spectacle frame to operate and control electro-active lenses (201) housed therein. In particular, the spectacle frame may allow electro-active lenses housed therein to focus and be controlled both automatically and manually with heretofore unrealized results.

WO 2008/002388 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US07/13600

A. CLASSIFICATION OF SUBJECT MATTER
IPC: **G02C 1/00**(2006.01);**G02F 1/29**(2006.01)

USPC: 351/158,132;359/319
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)
U.S. : 351/158,132,133,140,159,160H,160R,168,169; 359/319,245; 349/13,200; 381/327

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,463,428 A (LIPTON et al) 31 October 1995 (31.10.1995), column 2, line 64 to column 5, line 40.	1-3, 6
---		---
A		4, 5, 7-22
A	US 2007/0258039 A (DUSTON et al) 08 November 2007 (08.11.2007), all.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 February 2008 (27.02.2008)	04 MAR 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Loha Ben Telephone No. (571) 272-2323

Form PCT/ISA/210 (second sheet) (April 2007)

Continuation of B. FIELDS SEARCHED Item 3:
WEST: (1) (lens$2 WITH electr$6 WITH (active$2 or respons$7)) SAME (adapt$7 or mount$7 or connect$7) SAME (electric$4 NEAR5 (contact$3 or connect$3 or pad$1)) SAME (frame$1 or temple$1 or substrate$1)
(2) (lens$2 WITH electr$6 WITH (active$2 or respons$7)) SAME (adapt$7 or mount$7 or connect$7) SAME (electric$4 NEAR5 contact$3) and spectacle$1
(3) (lens$2 WITH electr$6 WITH (active$2 or respons$7)) SAME (adapt$7 or mount$7 or connect$7) SAME (electric$4 NEAR5 contact$3) and (adapt$7 WITH (separat$3 or detach$7 or demount$7))

US 20080273166A1

(19) **United States**

(12) **Patent Application Publication**

Kokonaski et al.

(10) **Pub. No.: US 2008/0273166 A1**

(43) **Pub. Date: Nov. 6, 2008**

(54) **ELECTRONIC EYEGLASS FRAME**

(76) Inventors: **William Kokonaski**, Gig Harbor, WA (US); **Ronald D. Blum**, Roanoke, VA (US); **Tiziano Tabacchi**, Pieve di Cadore (IT); **Martin Boch**, Kieselbronn (DE); **Massimo Pinazza**, Pieve di Cadore (IT); **Scott N. Richman**, Irvine, CA (US); **Volkan Ozguz**, Aliso Viejo, CA (US); **Joshua N. Haddock**, Roanoke, VA (US)

Correspondence Address:
PEARL, COHEN, ZEDEK & LATZER, LLP
1500 BROADWAY, 12TH FLOOR
NEW YORK, NY 10036 (US)

(21) Appl. No.: **12/054,299**

(22) Filed: **Mar. 24, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/924,225, filed on May 4, 2007, provisional application No. 60/929,419, filed on Jun. 26, 2007.

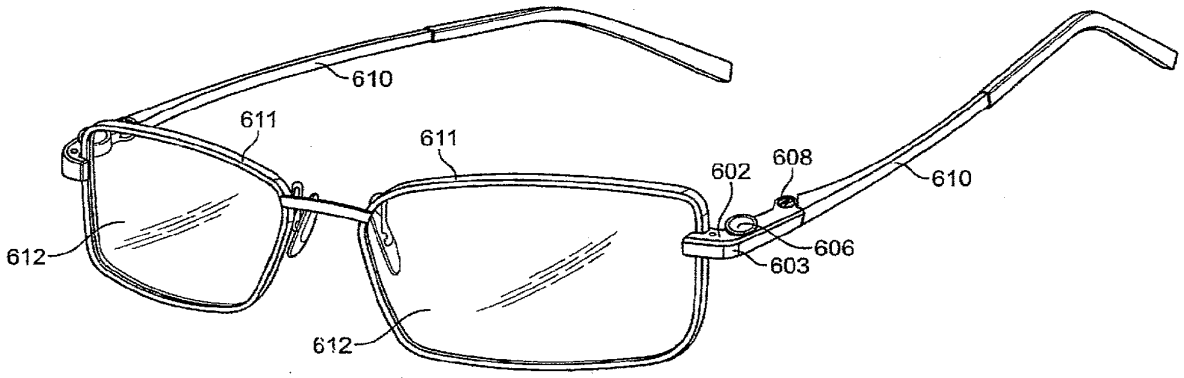
Publication Classification

(51) **Int. Cl.**
G02C 7/06 (2006.01)
G02C 11/00 (2006.01)

(52) **U.S. Cl.** **351/158**; 351/168

(57) **ABSTRACT**

The present invention generally relates to integrating electronic components into an electro-active frame for driving electro-active focusing lenses. This is accomplished in a cosmetically pleasing manner that allows a platform of frame systems to be built from a single electronic module. Specifically, the present invention discloses controlling an electro-active lens in a deliberate, hands free manner that gives the user control of the electro-active lens.



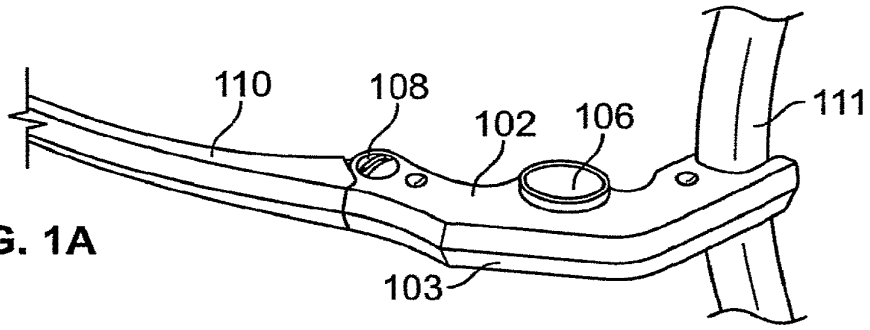


FIG. 1A

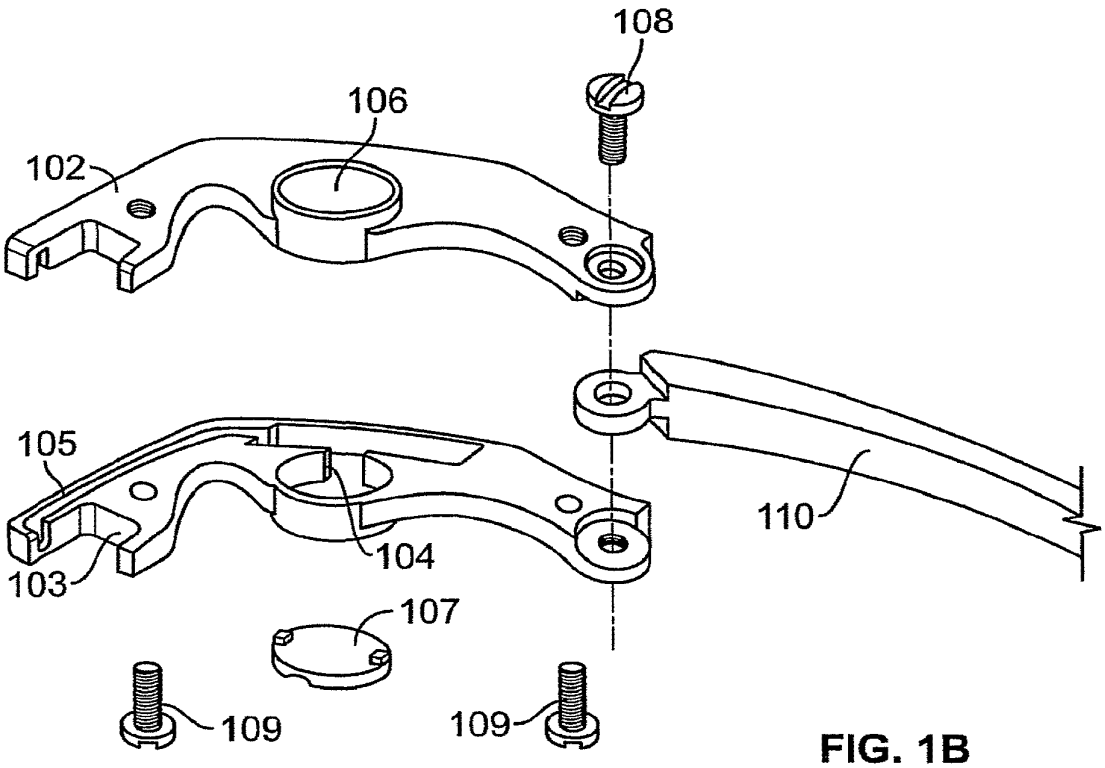


FIG. 1B

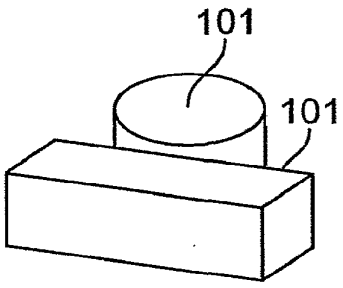


FIG. 1C

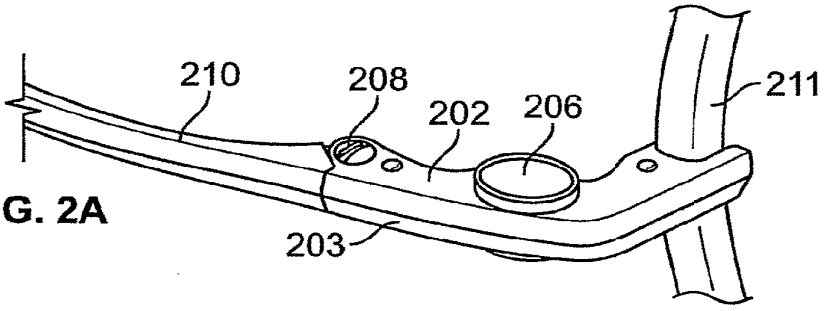


FIG. 2A

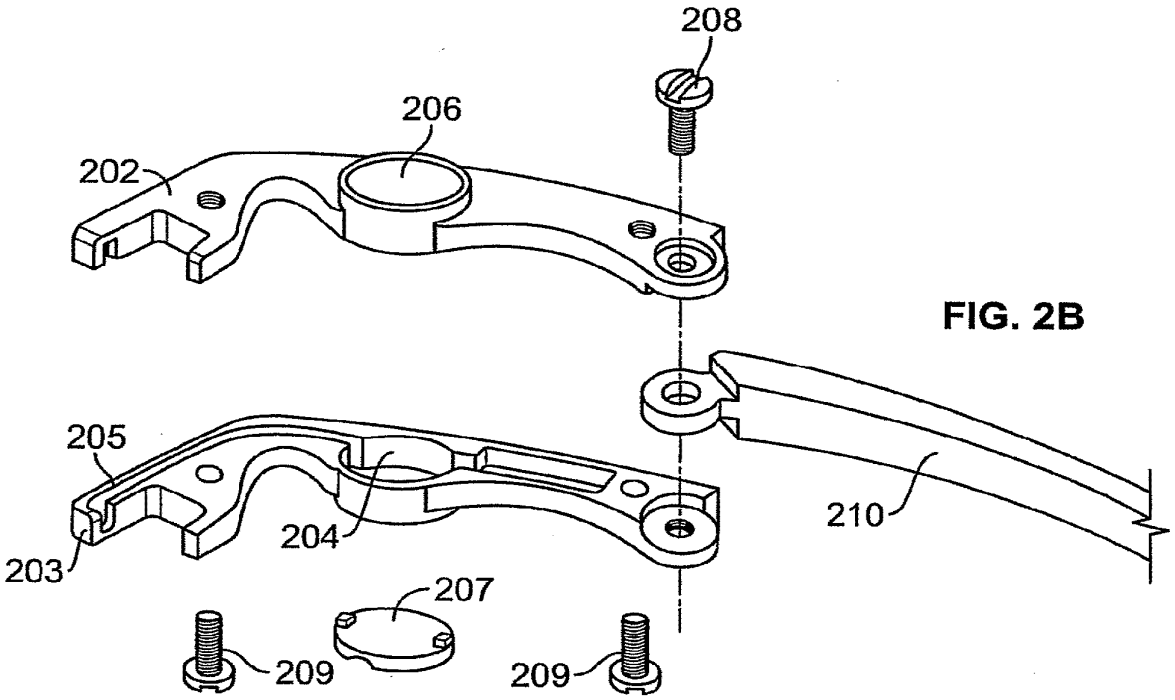


FIG. 2B

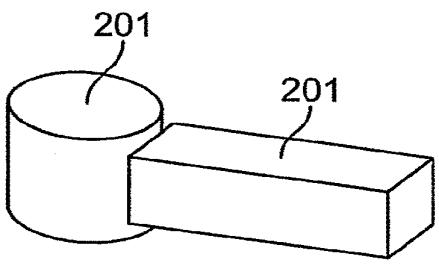


FIG. 2C

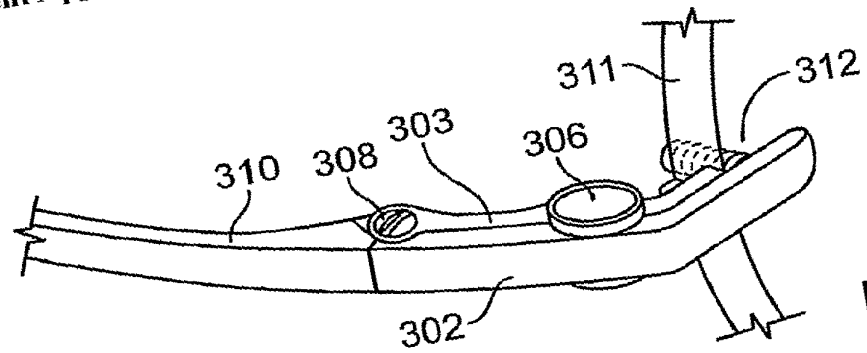


FIG. 3A

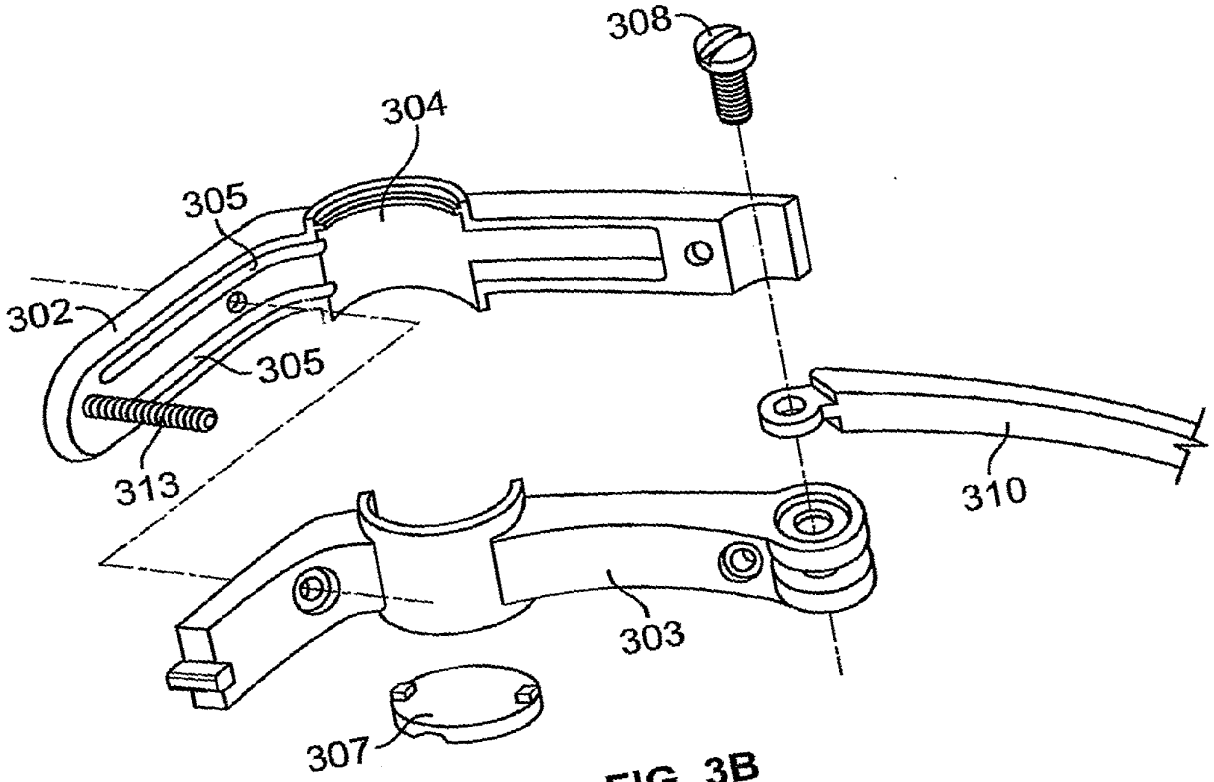


FIG. 3B

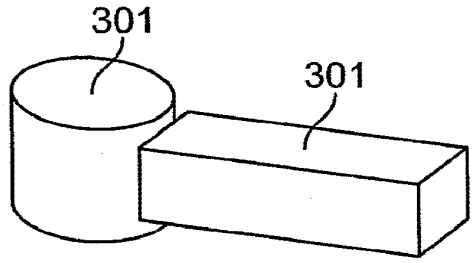


FIG. 3C

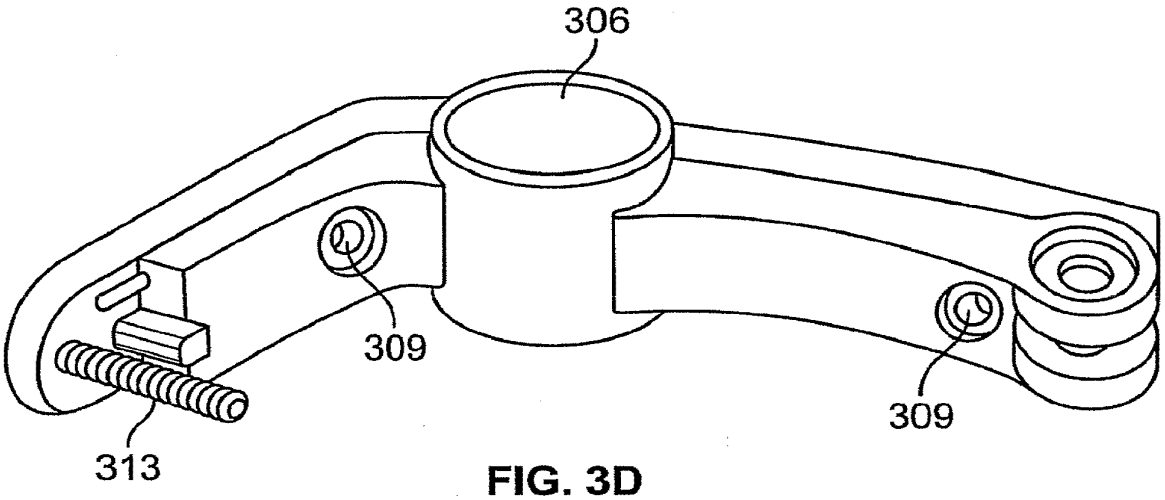


FIG. 3D

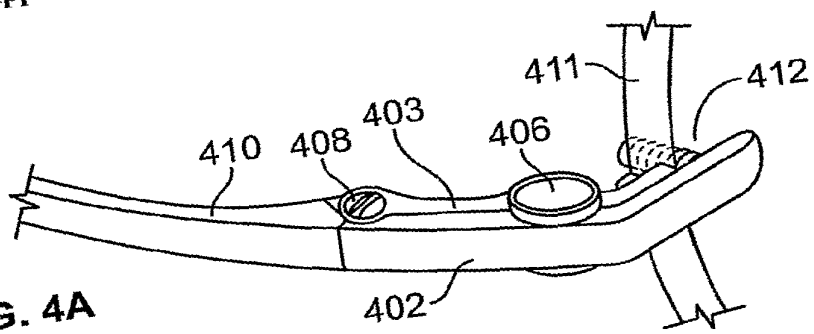


FIG. 4A

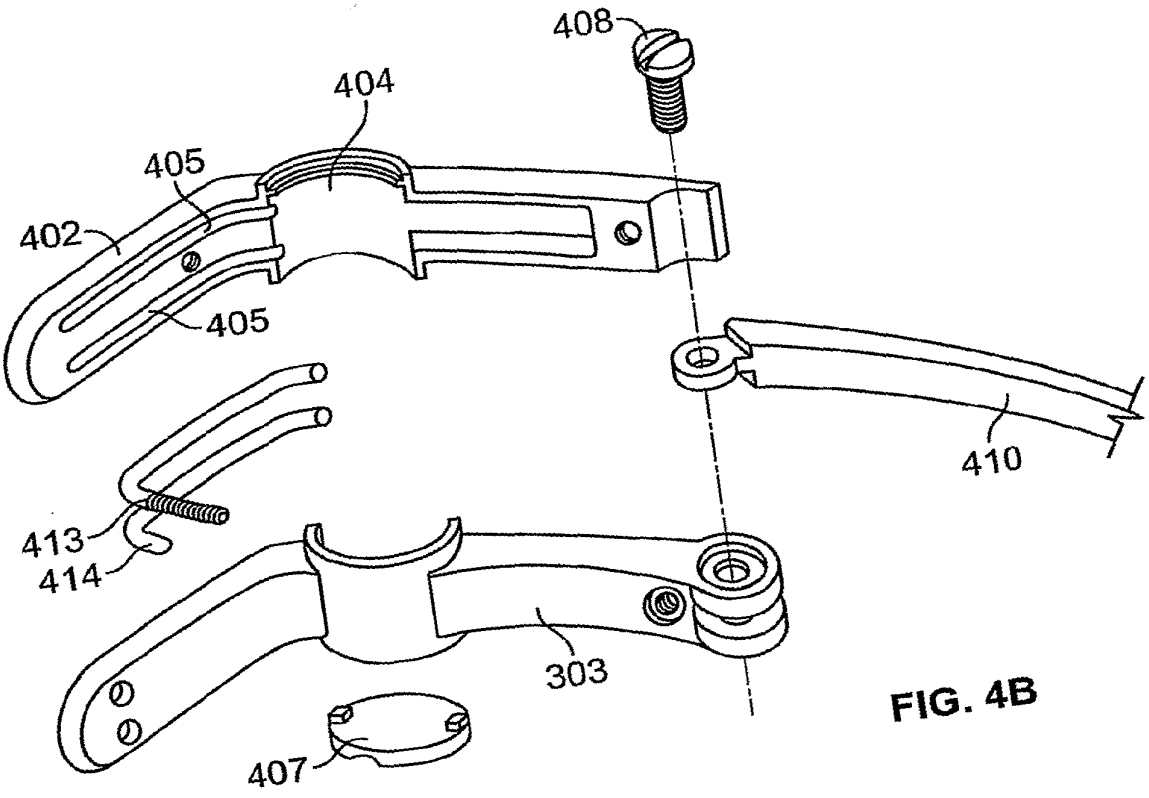


FIG. 4B

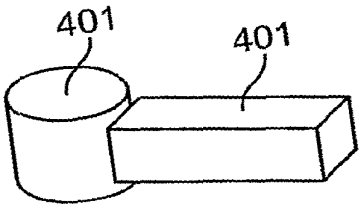


FIG. 4C

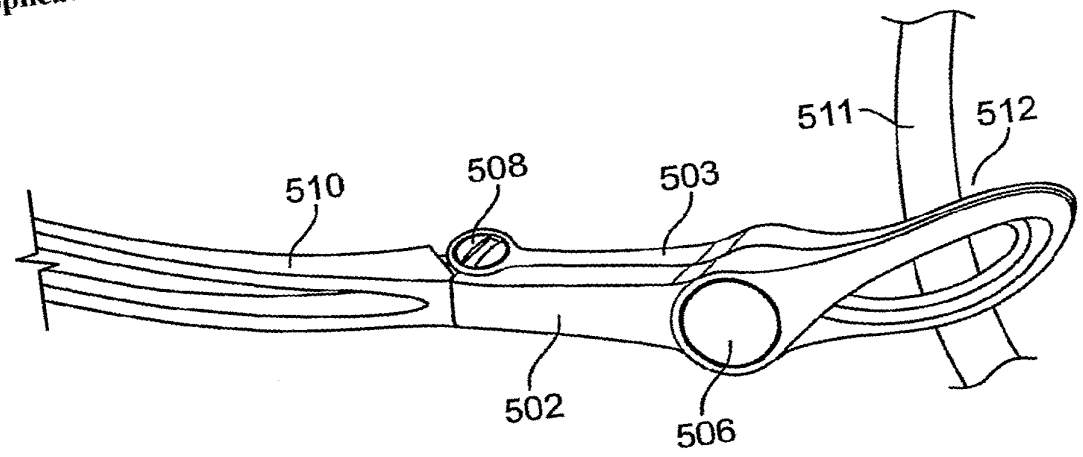


FIG. 5A

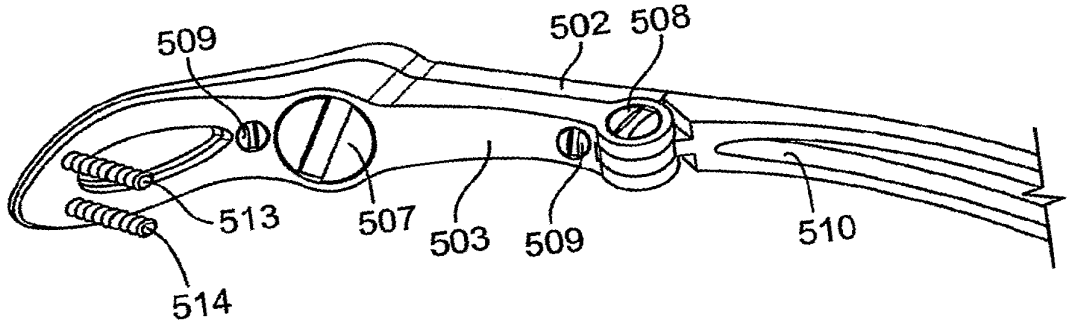


FIG. 5B

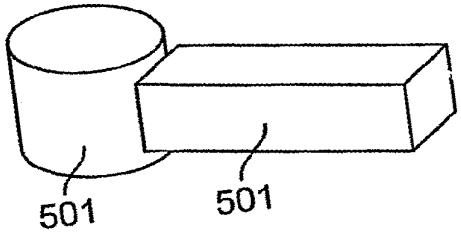


FIG. 5C

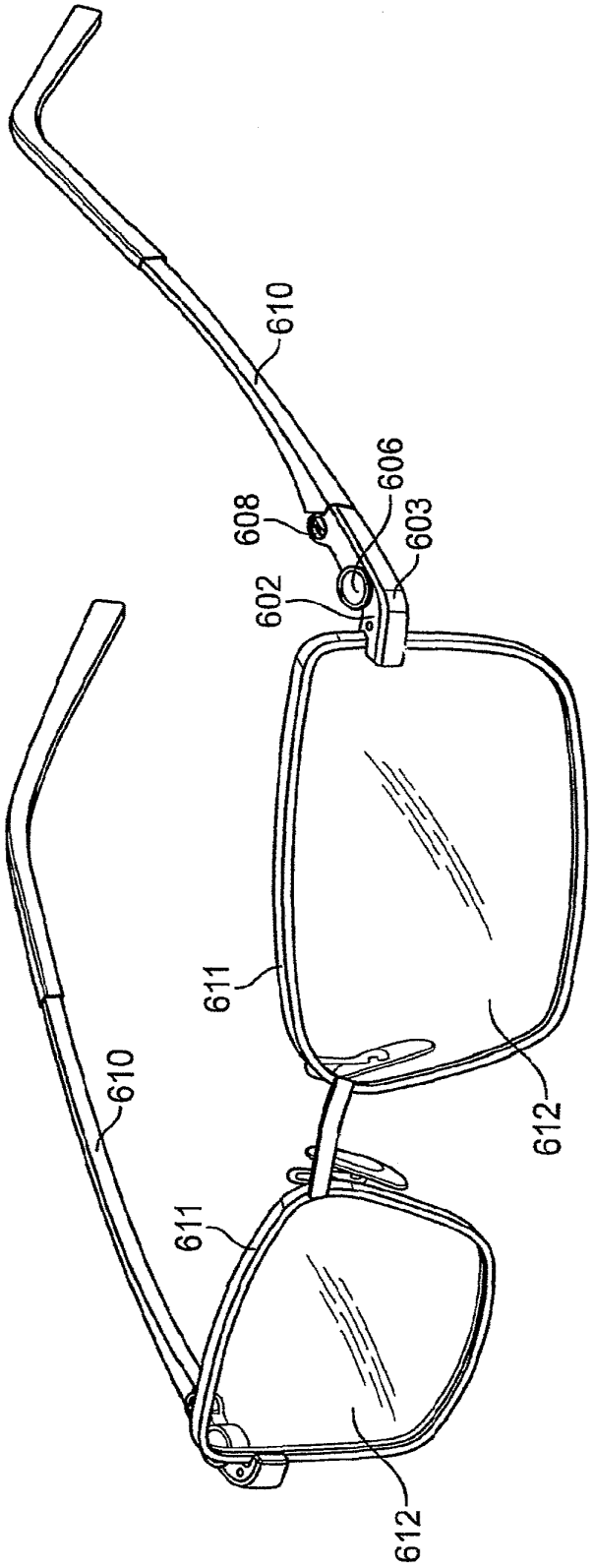


FIG. 6

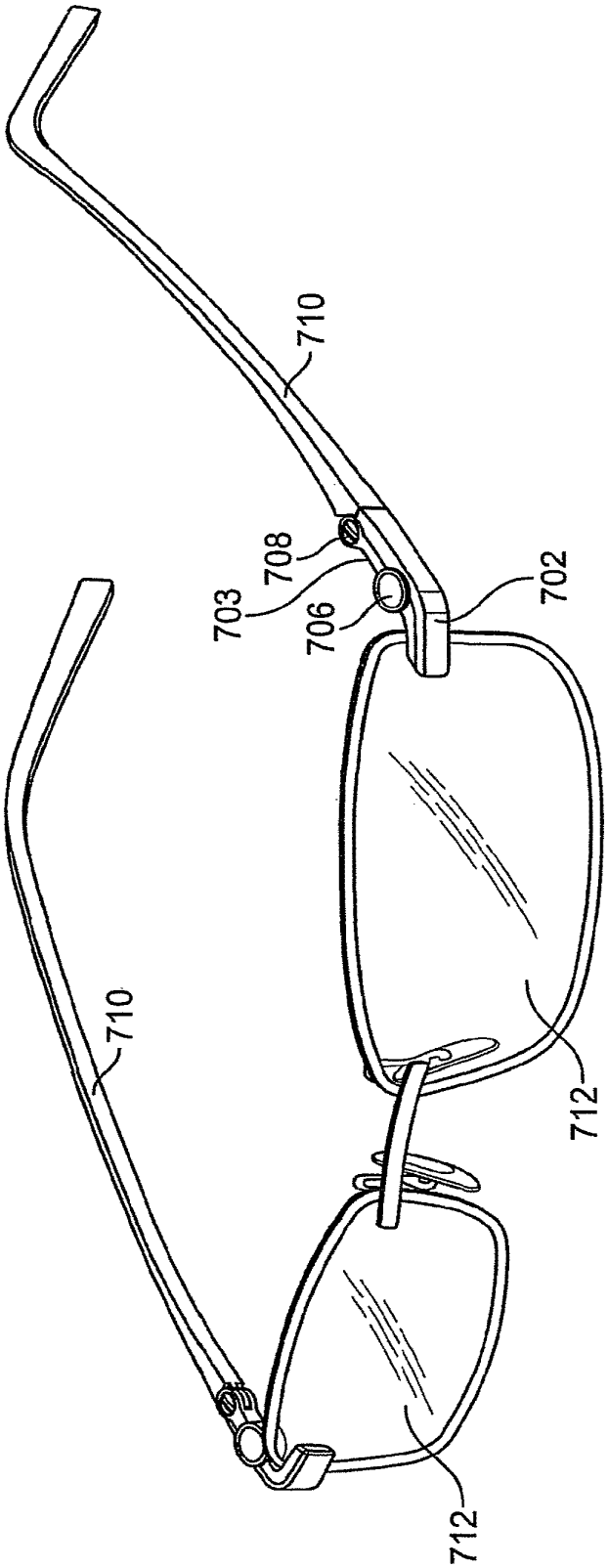


FIG. 7

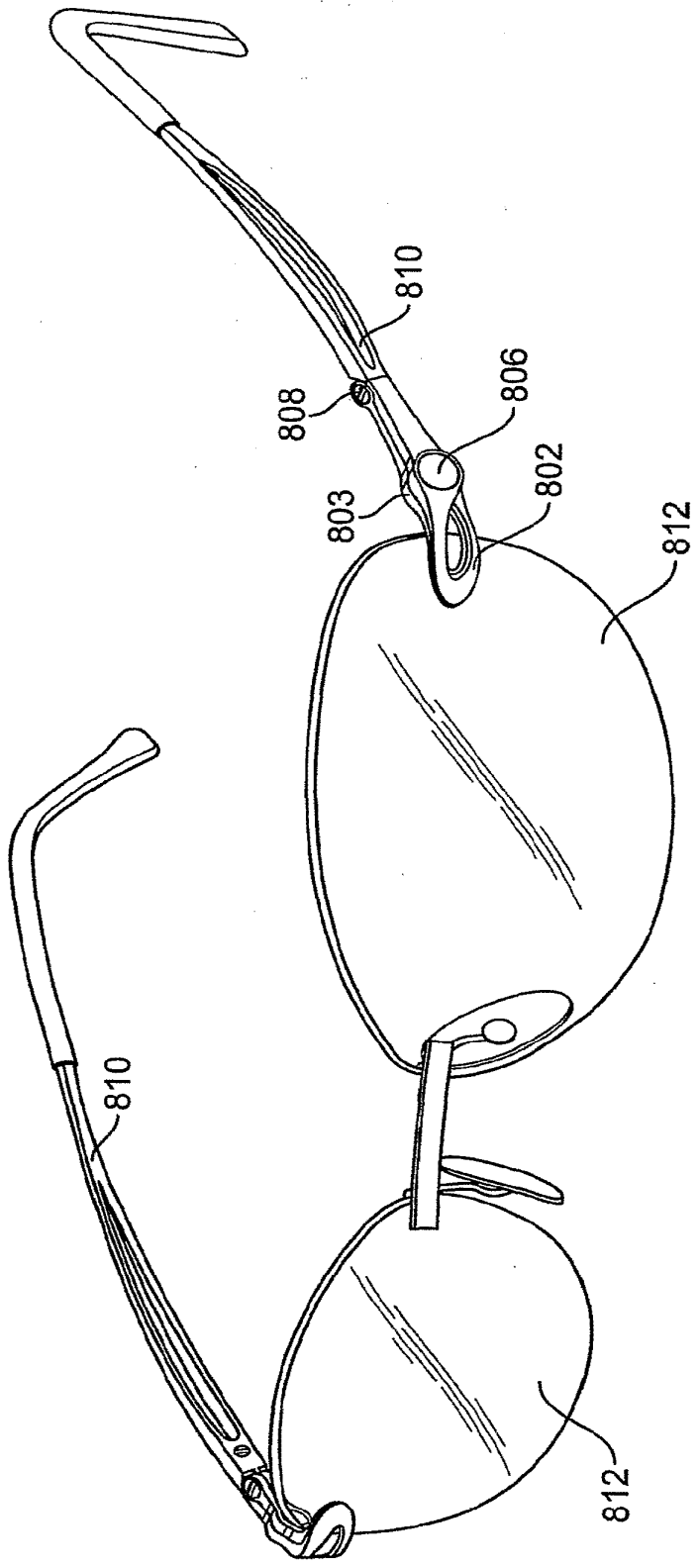


FIG. 8A

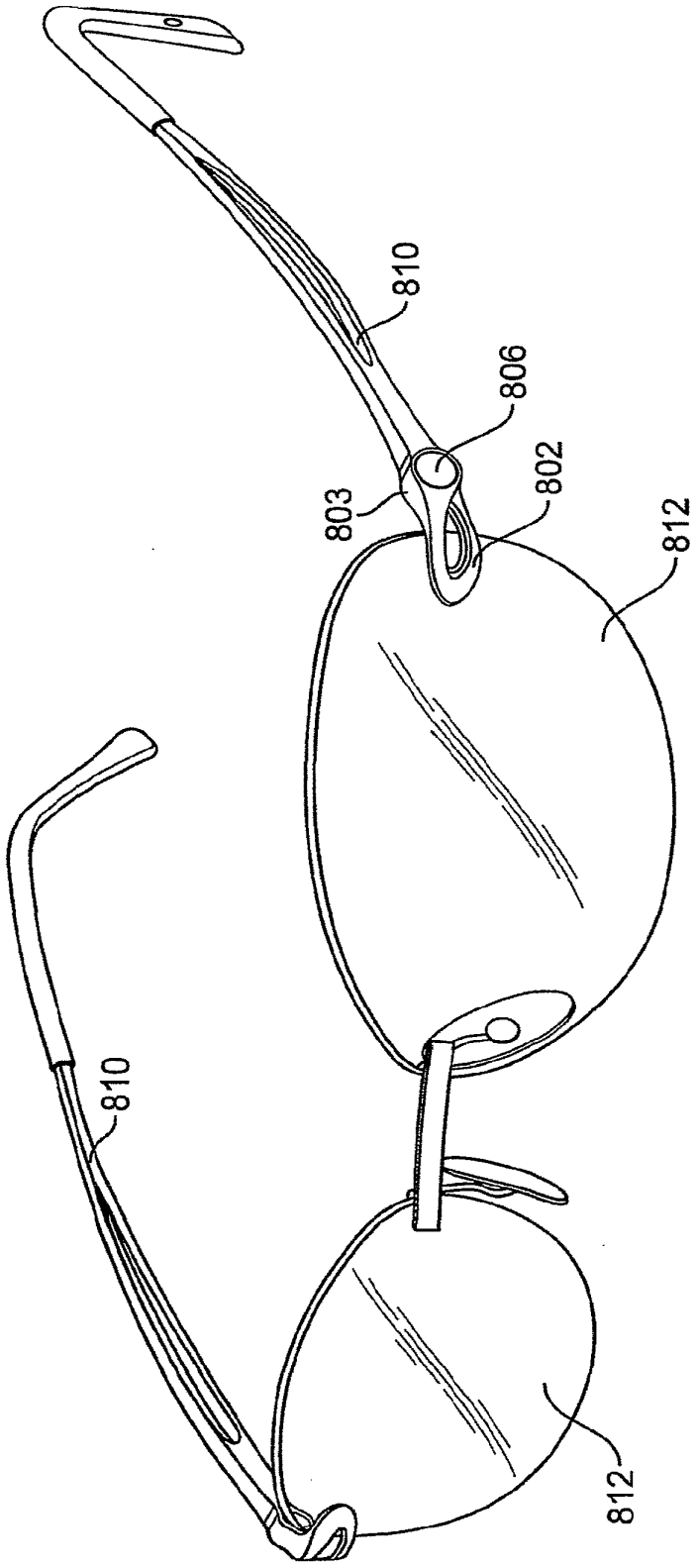


FIG. 8B

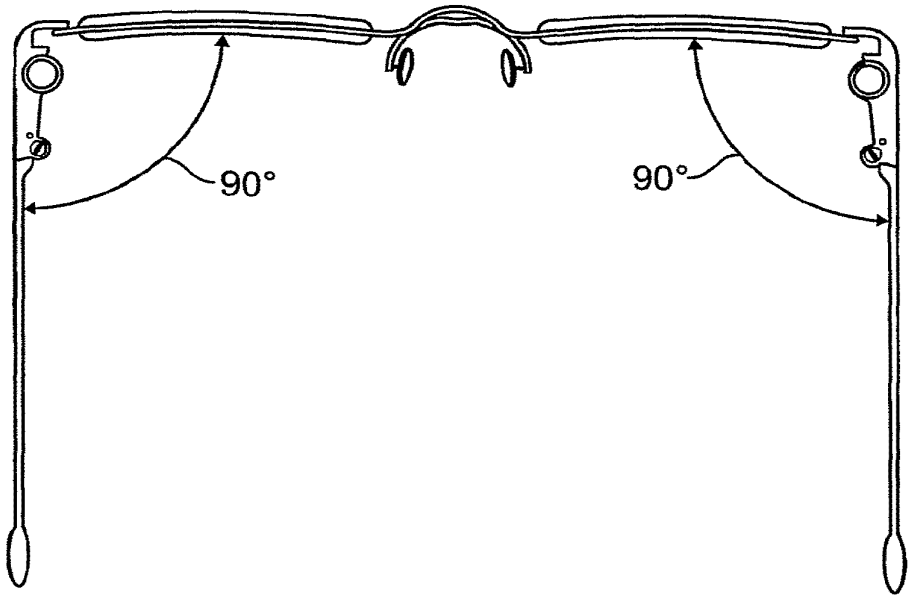


FIG. 9A

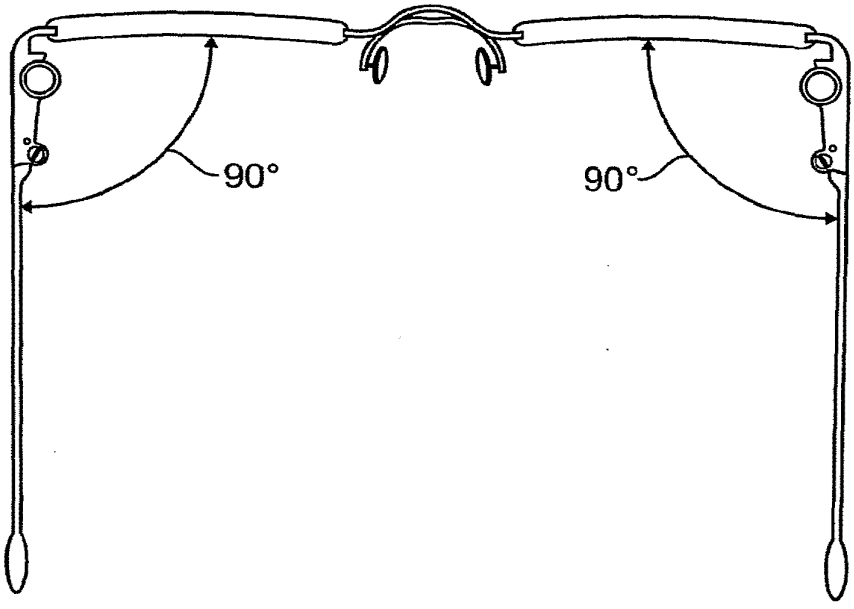


FIG. 9B

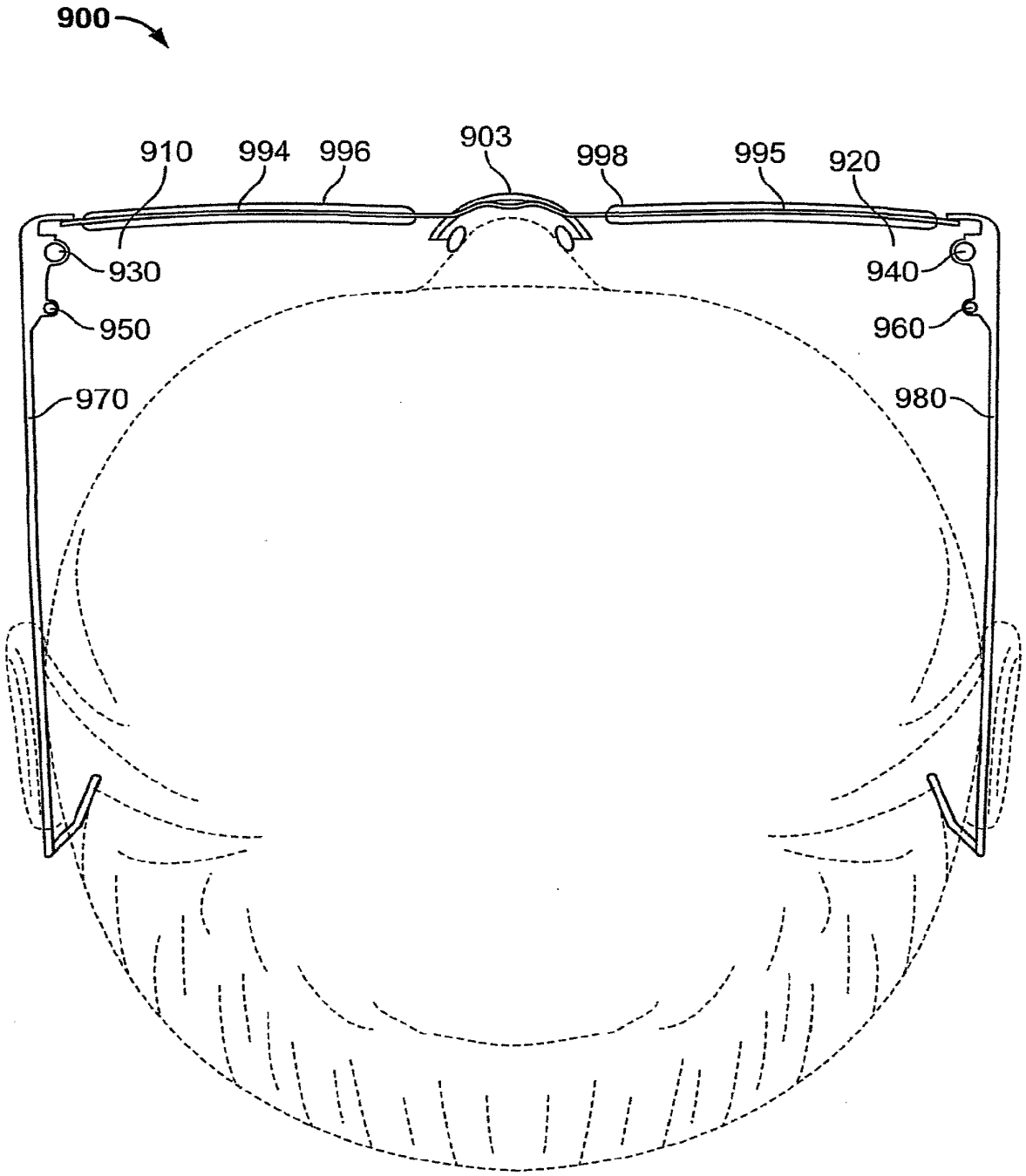


FIG. 9C

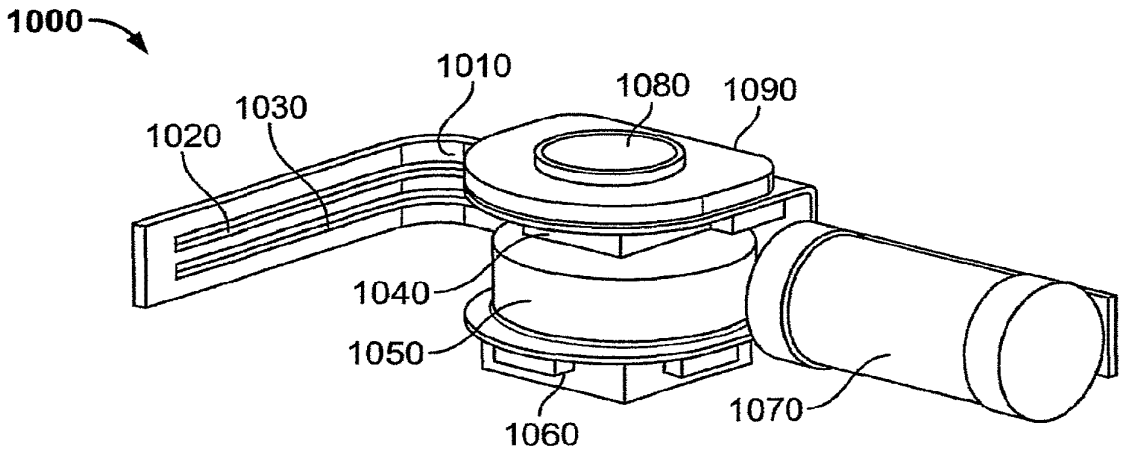

1000
1010
1080
1090
1030
1020
1040
1050
1060
1070

FIG. 10

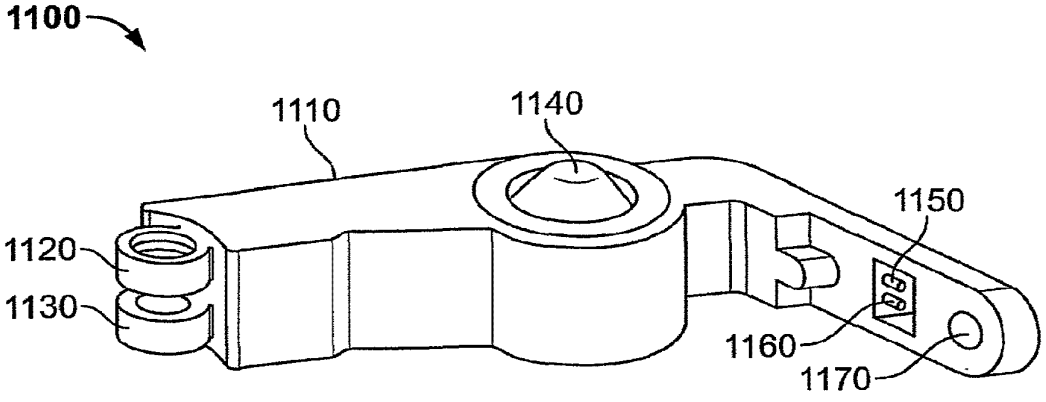

1100
1110
1140
1150
1120
1130
1160
1170

FIG. 11

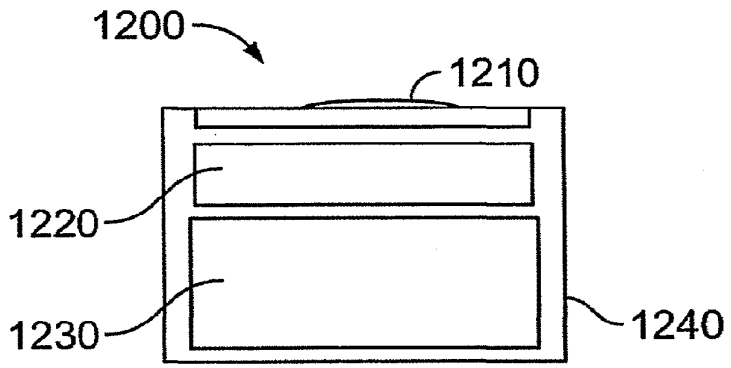


FIG. 12A

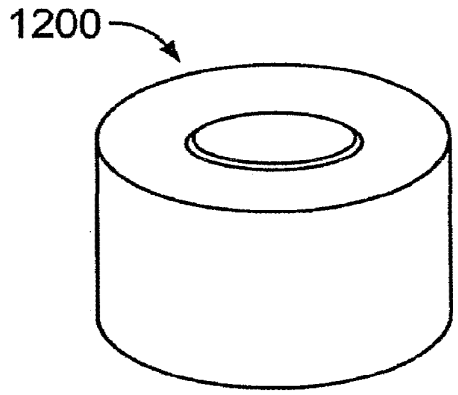


FIG. 12B

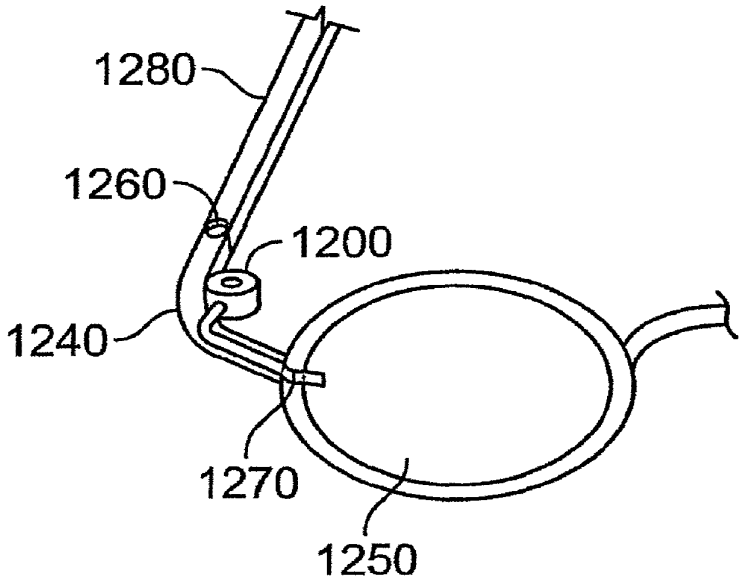


FIG. 12C

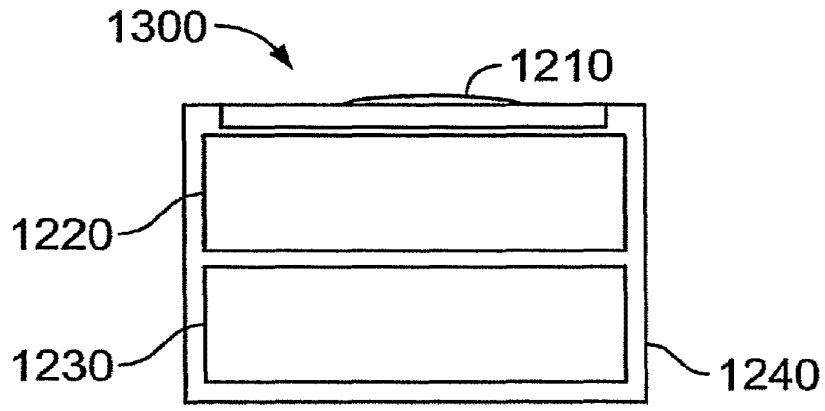


FIG. 13A

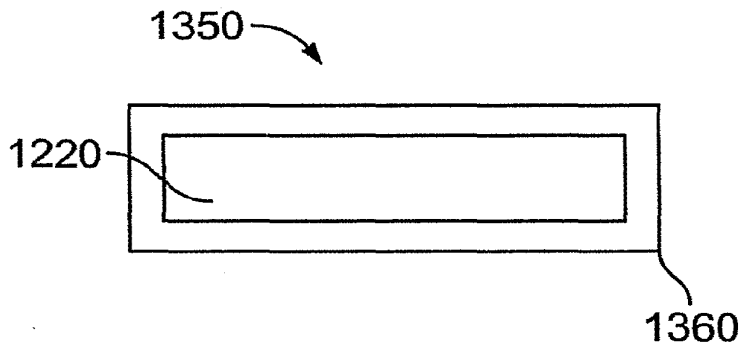


FIG. 13B

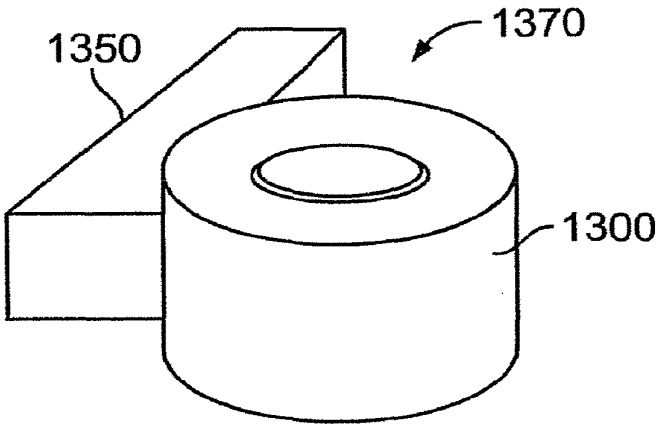


FIG. 13C

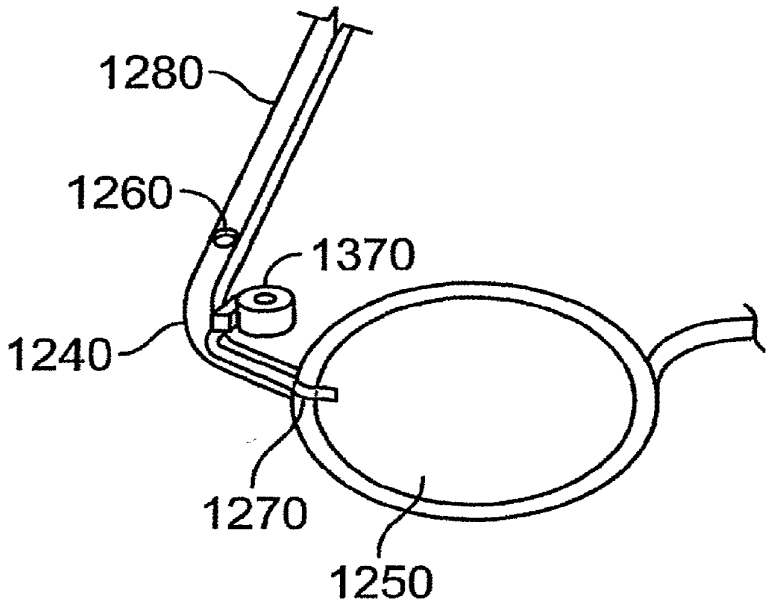


FIG. 13D

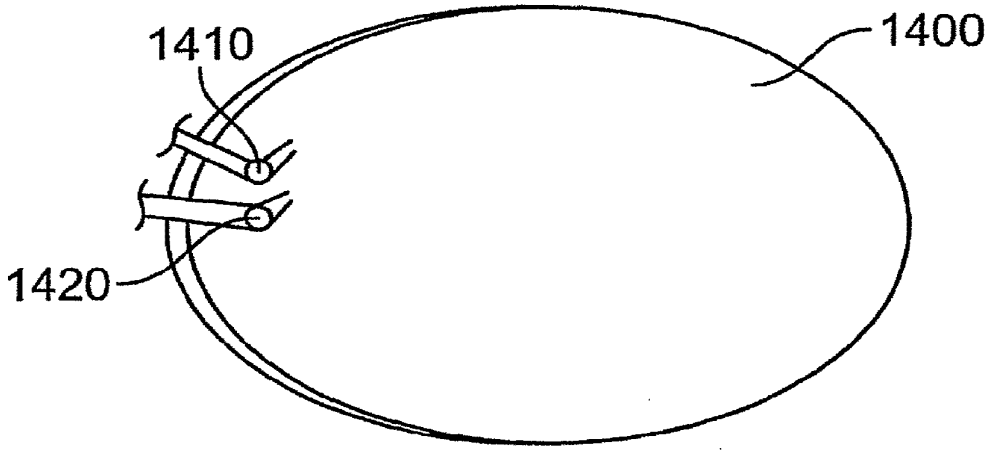


FIG. 14

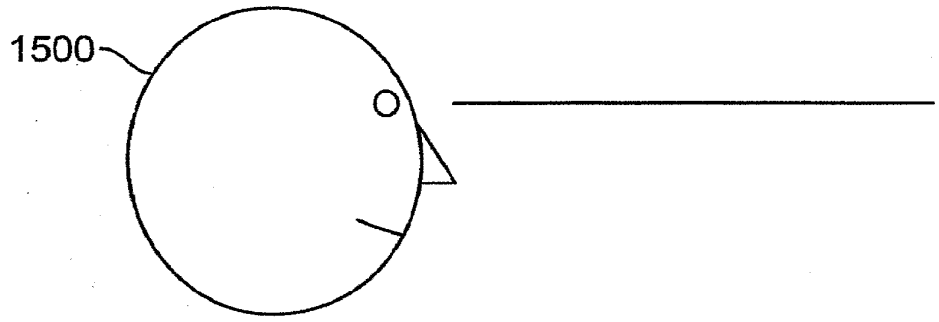


FIG. 15A

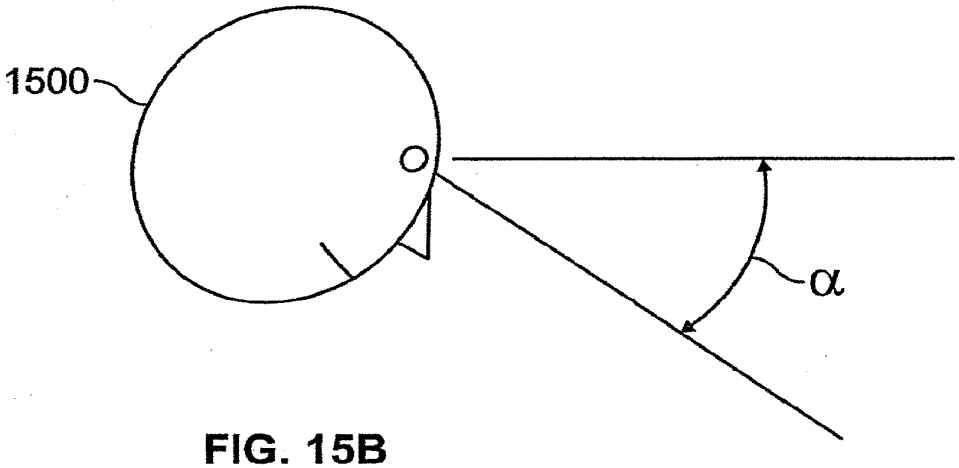


FIG. 15B

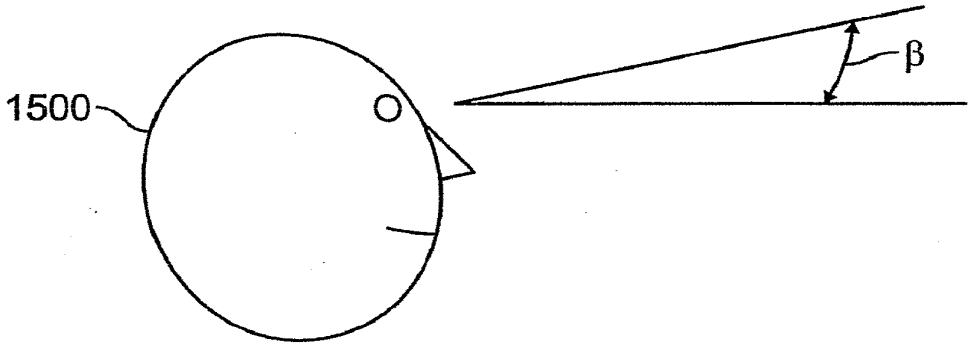


FIG. 15C

ELECTRONIC EYEGLASS FRAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/796,876 filed on May 3, 2006 and entitled, "Spectacle Frame Bridge Housing Electronics For Electro-active Spectacle Lenses" (now U.S. Ser. No. 11/797,210), U.S. Provisional Application No. 60/924,225 filed on May 4, 2007 and entitled, "Advanced Electro-Active Spectacles, U.S. Provisional Application No. 60/929,419 filed on Jun. 26, 2007 entitled, "Electronic Eyeglass Frames and Integration Thereof", and U.S. Provisional Applications No. 60/854,697 and 60/854,677 respectively entitled, "Advanced Electronic Eyewear" and "Universal Temple End Piece For Spectacles both of which were filed on Oct. 27, 2006 (now together as Ser. No. 11/976,199), all of which are incorporated in their entirety herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to integrating electronic components into an electronic eyeglass frame for driving electro-active lenses capable of one or more of dynamic focus, dynamic changeable tint, and other electronic applications such as, by way of example only, an electronic display that may or may not be incorporated within the lens. This is accomplished in a cosmetically pleasing manner that allows a platform of frame systems to be built from a single electronic module. The present invention discloses controlling an electro-active lens in a deliberate, hands free manner that gives the user control of the electro-active lens. In addition, the present invention allows for a mostly universal electronics module or modules that can be applied to most eyeglass frames in such a manner (and location) whereby conductive wiring of the temples and the frame front is minimized, cosmetics and form factor of the eyeglass frame is maintained, and complicating issues of connecting electrical current thru the bridge or hinge of the eyeglass frame are mitigated.

[0004] 2. Description of the Related Art

[0005] In today's world, spectacle eyeglass frames are very fashionable. While the trend for the eyeglass lenses is to make them thinner, lighter, and less visible, at the same time, it is the eyeglass frame that makes the fashion statement for the eyeglass wearer.

[0006] Concurrent with these trends is another concerning including electronics into spectacle eyewear. By way of example, Oakley™ has commercialized electronic eyewear called the Oakley Thump™ that incorporates a MP3 player into the temple of the eyewear that can be oriented properly for the wearer. The Oakley Thump is a prime example of what the invention disclosed here desires to avoid. That being a thick temple or frame housing electronics that distracts from the aesthetic appearance of the eyeglass frames. PixelOptics™ is developing electro-active eyewear that allow for the lens to dynamically focus for the wearer's distance vision needs without any moving parts. Electronic tints for the lens such as, by way of example only, electro-chromics, rapid change tint technology, and tint shuttering are being developed by others as well. Finally, electronic displays are being developed that fit within or on the eyeglass lens allowing the user to see an image floating in front of them in space. The trend of utilizing electronics in eyewear appears to be accelerating and the applications being developed by others are expanding.

[0007] As theses trends continue, it is becoming important to find ways to incorporate electronics into eyewear without harming the aesthetics and functionality of the eyewear. The challenge is to not limit the fashion design of the eyeglass frame or limit the materials which the eyeglass frame can be made of, maintain as few completed eyeglass frames or eyeglass frame components (frame fronts, bridges, temples) stock keeping units (SKUs) as possible, allow for robust placement of the electronics, and in a way that can be manufactured so that it remains affordable, and aesthetically desirable.

[0008] Various electronic components have been disclosed in prior art whereby said components are located in the side of one or both temples, in or on the end piece of the temple, in or on the eyeglass frame's bridge, in or on the lens or lenses, or affixed to the hinge or hinges that attach the frame's temple to the frame's front. While these approaches allow for enabling electronic frames and electro-active lenses, to date there has been no way for this to occur while minimizing the number of frame part SKUs, and maintaining the aesthetics of the frame.

[0009] The present invention also addresses the integration of electronic components into an electro-active frame for driving electro-active lenses for one or more of dynamically altering focus, tint or other electronic applications such as by way of example only an electronic display. The invention achieves this objective in a cosmetically pleasing manner that allows for a platform of frame systems to be built from one or more electronic modules.

[0010] These problems have been solved in a simple, convenient, and highly effective way by which to provide an improved electro-active frame having electronic components for driving electro-active lenses in a cosmetically pleasing manner that allows for a platform of frame systems to be built from one or more electronic modules. The present invention discloses controlling an electro-active lens in a deliberate, yet optional hands free control manner that effectively overcomes the aforementioned difficulties and longstanding problems inherent in electro-active eyewear. The invention further allows for the electronic module to control the electronic lens such that if the electronic lens is not in use the electronics are turned off to conserve battery power.

SUMMARY OF THE INVENTION

[0011] According to one aspect of the invention, an eyeglass frame is disclosed comprising a hinged temple. The temple further comprises an electronic module, which is located within a front spatial void of the eyeglass frame anterior to the hinge.

[0012] According to another aspect of the invention, an electronic module is disclosed that contains electronics and a power source for driving an electro-active lens. The module is designed to fit within a spatial void of an eyeglass frame directly connected to the electro-active lens without an intervening hinge.

[0013] According to another aspect of the invention, a method for controlling an electro-active lens is disclosed wherein the lens is activated when the wearer's head moves to a first position angled steeply down relative to the horizon, and wherein the lens, once activated, remains on until such a time as the wearer's head moves to a second position at an angle slightly above the horizon.

[0014] According to another aspect of the invention, a method for turning off the electronics is disclosed wherein after a specified period of time should the sensor sense there is no movement the controller will turn off the electrical power.

[0015] According to another aspect of the invention, a method for setting a time delay such to prevent the eyeglasses from switching their focus as one walks, runs, or moves his or her head while not intending to read at near.

[0016] According to a still further aspect of the invention, an electronic module attached to a rimless eyeglass frame near a rimless spatial void is disclosed wherein the frame has an electro-active lens to which the module is directly connected.

[0017] The method and apparatus of the present invention will be better understood by reference to the following detailed discussion of specific embodiments and the attached figures which illustrate and exemplify such embodiments.

[0018] According to still another aspect of the invention, a hinge-less temple is provided such that the electronic module can be located within the spatial void or any where on the temple including the end piece behind the ear.

DESCRIPTION OF THE DRAWINGS

[0019] A specific embodiment of the present invention will be described with reference to the following drawings, wherein:

[0020] FIG. 1A illustrates a universal frame housing that comprises the electronic module, electronic connectors, and a hinge.

[0021] FIG. 1B is an exploded view of the universal frame housing of FIG. 1A.

[0022] FIG. 1C is the electronic module of FIG. 1A.

[0023] FIG. 2A illustrates another universal frame housing that comprising an electronic module, electronic connectors, and a hinge

[0024] FIG. 2B is an exploded view of the universal frame housing of FIG. 2A.

[0025] FIG. 2C is the electronic module of FIG. 2A.

[0026] FIG. 3A illustrates another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0027] FIG. 3B is an exploded view of the universal frame housing of FIG. 3A.

[0028] FIG. 3C is the electronic module of FIG. 3A.

[0029] FIG. 3D illustrates a manual touch switch extending up though the assembly formed by the front and back electro-active lens frame component pieces.

[0030] FIG. 4A illustrates another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0031] FIG. 4B is an exploded view of the hinge FIG. 4A.

[0032] FIG. 4C is the electronic module of FIG. 4A.

[0033] FIG. 5A illustrates an external side view of another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0034] FIG. 5B is an inside or back view of the universal frame housing of FIG. 5A.

[0035] FIG. 5C is the module of the universal frame housing of FIGS. 5A and 5B.

[0036] FIG. 6 illustrates one embodiment of a fully assembled electronic frame.

[0037] FIG. 7 illustrates another embodiment of a fully assembled electronic frame.

[0038] FIG. 8A illustrates another embodiment of a fully assembled electronic frame having a hinged temple.

[0039] FIG. 8B illustrates another embodiment of a fully assembled electronic frame having a hinge-less temple.

[0040] FIG. 9A illustrates the top view of an electro-active spectacle lenses, rimmed frame and universal frame housings comprising electronic modules, electronic connectors, and hinges.

[0041] FIG. 9B illustrates the embodiment of FIG. 9A, but with a rimless style of lens mounting.

[0042] FIG. 9C illustrates the embodiment of FIG. 9A as worn on a wearer's head and further illustrates the right spatial void and the left spatial void.

[0043] FIG. 10 illustrates an electronic module of another embodiment of the present invention which includes a tilt switch.

[0044] FIG. 11 illustrates a universal frame housing that comprises the electronic module, electrical connectors, and hinge.

[0045] FIG. 12A illustrates a cross section of an embodiment of the electronic module of the present invention without a tilt switch

[0046] FIG. 12B is an isometric view of the module of FIG. 12A.

[0047] FIG. 12C illustrates the module of FIG. 12A in an eyeglass frame behind its frame stem section.

[0048] FIG. 13A illustrates another embodiment of the electronic module of the present invention which contains two batteries.

[0049] FIG. 13B is a cross section of the module of FIG. 13A.

[0050] FIG. 13C illustrates a combined electronic module which includes a tilt switch.

[0051] FIG. 13D illustrate the module of FIG. 13A placed in an eyeglass frame anterior to the hinge and connecting to the lens.

[0052] FIG. 14 illustrates one possible electrical contact into the lens from the frame.

[0053] FIG. 15A illustrates a wearer of an eyeglass frame having a tilt switch looking straight ahead approximately even with the horizon.

[0054] FIG. 15B illustrates a wearer of an eyeglass frame having a tilt switch with his head in a position where he is looking downward at angle α from the horizontal.

[0055] FIG. 15C illustrates a wearer of an eyeglass frame having a tilt switch with his head in a position where he is looking upward at angle β above the horizontal.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0056] The following definitions for elements referred to in this application are set forth below.

DEFINITIONS

[0057] a) Frame: A complete wearable housing that secures both spectacle lenses and aligns them in the proper place relative to the wearer's eyes when being worn.

[0058] b) Hinged temple: The side piece of a frame that connects to the frame front by way of a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0059] c) Hinge-less temple: The side piece of a frame that connects to the frame front without a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0060] d) Temple end piece: The part of the temple that is found farthest away from the frame front. The end piece usually begins behind the ear of the wearer and ends at the end of the temple that is located farthest away from the frame front.

[0061] e) Frame front end piece: The part of the frame front farthest away from the bridge and spatial to the bridge. Each frame has two, frame front end pieces; one on the spatial side of the right lens and/or right eye-wire and one on the spatial side of the left lens and/or eye-wire.

[0062] f) Bridge: The part of the frame front that fits over/superior to the wearer's nose. The bridge is usually found between the eye-wires that holds the right and left lenses, or the right and left lenses themselves.

[0063] g) Hinge: The part of the frame that allows for connecting the frame front and the temples in such away that the frame front and the temple can open and close against the frame front on its posterior side when not being worn.

[0064] h) Eye-wire: The part of the frame front that holds one lens (a right or a left). There are two eye-wires to each frame. However in a completely rimless frame there are no eye wires.

[0065] i) Frame front: The part of the frame to which the temples attach and which holds the lenses and if not a rimless frame front comprises both eye-wires.

[0066] j) Rimless frame: A frame that is designed without eye-wires.

[0067] k) Partially rimless: A frame that has a partial frame front and/or may have a nylon monofilament wire or similar feature that secures the lenses to the frame.

[0068] l) Zyle frame: A frame made out of largely plastic

[0069] m) Metal frame: A frame made out of mostly metal

[0070] n) Right spatial void: The space created where the right frame front that is within the plane of the front of the wearers face turns back to meet the right temple. The angle formed between the right frame front and the right temple is approximately (but not always) 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the right lens or inside right frame front, on a second side by that of an imaginary line that is located in the middle of the right temple not including any electronics affixed thereto, and on a third side which is bounded by the right side of the face and/or head of the wearer.

[0071] o) Left spatial void: The space created where the left frame front that is within the plane of the front of the wearers face turns back to meet the left temple. The angle formed between the left frame front and the left temple is approximately 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the left lens or inside left frame front, on a second side by that of an imaginary line that is located in the middle of the left temple not including any electronics affixed thereto, and on a third side which is bounded by the left side of the face and/or head of the wearer.

[0072] The following preferred embodiment as exemplified by the drawings is illustrative of the invention and is not intended to limit the invention as encompassed by the claims of this application. An electronic module for eyeglass frames containing electro-active lenses is disclosed herein.

[0073] FIGS. **1A-1C** illustrate a specific embodiment of an eyeglass frame containing an electronic module **101**. The module is specifically illustrated as a cylinder and a block section attached to the side of the cylinder in FIG. **1C**. In some embodiments, the cylinder portion of the electronic module may contain both the power source and the drive circuit. The block portion may contain a sensing mechanism, for example a tilt switch. The module may also house an antenna, a receiver, a transmitter, a transceiver, a sensor, a range finder, a micro-processor, and a controller.

[0074] The module **101** is shown housed between an upper electro-active lens frame component piece **102** and a lower electro-active lens frame component piece **103** that contains a receptacle **104** for the module **101**. The lower electro-active lens frame component piece **103** also contains a receptacle **105** for electrical conductors connecting an electro-active lens to the module. The electrical conductors may conduct for example, via a set of conductive wires or a flex circuit. A manual touch switch **106** extends up though the upper electro-active lens frame component piece **102**. In some embodiments, the battery or other electronic components may be accessed via a lower module receptacle cover **107**. The lower module receptacle cover **107** may be threaded and thereby opened and closed with a small screw driver. Screws **109** are used for attaching the upper and the lower electro-active lens frame component pieces together to form an electronic frame piece. The electronic frame piece may be attached to a frame temple **110** with a temple screw **108**, and bonded or otherwise attached to the edge of the eye-wire **111** to complete half of the frame. In a similar manner, the corresponding other half of the frame can be assembled.

[0075] FIGS. **2A-2C** illustrate another embodiment of the present invention wherein the electronic frame contains an electronic module **201**. The module is more particularly illustrated as a cylinder with a block section attached to the back of the cylinder in FIG. **2C**. In some embodiments, the cylinder portion of the module may contain both the power source and the drive circuit. The block portion may contain a sensing mechanism. For example, a tilt switch may be used as a type of sensing mechanism. The electronic module **201** is housed between an upper electro-active lens frame component piece **202** and a lower electro-active lens frame component piece **203** that contains a receptacle **204** for the module **201**. The lower electro-active lens frame component piece **103** also contains a receptacle **205** for electrical conductors connecting electro-active lens to the module. The electrical conductors may conduct for example, via a set of conductive wires or a flex circuit. A manual touch switch **206** extends up though the upper electro-active lens frame component piece **202**. In some embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **207**, which may threaded on the sides and opened and closed with a small screw driver. Screws **209** are used for attaching upper and lower electro-active lens frame component pieces together. The electronic frame piece may be attached to a frame temple **210** with a temple screw **208**, and bonded or otherwise attached to the edge of the eye-wire **111** to complete half of the frame. In a similar manner, the corresponding other half of the frame can be assembled.

[0076] FIGS. **1** and **2** illustrate two possible ways of configuring the electronics to fit them neatly into the frame. Although a cylinder and block arrangement have been spe-

cifically illustrated, other dimensional shapes may alternatively be used to form the module that will be preferably placed in a cavity and perhaps molded therein to form an electronic frame component that is hermetically sealed to prevent water from contacting the electronics.

[0077] FIGS. **3**A-3D illustrate another inventive embodiment wherein the electronic frame contains a electronic module **301**. The module is particularly illustrated as a cylinder with a block portion which is, in turn, attached to the back of the cylinder. As with the module of the previous figures, the module may contain a wide variety of similar electronic components and features. The electronic module **301** is housed between a front electro-active lens frame component piece **302** and a back electro-active lens frame component piece **303**. Together, these pieces form a receptacle **304** for the electronics module **301**. The front electro-active lens frame component piece **302** also contains a receptacle **305** for electrical conductors connecting electro-active lens to electronics module via way a set of conductive wires or a flex circuit. A manual touch switch **306** extends up though the assembly formed by the front and back electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **307**. The electronic frame piece is attached to a frame temple **310** with a temple screw **308**. In this embodiment, the electronic frame piece is shown as attached to the frame temple **310** near the edge of the edge of electro-active spectacle lens **311**. A threaded rod **313** is positioned through the front convex surface **312** of electro-active spectacle lens for the rimless mounting of the assembled front and back electro-active lens frame component pieces to an electro-active lens.

[0078] FIGS. **4**A-4B illustrate another embodiment of the present invention wherein the frame has an electronic module **401**. The module is illustrated as a cylinder with a block portion attached to the back of the cylinder. As referred to in other embodiments disclosed herein, the module has a cylinder portion and a block portion and may contain a wide variety of similar electronic components and features. The electronic module **401** is housed between a front electro-active lens frame component piece **402** and a back electro-active lens frame component piece **403** that together form a receptacle **404** for the electronics module **401**. The front electro-active lens frame component piece **302** also contains a receptacle **405** for electrical conductors connecting an electro-active lens to the module via way of set of conductive rods or pins. A manual touch switch **406** extends up though the assembly formed by the front and back electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **407**. The electronic frame piece is attached to a frame temple **410** with a temple screw **408**. In this embodiment, the electronic frame piece is shown as attached to the frame temple **410** near the edge of the edge of electro-active spectacle lens **411**. Threaded and electrically conductive rods **413** and **414** are positioned through their respective front convex surfaces the of electro-active lens for rimless mounting of the assembled front and back electro-active lens frame component pieces to the electro-active lens. Application of a first voltage to the electro-active lens through rod **413** and a second voltage through **414** to the respective edges of the electro-active lens is thereby accomplished.

[0079] FIGS. **5**A-5C illustrate another embodiment of the present invention. In this embodiment, the electronic frame contains a electronic module **501**. The module has a cylinder portion and a block portion as before described. The module **501** is housed between a front electro-active lens frame component piece **502** and a back electro-active lens frame component piece **503** that together form a receptacle **504** for the module **501**. The front electro-active lens frame component piece **502** also contains a receptacle **505** for electrical conductors connecting electro-active lens to electronics module via way of set of conductive pins or rods. A manual touch switch **506** extends up though the front electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **507**, which may be threaded on the sides and opened and closed with a small screw driver. Screws **409** are used for attaching front and back electro-active lens frame component pieces together. The electronic frame piece is attached to a frame temple **510** with a temple screw **508**. In this embodiment the frame piece is attached to the frame temple **510** near the edge of the edge of electro-active spectacle lens **511**. Threaded and electrically conductive rods **513** and **514** are positioned through their respective front convex surfaces the of electro-active lens for rimless mounting of the assembled front and back electro-active lens frame component pieces to the electro-active lens. Application of a first voltage to the electro-active lens through rod **513** and a second voltage through **514** to the respective edges of the electro-active lens is thereby accomplished.

[0080] FIG. **6** illustrates an embodiment of a fully assembled electro-active frame. This frame is constructed from an upper electro-active lens frame component piece **602** and a lower electro active frame component piece **603**. A manual touch switch **606** is shown extending from the upper electro-active lens frame component piece **602**. Two temples **610** are attached the combinations of the upper and lower electro-active lens frame component pieces with temple screws **608**. The temple assemblies are then mounted to the eye wires **611** of the front of the frame that contains the electro-active lenses **612**.

[0081] FIG. **7** illustrates another embodiment of a fully assembled electro-active frame. This frame is constructed from a front electro-active lens frame component piece **702** and a back electro active frame component piece **703**. A manual touch switch **706** is shown extending from the front electro-active lens frame component piece **702**. Two temples **710** are attached the combinations of the upper and lower electro-active lens frame component pieces with temple screws **708**. The temple assemblies are then mounted to directly to the electro-active lenses **712** in a rimless fashion by one of the methods described earlier.

[0082] FIG. **8**A illustrates another embodiment of a fully assembled electro-active frame having a hinged temple. This frame is constructed from a front electro-active lens frame component piece **802** and a back electro active frame component piece **803**. A manual touch switch **806** is shown extending from the front electro-active lens frame component piece **802**. Two temples **810** are attached to the combinations of the upper and lower electro-active lens frame component pieces by a hinge with temple screws **808**. The temple assemblies are then mounted to directly to the electro-active lenses **812** in a rimless fashion by one of the methods described earlier.

[0083] FIG. **8**B illustrates an embodiment similar to the embodiment of FIG. **8**A, but for having a hingless temple. This frame is constructed from a front electro-active lens frame component piece **802** and a back electro active frame component piece **803**. A manual touch switch **806** is shown extending from the front electro-active lens frame component piece **802**. Two temples **810** are directly attached to the combinations of the upper and lower electro-active lens frame component pieces with temple screws **808**. The temple assemblies are then mounted to directly to the electro-active lenses **812** in a rimless fashion by one of the methods described earlier.

[0084] FIG. **9**A illustrates a top view of a electro-active spectacle lenses and rimmed frame. The rimmed frame can be made of zyle, metal, or any combination thereof. Both right front spatial void **910** and left frame front spatial void **920** is shown. Within either or both of these voids, a module may be placed. As particularly shown in FIG. **9**A, modules **930** and **940** are placed on the frame and attached to the frame stems **970** and **980** with temple screws **950** and **960**. The modules are then connected to the eye wires **994** and **995** and are connected to the nose bridge **930**. The eye wires support the electro-active lenses **996** and **998**.

[0085] FIG. **9**B illustrates an embodiment of the electro-active spectacle lenses and frame as similar to that shown in FIG. **9**A but in a rimless style of lens mounting. Rimless right spatial void **910** and rimless left spatial void **920** are shown.

[0086] FIG. **9**C depicts the embodiment of FIG. **9**A worn on the head of a wearer. The spatial voids created by the space between the joint of the frame and temple on the one hand, and the curve of the wearer's head, on the other is clearly shown.

[0087] FIG. **10** illustrates an electronic module **1000** of another embodiment of the present invention. The module includes a flex circuit **1010** with two conductive buses **1020** and **1030** for making electrical contact to the front surface of an electro-active lens. The module includes a drive circuit **1040** placed above a rechargeable battery **1050**. Below the battery is a recharging coil **1060**. The charging coil is used to inductively recharge the battery without direct contact. In this way, the module may be hermetically sealed while still allowing the battery to be recharged without breaking a moisture resistant seal. A tilt sensor **1070** is also attached to the electronic module. A manual switch **1080** is attached to the top of the electronic module and is integrated with a sealing diaphragm **1090**. This module is sealed with an epoxy, silicone, or similar water resistant material to prevent water from contacting the electronic components. This module is shaped to fit into a universal frame electronic component as illustrated in FIG. **11**.

[0088] In FIG. **11**, a universal electronic frame component **1100** is shown. The universal electronic frame component comprises a housing **1110** for holding the electronic module described in FIG. **10**. A set of thread hinge bolt **1120** and **1130** are mounted on the housing for accommodating a wide variety of frame stem styles to be attached to the universal electronic frame component. The top of the housing **1110** has an aperture to allow a manual switch **1140** to extend outward so as to be accessed by the wearer. Extending out of an opening in the housing are two electrical contacts **1150** and **1160** from the buses described in FIG. **10**. Near these contact points, there is a through hole **1170** to allow a mounting pin to pass through the front of the universal electronic frame component for attaching to an electro-active lens.

[0089] The module **1200**, as illustrated schematically FIG. **12**A and in cross section in FIG. **12**B, contains a battery **1230** for powering an electro-active lens and related drive circuitry, a printed circuit board **1220** with drive and control electronics, and a switch **1210**. The module may also contain a membrane switch to allow for manual control of the electro-active lens.

[0090] FIG. **12**C illustrates the module **1200** placed in an eyeglass frame **1250**. The frame has a frame stem section **1240** near the front of the frame but also well in front of a frame hinge **1260** that connects a stem **1280** to the front of the frame. The module is preferably placed behind the frame stem section, provided that the frame is not of a full rimless design. In the event of a full rimless design, the inventive electronic module or modules would fit within or near the space (right spatial void and left spatial void) anterior to the hinge and would then attach to the lens. In certain other inventive embodiments where there is no hinge (hinge-less temples) and eyeglass frames that have a continuous temple that attaches directly to the frame front or directly to the lens, the module would preferably be located within or near the space (right spatial void and left spatial void). In fact, the module can be located anywhere within these two spatial voids.

[0091] Although in most embodiments of the invention, the modules are preferably located interior to that of the frame front or temple and closer to the wearer, there are other inventive embodiments where the module may be located on the side of the frame front, on the temple farthest away from the wearer, on both the inside of the temple closest to the wearer, on the outside of the temple away from the wearer, located within the temple, or any combination thereof.

[0092] When a hinge-less temple is used, the module can be located on or in the temple end piece behind the ear of the wearer. Alternatively, the module may be split such that one module is located behind the ear and another module is located within the right or left temple spatial void that is common to a side of the wearer's head.

[0093] By sizing the module to be no higher than the width of the front of the frame stem section **1240**, the module is completely undetectable by an observer. Power is preferably provided to the lens via a two conductor flex circuit **1270** extending from the module through the frame stem **1240**.

[0094] In some embodiments in which a hinge-less temple is used the hinge-less temple may be made of titanium which is conductive to electrical current. In this case, the titanium may be used as one of the electrical leads. Another lead may be affixed onto or into the frame. A very thin conductor may be adhesively applied to the inside of the temple and sealed by way of a lacquer or polymer that is cured over the thin conductor. In this embodiment, since the temple is hinge-less, the electronics can be located anywhere along or in said temple. The temple itself becomes, in part, a conductor of electrical current from the module or modules to where the hinge-less temple connects to either the lens or to the front of the eyeglass frame.

[0095] FIGS. **13**A and **13**B illustrate another embodiment of the present invention. This embodiment has a module **1240** containing two batteries **1220** and **1230**. In this embodiment, the height of the module may be too large to accommodate the printed circuit board that is used to drive the electro-active lenses. In such cases, a second module will be required to provide for the space required for the printed circuit board.

[0096] FIG. **13**C illustrates a module **1370** that combines **1350** and **1300**. The modules **1350** and **1300** may be electrically connected to each other via means of a flex circuit connector, or other means known in the art.

[0097] FIG. **13**D illustrates the combined module **1370** placed in the frame **1250** near the front of the frame but behind the frame stem section **1240** of the frame. This arrangement of the electronics in the frame allows for a cosmetically acceptable placement of the electronics and battery that is needed for powering an electro-active lens.

[0098] The module may further include one or more of the following: a manual switch (for example, a touch button, photo-detector, motion detector, capacitive touch sensor), a controller and/or micro-processor, a power source (for example, a small battery), a sensor (for example, one or more miniature or micro tilt switches, accelerometer, micro gyro, range finder, view detector, imager), an antenna, a transmitter, a transceiver or a receiver. The module preferably houses any of the aforementioned electrical components in a substantially water-proof and wear resistant/moisture resistant environment and is preferably hermetically sealed. In the event of a malfunction of one or more of the electronic components housed within the module, the module can be replaced without having to repurchase a complete pair of new electronic eyewear (lenses and frames) or just the frames. It should be pointed out that in certain applications, a single inventive electronic module may be sufficient, and in others, two or more modules may be needed. The embodiments described in FIGS. **12** and **13** allow for modification of any number of existing frames that otherwise were not originally designed to support electronics for driving electro-active lenses.

[0099] FIG. **14** illustrates one possible electrical contact into the lens from the frame. Pins or bolts **1410** and **1420** provide electrical power from the drive circuit into the lens **1400**.

[0100] FIGS. **15**A through 15C illustrate a method of controlling the electro-active lens using a tilt switch that may be contained in the module. The tilt switch should preferably have a wide angle for making contact and a smaller angle for breaking contact. In particular, FIG. **15**A illustrates the wearer looking on a straight level ahead substantially to the horizon. In this position, the lens would be preferably switched off. As wearer lowers his head passed angle α, the electro-active lens would be deliberately turned off. In this illustration, the angle α may be a large angle, perhaps as large as 45 degrees or more. In preferred embodiments, angle α may be in a range of from about 25 to about 85 degrees, with a most preferred range of 35 to 75 degrees. When the switch has been activated, because the wearer has deliberately moved his head to past angle α, the electro-active lens would remain in its on state until the person raises his head above the angle β, as illustrated in FIG. **15**C. In preferred embodiments, angle β may be in a range of from about 0 to about 45 degrees with a most preferred range of 0 to 25 degrees. By having a tilt switch of an electro-active lens operate in this manner, a person can control his lens without having to manually touch a switch on the frame.

[0101] Although the particular embodiments shown and described above will prove to be useful in many applications in the ophthalmic and the electronic eyewear art to which the present invention pertains, further modifications of the present invention will occur to persons skilled in the art. All such modifications are deemed to be within the scope and spirit of the present invention as defined by the appended claims.

What is claimed is:

1) An eyeglass frame comprising an electronic module, wherein said module is located within a spatial void of the eyeglass frame anterior to the hinge.

2) The eyeglass frame of claim **1**, wherein the eyeglass frame is adapted for housing an electro-active lens and said module contains electronics and a power source for driving the electro-active lens.

3) An electronic module that contains electronics and a power source for driving an electro-active lens, wherein said module is designed to fit within a spatial void of an eyeglass frame directly connected to the electro-active lens without an intervening hinge.

4) A method for controlling an electro-active lens wherein said lens is activated when the wearer's head moves to a first position angled steeply down relative to the horizon, and wherein said lens, once activated, remains on until such a time as the wearer's head moves to a second position at an angle slightly above the horizon.

5) An electronic module attached to a rimless eyeglass frame located within a spatial void, wherein the frame has an electro-active lens to which the module is directly connected.

6) The method of claim **4**, wherein said module is moisture resistant.

7) The module of claim **5**, wherein said module is moisture resistant.

8) The method of claim **4**, wherein said module houses a power source.

9) The module of claim **5**, wherein said module houses a power source.

10) The method of claim **4**, wherein said module houses a switch.

11) The module of claim **5**, wherein said module houses a switch.

12) The frame of claim **1**, wherein said module is sealed from the outside environment.

13) The frame of claim **1**, wherein said module is affixed to a temple.

14) The module of claim **3**, wherein said module is affixed to one of the group comprising rimless, rimmed, and semi-rimless frames.

15) The module of claim **14**, wherein the frame comprises one of the group comprising zyle, metal, a combination of zyle and metal.

16) The frame of claim **1**, wherein said module houses at least one of the group comprising an antenna, a receiver, a transmitter, a transceiver, a sensor, a range finder, a power source, a micro-processor, and a controller.

17) The module of claim **3**, wherein said frame is a hinge-less frame.

18) The method of claim **10**, wherein said switch is a tilt switch.

19) The module of claim **11**, wherein said switch is an automatic switch.

20) The method of claim **10**, wherein said switch is a automatic switch.

21) The module of claim **11**, wherein said switch is a manual switch.

22) The method of claim **10**, wherein said switch is a manual switch.

23) The module of claim **19**, wherein said switch is a tilt switch.

24) The method of claim **20**, wherein said switch is a tilt switch.

25) The frame of claim **16**, further comprising a sensor, wherein said controller provides for timing feed back from said sensor, wherein said controller turns off the electronic power if said sensor does not indicate movement within a set period of time.

26) The frame of claim **25**, wherein said sensor is a tilt switch

27) The frame of claim **25**, wherein said sensor is a range finder.

28) The frame of claim **16**, further comprising a sensor, wherein said controller provides for a timing delay after receiving a signal from said sensor.

29) The frame of claim **28**, wherein said sensor is a tilt switch.

30) The frame of claim **28**, wherein said sensor is a range finder.

31) An eyeglass frame, comprising:

a) a hinged temple connected to the frame; and

b) a universal eyeglass frame housing positioned anterior to the hinge, wherein said housing contains an electronic module.

* * * * *

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Lafferty, Patrick M.
Kilpatrick Townsend & Stockton LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
ETATS-UNIS D'AMERIQUE

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 91904-12910P	Date of mailing *(day/month/year)* 29 February 2012 (29-02-2012) **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US2011/061495	International filing date *(day/month/year)* 18 November 2011 (18-11-2011)
Applicant PIXELOPTICS, INC.	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the International Searching Authority European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	Authorized officer CALAFUS, Florentina Tel: +49 (0)89 2399-8694

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
91904-12910P		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2011/061495	18/11/2011	19/11/2010
Applicant		
PIXELOPTICS, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 28
      [X] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/061495

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02C11/06 G02C7/08
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)
G02C

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/080999 A1 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; WANG YONGPING [US]; BLUM) 15 July 2010 (2010-07-15)	1-11, 15-22
Y	figures 6,7,11,12 paragraphs [0045], [0072], [0073], [0078], [0080], [0082], [0084], [0090]	12-14
X	US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)	1-11, 15-22
Y	figure 5B paragraphs [0067], [0079], [0094]	12-14
X	US 5 463 428 A (LIPTON LENNY [US] ET AL) 31 October 1995 (1995-10-31)	1-11, 15-22
Y	figure 1 column 4, line 50	12-14

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 February 2012	29/02/2012

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	de Lajarte, Gilles

3

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/316420 A1 (AGAZAROVA MAZAL [US]) 25 December 2008 (2008-12-25)	12-14
A	figure 1	1-11, 15-22

Y	EP 1 647 854 A1 (SUNSHINE OPTICAL COMPANY LTD [CN]) 19 April 2006 (2006-04-19)	12-14
A	figure 7A paragraphs [0011] - [0013]	1-11, 15-22

Y	US 5 764 338 A (MACK CAROL ANNE [US]) 9 June 1998 (1998-06-09)	12-14
A	figure 8a	1-11, 15-22

3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/061495

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010080999 A1	15-07-2010	AU 2010203515 A1	11-08-2011
		CA 2749366 A1	15-07-2010
		CN 102326116 A	18-01-2012
		EP 2386071 A1	16-11-2011
		KR 20110126612 A	23-11-2011
		SG 172914 A1	29-08-2011
		US 2010177277 A1	15-07-2010
		WO 2010080999 A1	15-07-2010
US 2008273166 A1	06-11-2008	AR 066226 A1	05-08-2009
		TW 200921179 A	16-05-2009
		US 2008273166 A1	06-11-2008
		US 2010271588 A1	28-10-2010
US 5463428 A	31-10-1995	US 5463428 A	31-10-1995
		WO 9522074 A1	17-08-1995
US 2008316420 A1	25-12-2008	NONE	
EP 1647854 A1	19-04-2006	CN 1760718 A	19-04-2006
		EP 1647854 A1	19-04-2006
		JP 2006113549 A	27-04-2006
US 5764338 A	09-06-1998	NONE	

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2011/061495	18.11.2011	19.11.2010

International Patent Classification (IPC) or both national classification and IPC
INV. G02C11/06 G02C7/08

Applicant
PIXELOPTICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	de Lajarte, Gilles Telephone No. +49 89 2399-2697

Form PCT/ISA/237 (Cover Sheet) (July 2009)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	12-14
	No:	Claims	1-11, 15-22
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-22
Industrial applicability (IA)	Yes:	Claims	1-22
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII

Certain observations on the international application

1 Clarity

Claim 1 is not clear for the following reasons:

It is not clear what is the limitation of the term "lens housing" in the case of a rimless spectacles. It is not clear which limitation is meant by the term "supported" other than "in contact with". It is not clear whether the façade is only a decorative component or whether it is a necessary part of the frame (e.g. whether the façade is required to fulfil the function of the bridge, holding both lenses together).

It appears at first sight (see also [0289] in the description of the application) that the term "façade" means a decorative element placed in the front part of an existing structure (rim, semi-rimless or rimless structure). This, however, **contradicts** the one example (Fig 28, 29) given in the application, whereby the façade has a structural function of holding the two lenses together ("bridge" function).

Claim 1 lacks the essential features "the façade is a separate component that can attach to a lens housing or the temples" and "the façade is detachable and re-attachable"such that "the user can change the appearance of the electronic frame without changing or damaging the the underlying frames or components therein" ([0291]; claim 19).

Furthermore, claim 1 lacks the essential feature that the façade hides or conceals electrical portions of the conductive path to electro-active lenses ([0297]).

It is assumed here that the claims are related only to paragraphs [0288-0314] and to Fig 28, 29.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 WO 2010/080999 A1 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; WANG YONGPING [US]; BLUM) 15 July 2010 (2010-07-15)

D2 US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)

D3 US 5 463 428 A (LIPTON LENNY [US] ET AL) 31 October 1995 (1995-10-31)

D4 US 2008/316420 A1 (AGAZAROVA MAZAL [US]) 25 December 2008 (2008-12-25)

D5 EP 1 647 854 A1 (SUNSHINE OPTICAL COMPANY LTD [CN]) 19 April 2006 (2006-04-19)

D6 US 5 764 338 A (MACK CAROL ANNE [US]) 9 June 1998 (1998-06-09)

2 Independent claim 1

The present application does not meet the criteria of Article 33(2) PCT, because the subject-matter of independent claim 1 is not novel.

D1 discloses a first device comprising eyeglasses ([0071-0073]), the eyeglasses further comprising:

a lens housing (Fig 7, (708, 710));

a first temple and a second temple coupled to the lens housing;

a first and a second lens supported by the lens housing (Fig 3, (102, 202));

a facade that covers the lens housing (Fig 7, 8, (702)); and

an electronic component (Fig 7, (202));

wherein at least one conductive path is provided from the electronic component to the first lens having a portion that runs through the lens housing ([0073]).

Thus, the device of D1 has all the features of claim 1, its subject matter being therefore not novel.

Furthermore, the spectacles of D2 (Fig 5B, lens housing (503, 513, 514), façade (502), electronic component (507)), D3 (Fig 1, lens housing (14, 16), façade (10); electronic component (claim 1)) also each anticipates the subject matter of claim 1 (see corresponding passages in the search report).

Alternatively, faced with the problem of hiding the electrical connection to the lenses of electro-active spectacles of D1 or D2, the person skilled in the art would consider adding the façade of D4, Fig 1 or D5, Fig 7A, [0011-0013] or even D6, Fig 8a which covers the lens housing (as in the whole front frame) without requiring an inventive activity. He would do so based on purely aesthetical reasons.

2.1 Dependent claims 2-22

Dependent claims 2-22 do not appear to contain any additional features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2, 3) PCT), the reasons being as follows:

- claim 2: electronics module (D1, [0048]; D2, [0079]; D3, claim 7),

- claim 3: electronic module coupled to temple (D1, ([0073]; alternative solution for D2; implicit from D3, claim 7 or Fig 3A),

- claim 4: electronic component coupled to lens housing (D1, Fig 11, 12; D2, Fig 5B; D3, Fig 6),

- claim 5: one conductive path from electronic component to second lens (D1-D3, see corresponding figures),

- claim 6: same feature as in claim 1,

- claim 7: façade covers the entire lens housing (D1, Fig 7; D2, Fig 5B; D3, Fig 1),

- claim 8: lens housing comprises rimless or semi-rimless spectacles frame (D1, [0050]; D2, Fig 5B),

- claim 9: lens housing with screws or rim wire (D1, Fig 7; D2, Fig 5B),

- claim 10: conductive path with conductive wire (D1, [0082]); D2, Fig 5B),

- claim 11: façade provides appearance of rimmed spectacles frame (D1, Fig 7; D3, Fig 1),

- claim 12: lens housing rimless spectacles frame and façade with appearance semi-rimless or full rimmed spectacles (not inventive in the light of D1, Fig 9 or D2, Fig 5B combined with any removable façade such as in D4, Fig 1 or D5, Fig 7A, [0011-0013]) or even D6, Fig 8a),

- claim 13: lens housing semi rimless, façade with appearance of full rimmed frame (D1, [0078] or D2, [0067], claim 14) combined with one of D4-D6),

- claim 14: lens housing full rimmed, façade full rimed (D1, [0080] or D2, [0090] combined with one of D4-D6),

- claim 15: the façade masks a portion of conductive path (D1, Fig 7; D2, Fig 5B combined with one of D4-D6),

- claim 16: conductive path with wire, rubber, portion of lens housing (D1, [0045]; D2, Fig 4B, (413, 414); D3, Col 4, L 50),

- claim 17: façade coupled to lens housing with adhesive material (D1, [0090]; D2, [0094]),

- claim 18: façade coupled to lens housing with screw (D2, Fig 5B, (509)),

- claim 19: façade removably coupled to lens housing (D1, Fig 7; D2, Fig 5B; D3, Fig 1),

- claim 20: lens housing can be coupled to different facades (implicit from D1, [0072]; not inventive from D2 or D3, as providing different façades, e.g. different colours for a front frame is standard, and would not require an inventive activity for the person skilled in the art),

- claim 21: façade with metal, lens housing with plastic (D1, [0084], whereby the lens housing is merely the part directly connecting to the lens and providing insulation, e.g. most likely with plastic; implicit from D3),

- claim 22: façade with plastic, lens housing with metal (at least implicit from D1-D3 since metal will most likely be included in any electrical connections to the lens, and the front of a spectacles frame is normally in plastic).

Possible steps after receipt of the international search report (ISR) and written opinion of the International Searching Authority (WO-ISA)

General information	For all international applications filed on or after 01/01/2004 the competent ISA will establish an ISR. It is accompanied by the WO-ISA. Unlike the former written opinion of the IPEA (Rule 66.2 PCT), the WO-ISA is not meant to be responded to, but to be taken into consideration for further procedural steps. This document explains about the possibilities.
Amending claims under Art. 19 PCT	Within 2 months after the date of mailing of the ISR and the WO-ISA the applicant may file amended claims under Art. 19 PCT directly with the International Bureau of WIPO. The PCT reform of 2004 did not change this procedure. For further information please see Rule 46 PCT as well as form PCT/ISA/220 and the corresponding Notes to form PCT/ISA/220.
Filing a demand for international preliminary examination	In principle, the WO-ISA will be considered as the written opinion of the IPEA. This should, in many cases, make it unnecessary to file a demand for international preliminary examination. If the applicant nevertheless wishes to file a demand this must be done before expiry of 3 months after the date of mailing of the ISR/WO-ISA or 22 months after priority date, whichever expires later (Rule 54bis PCT). Amendments under Art. 34 PCT can be filed with the IPEA as before, normally at the same time as filing the demand (Rule 66.1 (b) PCT). If a demand for international preliminary examination is filed and no comments/amendments have been received the WO-ISA will be transformed by the IPEA into an IPRP (International Preliminary Report on Patentability) which would merely reflect the content of the WO-ISA. The demand can still be withdrawn (Art. 37 PCT).
Filing informal comments	After receipt of the ISR/WO-ISA the applicant may file informal comments on the WO-ISA directly with the International Bureau of WIPO. These will be communicated to the designated Offices together with the IPRP (International Preliminary Report on Patentability) at 30 months from the priority date. Please also refer to the next box.
End of the international phase	At the end of the international phase the International Bureau of WIPO will transform the WO-ISA or, if a demand was filed, the written opinion of the IPEA into the IPRP, which will then be transmitted together with possible informal comments to the designated Offices. The IPRP replaces the former IPER (international preliminary examination report).
Relevant PCT Rules and more information	Rule 43 PCT, Rule 43bis PCT, Rule 44 PCT, Rule 44bis PCT, PCT Newsletter 12/2003, OJ 11/2003, OJ 12/2003

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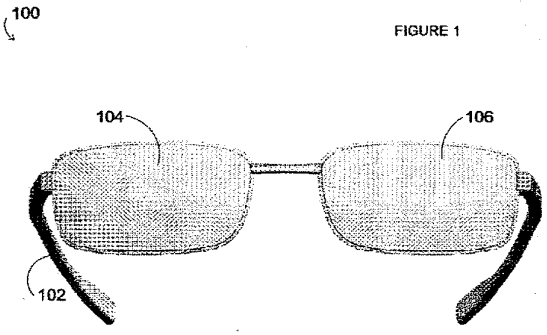


FIGURE 1

(57) Abstract: Aspects of the present invention provide electronics for controlling and synchronizing operation of electro-active lenses regardless of frame type, size or style. The controlling electronics can be contained within one or more electronic modules positioned within the frame temples and can be removable and reprogrammable and can include inductive charge regions. Conductive links between electronic modules and / or between left and right sides of the electro-active spectacles can include left and right upper and lower rim portions of the frame, the bridge, conductive layers of the electro-active lenses, the upper and lower grooves of the electro-active lenses, and / or wires embedded within any portion of the frame. Aspects of the present invention also provide chargers for recharging electro-active spectacles of any size, shape or style using adjustable inductive charging cradles to inductively charge electro-active spectacles of the present invention.

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ELECTRO-ACTIVE SPECTACLES AND ASSOCIATED ELECTRONICS

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from and incorporates by reference in their entirety the following provisional applications:

U.S. Appl. No. 61/143,459, filed on January 9, 2009;

U.S. Appl. No. 61/152,140, filed on February 12, 2009;

U.S. Appl. No. 61/157,579, filed on March 5, 2009;

U.S. Appl. No. 61/157,580, filed on March 5, 2009;

U.S. Appl. No. 61/170,222, filed on April 17, 2009;

U.S. Appl. No. 61/242,406, filed on September 15, 2009; and

U.S. Appl. No. 61/252,770, filed on October 19, 2009.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention generally relates to electro-active spectacles. More specifically, the present invention provides electronics for operating and synchronizing electro-active lenses compatible with any frame type, style or size, as well as associated charging devices.

Background Art

[0003] Electro-active lenses generally provide a region of adjustable optical power by changing the refractive index of an electro-active material (e.g., a liquid crystal material) by the application and removal of electrical power. Conventional electro-active lenses and spectacles fail to provide cosmetically acceptable and practical mechanisms for (a) controlling and synchronizing

operation of the electro-active lenses, (b) providing electrical connectivity between controlling electronics and the electro-active lenses, and (c) recharging the electro-active lenses. Further, conventional devices and techniques for addressing these problems are limited in that they are not generally compatible with any frame size, type or style.

[0004] Accordingly, what is needed are electronics for controlling and synchronizing operation of electro-active lenses that can be housed in any type of frame in a cosmetically acceptable and easily implementable manner. Further, power charger devices for recharging electro-active lenses of any frame size, shape or style are also needed.

BRIEF DESCRIPTION OF THE DRAWINGS/FIGURES

[0005] FIG. 1 illustrates electro-active spectacles in accordance with an aspect of the present invention.

[0006] FIG. 2 illustrates a side view of the electro-active spectacles depicted in FIG. 1 in accordance with an aspect of the present invention.

[0007] FIG. 3 illustrates an exemplary configuration of electrical components of the electro-active spectacles in accordance with an aspect of the present invention.

[0008] FIG. 4 illustrates an exemplary configuration of electrical connectivity between a battery and an electronic module depicted in FIG. 3 in accordance with an aspect of the present invention.

[0009] FIG. 5 illustrates an electronic module in accordance with an aspect of the present invention.

[0010] FIG. 6 illustrates an electro-active lens in accordance with an aspect of the present invention.

[0011] FIG. 7 illustrates a portion of a frame in accordance with an aspect of the present invention.

[0012] FIG. 8 illustrates an exploded view of the frame depicted in FIG. 7 in accordance with an aspect of the present invention.

[0013] FIG. 9 illustrates a portion of electro-active spectacles in accordance with an aspect of the present invention.

[0014] FIG. 10 illustrates a front a view of electro-active spectacles in accordance with an aspect of the present invention.

[0015] FIG. 11 illustrates a portion of a right temple of electro-active spectacles in accordance with an aspect of the present invention.

[0016] FIG. 12 illustrates a portion of a right temple of electro-active spectacles in accordance with an aspect of the present invention.

[0017] FIG. 13 illustrates a representative block diagram of electro-active spectacles in accordance with an aspect of the present invention.

[0018] FIG. 14 illustrates a slim line charger in accordance with an aspect of the present invention.

[0019] FIG. 15 illustrates a side view of the slim line charger depicted in FIG. 14 in accordance with an aspect of the present invention.

[0020] FIG. 16 illustrates the slim line charger of FIGs. 14 and 15 in a closed positioned in accordance with an aspect of the present invention.

[0021] FIG. 17 illustrates an electro-active frame in accordance with an aspect of the present invention.

[0022] FIG. 18 illustrates electro-active spectacles in accordance with an aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Aspects of the present invention provide electronics for controlling and synchronizing operation of electro-active lenses. The controlling electronics can be positioned within a variety of frame types, sizes and styles and enable efficient user interaction. The controlling electronics, or a portion thereof, can be contained within an electronic module. The electronic module can be positioned within a frame temple and can be removable and reprogrammable and can include an inductive charge region. Electro-active spectacles of the present invention can use one or more electronic modules. When a single electronic module is used, the electronic module can activate and deactivate each electro-active lens at substantially the same time. If two electronic modules are used, then a first electronic module can synchronize operation of

a second electronic module to ensure coordinated operation of both electro-active lenses.

[0024] Aspects of the present invention provide connectivity between one or more electronic modules and/or between a left-side portion and a right-side portion of electro-active spectacles. Connectivity can vary depending upon frame type. Aspects of the present invention allow electro-active spectacles to include one or more conductive links using left and right upper and lower rim portions of the frame that support the electro-active lenses, the bridge, conductive layers of the electro-active lenses, the upper and lower grooves of the electro-active lenses, wires or other conductive links embedded within any portion of the frame, and/or a wireless connection.

[0025] Aspects of the present invention provide chargers for recharging a power source of electro-active spectacles of any size, shape or style. A slim line charger of the present invention can include a base and arms to support electro-active spectacles of the present invention. The slim line charger can include one or more adjustable inductive charging cradles to inductively charge a power source (e.g., one or more batteries) of electro-active spectacles of the present invention.

[0026] FIG. 1 illustrates electro-active spectacles or eyeglasses 100 in accordance with an aspect of the present invention. The electro-active spectacles 100 shown in FIG. 1 are fully rimmed eyeglasses comprising left and right temples and a frame front (the frame front can comprise left and right eyewires or rims as will be appreciated by one skilled in the pertinent art). Electro-active spectacles and frames of the present invention can be fully rimmed, partially rimmed, or rimless. The electro-active spectacles 100 can include a frame 102, a first electro-active lens 104, and a second electro-active lens 106. The frame 102 can include left and right temple portions, a bridge, and rim portions (e.g., upper and/or lower rim portions) supporting the electro-active lenses 104 and 106. The first and second electro-active lenses 104 and 106 can each be an electro-active lens as described in U.S. Pat. Appl. No. 12/408,973 (hereinafter the '973 application), filed March 23, 2009, entitled "Electro-Active Diffractive Lens and Method for Making the Same," which is

hereby incorporated by reference in its entirety. In general, the first and second electro-active lenses 104 and 106 can be any lens or optic capable of changing, varying or tuning the optical power they each provide with the application of electricity.

[0027] The right temple portion can be considered to be a first temple portion that is positioned adjacent to the first electro-active lens 104. The left temple portion can be considered to be a second temple portion that is positioned adjacent to the second electro-active lens 106. The bridge can be considered to be part of the frame or to be a separate portion of the electro-active spectacles 100 that connects, joins or supports the first and second electro-active lenses 104 and 106.

[0028] The electro-active spectacles 100 can include one or more power sources for powering the first and second electro-active lenses 104 and 106. As an example, each power source can include one or more batteries (e.g., conventional rechargeable batteries and/or solar batteries). The electro-active spectacles 100 can also include electronics that can govern operation of the electro-active lenses 104 and 106. The electronics can comprise one or more control units (e.g., a control unit matched to each electro-active lens) to determine when to activate and when to deactivate the electro-active lenses 104 and 106. The one or more power sources and the electronics of the electro-active spectacles 100 can be housed or contained within any portion of the frame 102. The one or more power sources and the one or more control units of the electro-active spectacles 100 can be grouped together or distributed or dispersed in any manner within or throughout the frame 102.

[0029] In accordance with an aspect of the present invention, the one or more power sources and the one or more control units of the electro-active spectacles 100 can be arranged in a manner that can accommodate a wide variety of frame types and styles. Specifically, an aspect of the present invention enables the one or more power sources and the one or more control units of the electro-active spectacles 100 to be arranged in a manner that can accommodate fully-rimmed, partially rimmed, and rimless frames.

[0030] In accordance with an aspect of the present invention, the operation of the electro-active lenses 104 and 106 can be synchronized. That is, the one or more control units housed in the frame 102 can coordinate the activation and deactivation of the electro-active lenses 104 and 106 such that the electro-active lenses 104 and 106 are activated or deactivated at substantially the same time.

[0031] In accordance with an aspect of the present invention, the one or more control units housed in the frame 102 can automatically operate (e.g., activate and deactivate) the electro-active lenses 104 and 106. As an example, the electro-active lenses 104 and 106 can be activated or deactivated based on a user's head tilt as sensed by the one or more control units. The one or more control units can also enable a user to interact with the electro-active lenses 102 and 104. As an example, a user can manually activate or deactivate the electro-active lenses 104 and 106, override automatic operation of the electro-active lenses 104 and 106, place the electro-active spectacles 100 into a standby mode (in which the electro-active lenses 104 and 106 are neither automatically or manually activated or deactivated), or power off the electro-active spectacles 100.

[0032] The electronics of the electro-active spectacles 100 can include a processor, memory, a power source (e.g., a battery) and a gyroscope or accelerometer. As previously mentioned, these components can be grouped together or can be distributed within different portions of the frame 102. As an example, all or a portion of these components can be grouped together to form a self-contained electronic module. The electro-active spectacles 100 can comprise a single electronic module that governs synchronized operation of both the first and second electro-active lenses 104 and 106. Alternatively, operation of the first electro-active lens 104 can be governed by a first electronic module and operation of the second electro-active lens 106 can be governed by a second electronic module. Under this scenario, the first and second electronic modules can communicate using one or more conductive wires (e.g., embedded within a portion of the frame 102), one or more conductive portions of the frame 102 (e.g., conductive metal layers or

conductive cores encapsulated by non-conductive material), one or more conductive layers of the electro-active lenses 104 and 106, an optical link, and/or via a wireless communications link. Communication between the first and second electronic modules can facilitate coordinated operation of the first and second electro-active lenses 104 and 106.

[0033] FIG. 2 illustrates a side view of the electro-active spectacles 100 depicted in FIG. 1. As shown in FIG. 2, the electro-active spectacles 100 can comprise an electronic module (or control unit) 202. As described above, the electronic module 202 can include various electronics components. The electronic module 202 can be positioned near the front temple of the frame 102. The electronic module 202 can be positioned within the frame 102 (e.g., in an area or cavity of the frame 102) and can be removable and replaceable. Alternatively, the electronic module can be built into the frame 102 and form a part of the frame 102. The electronic module 202 can be located on an outer portion of a temple of the frame 102 (further from a wearer) or can be located on an inner portion of the temple of the frame 102 (closer to the wearer). The electronic module 202 can be positioned on a left temple or a right temple of the frame 102 (i.e., on either side of the frame 102). The electronic module 202, when inserted into the temple of the frame 102, can be flush with the other portions of the frame 102. All or a portion of the electronic components used to operate the electro-active lens 104 can be contained within the electronic module 202.

[0034] The electronic module 202 can also control operation (or at least ensure synchronized operation) of the electro-active lens 106. Electrical connections between the electronic module 202 and one or more of the electro-active lenses 104 and 106 can be routed through the frame 102 and/or the electro-active lenses 104 and 106 as will be described in more detail below. According to an aspect of the present invention, connectivity between the electronic module 202 and one or more of the electro-active lenses 104 and 106 can be accomplished by using a single conductive wire.

[0035] According to an aspect of the present invention, a first electrical connection (e.g., comprising one or more conductive links or wires) can be

used to provide connectivity between one or more power sources of the electro-active spectacles 100 and one or more electronic modules 202 and a second electrical connection (e.g., comprising one or more conductive links or wires) can be used to provide connectivity between the one or more electronic modules 202 and the one or more electro-active lenses (e.g., the electro-active lenses 104 and 106). For example, a battery positioned within the frame 102 can be coupled to an electronic module 202 also positioned within the frame 102 using a first conductive link. A second, distinct conductive link (e.g., electrically isolated from the first conductive link) can be used to couple the electronic module 202 to the electro-active lenses 104 and 106.

[0036] According to an aspect of the present invention, the same conductive link (e.g., comprising one or more electrical wires) can be used to couple the one or more power sources of the electro-active spectacles 100, the one or more electronic modules 202 and the electro-active lenses 104 and 106 as will be appreciated by one skilled in the pertinent art. This can enable a power source to be positioned on one side of the frame 102 (e.g., in a first temple) and an electronic module 202 to be positioned on the other side of the frame 102 (e.g., in a second temple) while using the same conductive link to simultaneously provide power to the electronic module 202 and controlling signals from the electronic module 202 to the electro-active lenses 104 and 106. As a result, the number of conductive links (e.g., embedded wires) positioned within the frame 102 can be minimized.

[0037] FIG. 3 illustrates an exemplary configuration of electrical components of the electro-active spectacles 100. Specifically, FIG. 3 shows a battery 302 located near the end of the frame 102 of the electro-active spectacles 100. A portion of the end of the frame 102 is removed for illustration purposes only. The battery 302 can be a rechargeable battery and can provide power to the electrical components located within the electronic module 202. The battery 302 can provide power to one or more electronic modules of the present invention.

[0038] FIG. 4 illustrates an exemplary configuration of electrical connectivity between the battery 302 depicted in FIG. 3 and the electronic module 202. A

portion of the frame 102 is removed for illustration purposes only. As shown in FIG. 4, conducting wires 402 can couple the battery 302 to the electronic module 202. The conducting wires 402 can be positioned within the frame 102 (e.g., embedded within the frame 102) of the electro-active spectacles 100.

[0039] FIG. 5 illustrates the electronic module 202 in accordance with an aspect of the present invention. The electronic module 202 can contain all or a portion of the electronic components that govern operation of one or more electro-active lenses including a power source (e.g., a rechargeable battery or a solar battery). As shown in FIG. 5, the electronic module 202 can comprise a housing 502, first contacts 504 and second contacts 506. The housing 502 can contain the electrical components of the electronic module 202 – e.g., a processor, memory, power source, and/or a gyroscope/accelerometer.

[0040] The first contacts 504 can provide electrical connectivity between the electrical components of the housing 502 and other portions of one or more associated electro-active lens (e.g., the first electro-active lens 104). The second contacts 506 can provide electrical connectivity to a memory of the electronic module 506. The second contacts 506 can be used, for example, to program or reprogram the electronic module 202 directly. Additional contacts (not illustrated for simplicity), or the first and/or second contacts 504 and 506, can also provide connectivity to a remote battery (e.g., the battery 302 depicted in FIG.s 3 and 4) or to another electronic module or control unit. Alternative or additional contacts (e.g., an antenna) can allow wireless programming of the electronic module 202.

[0041] In general, the electronic module 202 can be positioned anywhere on the frame 102 (e.g., in any portion of the frame 102 having an area or cavity designed to accept insertion of the electronic module 202). The electronic module 202, as shown in FIG. 2, can be located near the front temple of a wide variety of frame types and styles. Specifically, the electronic module 202 can be located within a portion of a frame that is fully rimmed, partially-rimmed, or rimless. The electronic module 202 can be removed and replaced with a new module or can be reprogrammed. As an example, the electronic

module 202 can be initially programmed with a first mode of operation or a first prescription for a user. At a later time, the electronic module 202 can be removed and reprogrammed using the second contacts 506 with a second mode of operation or a second prescription for a user.

[0042] As an alternative to the second contacts 506, the electronic module 202 can be reprogrammed using a wireless communication link such that removal of the electronic module 202 from the frame is not necessary to enable reprogramming. Reprogramming can include changing a specified angle of head tilt for activating or deactivating an associated electro-active lens.

[0043] The electronic module 202 can also include or be coupled to one or more light emitting diodes (LEDs). The one or more LEDs can be used to indicate operating conditions or states of the electro-active spectacles of the present invention including, but not limited to, the power level of the power source of the spectacles.

[0044] A wireless communication link between the electronic module 202 and a remote communication device can, as described above, provide a mechanism for reprogramming the electronic module 202 but can also provide a mechanism for collecting information on the operating status and history of operation of the electro-active spectacles of the present invention. Reprogramming verification (e.g., verifying successful uploaded controlling firmware) and other data collection can be enabled using such a communications link.

[0045] The one or more LEDs of the electronic module 202 can also be used to facilitate communication with a remote device. For example, the one or more LEDs can be opto-coupled to a receiving station to readout electronic module 202 operating parameters and to aid in re-configuration or reprogramming (e.g., verifying uploaded firmware).

[0046] Additionally, a communication link between the electro-active spectacles of the present invention and a remote device can be established using the electro-active lenses themselves. For example, the electro-active lenses of the present invention can be used to transmit a signal to a receiving

station by encoding data with lens "flicker" as will be apparent to one skilled in the pertinent art.

[0047] The electronic module 202 can contain any number of mechanism by which a user can interact with the electronic module 202 to adjust operation of the electro-active spectacles of the present invention. For example, the electronic module 202 can include a switch or device to enable a user to interact with the electronic module 202. The switch or device can be a press button switch, a capacitive switch (e.g., comprising a capacitive sense pad), a toggle switch or other manual switch. The switch or device can enable a user to activate or deactivate the associated electro-active lens or lenses, to override or initiate automatic operation of the associated electro-active lens or lenses, and to select a mode of operation or prescription correction for a user. A capacitive switch can be located on a surface of the electronic module 202 that is exposed or accessible when positioned in the frame 102. Alternatively, or in addition thereto, capacitive sense pads can be deposited or built into the frame 102 that can be coupled to the electronic module 202.

[0048] The electronic module 202 can also include an ability to toggle among modes or be activated or deactivated through voice activation or based on light sensitivity. For example, a user can activate or deactivate the lenses or otherwise adjust operation by issuing or speaking voice commands or instructions. Further, the electronic module 202 can be activated or deactivated or change operating modes based on the amount of light measured or sensed by electronics included in the electronic module 202. For example, in relatively low light, the electronic module 202 can be deactivated automatically (or placed into a standby, non-switchable mode) and can be activated (or switched out of a standby non-switchable mode) when in relatively bright light conditions. Lastly, the electronic module 202 can include electronics to allow remote activation or toggling of operational modes. For example, the electronic module 202 can include electronics to allow remote wireless activation or activation by a switch connected by a wired link from a position remote from the electro-active spectacles of the present invention. Remote activation may be particularly useful for

individuals that are physically challenged (e.g., individuals that cannot move their arms to touch the frame temple with ease).

[0049] All of the mechanism described above can be used by a user to adjust the operation of the electro-active spectacles of the present invention. For example, a user can use one of the mechanisms described above to switch the lens from a first mode to a second mode of operation or between any number of different modes of operation. For example, a first mode of operation can be a standby mode of operation. In a standby mode of operation, the electro-active spectacles of the present invention can be placed into a non-switchable state (such that the electro-active lenses do not automatically activate or deactivate based on a sensed signal received from a tilt sensor, rangefinder or other activation/deactivation sensing device including manual control).

[0050] A second mode of operation can be an active mode of the electro-active spectacles. In the active mode of operation, the electro-active spectacles of the present invention can be placed into a switchable state (such that the electro-active lenses will automatically activate or deactivate based on a sensed signal received from a tilt sensor, rangefinder or other activation/deactivation sensing device or will respond to direct manual control to activate or deactivate).

[0051] The electro-active spectacles of the present invention can also include additional operational states or modes that the user can use (and toggle or transition between them using one of the interaction mechanism described above). For example, the electro-active spectacle of the present invention can include a manual operation state. In a manual operation state, the user can manually direct the electro-active lenses of the present invention to activate or deactivate. Manual direction can be though voice command or the touching or toggling of a switch as described above.

[0052] Another mode of operation can be an on mode. In the on mode or on state, the electro-active spectacles of the present invention can maintain the electro-active lenses of the present invention in an activate state. Accordingly, an off mode can maintain the electro-active lenses of the present invention in a deactivated state.

[0053] The ability to program or reprogram the electronic module 202 enables the electro-active spectacles of the present invention to be customized or re-customized for a particular user. Customizable features of the electro-active spectacles of the present invention include any of the following: head tilt angle at which to active one or more electro-active lenses of the present invention; head title angle at which to deactivate one or more electro-active lenses of the present invention; distance between an object viewed by the user and the user at which to activate or deactivate one or more electro-active lenses of the present invention; number of operational modes (e.g., inclusion or exclusion of operational modes such as standby mode or activation mode or off mode); method of toggling between selected operational modes (e.g., selection of which mechanism described above to use to allow a user to toggle between modes including the order of toggling or states); user prescription (e.g., the optical power provided by the electro-active area of the electro-active lenses of the present invention).

[0054] Any of the customizable features of the electro-active spectacles of the present invention can be programmed into the electronic module 202 directly (e.g., using a flash programmer or direct wired link) or indirectly (e.g., using a wireless link such as an infrared link or RF link).

[0055] The electronic module 202 can include an inductive charge area. That is, the electronic module 202 can include electronics for enabling a power source of the electronic module 202 (or a power source coupled to the electronic module 202) to be recharged inductively by an inductive charging device. The inductive charge area can include inductive charge coils. According to an aspect of the present invention, the inductive charge coils can function as an antenna to communicate with a remote communication device. Communication with a remote communication device can enable remote wireless programming of the electronic module 202 or can enable communication between two or more electronic modules 202 as described above. In general, the inductive charge area can be configured to serve these purposes.

[0056] A gyroscope or accelerometer of the electronic module 202 can be used to facilitate activation and deactivation of the associated electro-active lens or lenses based on a head tilt of a user. For example, the gyroscope or accelerometer can activate the associated electro-active lens or lenses when the user's head dips below a first predetermined threshold angle and can deactivate the associated electro-active lens or lenses when the user's head rises above a second predetermined threshold. Additionally, the gyroscope or accelerometer can power down or power off the associated electro-active lens or lenses when the electro-active spectacles housing the electronic module 202 are positioned upside down. For example, a user can power down or power off electro-active spectacles 100 housing the electronic module 202 by simply placing the electro-active spectacles 100 upside down on a relatively flat surface. Alternatively, positioning the electro-active spectacles 100 upside down can place the electro-active spectacles 100 in a standby mode (e.g., a mode where the electro-active spectacles 100 will not switch between active and deactivate states but otherwise are turned on).

[0057] The electronic module 202 can also include or can alternatively include a rangefinder. The rangefinder can be used to facilitate activation and deactivation of the associated electro-active lens or lenses based on the distance between a wearer of electro-active spectacles of the present invention and an object the wearer is looking at or observing.

[0058] FIG. 6 illustrates an electro-active lens 600 in accordance with an aspect of the present invention. The electro-active lens 600 can represent one of the electro-active lenses 104 or 106. The electro-active lens 600 is depicted as a finished lens in FIG. 6. That is, the electro-active lens 600 has been edged and grooved to fit into an eyeglass frame.

[0059] As shown in FIG. 6, the electro-active lens 600 can comprise a first substrate (e.g., a top substrate) 602 and a second substrate (e.g., a bottom substrate) 604. During an edging process, a groove 606 can be formed (e.g., near or between the interface of the first and second substrates 602 and 604). The groove 606 can be used to position and stabilize the electro-active lens 600 within an eyeglass frame as is done with conventional lenses.

[0060] The electro-active lens 600 can comprise a first electrical lead or connector 608 and a second electrical lead or connector 610. The first and second electrical leads 608 and 610 can provide power (e.g., a drive signal or a control signal) to the electro-active region of the electro-active lens 600. In particular, the first and second electrical leads 608 and 610 can link or connect the electro-active region of the electro-active lens 600 to a power source and electronic components that can be housed within an associated eyeglass frame (e.g., the electronic module/control unit 202 depicted in FIG. 5). The first and second electrical leads 608 and 610 can comprise any conductive material including, but not limited to, silver ink. The first and second electrical leads 608 and 610 can be painted, applied or otherwise deposited onto the transparent conductive layers placed on the substrates 602 and 604.

[0061] To ensure or improve connectivity, after edging and grooving the electro-active lens 600, a small quantity of conductive material, paint or paste can be placed on top of the first and second electrical leads 608 and 610. Specifically, as shown in FIG. 6, a first conductive material 612 can be placed in the groove 604 on top of the first electrical lead 608 and a second conductive material 614 can be placed in the groove 604 on top of the second electrical lead 610. The first and second conductive materials 612 and 614 can be substantially transparent and can comprise an indium tin oxide (ITO) paste or a paint containing silver particles (e.g., silver ink).

[0062] FIG. 7 illustrates a portion of a frame 700 in accordance with an aspect of the present invention. The frame 700 can provide electrical connectivity between the electro-active lenses (not depicted in FIG. 7 for simplicity) and the electrical components used to operate electro-active lenses.

[0063] The frame 700 can include an upper portion of the right eye-wire or rim 702 and a lower portion of the right eye-wire or rim 704. For a fully rimmed frame, the lower portion 704 can extend underneath an electro-active lens to a bridge 706. For a partially-rimmed frame, the lower portion 704 generally does not extend to the bridge 706.

[0064] The frame 700 can include an electronic module 202 and an area to accept an electronic module 202. A first conductor 708 can be positioned

within a groove of the upper rim portion 702. A second conductor 710 can be positioned within a groove of the lower rim portion 704. The first and second conductors 708 and 710 can comprise flexible, compressible materials. When an electro-active lens – e.g., the electro-active lens 600 depicted in FIG. 6 – is positioned within the frame 700, the first and second conductors 708 and 710 can be compressed to fit in the groove of the upper and lower rim portions 708 and 710, respectively, and the groove 606 of the electro-active lens 600. The first conductor 708 can be positioned to make contact with the first conductive material 612. The second conductor 710 can be positioned to make contact with the second conductive material 614.

[0065] The frame 700 can include an upper conducting member 712, a lower conducting member 714 and an insulating or isolation member 716. The upper conducting member 712, the lower conducting member 714 and the insulating member 716 can physically couple the temple of the frame 700 to the eye-wire portion (i.e., the upper and lower rim portions 702 and 704).

[0066] The upper conducting member 712 can provide connectivity between the electronic module 202 and the first conductor 708. The first conductor 708 can provide connectivity to the first conductive material 612 (and, as a result, connectivity to the first electrical lead 608) depicted in FIG. 6. The lower conducting member can provide connectivity between the electronic module 202 and the second conductor 710. The second conductor 710 can provide connectivity to the second conductive material 614 (and, as a result, connectivity to the second electrical lead 610) depicted in FIG. 6. The insulating member 716 can ensure that the connectivity path between the electronic module 202, the upper conducting member 712 and the first conductor 708 remains insulated or electrically separated from the connectivity path between the electronic module 202, the lower conducting member 714 and the second conductor 710.

[0067] Any portion of the upper conducting member 712 and the lower conducting member 714 can provide a conductive link. As an example, the entirety of the upper and lower conducting members 712 and 714 can be conductive (e.g., made of metal and coated with a non-conductive material) or

a portion of the upper and lower conducting members 712 and 714 can be conductive (e.g., an internal portion that is encapsulated by non-conductive material).

[0068] FIG. 8 illustrates an exploded view of the frame 700 depicted in FIG. 7. As shown in FIG. 8, the frame 700 can be assembled by connecting the upper conducting member 712, the insulating member 715 and the lower conducting member 714 to the upper rim portion 702 and the lower rim portion 704. The first conductor 708 and the second conductor 710 can then be positioned in the groove of the upper rim portion 702 and the lower rim portion 704, respectively. The first and second conductors 708 and 710 can be positioned in areas where they will make contact with the first conductive material 612 and the second conductive material 614, respectively.

[0069] The components illustrated in FIGs. 7 and 8 – namely, the upper conducting member 712, the lower conducting member 714, the insulating member 716, the upper rim portion 702, the lower rim portion 704, the first conductor 708 and the second conductor 710 – can be used to form a portion of the frame 700 as a partially-rimmed frame or a fully-rimmed frame and to provide connectivity between an electronic module of the present invention and an electro-active lens of the present invention for each type of frame (and a variety of styles therein).

[0070] For a fully-rimmed frame, both the upper rim portion 702 and the lower rim portion 704 can extend from the upper conducting member 712 and the lower conducting member 714, respectively, to the bridge 706. For a partially-rimmed frame, generally only the upper rim portion 702 extends from the upper conducting member 712 to the bridge 706 while the lower rim portion 704 does not extend to the bridge 706.

[0071] When the frame 700 is implemented as a fully-rimmed frame or a partially-rimmed, the first conductor 708 can be of any size or length. That is, the first conductor 708 can extend along any portion of the upper rim 702 to make electrical connectivity with a desired lead of the electro-active lens 104. When the frame 700 is implemented as a fully-rimmed frame, the second conductor 710 can similarly be of any size or length to make electrical

connectivity with a separate or second desired lead of the electro-active lens 104. However, when the frame 700 is implemented as a partially-rimmed frame, the second conductor 710 will be of the same length or shorter than the lower rim portion 704.

[0072] FIG. 9 illustrates a portion of electro-active spectacles 900 in accordance with an aspect of the present invention. The electro-active spectacles 900 are implemented as rimless spectacles. That is, no upper or lower rim supports the electro-active lens 104.

[0073] As shown in FIG. 9, the electro-active spectacles 900 can include an electronic module 202 and an area to accept an electronic module 202. The electronic module 202 can be electrically coupled to the electro-active lens 104 using upper conducting member 902 and lower conducting member 904 (similar to upper conducting member 712 and lower conducting member 714 depicted in FIGs. 7 and 8). Both the upper and lower conducting members 902 and 904 can be isolated or insulated conductors having a protected, internal conductive routes (e.g., a conductive wire) enclosed by a non-conductive material (e.g., a plastic). Alternatively, the upper and lower conducting members 902 and 904 can entirely comprise conductive material and can be coated with non-conductive material.

[0074] The frame of the electro-active spectacles 900 can support the electro-active lens 104 using upper support member 910 and lower support member 912. As an alternative, one of the upper and lower support members 910 and 912 can be used. Both the upper and lower supporting members 910 and 912 can be positioned through holes residing in the electro-active lens 104. The frame of the electro-active spectacles 900 can also be supported by upper contact 906 and lower contact 908. Both the upper and lower contacts 906 and 908 can be positioned through holes residing in the electro-active lens 104. The upper and lower contacts 906 and 908 can be compression pin connectors having a portion that can make electrical contact with appropriate elements of the electro-active lens 104.

[0075] While simultaneously supporting the electro-active lens 104, the upper contact 906 can make electrical contact with a first electrical lead of the

electro-active lens (e.g., the first electrical lead 608 depicted in FIG. 6). Similarly, the lower contact 908 can support the electro-active lens 104 while also providing electrical contact to a second electrical lead of the electro-active lens (e.g., the second electrical lead 610 depicted in FIG. 6).

[0076] Both the upper contact 906 and the upper support member 910 can form part of an arm or extension of the upper conducting member 902. The upper contact 906 and the upper support member 910 can comprise one or more conductors (e.g., a wire) insulated or contained by an insulating material (e.g., plastic). The upper contact 906 and the upper support member 910 can be positioned in front of the electro-active lens 104 (and connect through to the back of the electro-active lens 104 – as shown in FIG. 9) or can be positioned behind the electro-active lens 104 (and connect through to the front of the electro-active lens 104 – not shown in FIG. 9). The lower contact 908 and the lower support member 912 can be positioned in a manner similar to the upper contact 906 and the upper support member 910 pairing (and can form part of an arm or extension of the upper conducting member 904).

[0077] FIG. 10 illustrates a front a view of electro-active spectacles 1000 in accordance with an aspect of the present invention. The electro-active spectacles 1000 are implemented as partially-rimmed spectacles. Electrical connectivity between a right side of the electro-active spectacles (e.g., from a right-side portion of a frame 1002) to a left side of the electro-active spectacles (e.g., from a left-side portion of a frame 1004) can be provided in a variety of ways and is not limited to partially-rimmed designs. Electrical connectivity between the right-side portion 1002 and the left-hand portion 1004 can enable a single electronic module (e.g., the electronic module 202) located on either side to govern operation of both electro-active lenses 104 and 106. Further, this connectivity can ensure synchronized operation of the electro-active lenses 104 and 106 even if each of the electro-active lenses 104 and 106 is driven by separate electronic modules.

[0078] One or more conducting elements (e.g., conducting wires) can be embedded in a right-side upper frame or rim member 1006, a left-side upper frame or rim member 1008 and a bridge 1010 (as well as a left-side lower

frame or rim member and a right-side lower frame or rim member for some frame designs). The conducting elements can be embedded and surrounded by insulating material. Embedding one or more conducting elements in the right-side upper frame member 1006, the bridge 1010 and the left-side upper frame member 1008 can enable an electronic module on either side of the electro-active spectacles 1000 to control and/or synchronize operation of both electro-active lenses 104 and 106.

[0079] Rimless frames generally do not include the right-side upper frame member 1006 or the left-side upper frame member 1008. Rimless frames, however, do generally include a bridge 1010. Electrical connectively between the right-side portion 1002 and the left-hand portion 1004 of a rimless frame can be accomplished by using conductive elements incorporated into the manufacture of the electro-active lenses 104 and 106. Specifically, the bridge 1010 can electrically connect (e.g., using an embedded conductive link or a conductive link adjacent to or connected to the bridge) one or more conducting elements of the electro-active lenses 104 and 106 (e.g., using one or more ITO layers) which are themselves coupled to the right-side portion 1002 and the left-hand portion 1004, respectively, of a spectacles lens. Electrical connectively between the right-side portion 1002 and the left-hand portion 1004 of a rimless frame can also be accomplished by using conductive wires positioned within the grooves an electro-active lens (e.g., the groove 606 depicted in FIG. 6) to couple the right-side portion 1002 to the left-hand portion 1004. Portions of the groove on the top part of the electro-active lens or on the bottom part of the electro-active lens can be used to house or contain one or more conductive wires. The conductive wires positioned within such a groove can be insulated.

[0080] According to an aspect of the present invention, one or more conductive wires can be embedded in the upper rim connectors, the bridge and/or the lower rim connectors of electro-active spectacles and frames of the present invention during a mold casting process. That is, when the upper rim connectors, the bridge and/or the lower rim connectors are formed using a casting process, one or more conductive wires can be cast over when the upper

rim connectors, the bridge and/or the lower rim connectors are prepared. Generally, thicker conductive wires can be used during such a process. Nylon is an example material that can be used to mold over one or more conductive wires to from the upper rim connectors, the bridge and/or the lower rim connectors.

[0081] According to an aspect of the present invention, one or more conductive wires can be embedded in the upper rim connectors, the bridge and/or the lower rim connectors of electro-active spectacles and frames of the present invention as each frame component is assembled. More specifically, any of the upper rim connectors, the bridge and/or the lower rim connectors that will be used to embed one or more conductive wires can be fabricated by two or more individual or separate pieces. For example, the upper rim connectors can be formed from two substantially symmetrical pieces of substantially the same shape – a front piece and a back piece which individually may appear to be a portion of the upper rim connector split in half lengthwise. Prior to assembling the front and back pieces to form a complete upper rim connector, one or more wires can be embedded (e.g., in a groove formed by mold or machined into the front and/or back pieces) between the front and back pieces (i.e., at the interface between the front and back pieces). The front and back pieces used to form the complete upper rim connector can subsequently be combined, for example, using an adhesive.

[0082] According to an aspect of the present invention, one or more conductive wires can be embedded in the upper rim connectors, the bridge and/or the lower rim connectors of electro-active spectacles and frames of the present invention after the frame is assembled. Specifically, one or more grooves can be machined into the upper rim connectors, the bridge and/or the lower rim connectors that can be used to contain one or more conductive wires. The machined grooves can then be filled or covered with material to cosmetically hide the conductive wires. The assembled frame can then be polished to hide or mask the area in which the wires are embedded. Acetate is an example material that can be manipulated in this fashion to embed one or more conductive wires.

[0083] FIG. 17 illustrates electro-active frame 1700 in accordance with an aspect of the present invention. Electro-active lenses can be mounted within the electro-active frame 1700. For simplicity, a portion of electronics 1702 that can be used to govern operation of the electro-active lenses are shown. The electronics 1702 can represent a portion of an electronic module 202 described above and/or can represent conductive elements positioned to provide electrical connectivity between a temple of the electro-active frame 1700 and a front portion of the electro-active frame 1700. The electro-active frame 1700 is shown as including electronics 1702 on only one side of the electro-frame 1700 but is not so limited.

[0084] As further shown in FIG. 17, the electro-active frame 1700 can include conductive leads 1704 and 1706 and conductive link 1708. Conductive link 1708 can provide electrical connectivity from one side of the electro-active frame 1700 to the other side of the electro-active frame 1700. Conductive leads 1704 can provide electrical connectivity between electronics 1702 and a first electro-active lens mounted within the electro-active frame 1700. Conductive leads 1706 can provide electrical connectivity between the conductive link 1708 and a second electro-active lens mounted within the electro-active frame 1700.

[0085] As shown in FIG. 17, the conductive link 1708 can be embedded or positioned within the electro-active frame 1700. The conductive link 1708 can include any number of conductive elements (e.g., wires) that can be insulated not insulated. If the electro-active frame 1700 uses driver electronics on each side of the frame 1700 (e.g., a master and slave driver electronics or electronic modules 202) then as few as only one single wire can comprise the conductive link 1708). If the electro-active frame 1700 has driver electronics on only one side of the electro-active frame 1700, then at least two wires or conductive elements can be used. The conductive link 1708 can be positioned inside the electro-active frame 1700 in accordance with any of the methods described above for embedding conductive links including, but not limited to, (1) embedding during a mold casting process; (2) embedding during an assembly process of the front frame portion of the electro-active frames 1700; and (3)

embedding after assembly of the electro-active frames by providing a groove or route for the conductive link 1708. The conductive link 1708 can also use or can alternatively comprise the conductive layers of the electro-active lenses of the present invention that can be positioned into the frames 1700 as described above.

[0086] FIG. 18 illustrates electro-active spectacles 1800 in accordance with an aspect of the present invention. The electro-active spectacles 1800 can include an electronic module 202. The electro-active spectacles 1800 can also include conductive link 1802. Conductive link 1802 can include any number of conductive elements (e.g., wires) that can be insulated or not insulated. Conductive link 1802 can provide electrical connectivity between the electronic module 202 and the electro-active lens 104 and the electro-active lens 106.

[0087] As shown in FIG. 18, a portion of the conductive link 1802 can be positioned or embedded within a portion of the frame of the electro-active spectacles 1800. For rimless spectacles, the conductive link 1802 can be routed through a groove in an electro-active lens (e.g., the groove 606 depicted in FIG. 6). As further shown in FIG. 18, the conductive link 1802 can be routed adjacent to a bridge 1804 of the electro-active spectacles 1800. For example, the conductive link can be routed through tubing 1806 that is positioned adjacent to the bridge 1804.

[0088] FIG. 11 illustrates a portion of a right temple 1100 of electro-active spectacles in accordance with an aspect of the present invention. The portion of the right temple 1100 depicted in FIG. 11 shows a right temple area 1102 that can be coupled to an electro-active lens (not depicted in FIG. 11 for simplicity). The right temple area 1102 can include an electro-active module of the present invention. The right temple area 1102 can be coupled to the first conductor 708 through first conductor link 1104. The right temple area 1102 can further be coupled to the second conductor 710 through a second conductor link 1106.

[0089] The first and second link conductors 1104 and 1106 can be shaped and constructed to tolerate bending of the frame (not depicted in FIG. 11 for

simplicity) when the electro-active spectacles are opened and closed. The first and second link conductors 1104 and 1106 can contain one or more conducting elements (e.g., conducting wires) and can enclose them with insulating or non-conductive material or can themselves be entirely conductive. The first and second link conductors 1104 and 1106 can be considered to be continuous conductive links since they provide an uninterruptable physical connection between the right temple area 1102 and the conductive elements of the electro-active lenses (e.g., to conductive elements 708 and 710).

[0090] FIG. 12 illustrates a portion of a right temple 1200 of electro-active spectacles (implemented as rimless spectacles) in accordance with an aspect of the present invention. The portion of the right temple 1200 depicted in FIG. 12 shows a right temple area 1102 that can be coupled to an electro-active lens (not depicted in FIG. 11 for simplicity). The right temple area 1102 can include an electro-active module of the present invention. The right temple area 1102 can be coupled to the upper conducting member 712 through a first spring conductor 1202. The right temple area 1102 can further be coupled to the lower conducting 714 through a second spring conductor 1204. The first and second spring conductors 1202 and 1204 can contain one or more conducting elements (e.g., conducting wires) and can enclose them with insulating or non-conductive material or can themselves be entirely conductive. The first and second spring conductors 1202 and 1204 can be considered to be discontinuous conductive links since they can provide an interruptible physical connection between the right temple area 1102 and the conductive elements of the electro-active lenses (to upper and lower conducting members 712 and 714).

[0091] The first and second spring conductors 1202 and 1204 can extend proud of the right temple portion 1102 when the spectacles are in use (i.e., when they are opened). The first and second spring conductors 1202 and 1204 can retract inside the right temple portion 1102 when the spectacles are not in use (i.e., when they are closed). When opened, the first and second spring

conductors 1202 and 1204 can extend to make contact with the upper and lower conducting members 712 and 714, respectively.

[0092] The connectivity mechanisms illustrated in FIGs. 11 and 12 and described above can be used for any type of frame style – that is, for fully rimmed, partially-rimmed and rimless frames of the present invention. Further, according to an aspect of the present invention, the first and second spring conductors 1202 and 1204 can be used to activate, deactivate, or place electro-active spectacles of the present invention into a standby mode or off mode of operation. For example, when the spring conductors 1202 and 1204 are not coupled or in contact with the upper and lower conducting members 712 and 714, the electro-active spectacles of the present invention can be powered-off or placed into a standby mode. When the spring conductors 1202 and 1204 are coupled or in contact with the upper and lower conducting members 712 and 714, the electro-active spectacles of the present invention can be powered-on and placed into an active mode (e.g., a switchable mode based on sensed input) or can immediately activate the electro-active lenses.

[0093] As will be apparent to one skilled in the pertinent art, electronics housed within the frame can sense such a lens disconnect condition by observing a reduction in capacitance or change in drive signal waveform that can occur when the spring conductors 1202 and 1204 are not coupled or in contact with the upper and lower conducting members 712 and 714. Once in the lens disconnect state, the electronics of the electro-active spectacles of the present invention can transition into a low power, standby or off mode. When in a low power or standby mode, the electronics of the electro-active spectacles of the present invention can periodically or randomly observe sensed capacitance or changes in the drive signal waveform to detect when the frame is re-opened for use.

[0094] FIG. 13 illustrates a representative block diagram of electro-active spectacles 1300 in accordance with an aspect of the present invention. The electro-active spectacles 1300 can represent the electro-active spectacles of the present invention described above (e.g., the electro-active spectacles 100). The electro-active spectacles 1300 can include a right electro-active lens 1302

and a left electro-active lens 1304. The right and left electro-active lenses 1302 and 1304 can represent the first and second electro-active lenses 104 and 106 described earlier. The electro-active spectacles 1300 can include a right control unit 1306 and a left control unit 1308. The left and right control units 1306 and 1308 can each represent an electronic module 202, or a portion thereof, described above.

[0095] The right control unit 1306 can include an isolation switch 1310, driver circuits 1312, and transmitter circuits 1314. The driver circuits 1312 can generate a driver signal for operating (e.g., activating) the right electro-active lens 1302. For example, to activate the right electro-active lens 1302, the driver circuits 1312 can provide, generate or transmit a driver signal or activation signal. Further, to deactivate the right electro-active lens 1302, the driver circuits 1312 can simply stop providing, generating or transmitting the driver signal.

[0096] The transmitter circuits 1314 can generate a synchronization signal for coordinating operation of the right and left electro-active lenses 1302 and 1304. Specifically, the transmitter circuits 1314 can transmit a synchronization signal instructing the left electro-active lens 1304 to activate or deactivate. As an example, the left electro-active lens 1304 can be activated based on receipt of the synchronization signal or a synchronization signal of a first type instructing activation. Further, the left electro-active lens can be deactivated based on the absence of the synchronization signal or receipt of a synchronization signal of a second type instructing deactivation. As a result, the right and left electro-active lenses 1302 and 1304 can be activated and deactivated at substantially the same time.

[0097] The isolation switch 1310 can determine when the driver circuits 1312 and the transmitter circuits 1314 can access a conductive link 1316 coupling the right electro-active lens 1302 to the control unit 1306. The conductive link 1316 can comprise one or more conductive wires. The conductive link 1316 can represent one or more of the connectivity mechanisms depicted and described above (e.g., the routing and connectivity features illustrated in FIGs. 11 and 12 and described above).

[0098] When the electro-active spectacles are implemented with only a single control unit (e.g., the control unit 1306), then the control unit 1306 can control operation of both the right and the left electro-active lenses 1302 and 1304. Under such a scenario, the isolation switch 1310 and transmitter circuits 1314 can be optional. Further, the left and right electro-active lenses 1302 and 1304 can be activated at substantially the same time by a driver signal provided by the driver circuits 1312.

[0099] A communications link between the right and left control units 1306 and 1308 can comprise any portion of the conducive link 1316, conductive elements within the right electro-active lens 1302, a bridge conductive link 1318 contained within or adjacent to a bridge of the electro-active spectacles 1300, conductive elements within the left electro-active lens 1304, and a conductive link 1320. The conductive link 1320 can comprise one or more conductive wires and can represent one or more of the connectivity mechanism depicted and described above (e.g., the routing and connectivity features illustrated in FIGs. 11 and 12 and described above). The communications link between the right and left control units 1306 and 1308 can also include or alternatively include a frame conductive link 1222 (shown in phantom in FIG. 13).

[00100] The frame conductive link 1322 can include one or more conductive wires wrapped over the right and left electro-active lens 1302 and 1304 – e.g., either embedded within a portion of the frame and/or contained in a groove of the right and left electro-active lenses 1302 and 1304 as described above. The frame conductive link 1322 can also include conductive elements of the right and left electro-active lenses 1302 and 1304 (e.g., one or more layers of ITO or other transparent conductive layers of the right and left electro-active lenses 1302 and 1304). For example, the frame conductive link 1322 can be a wireless link that uses conductive layers of the right and left electro-active lenses 1302 and 1304 as antennas to facilitate communication and/or synchronization between the right and left electro-active lenses 1302 and 1304. Alternatively, other conductive elements can be embedded within the electro-active spectacles of the present invention to facilitate communication

and/or synchronization between the right and left electro-active lenses 1302 and 1304. One or more of these embedded antennas could also provide a wireless communication link between the electro-active spectacles of the present invention and a remote communication device.

[00101] Overall, the right control unit 1306 can communicate with the left control unit 1308 and/or can operate the left electro-active lens 1304 using a single conductive wire or link. The single conductive wire can also be used to operate the right electro-active lens 1302. The single conductive wire or link can be embedded within a portion of a frame and can include conductive elements of the electro-active lenses.

[00102] The left control unit 1308 can include an isolation switch 1324, driver circuits 1326, and receiver circuits 1328. The driver circuits 1326 can generate a driver signal for operating (e.g., activating) the left electro-active lens 1302. The receiver circuits 1326 can receive and process a synchronization signal transmitted by the right electro-active module 1306. The isolation switch 1324 can determine when the driver circuits 1312 and the receiver circuits 1328 can access the conductive link 1320 coupling the left electro-active lens 1304 to the control unit 1308.

[00103] The receiver circuits 1326 can listen for a synchronization signal transmitted over conductive link 1320. The receiver circuits 1326 can listen periodically or randomly for a specific or random amount of time. Once a synchronization signal is received, the control unit 1308 can operate accordingly – i.e., either activate or deactivate the left electro-active lens 1304 using a driver signal transmitted by the driver circuits 1328.

[00104] The transmitter circuits 1314 can transmit a synchronization signal in response to detection of a head tilt change of the user (e.g., detected by a gyroscope or accelerometer included in the right control unit 1306 – not illustrated for clarity) or manual command issued by the user. The synchronization signal transmitted by the transmitter circuits 1314 can be coded to distinguish it from noise and to prevent false triggering.

[00105] FIG. 14 illustrates an electro-active spectacles charger 1400 in accordance with an aspect of the present invention. The charger 1400 (as a

slim line charger) can be used to charge/re-charge electro-active spectacles (e.g., the electro-active eyeglasses 100) of the present invention.

[00106] As shown in FIG. 14, the slim line charger 1400 comprises a front member or base member 1402, a first movable arm 1404, and a second movable arm 1406. The front member 1402 can include a raised support member 1408 and a charging state indicator 1410. The charging state indicator 1410 can be a light emitting diode (LED). The first arm 1404 can include a first adjustable charging area 1412 (or first adjustable inductive charging cradle) and the second arm 1406 can include a second adjustable charging area 1414 (or second adjustable inductive charging cradle).

[00107] The base member 1402 can support a front portion of the electro-active spectacles 100 (e.g., the first and second electro-active lenses 104 and 106 and any surrounding frame rim portions). The raised support member 1408 can support a bridge area of the electro-active spectacles 100. Alternatively, or in addition thereto, the raised support member 1408 can support one or more electro-active lenses or rim portions of the electro-active spectacles 100.

[00108] The first arm 1404 can be moveable. Specifically, the first arm 1404 can rotate to an open position from a closed positioned about a point where the first arm 1404 is attached to the front member 1402. The first arm 1404 is depicted in an open position in FIG. 14. In a closed position, the first arm 1404 can be adjacent and parallel to the first member 1402. Similar to the first arm 1404, the second arm 1406 can also be moveable. Specifically, the second arm 1406 can rotate to an open position from a closed positioned about a point where the second arm 1406 is attached to the front member 1402. The second arm 1406 is depicted in an open position in FIG. 14. In a closed position, the second arm 1406 can be adjacent and parallel to the first member 1402.

[00109] The first adjustable charging cradle 1412 can be moved along the first arm 1404. As an example, the first adjustable charging cradle 1412 can be held into position using a set screw and can be moved along a groove positioned in the first arm 1404. The first charging area 1412 can be adjusted to be located near or next to a charging area of the electro-active spectacles

100. The first charging area 1412 can include an indicative charger to inductively charge an inductive charging region of the electro-active spectacles 100. As an example, the electro-active spectacles 100 can include an inductive charger region within an electronic module as described above. To recharge the electro-active spectacles 100, the first adjustable charging area 1412 can be positioned to be in close proximity with the inductive charging region of the electro-active spectacles 100.

[00110] Correspondingly, the second adjustable charging cradle 1414 can be moved along the second arm 1406. As an example, the second adjustable charging cradle 1414 can be held into position using a set screw and can be moved along a groove positioned in the second arm 1406. The second charging area 1414 can be adjusted to be located near or next to a charging area of the electro-active spectacles 100. The second charging area 1414 can include an inductive charger to inductively charge an inductive charging region of the electro-active spectacles 100. To recharge the electro-active spectacles 100, the second adjustable charging area 1414 can be positioned to be in close proximity with the inductive charging region of the electro-active spectacles 100.

[00111] As shown in FIG. 14, the slim line charger 1400 can be used to recharge two electronic modules. The slim line charger 1400 can also be used to charge electro-active spectacles 100 having a single electronic module. By allowing the first and second adjustable charging areas 1412 and 1414 to move, the slim line charger 1400 can be used to recharge a wide variety of frame sizes and styles. That is, since frames sizes may vary for different users, the recharging area of the frames may be located in different positions relative to the front member 1402. Accordingly, the first and second adjustable charging areas 1412 and 1414 can be moved to line up or be close to these charging areas. Overall, the slim line charger 1400 can support any frame type – fully-rimmed, partially-rimmed and rimless – and any frame size or shape.

[00112] As an alternative to inductive charging, the charger 1400 can be used to charge electro-active spectacles directly. That is, the charger 1400 can

include a conductive link that can be used to plug into electro-active spectacles to transfer power directly rather than inductively.

[00113] The charging state indicator 1410 can change states to indicate a change in the charging status of the electro-active spectacles 100. For example, the charging state indicator 1410 can have a first state to indicate the charger 1400 is not charging (e.g., an off state), a second state to indicate the charger 1400 is recharging the electro-active spectacles 100 (e.g., a charging state), and a third state to indicate the charger 1400 has completed or fully recharged the electro-active spectacles 100 (e.g., a charged or completed state). The slim line charger 1400 can include a rechargeable power supply to enable charging of electro-active spectacles 100 when the charger is not connected to a power supply source (e.g., a wall outlet) directly. The slim line charger 1400 can include a port to connect the charger 1400 to a power supply (e.g., a wall outlet). The slim line charger 1400 can therefore charge the electro-active spectacles 100 when either plugged into or not plugged into a power source.

[00114] FIG. 15 illustrates a side view of the slim line charger 1400. As shown in FIG. 15, the electro-active spectacles can be stabilized or supported by the charger 1400 at three locations – a front portion of the spectacles 100 (at or near the lenses of the electro-active spectacles 100), a right side temple area of the frame of the electro-active spectacles 100 (shown in FIG. 15), and a left side temple area of the frame of the electro-active spectacles 100 (not shown in FIG. 15). The second adjustable charging area 1414 can be moved laterally to be in close proximity with any portion of the front temple area of the electro-active spectacles 100 (i.e., to place the second adjustable charging area 1414 in close proximity to an inductive charging area of the electro-active spectacles 100).

[00115] FIG. 16 illustrates the slim line charger 1400 in a closed positioned. Specifically, the first and second arms 104 and 1406 have been rotated and positioned adjacent and parallel to the base member 1402. A hinge or lock or other device can be used to lock each of the first and second arms 1404 and 1406 in place. The charger 1400 can include a button, knob or other device to

release the first and second arms 1404 and 1406 from their closed, locked positions.

[00116] Aspects of the present invention also include a charger case for electro-active spectacles having a top cover and a bottom cover as is found with conventional eyeglass cases. The charger case of the present invention can include one or more inductive charge regions and a power source. The power source of the charger case of the present invention can be rechargeable.

Conclusion

[00117] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example and not limitation. Any conductive element described above (e.g., the upper or lower portions of the frame) can be entirely conductive (and possibly coated with non-conductive material) or can contain an embedded or buried conductive element (e.g., a conductive core) and a non-conductive outer or surrounding layer. Further, any conductive link – e.g., described or referred to as an electrical wire or connection – could alternatively, or in addition thereto, be or include an optical conductive link as will be apparent to one skilled in the pertinent art. The exemplary techniques for coupling or connecting the electrical elements of the electro-active spectacles of the present invention (e.g., the controlling electronics and power supplies and electro-active lenses) using embedded conductive links can be used to embed one or more conductive optical links (e.g., one or more optical fibers) as will be apparent to one skilled in the pertinent art.

[00118] Overall, it will be apparent to one skilled in the pertinent art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Therefore, the present invention should only be defined in accordance with the following claims and their equivalents.

WHAT IS CLAIMED IS:

1. Electro-active spectacles, comprising:

a first electro-active lens;

a second electro-active lens;

a bridge connected to the first and second electro-active lenses;

a frame comprising a first temple portion adjacent to the first electro-active lens and a second temple portion adjacent to the second electro-active lens; and

a removable electronic module positioned within the first temple portion,

wherein the electronic module comprises an inductive charge area,

wherein the electronic module provides a first driver signal to activate the first electro-active lens.

2. The electro-active spectacles of claim 1, wherein the first driver signal activates the second electro-active lens.

3. The electro-active spectacles of claim 2, wherein the first and second lenses are activated at substantially the same time by the first driver signal.

4. The electro-active spectacles of claim 1, further comprising a second removable electronic module having an inductive charge area and positioned within the second temple portion.

5. The electro-active spectacles of claim 4, wherein the first electronic module transmits a synchronization signal to the second electronic module.

6. The electro-active spectacles of claim 5, wherein the second electronic module provides a second driver signal to activate the second electro-activate lens based on receipt of the synchronization signal.

7. The electro-active spectacles of claim 6, wherein the first and second

lenses are activated at substantially the same time by the first and second driver signals, respectively.

8. The electro-active spectacles of claim 4, wherein the first electronic module is electrically coupled to the second electronic module over a single conductive link.

9. The electro-active spectacles of claim 4, wherein the frame is a fully-rimmed frame and the first electronic module is electrically coupled to the second module over a conductive link comprising a first upper rim portion of the frame supporting the first electro-active lens, a second upper rim portion of the frame supporting the second electro-active lens, and the bridge.

10. The electro-active spectacles of claim 9, wherein the conductive link further comprises a first lower rim portion of the frame supporting the first electro-active lens and a second lower rim portion of the frame supporting the second electro-active lens.

11. The electro-active spectacles of claim 4, wherein the frame is a partially-rimmed frame and the first electronic module is electrically coupled to the second module over a conductive link comprising a first upper rim portion of the frame supporting the first electro-active lens, a second upper rim portion of the frame supporting the second electro-active lens, and the bridge.

12. The electro-active spectacles of claim 4, wherein the frame is a rimless frame and the first electronic module is electrically coupled to the second module over a conductive link comprising a first conductive layer of the first electro-active lens and a first conductive layer of the second electro-active lens, and the bridge.

13. The electro-active spectacles of claim 12, wherein the conductive link

further comprises a second conductive layer of the first electro-active lens and a second conductive layer of the second electro-active lens.

14. The electro-active spectacles of claim 4, wherein the frame is a rimless frame and the first electronic module is electrically coupled to the second module over a conductive link comprising a first conductive wire positioned in a first groove of the first electro-active lens and a second conductive wire positioned in a first groove of the second electro-active lens, and the bridge.

15. A charger for electro-active spectacles, comprising:

a base member to support a front portion of the electro-active spectacles,

a first movable arm connected to the base member to support a portion of a first frame temple of the electro-active spectacles;

a second movable arm connected to the base member to support a portion of a second frame temple of the electro-active spectacles; and

a first inductive charging cradle connected to the first movable arm.

16. The charger of claim 15, further comprising a second inductive charging cradle connected second movable arm.

17. The charger of claim 16, further comprising a power source for charging the electro-active spectacles inductively using the first and second inductive charging cradles.

18. The charger of claim 17, wherein the power source is rechargeable.

19. The charger of claim 16, wherein a positioning of the first inductive charging cradle is adjustable along the first movable arm and a positioning of the second inductive charging cradle is adjustable along the second movable arm.

20. The charger of claim 15, further comprising at least one light emitting

diode (LED) to indicate a charging status of the electro-active spectacles.

21. The charger of claim 15, wherein the first movable arm can be rotated to be in a locked position parallel and adjacent to the base member and the second movable arm can be rotated to be in a locked position parallel and adjacent to the base member.

22. The charger of claim 21, further comprising one of a button and a knob to release both the first and second movable arms from their locked positions.

23. Electro-active spectacle frames, comprising:

a first temple;

a second temple;

a frame front attached to the first temple and the second temple, the frame front comprising a first rim to house a first electro-active lens and a second rim to house a second electro-active lens;

an electronic module positioned within the first temple; and

a conductive link embedded within the frame front coupled to the electronic module,

wherein the electronic module comprises an inductive charge area.

24. Electro-active spectacle frames, comprising:

a first temple;

a second temple;

a frame front attached to the first temple and the second temple, the frame front comprising a first rim to house a first electro-active lens and a second rim to house a second electro-active lens;

an electronic module positioned within the first temple; and

a conductive link embedded within the frame front coupled to the electronic module,

wherein the electronic module comprises a capacitive switch for toggling between operational modes of the first and second electro-active lenses.

25. A method for controlling electro-active spectacles, comprising:

receiving a first input;

transitioning the electro-active spectacles from a first mode of operation to a second mode of operation based on receipt of the first input;

receiving a second input; and

transitioning the electro-active spectacles from the second mode of operation to a third mode of operation based on receipt of the second input.

26. The method of claim 25, further comprising:

receiving a third input; and

transitioning the electro-active spectacles from the third mode of operation to the first mode of operation based on receipt of the third input.

27. The method of claim 26, wherein the first mode of operation is a standby mode of operation, the second mode of operation is an active mode of operation, and the third mode of operation is an inactive or off mode of operation.

28. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user touching a capacitive switch.

29. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user touching a button switch.

30. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user speaking a voice command or instruction.

31. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user opening a frame of the electro-active spectacles.

32. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user closing a frame of the electro-active spectacles.

33. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user positioning the electro-active spectacles upside down.

34. The method of claim 27, wherein at least one of receiving the first input, receiving the second input, and receiving the third input comprises a user positioning the electro-active spectacles right-side up.

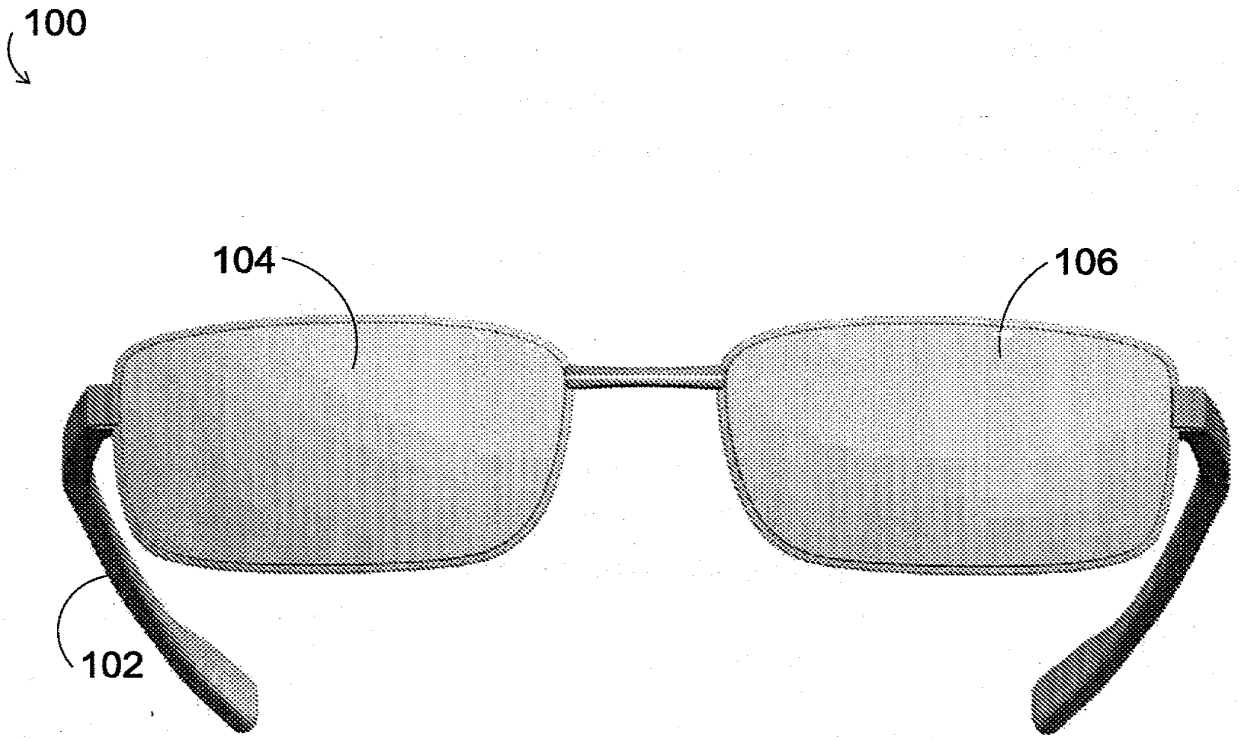


FIGURE 1

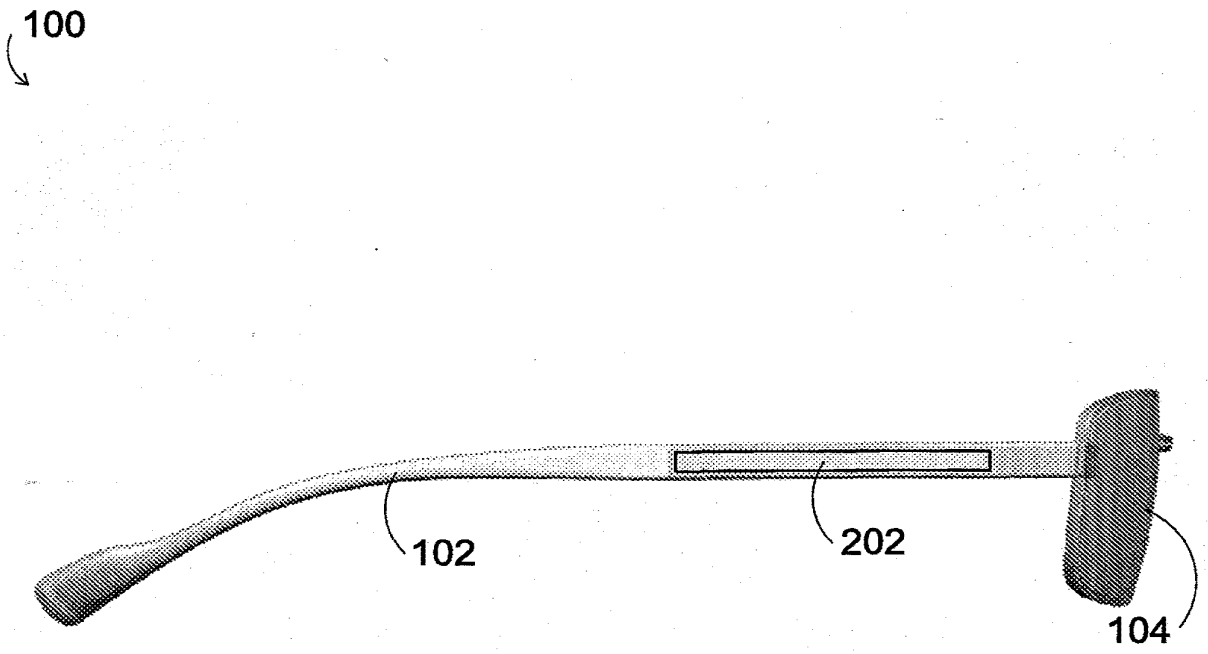


FIGURE 2

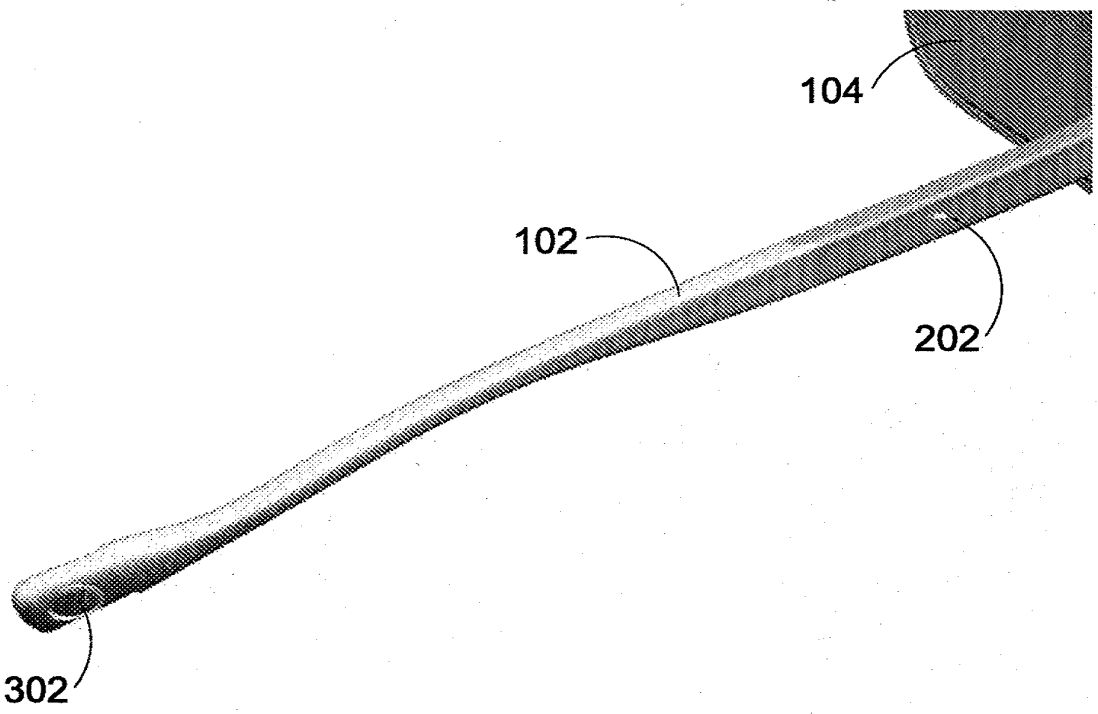


FIGURE 3

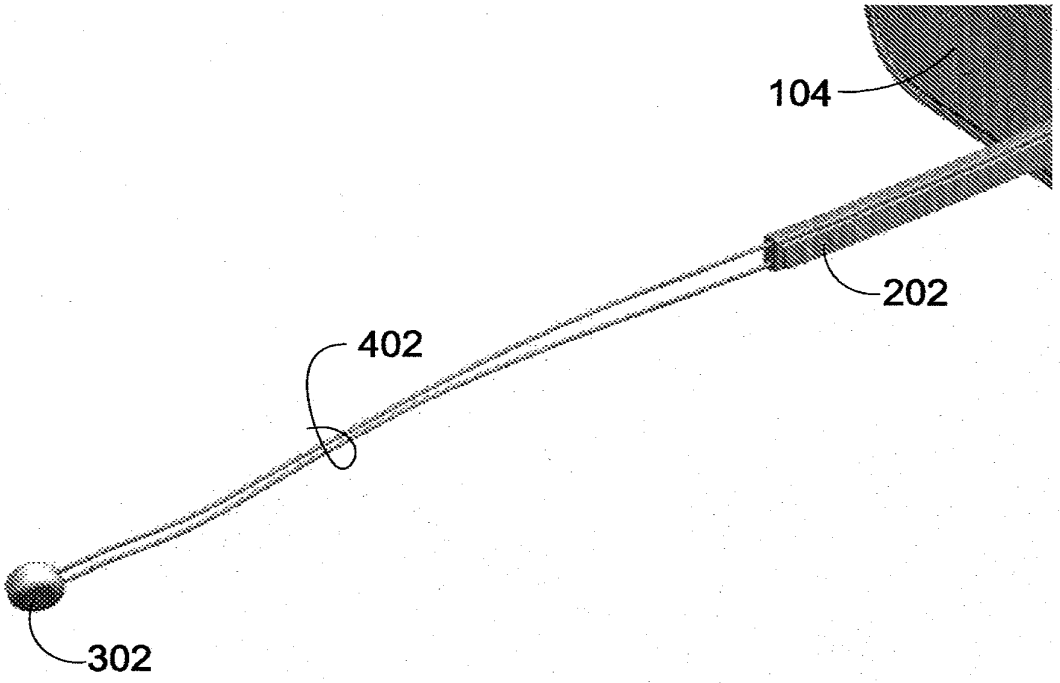


FIGURE 4

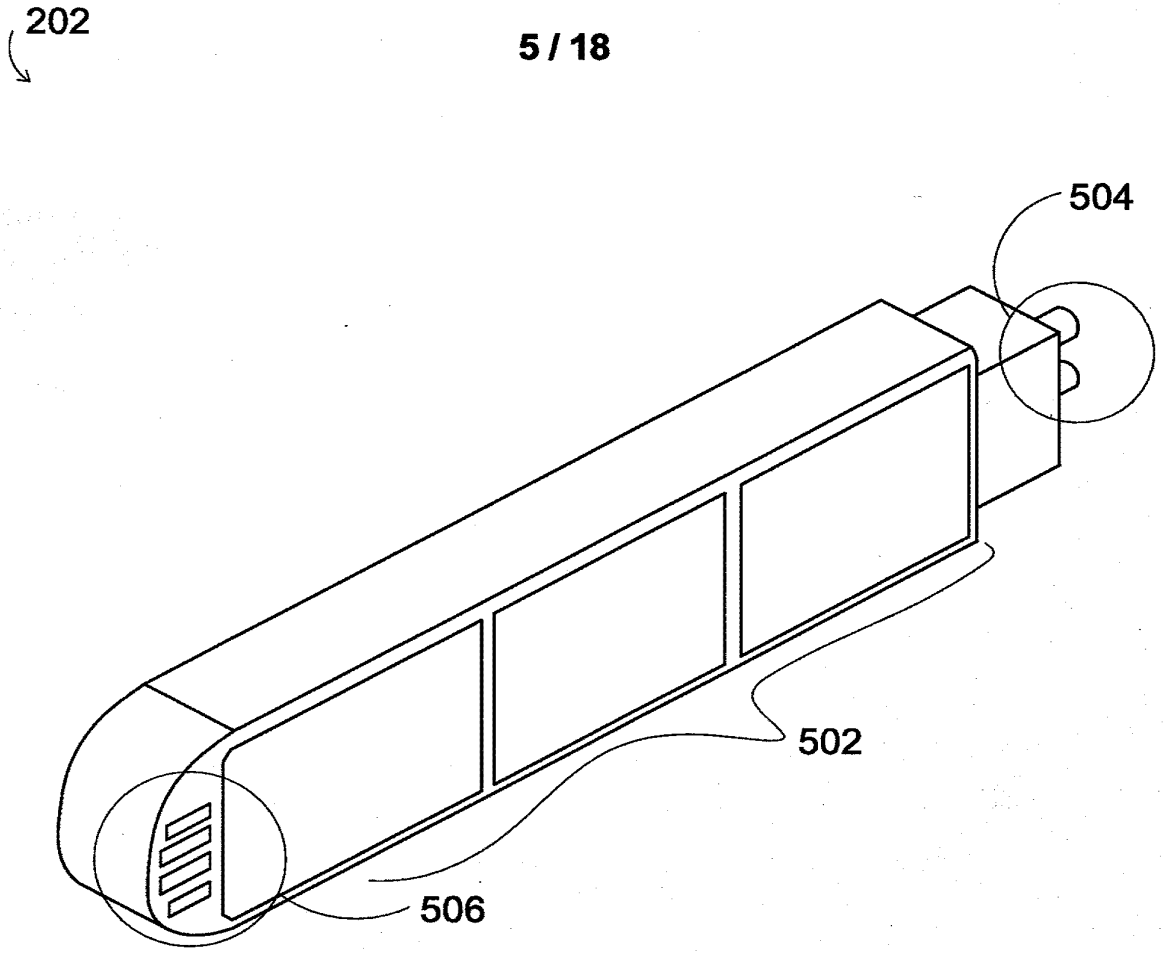


FIGURE 5

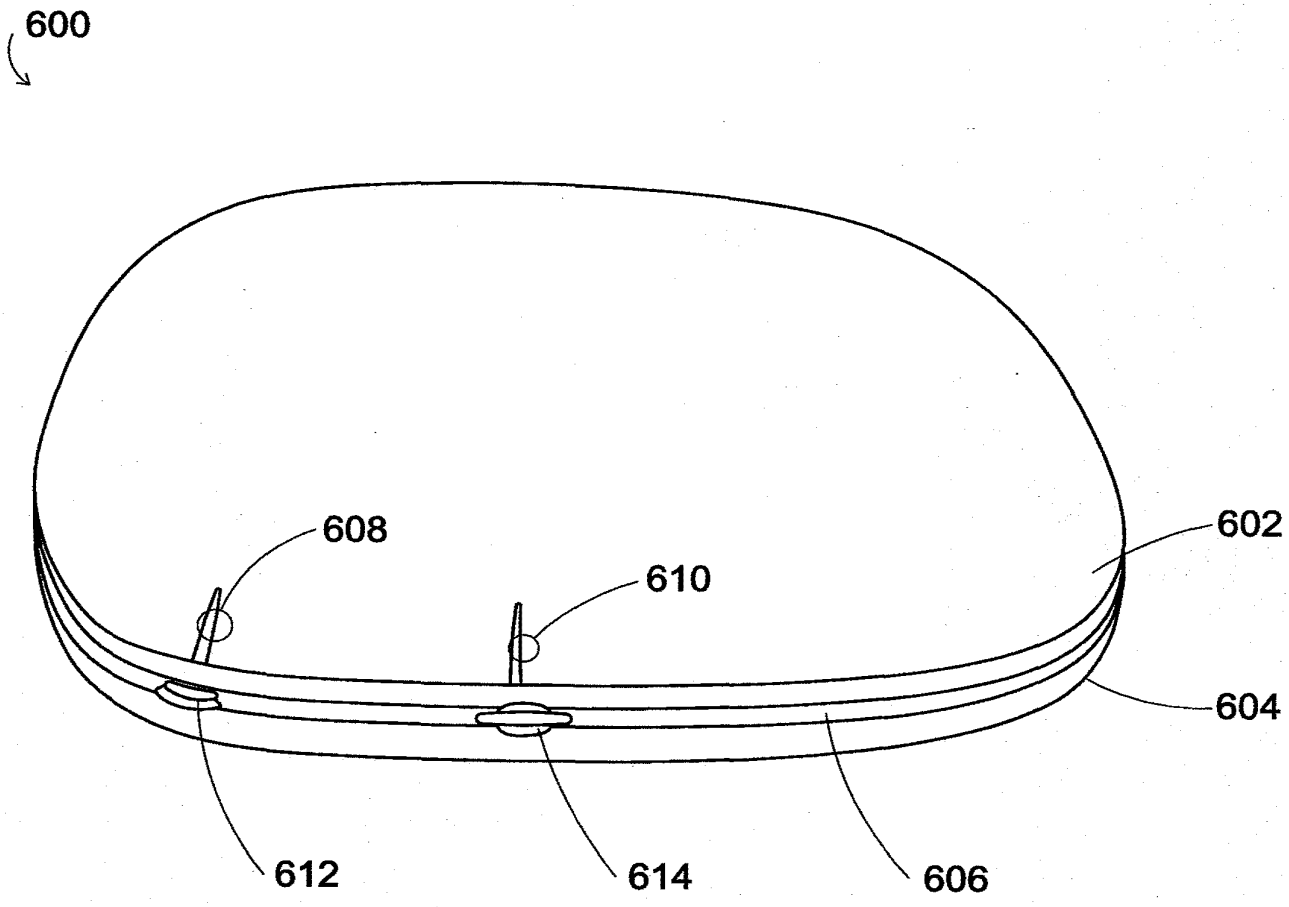


FIGURE 6

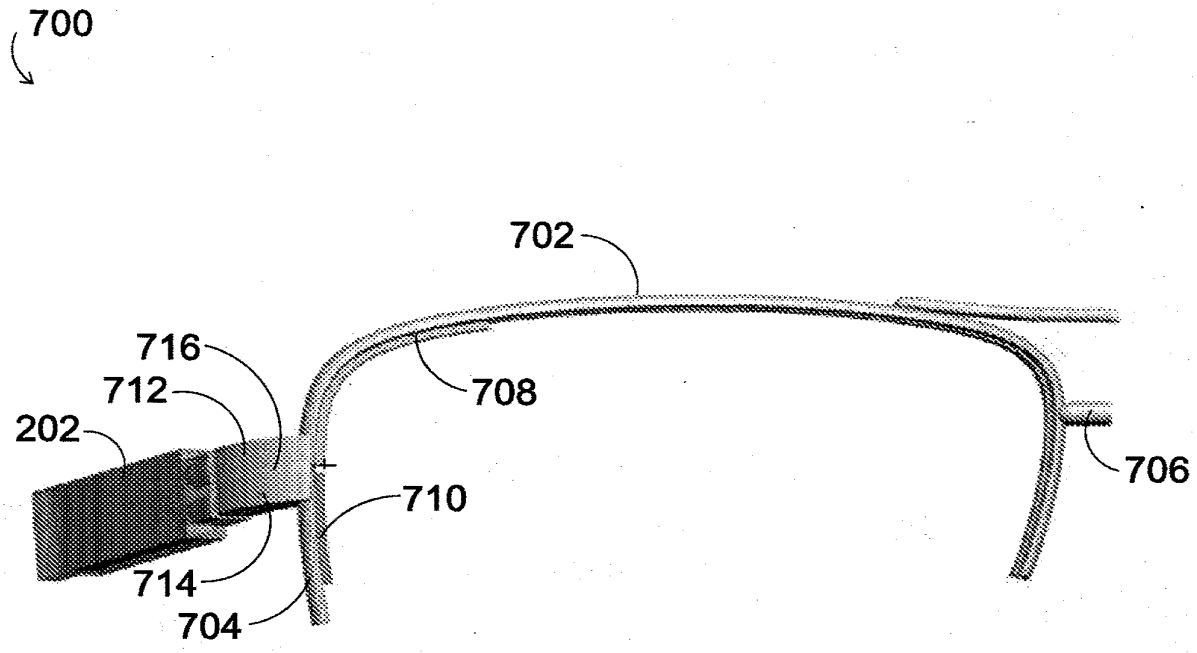


FIGURE 7

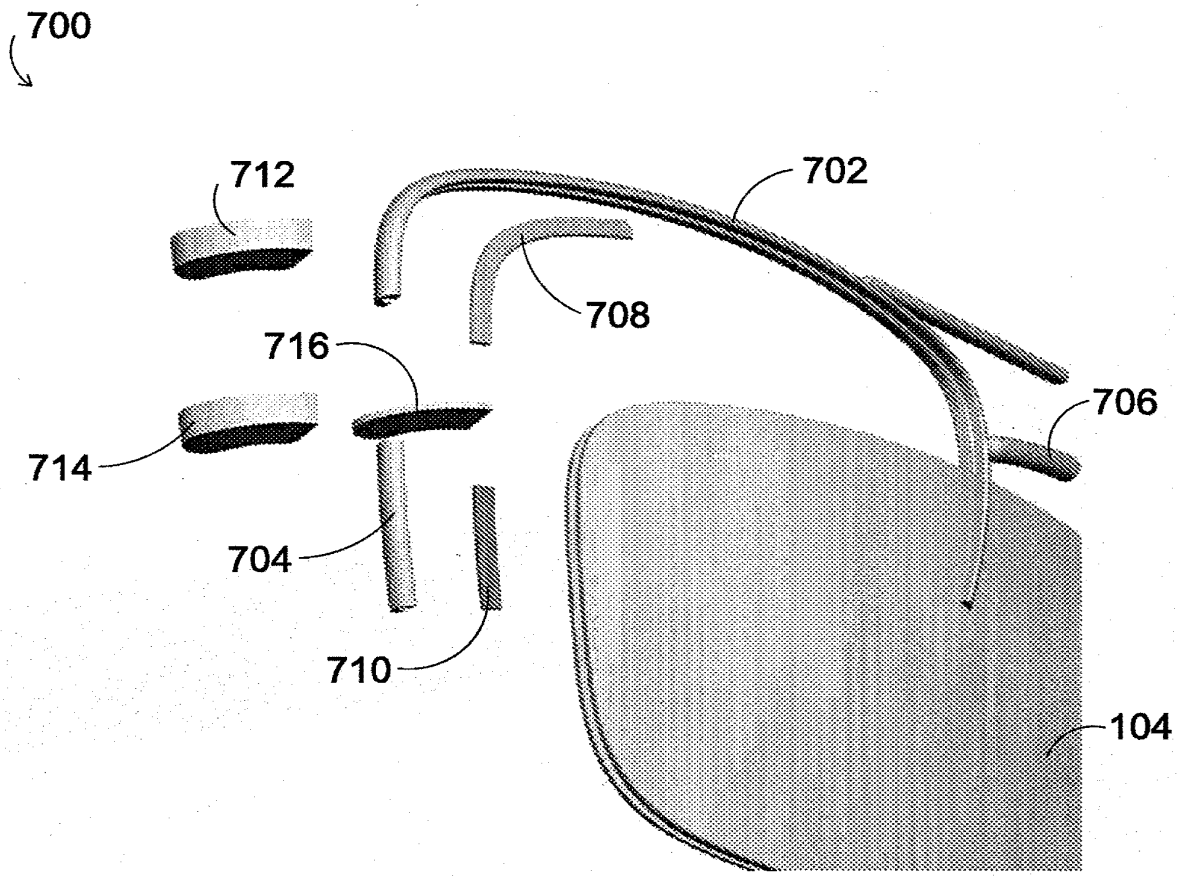


FIGURE 8

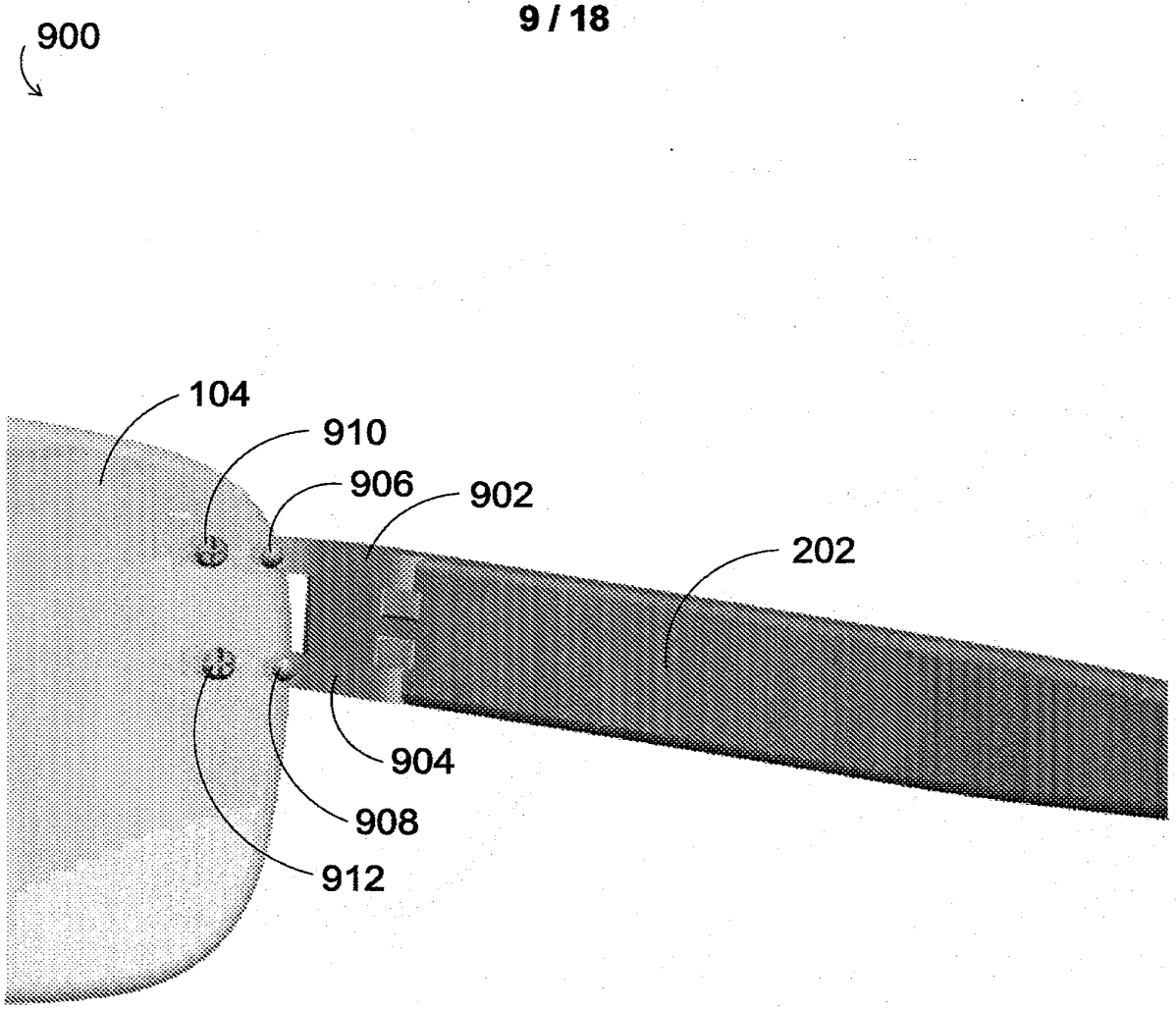


FIGURE 9

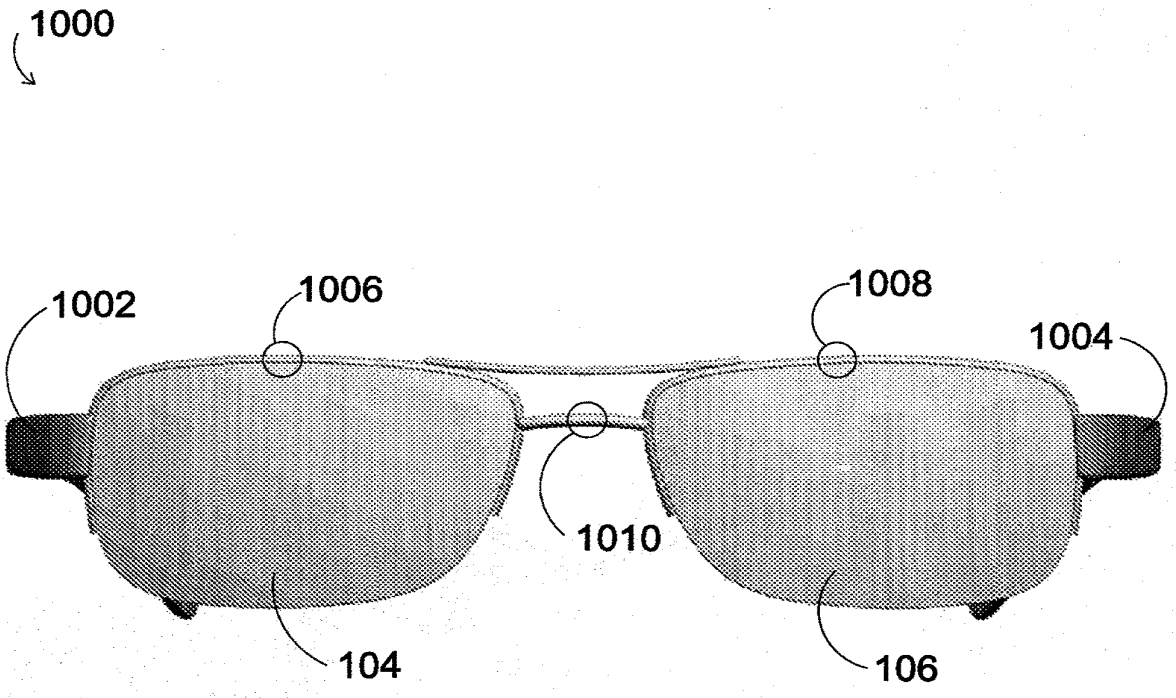


FIGURE 10

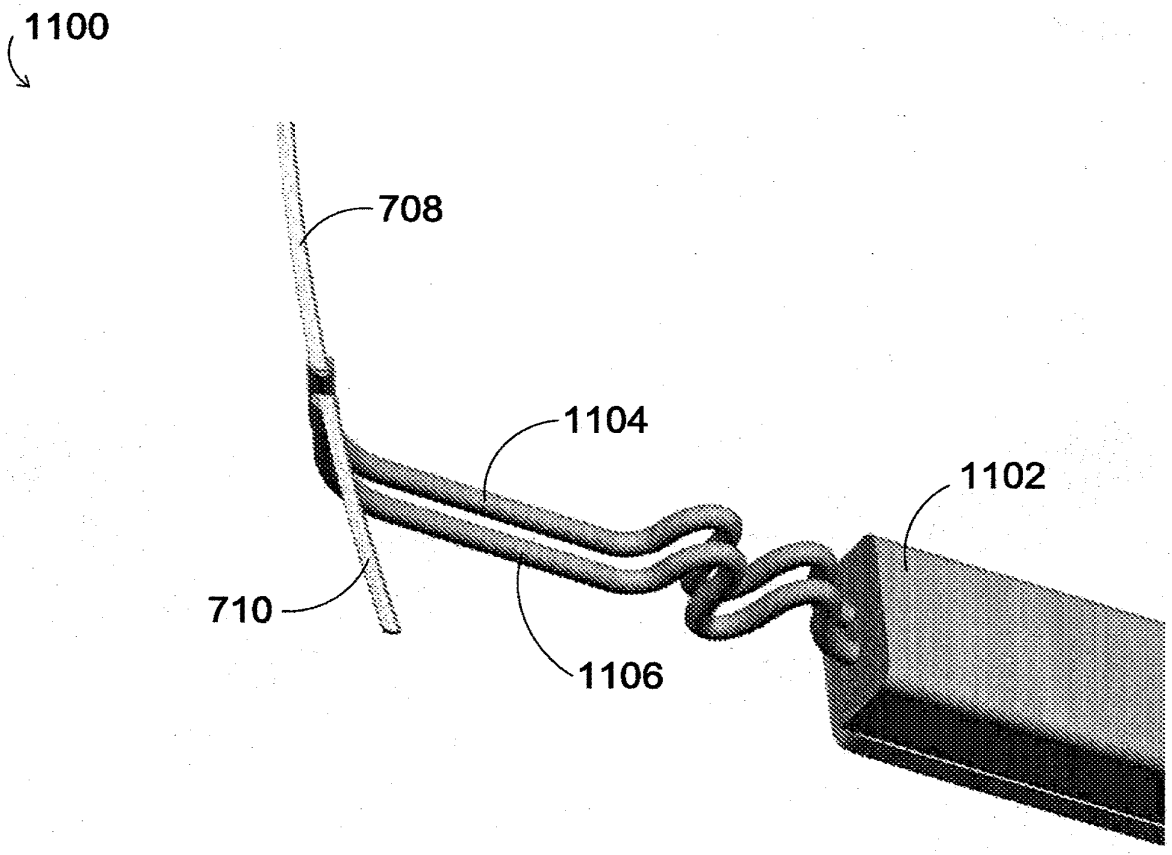


FIGURE 11

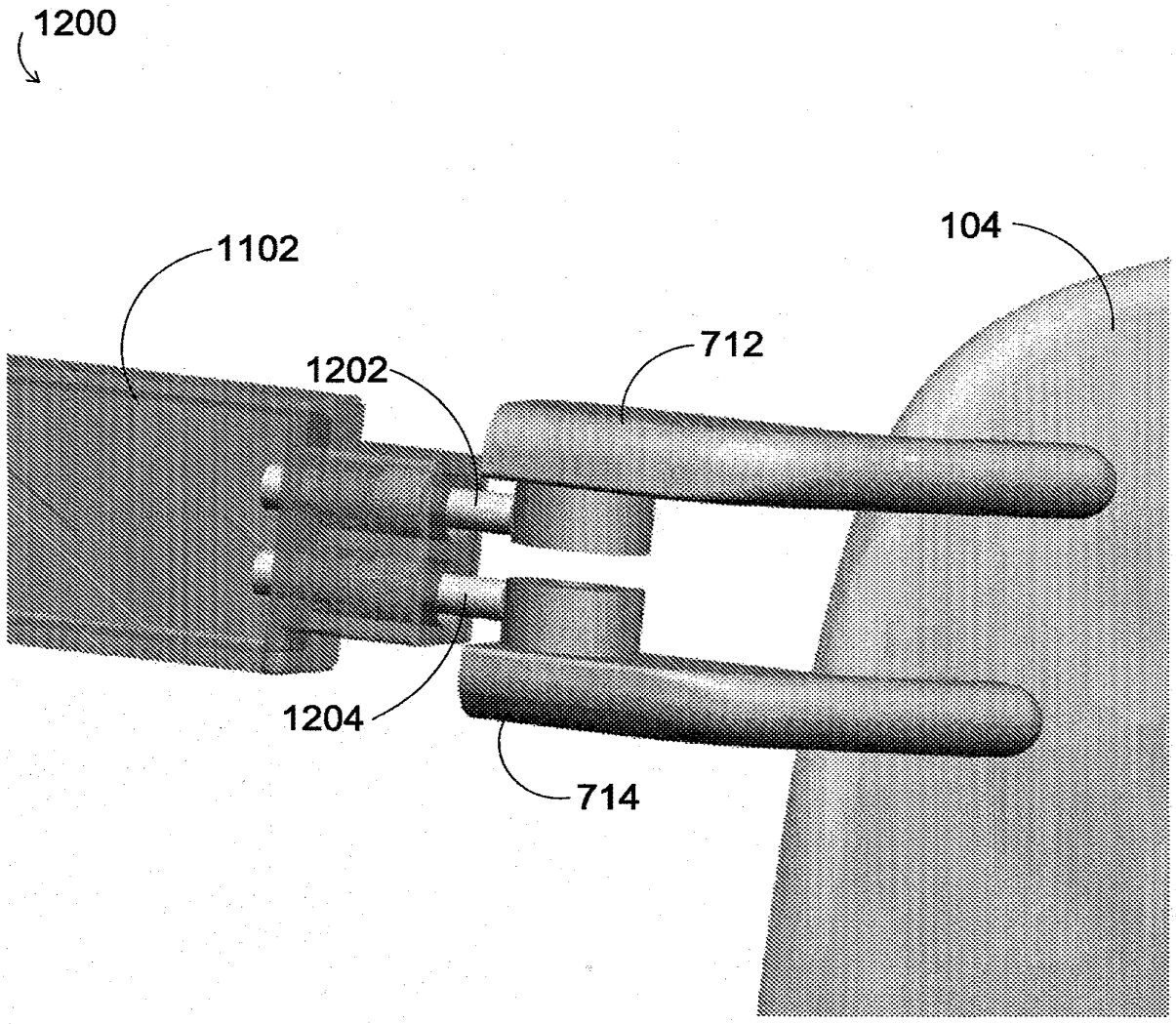


FIGURE 12

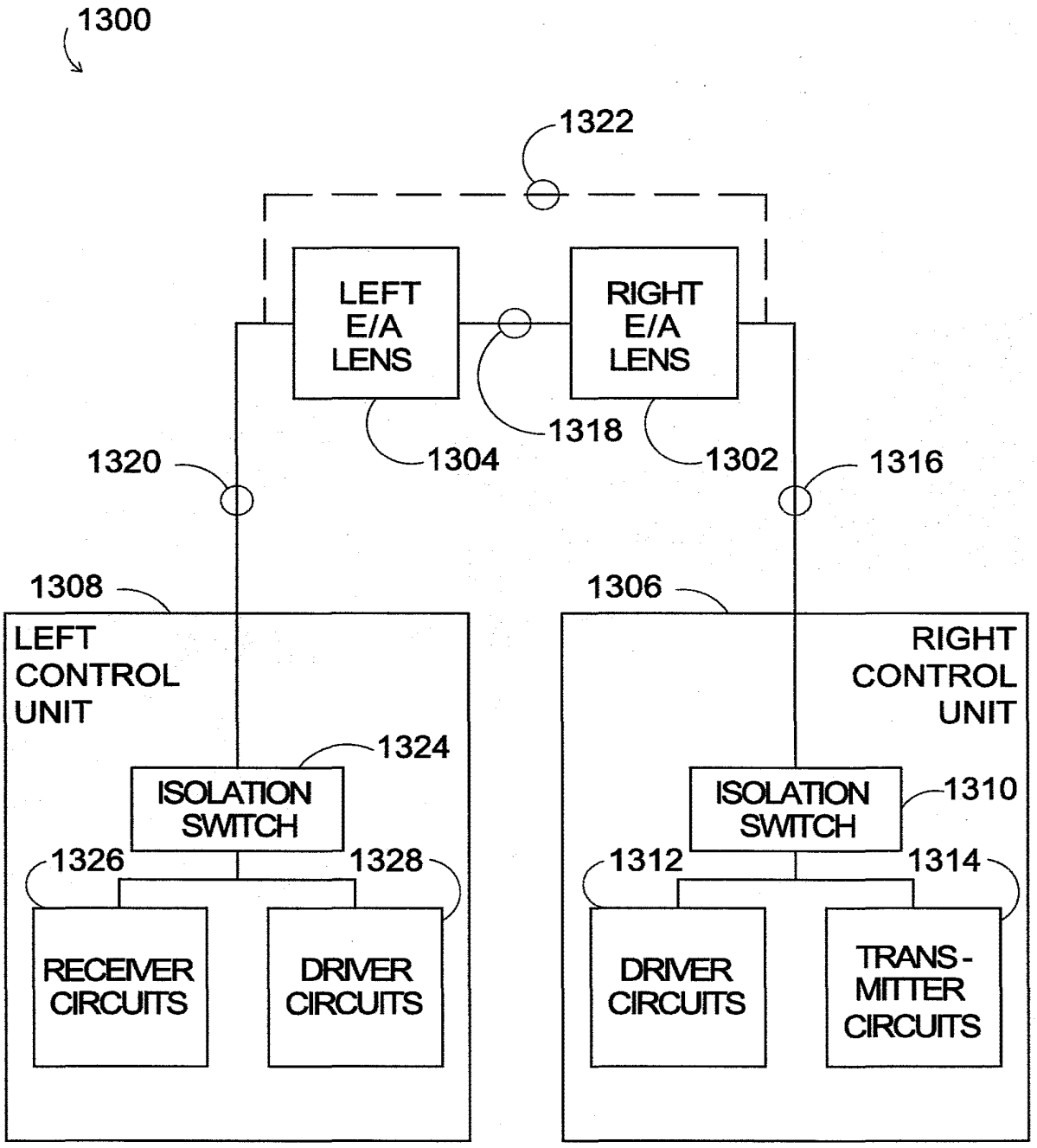

1300
1322
LEFT E/A LENS
RIGHT E/A LENS
1318
1304
1302
1320
1316
1308
1306
LEFT CONTROL UNIT
RIGHT CONTROL UNIT
1324
ISOLATION SWITCH
1310
ISOLATION SWITCH
1326
1328
1312
1314
RECEIVER CIRCUITS
DRIVER CIRCUITS
DRIVER CIRCUITS
TRANS-MITTER CIRCUITS

FIGURE 13

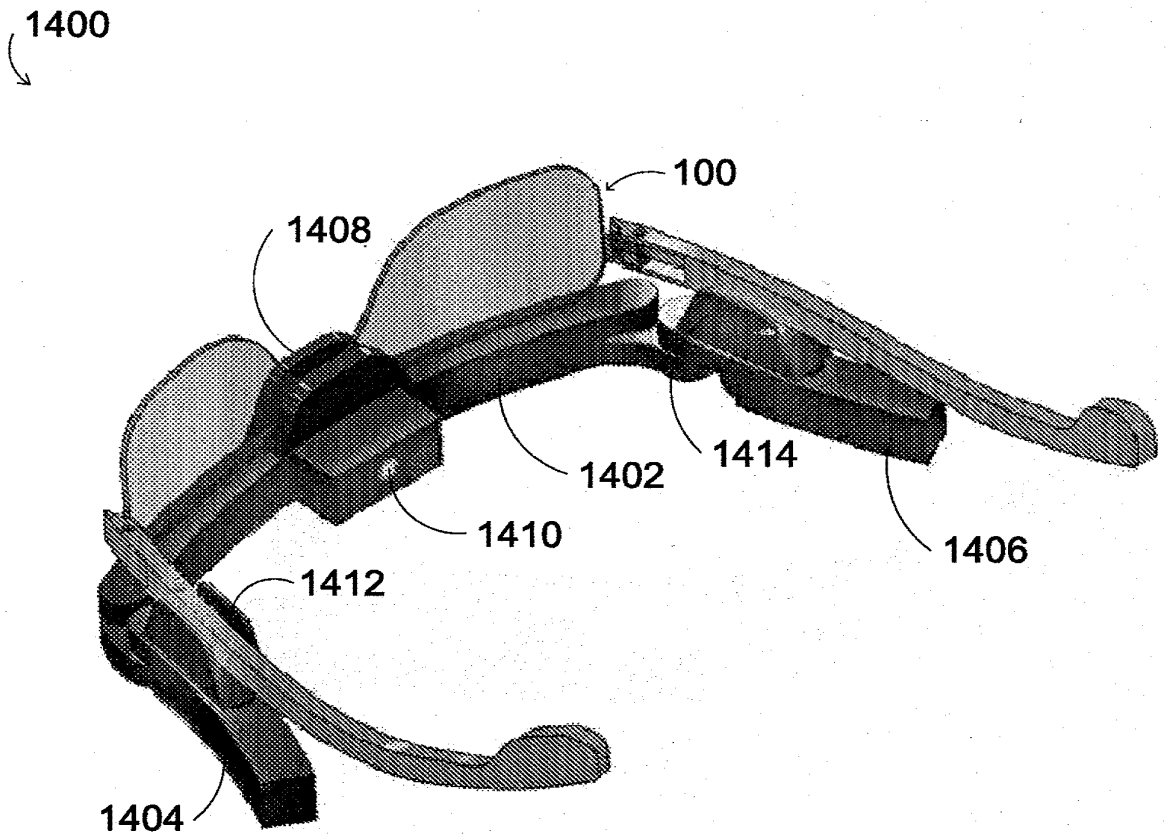


FIGURE 14

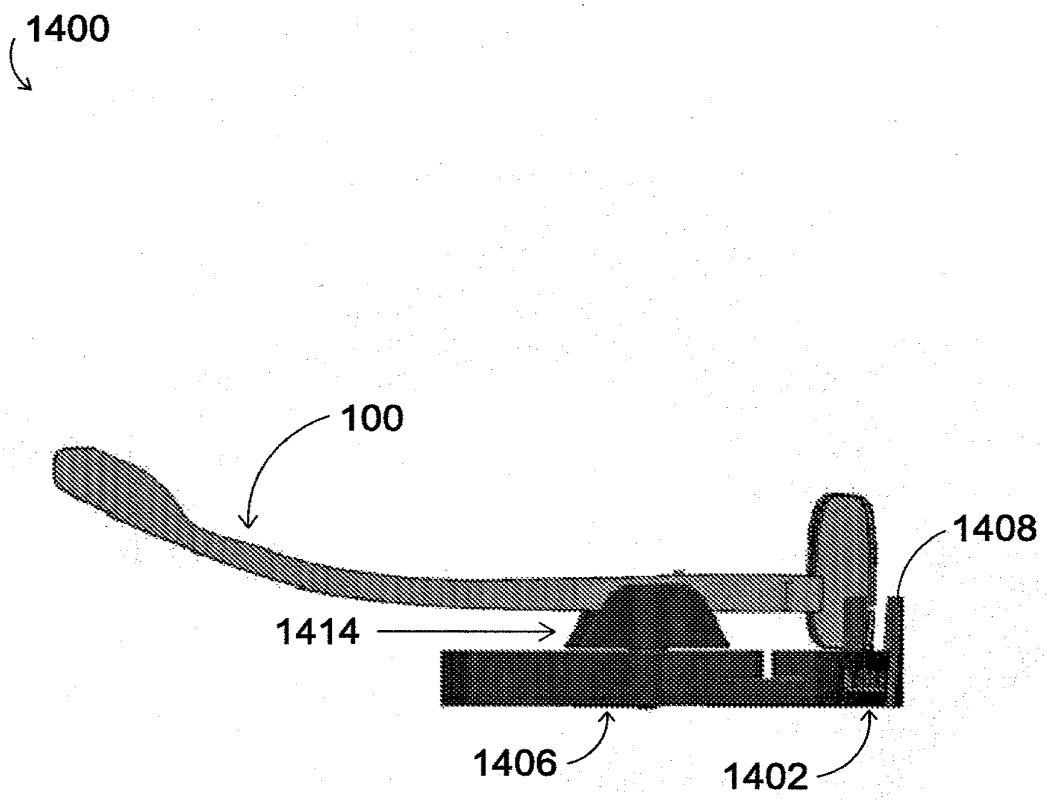


FIGURE 15

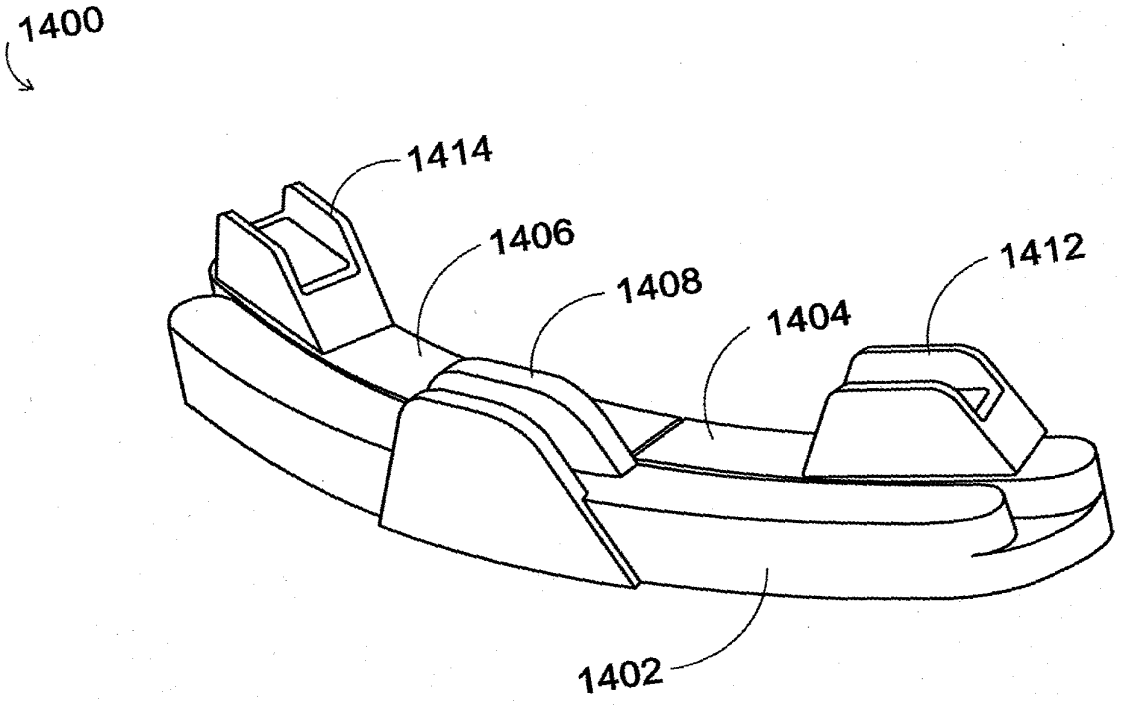


FIGURE 16

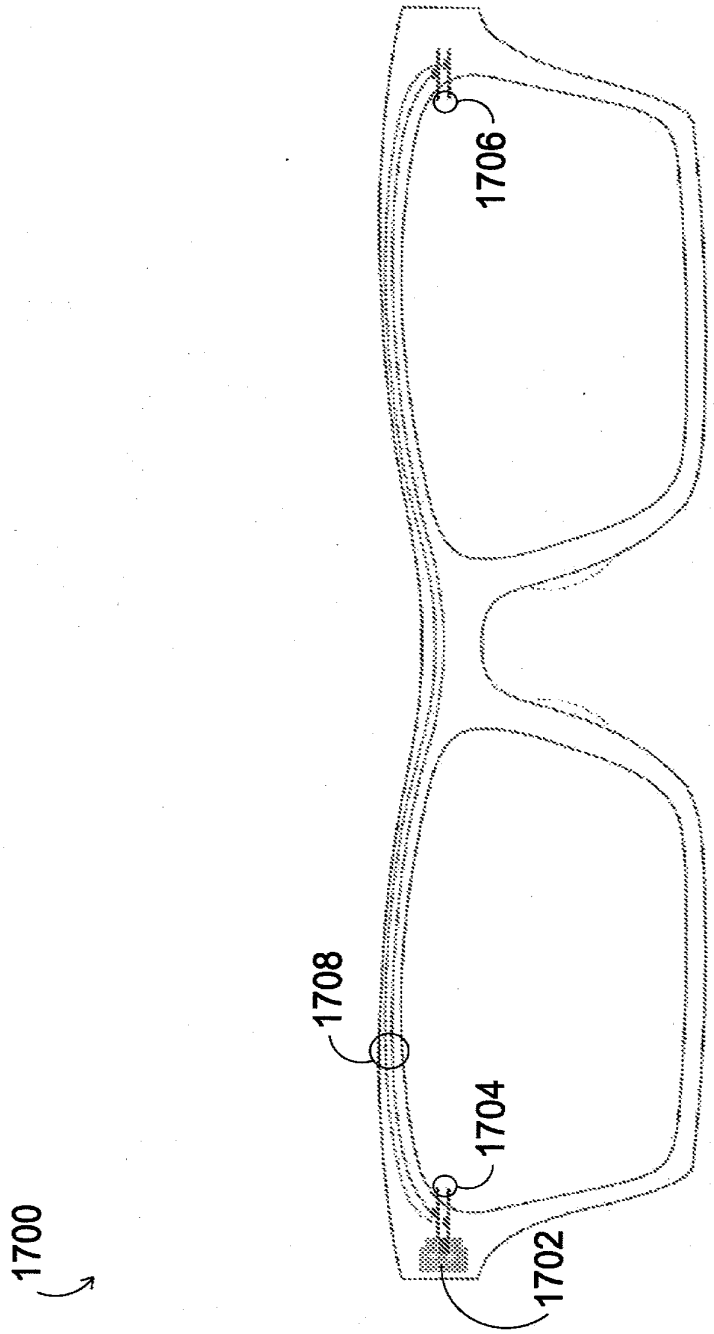


FIGURE 17

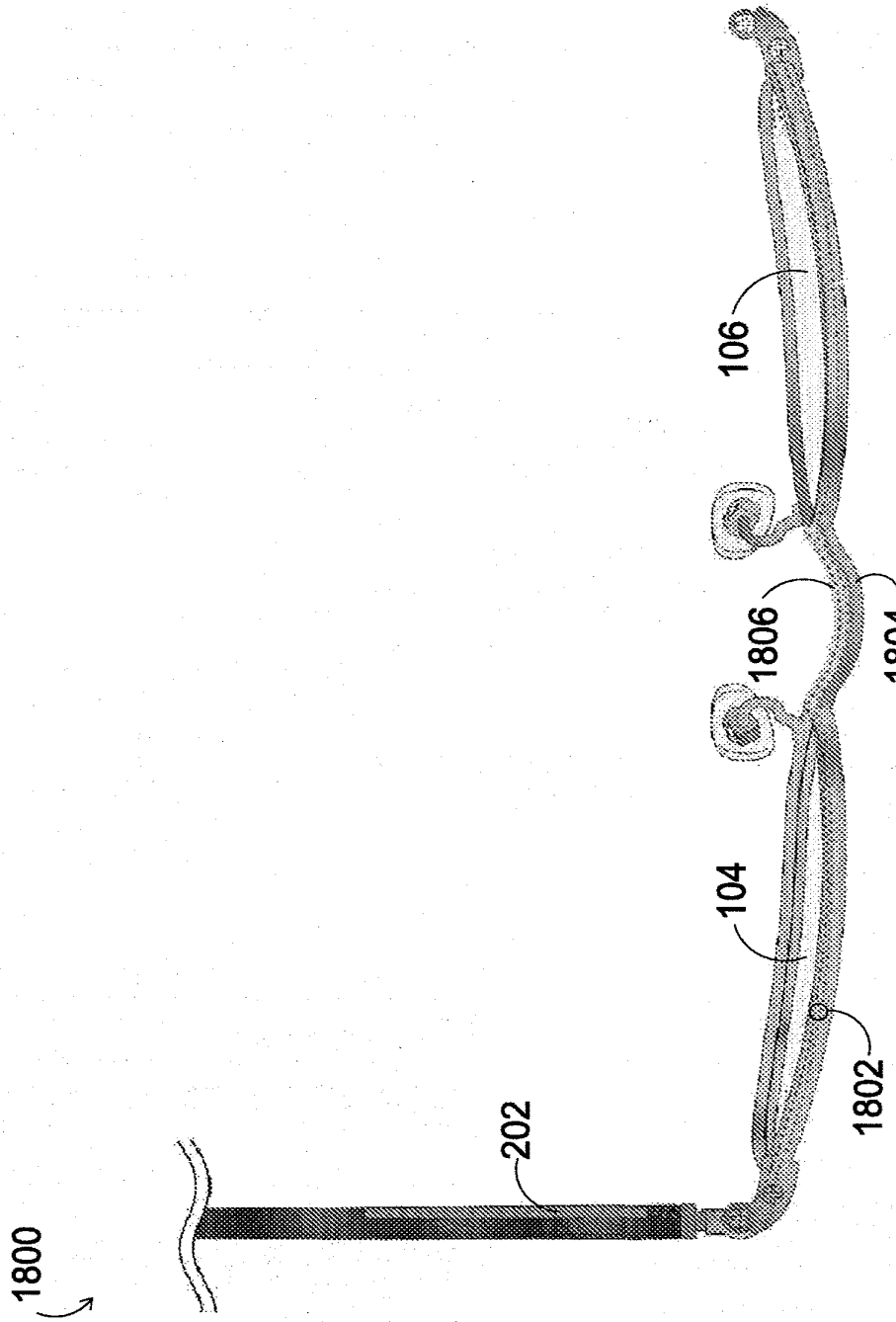


FIGURE 18

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/020498

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02C7/10 H02J7/00
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)
G02C H02J

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 practical, search terms used)
EPO-Internal, COMPENDEX, INSPEC, 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 Y	US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06) paragraph [0078] - paragraph [0098]; figures 9C,10,11	1-4,23 5-14
X Y	WO 2008/002388 A2 (PIXELOPTICS INC [US]; BLUM RONALD D [US]; HADDOCK JOSHUA N [US]; DUSTO) 3 January 2008 (2008-01-03) paragraph [0027] - paragraph [0033]	24 5-8, 12-14, 25-34
Y	US 4 991 951 A (MIZUNO MITSUYOSHI [JP] ET AL) 12 February 1991 (1991-02-12) * abstract	9-11

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 June 2010	25/06/2010

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	Girardin, François

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/020498

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2005/016057 A1 (LEWIS GENE LEE CHEYENNE [GB]) 24 February 2005 (2005-02-24) page 4, line 9 - line 14 figure 3	15-22
Y	WO 2006/126881 A2 (VARIBEL B V [NL]; VAN DER ZWAN JACOB [NL]; SIPKEMA MARCUS KAREL [NL]) 30 November 2006 (2006-11-30) figure 9A page 20, line 22 - page 21, line 13 page 23, line 23 - page 24, line 27	15-22
Y	US 5 455 638 A (KALLMAN WILLIAM R [US] ET AL) 3 October 1995 (1995-10-03) * abstract column 9, line 21 - line 40	25-34
A	US 2007/258039 A1 (DUSTON DWIGHT P [US] ET AL) 8 November 2007 (2007-11-08) paragraphs [0036], [0045]	1-14,23
A	WO 2006/086155 A2 (COLGATE PALMOLIVE CO [US]; WAGUESPACK KENNETH [US]) 17 August 2006 (2006-08-17) * abstract	17,18
A	WO 2008/051520 A2 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; BOCHNOWSKI JAMES J [US];) 2 May 2008 (2008-05-02) the whole document	15-22
A	US 2004/156012 A1 (JANNARD JAMES [US] ET AL) 12 August 2004 (2004-08-12) paragraph [0125]	26-34

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/020498

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14, 23

   Electro-active frames and spectacles having an inductive charge area in one of the temples.

   ---

2. claims: 15-22

   An inductive charger for electro-active spectacles having two movable arms and one inductive charging area.

   ---

3. claims: 24-34

   Frame for electro-active spectacles and method of controlling such spectacles wherein a switch is used to switch the electro-active lenses/spectacles between at least two different states.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/020498

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(19) **United States**

(12) **Patent Application Publication**

Kokonaski et al.

(10) **Pub. No.: US 2008/0273166 A1**

(43) **Pub. Date: Nov. 6, 2008**

(54) **ELECTRONIC EYEGLASS FRAME**

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(21) Appl. No.: **12/054,299**

(22) Filed: **Mar. 24, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/924,225, filed on May 4. 2007, provisional application No. 60/929,419, filed on Jun. 26, 2007.

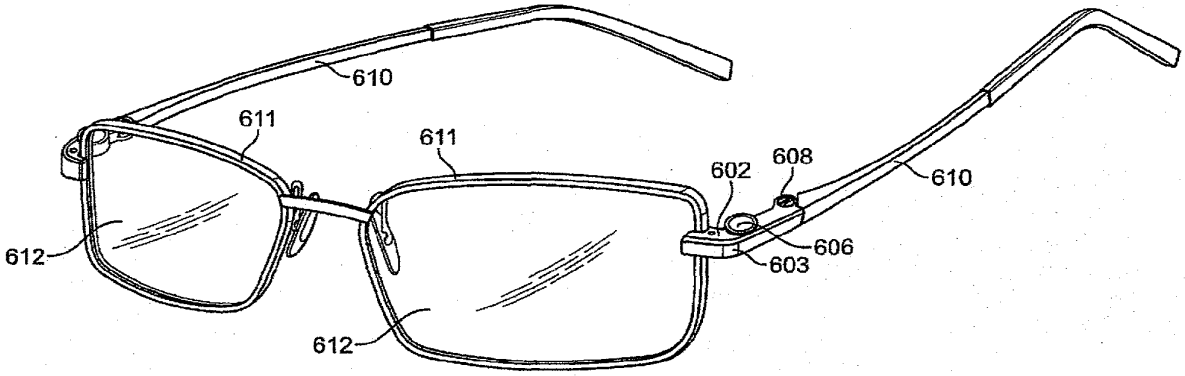
Publication Classification

(51) **Int. Cl.**
G02C 7/06 (2006.01)
G02C 11/00 (2006.01)

(52) **U.S. Cl.** **351/158**; 351/168

(57) **ABSTRACT**

The present invention generally relates to integrating electronic components into an electro-active frame for driving electro-active focusing lenses. This is accomplished in a cosmetically pleasing manner that allows a platform of frame systems to be built from a single electronic module. Specifically, the present invention discloses controlling an electro-active lens in a deliberate, hands free manner that gives the user control of the electro-active lens.



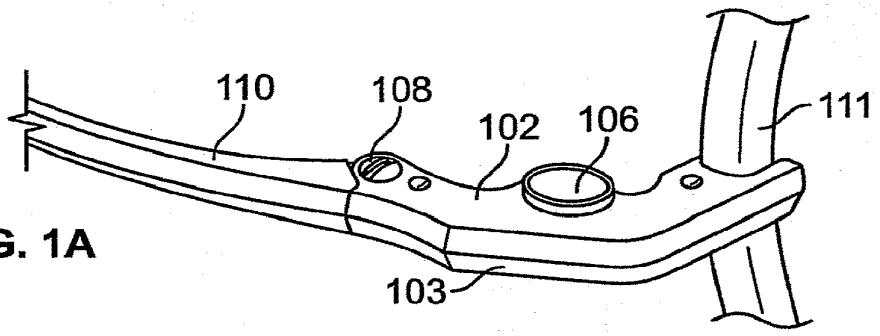


FIG. 1A

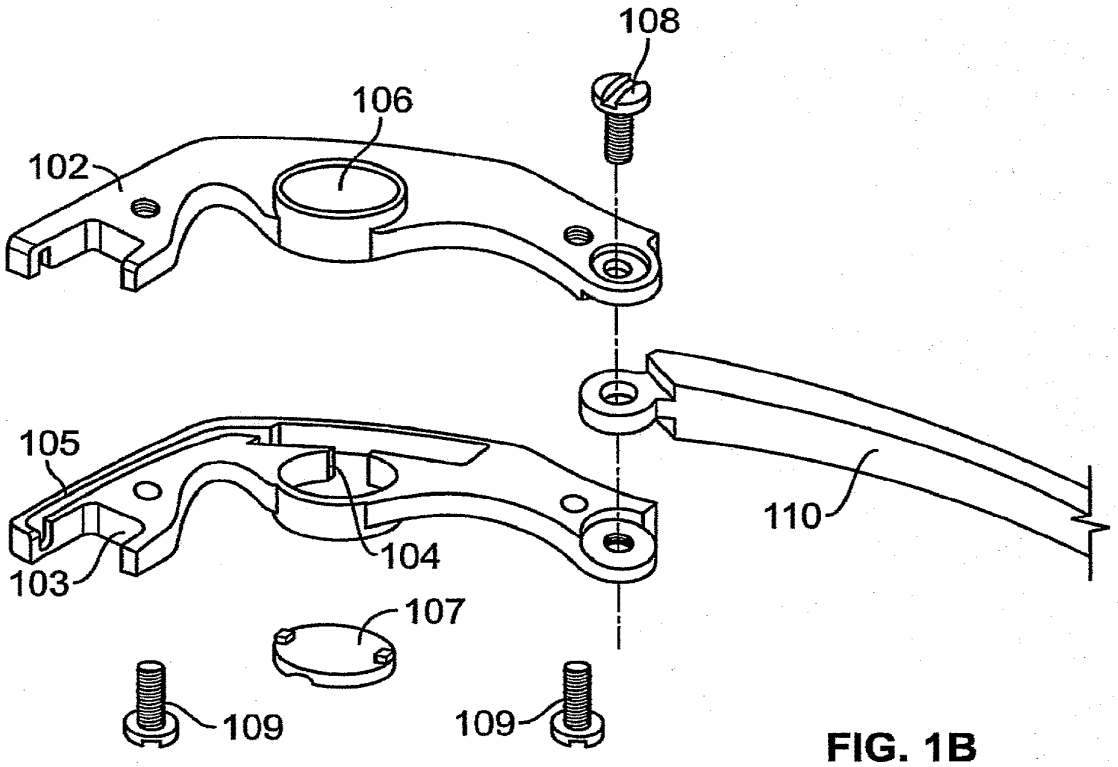


FIG. 1B

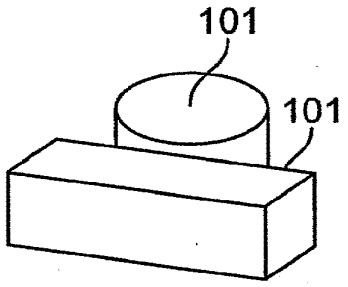


FIG. 1C

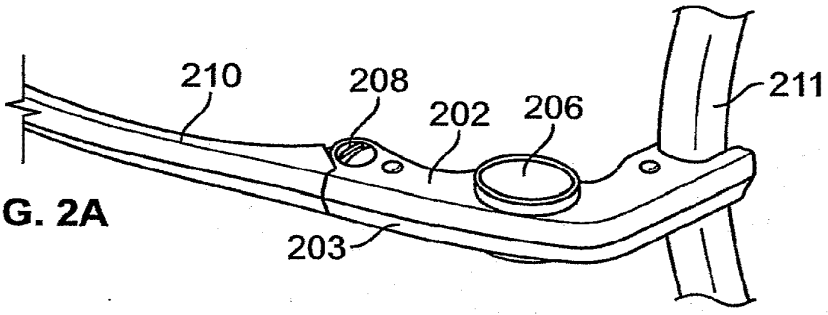


FIG. 2A

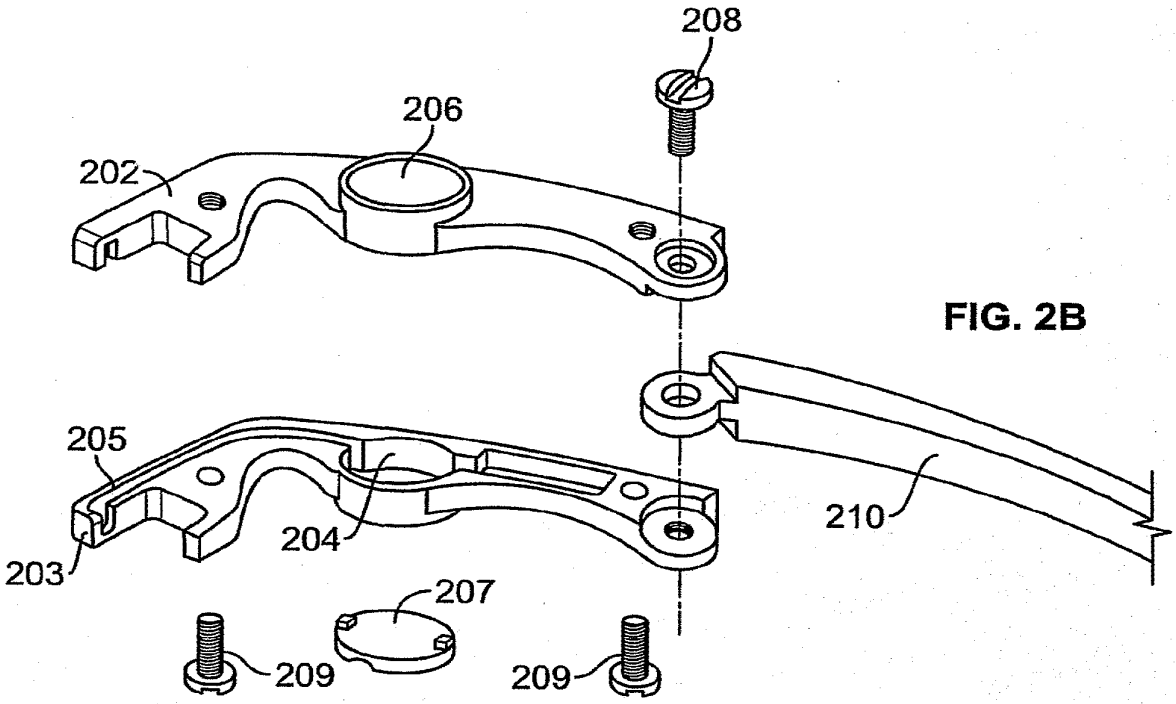


FIG. 2B

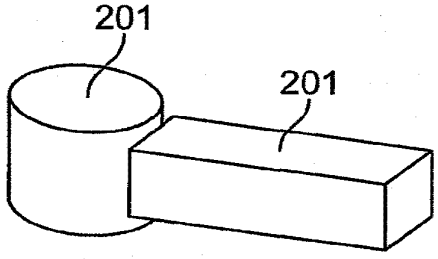


FIG. 2C

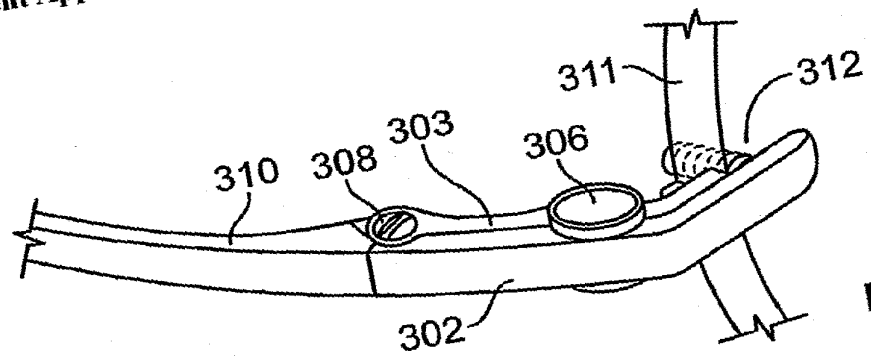


FIG. 3A

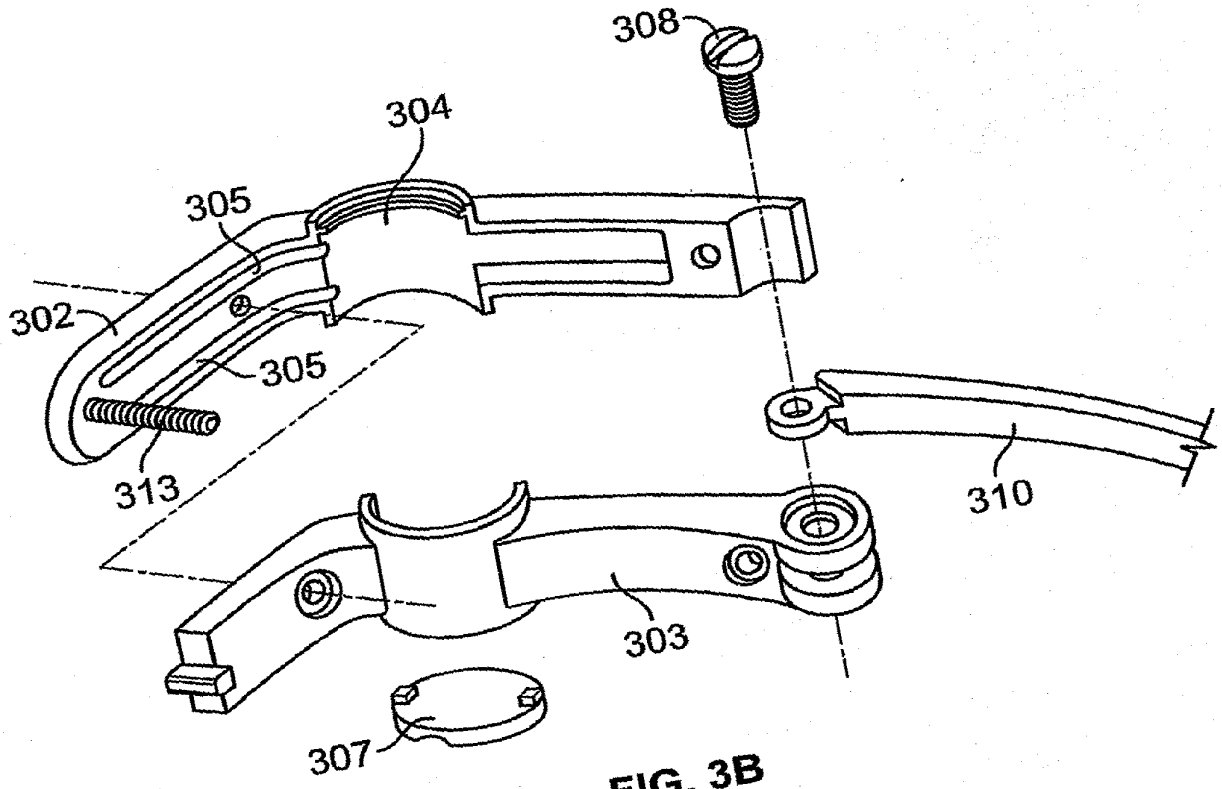


FIG. 3B

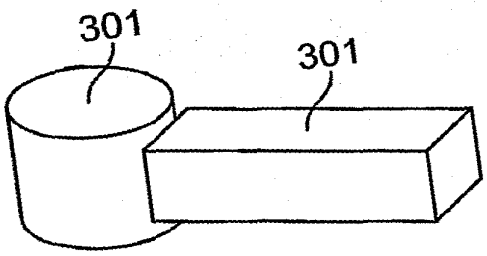


FIG. 3C

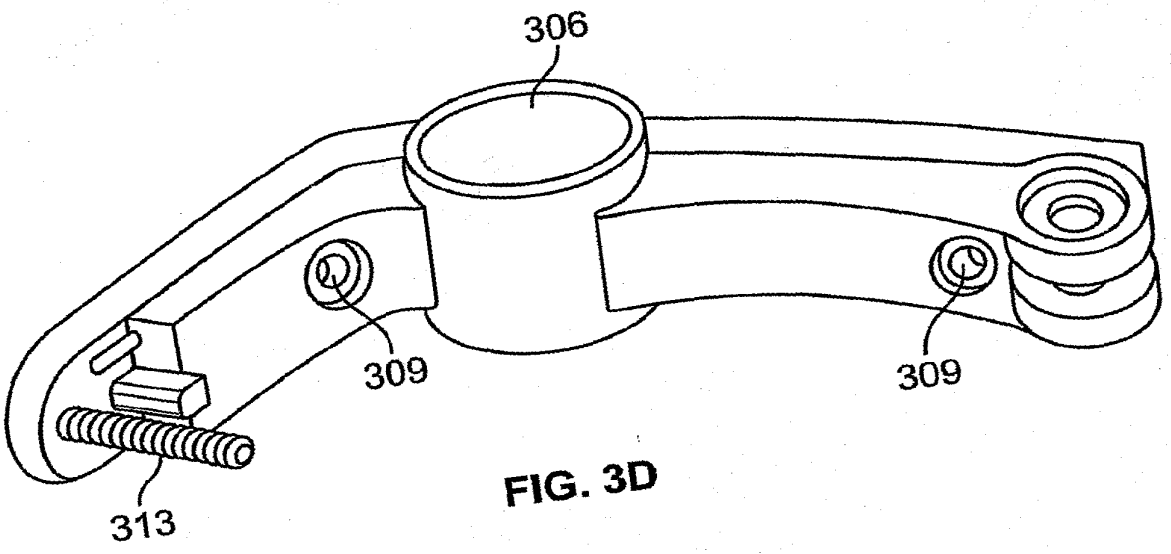


FIG. 3D

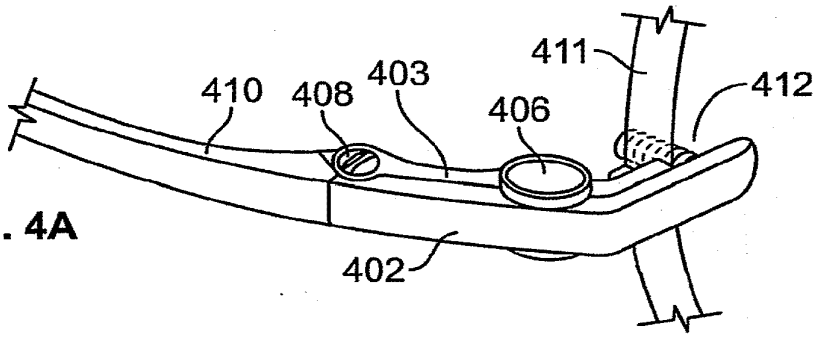


FIG. 4A

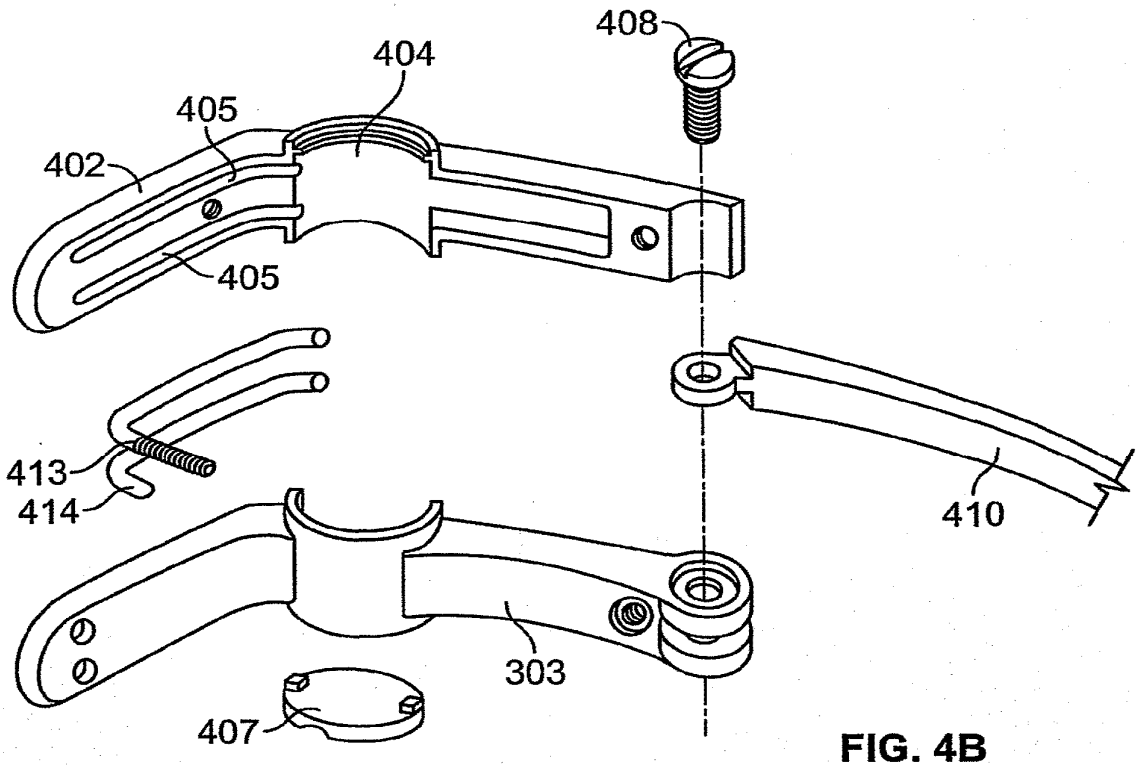


FIG. 4B

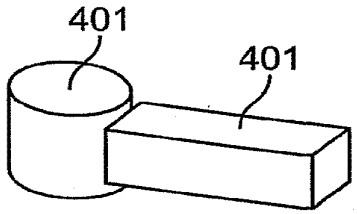


FIG. 4C

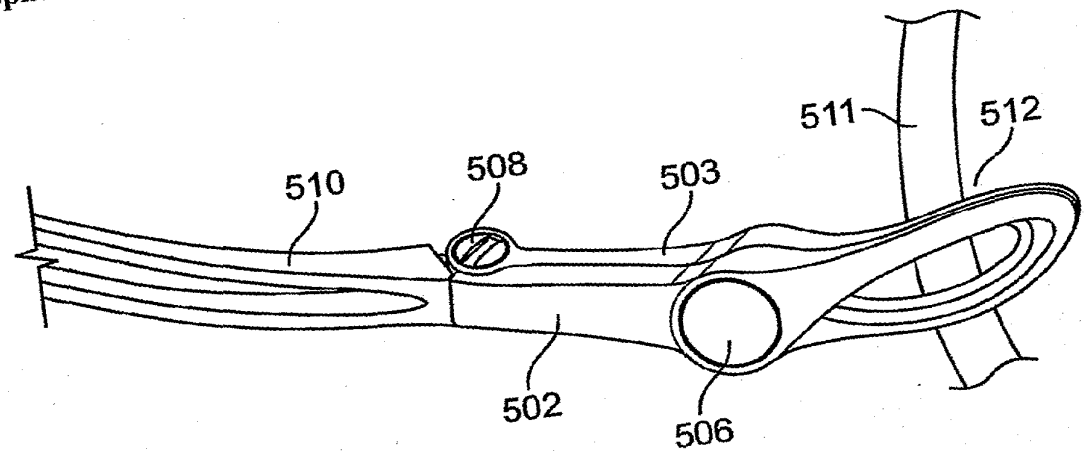


FIG. 5A

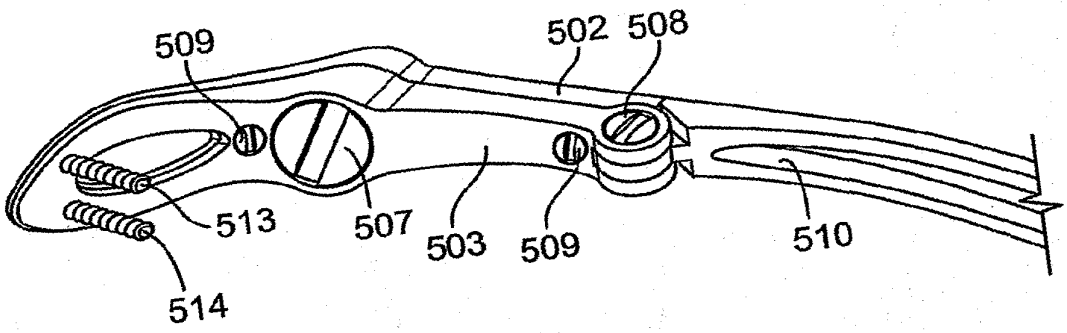


FIG. 5B

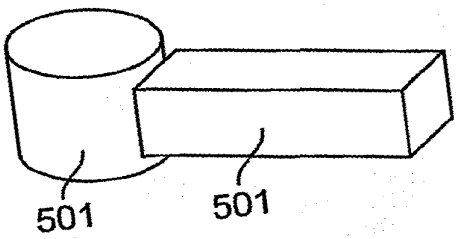


FIG. 5C

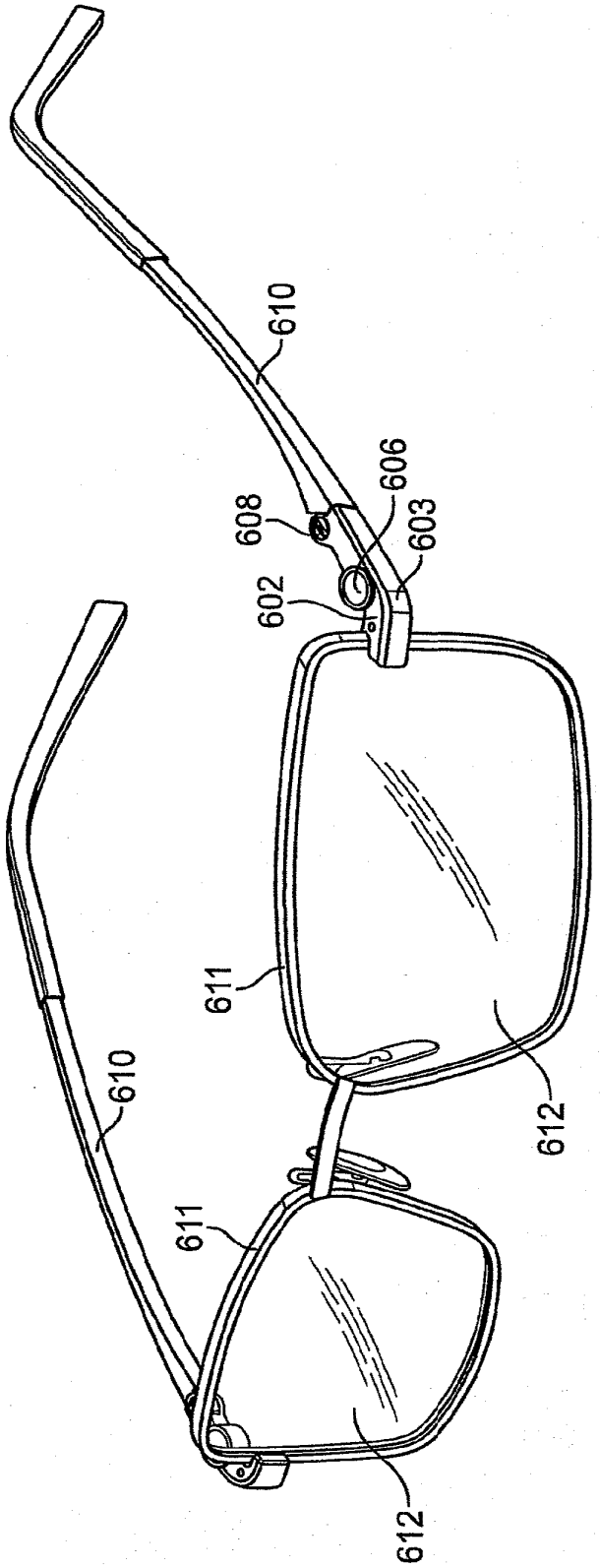


FIG. 6

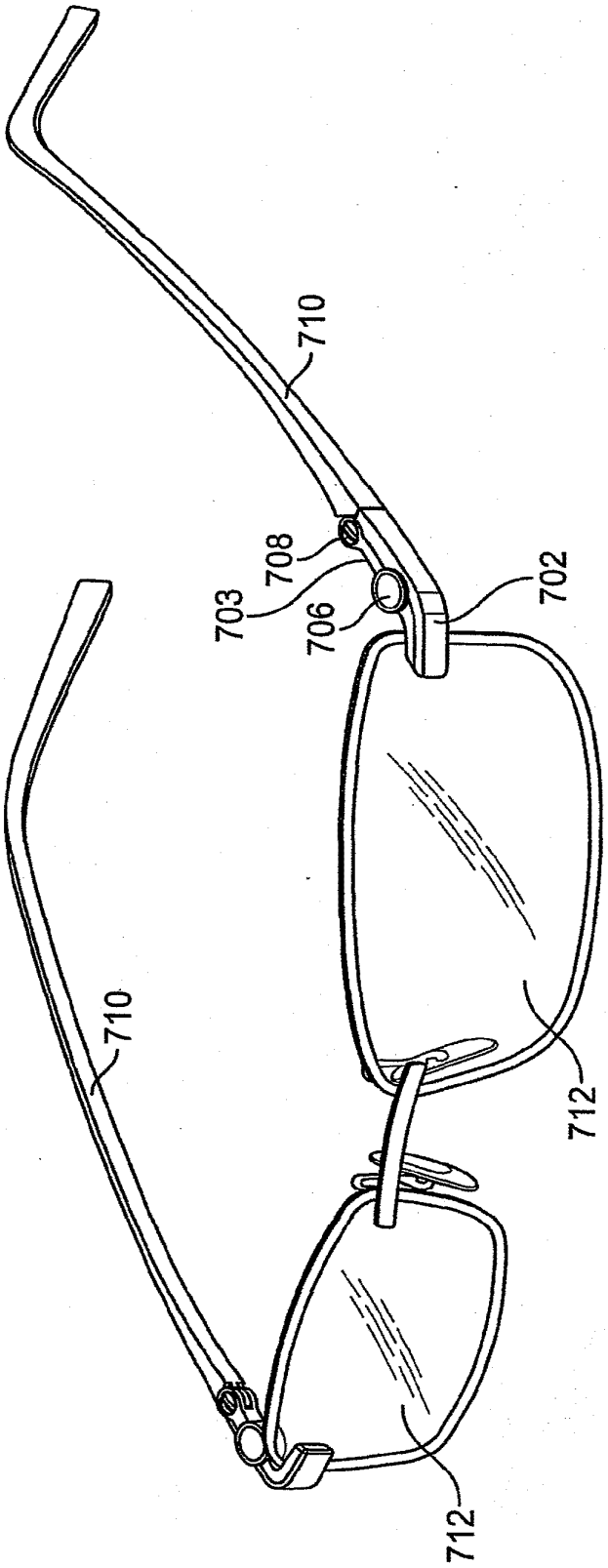


FIG. 7

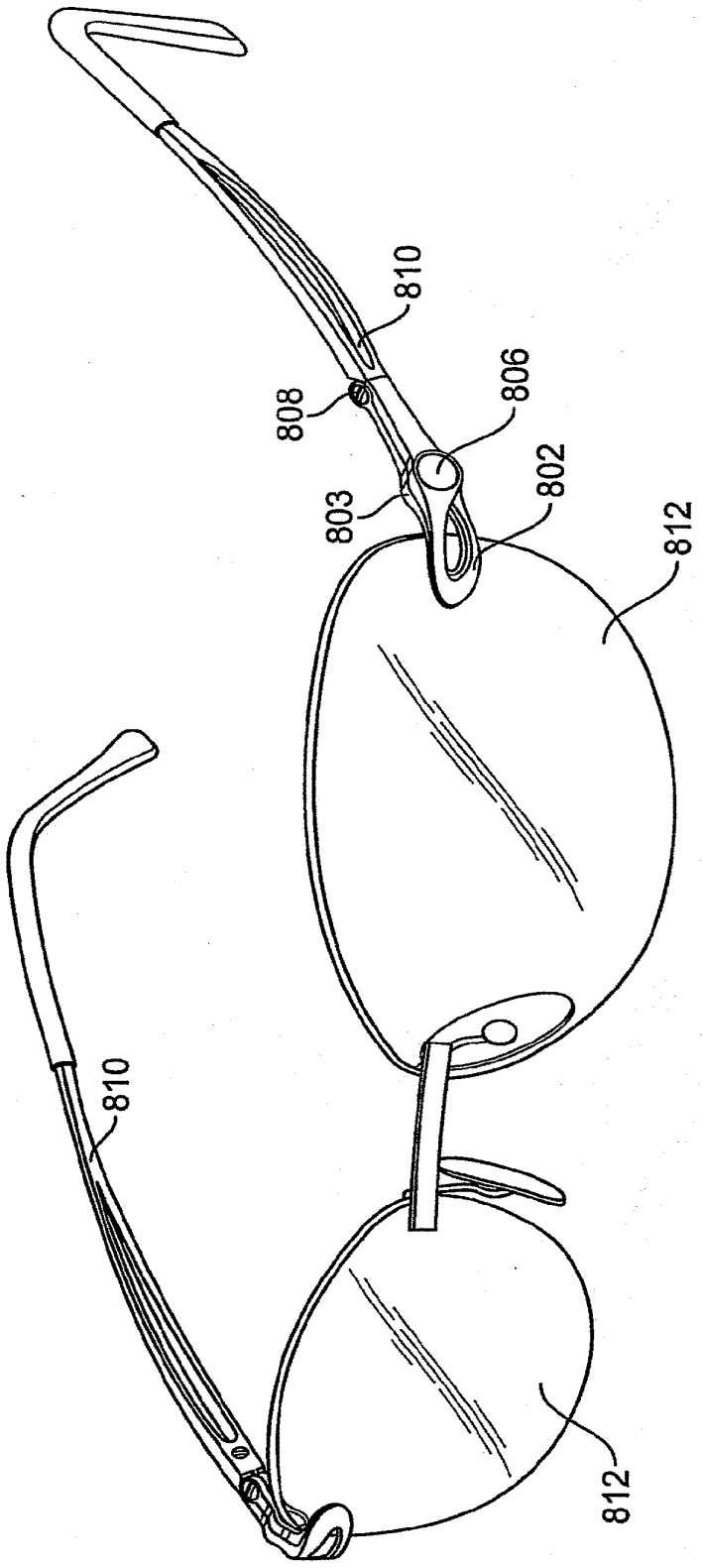


FIG. 8A

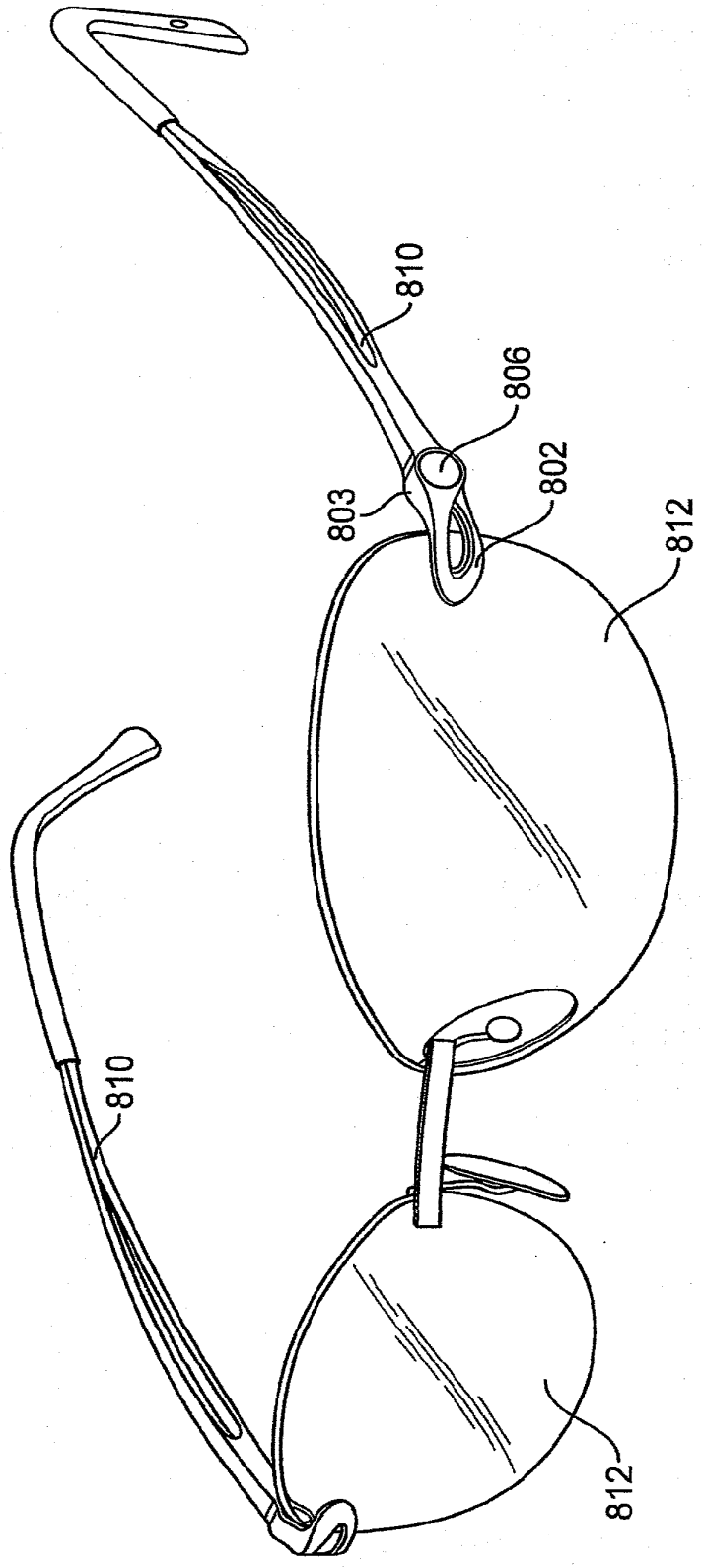


FIG. 8B

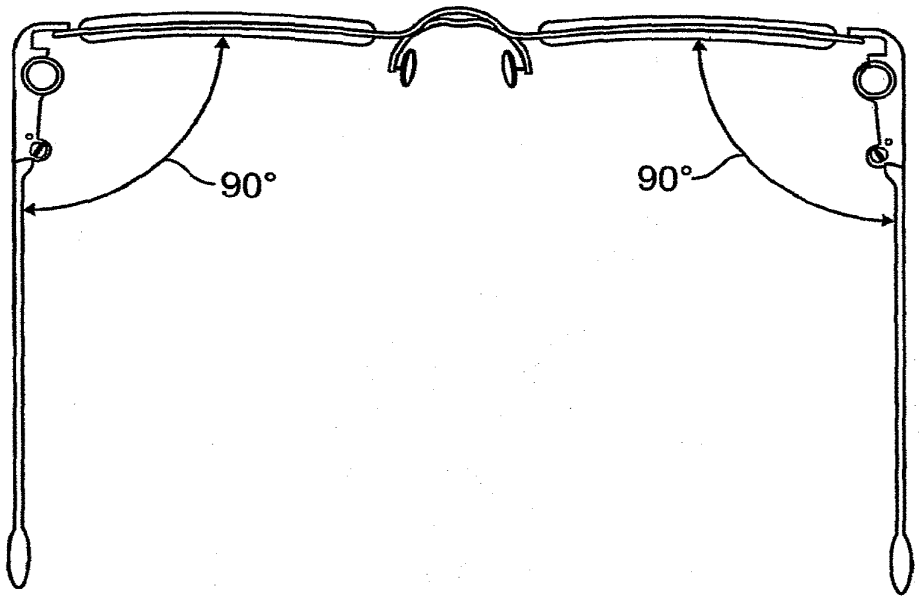


FIG. 9A

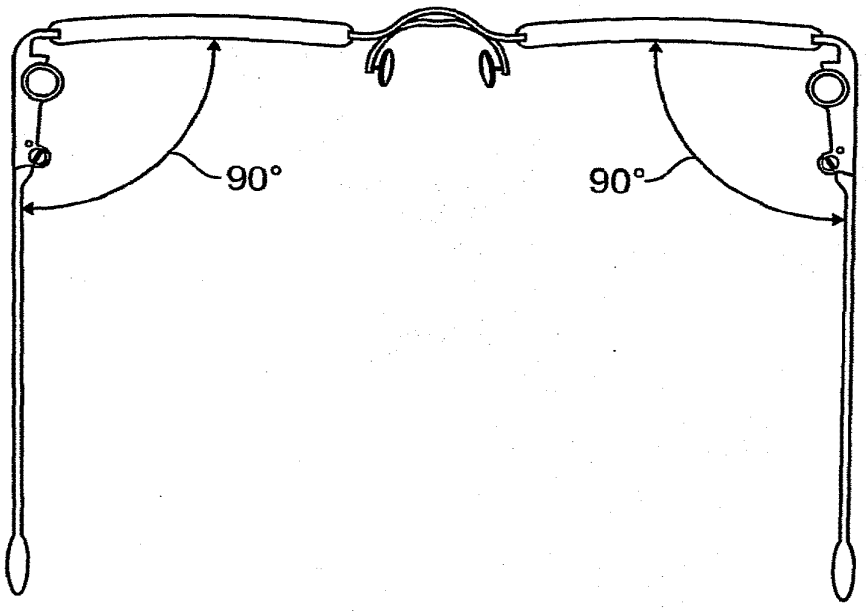


FIG. 9B

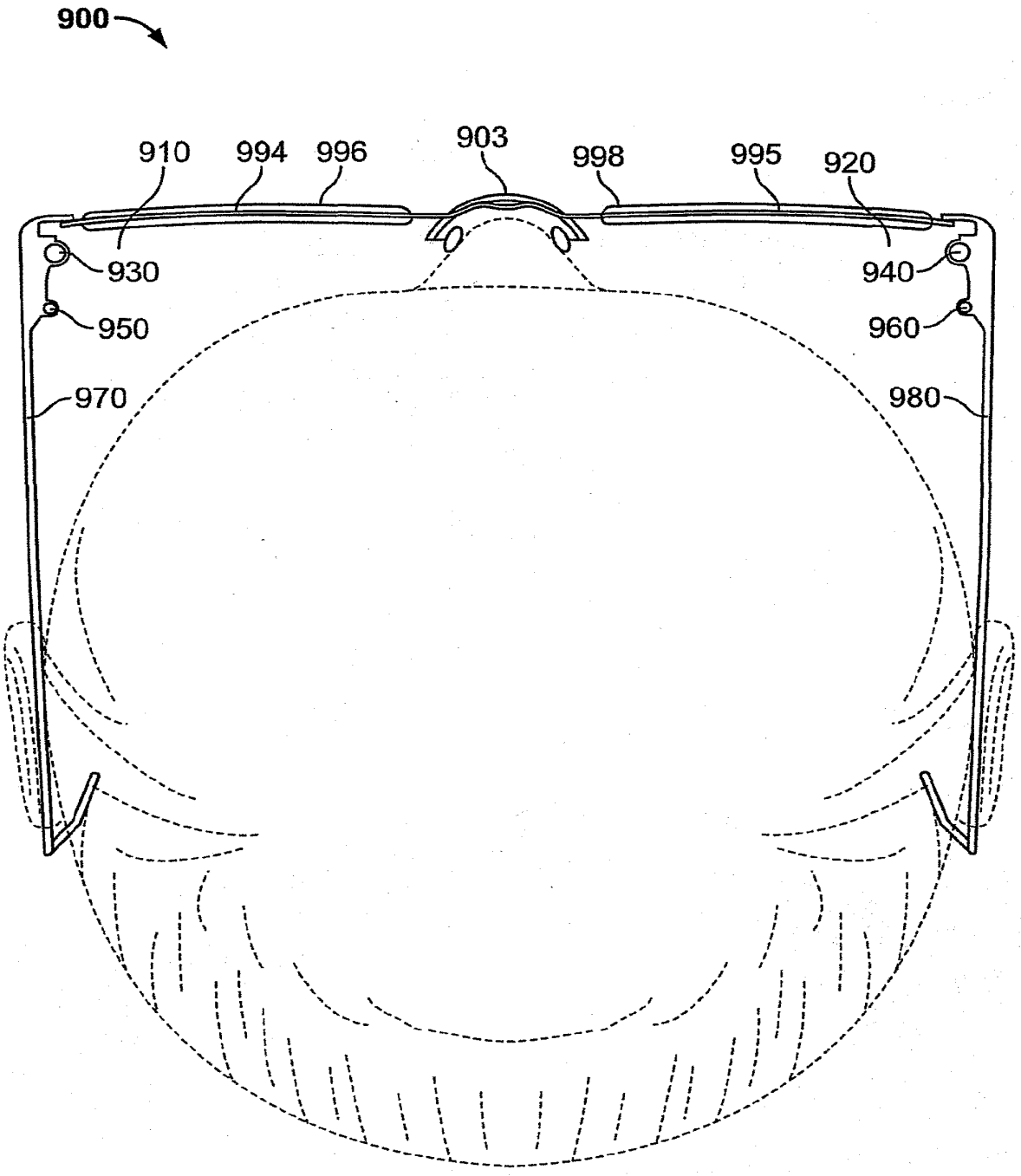


FIG. 9C

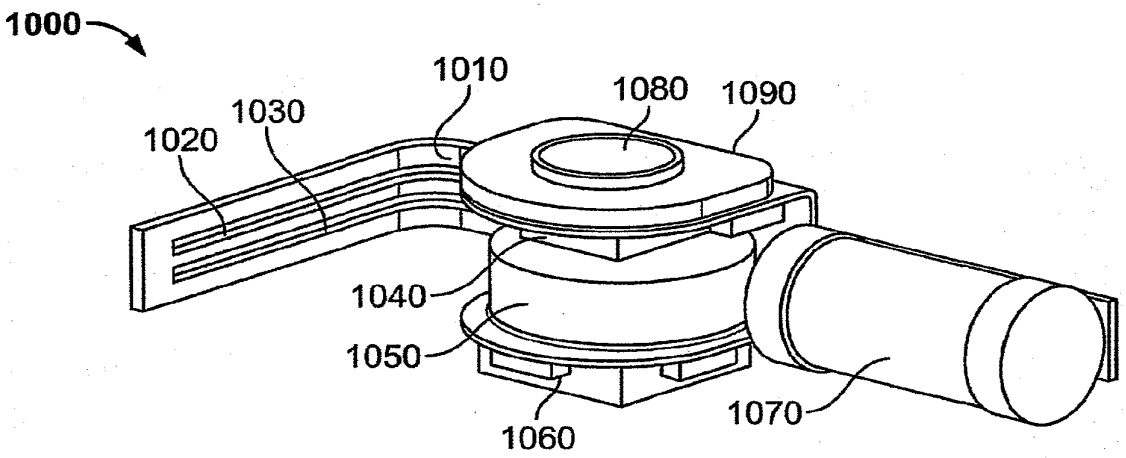

1000
1010
1080
1090
1030
1020
1040
1050
1060
1070

FIG. 10

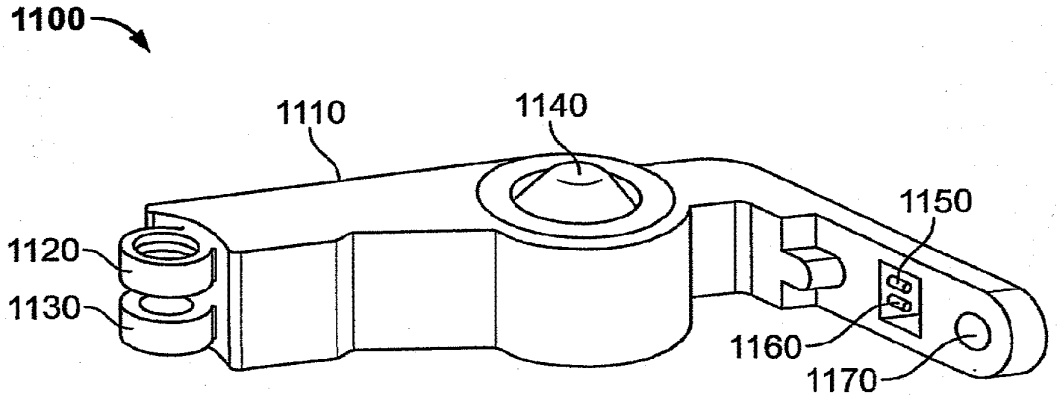

1100
1110
1140
1150
1120
1130
1160
1170

FIG. 11

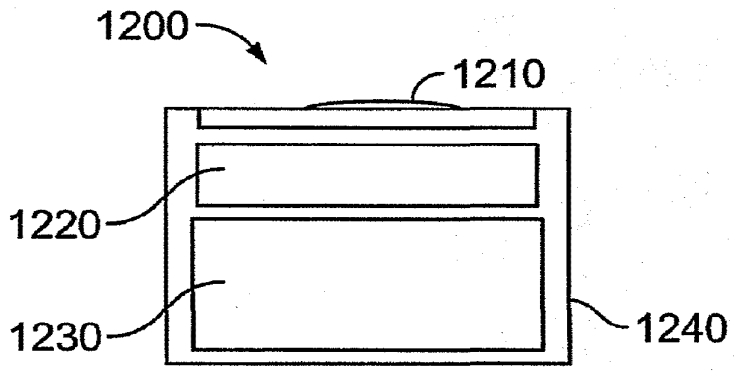


FIG. 12A

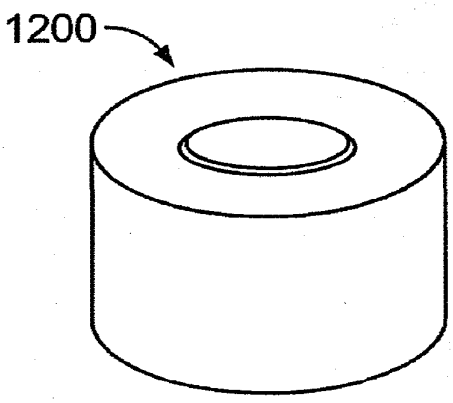


FIG. 12B

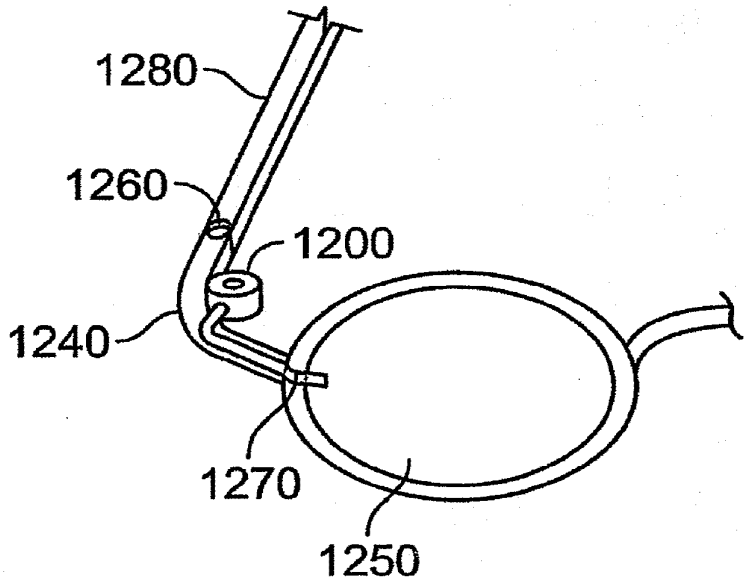


FIG. 12C

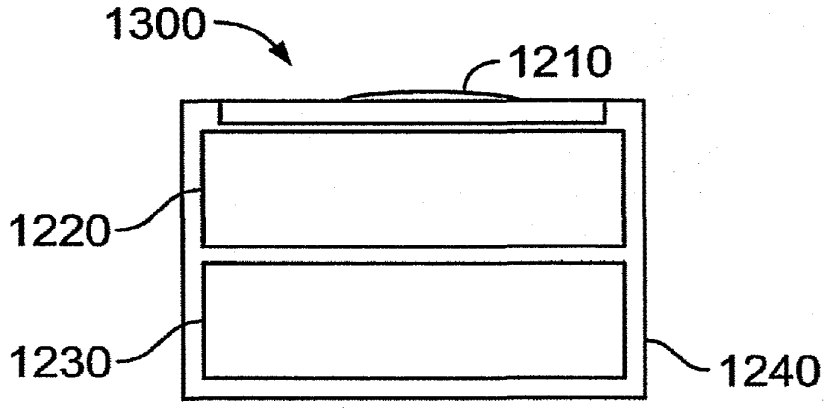


FIG. 13A

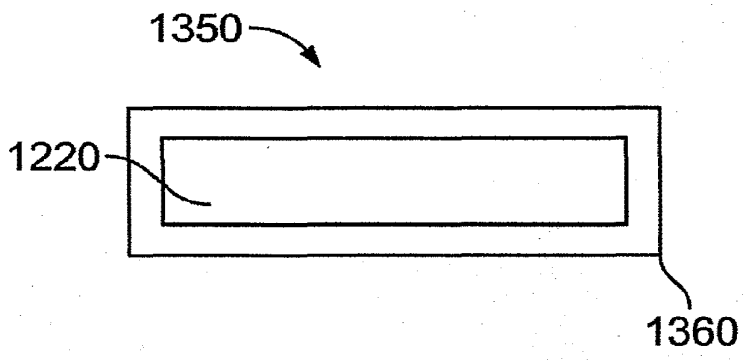


FIG. 13B

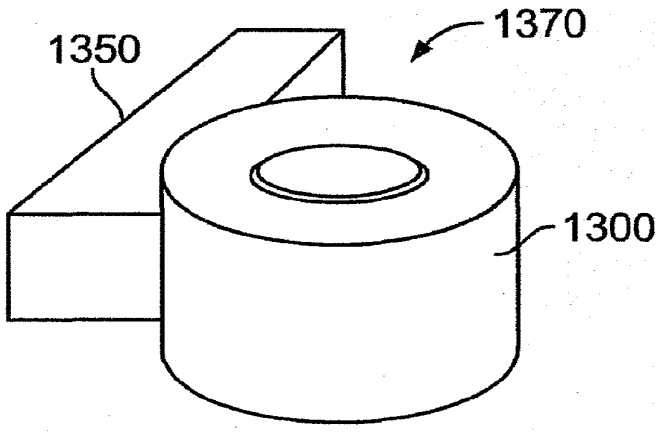


FIG. 13C

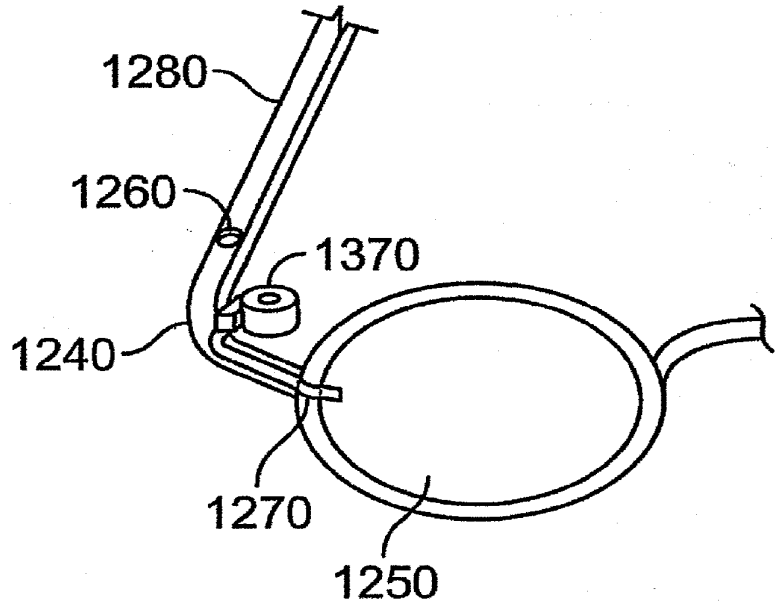


FIG. 13D

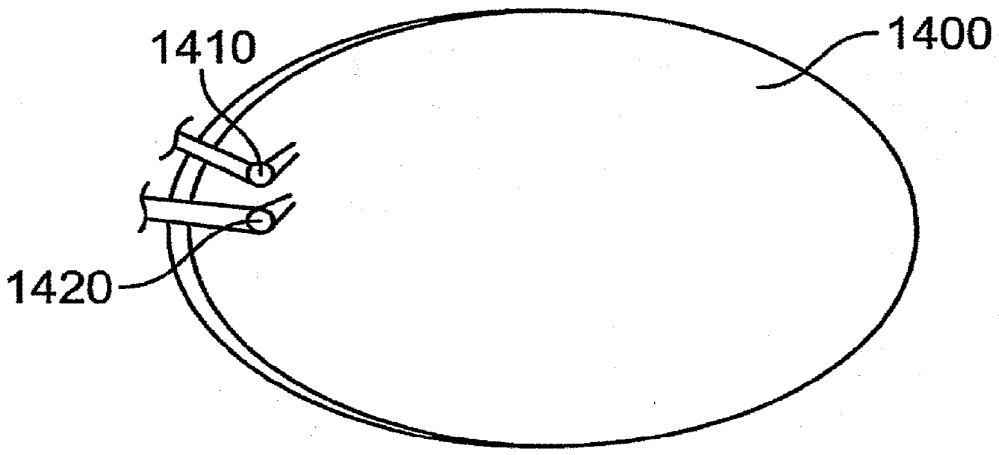


FIG. 14

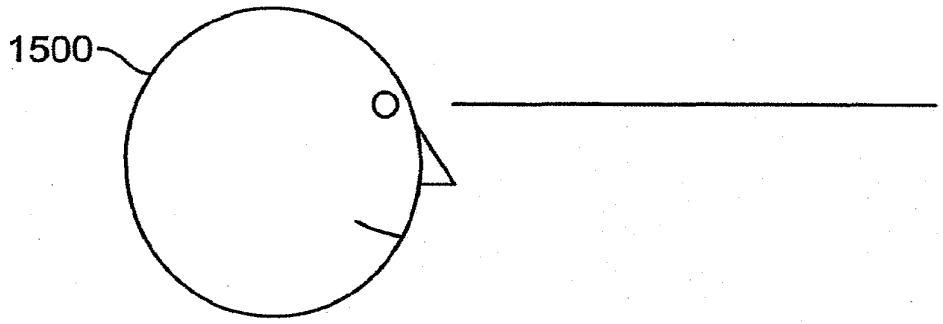


FIG. 15A

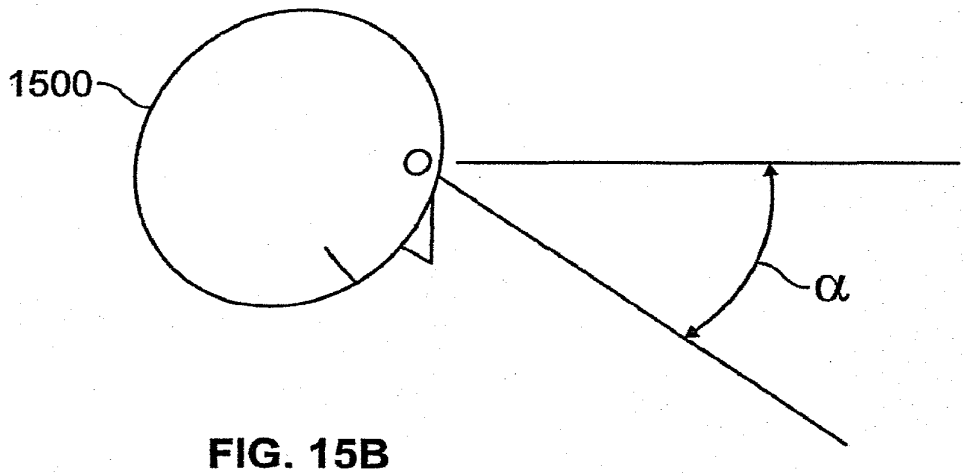


FIG. 15B

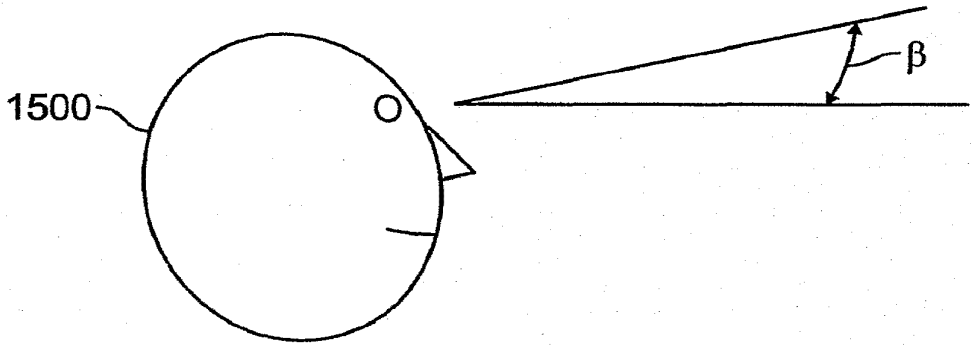


FIG. 15C

ELECTRONIC EYEGLASS FRAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/796,876 filed on May 3, 2006 and entitled, "Spectacle Frame Bridge Housing Electronics For Electro-active Spectacle Lenses" (now U.S. Ser. No. 11/797,210), U.S. Provisional Application No. 60/924,225 filed on May 4, 2007 and entitled, "Advanced Electro-Active Spectacles, U.S. Provisional Application No. 60/929,419 filed on Jun. 26, 2007 entitled, "Electronic Eyeglass Frames and Integration Thereof", and U.S. Provisional Applications No. 60/854,697 and 60/854,677 respectively entitled, "Advanced Electronic Eyewear" and "Universal Temple End Piece For Spectacles both of which were filed on Oct. 27, 2006 (now together as Ser. No. 11/976,199), all of which are incorporated in their entirety herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to integrating electronic components into an electronic eyeglass frame for driving electro-active lenses capable of one or more of dynamic focus, dynamic changeable tint, and other electronic applications such as, by way of example only, an electronic display that may or may not be incorporated within the lens. This is accomplished in a cosmetically pleasing manner that allows a platform of frame systems to be built from a single electronic module. The present invention discloses controlling an electro-active lens in a deliberate, hands free manner that gives the user control of the electro-active lens. In addition, the present invention allows for a mostly universal electronics module or modules that can be applied to most eyeglass frames in such a manner (and location) whereby conductive wiring of the temples and the frame front is minimized, cosmetics and form factor of the eyeglass frame is maintained, and complicating issues of connecting electrical current thru the bridge or hinge of the eyeglass frame are mitigated.

[0004] 2. Description of the Related Art

[0005] In today's world, spectacle eyeglass frames are very fashionable. While the trend for the eyeglass lenses is to make them thinner, lighter, and less visible, at the same time, it is the eyeglass frame that makes the fashion statement for the eyeglass wearer.

[0006] Concurrent with these trends is another concerning including electronics into spectacle eyewear. By way of example, Oakley™ has commercialized electronic eyewear called the Oakley Thump™ that incorporates a MP3 player into the temple of the eyewear that can be oriented properly for the wearer. The Oakley Thump is a prime example of what the invention disclosed here desires to avoid. That being a thick temple or frame housing electronics that distracts from the aesthetic appearance of the eyeglass frames. PixelOptics™ is developing electro-active eyewear that allow for the lens to dynamically focus for the wearer's distance vision needs without any moving parts. Electronic tints for the lens such as, by way of example only, electro-chromics, rapid change tint technology, and tint shuttering are being developed by others as well. Finally, electronic displays are being developed that fit within or on the eyeglass lens allowing the user to see an image floating in front of them in space. The trend of utilizing electronics in eyewear appears to be accelerating and the applications being developed by others are expanding.

[0007] As theses trends continue, it is becoming important to find ways to incorporate electronics into eyewear without harming the aesthetics and functionality of the eyewear. The challenge is to not limit the fashion design of the eyeglass frame or limit the materials which the eyeglass frame can be made of, maintain as few completed eyeglass frames or eyeglass frame components (frame fronts, bridges, temples) stock keeping units (SKUs) as possible, allow for robust placement of the electronics, and in a way that can be manufactured so that it remains affordable, and aesthetically desirable.

[0008] Various electronic components have been disclosed in prior art whereby said components are located in the side of one or both temples, in or on the end piece of the temple, in or on the eyeglass frame's bridge, in or on the lens or lenses, or affixed to the hinge or hinges that attach the frame's temple to the frame's front. While these approaches allow for enabling electronic frames and electro-active lenses, to date there has been no way for this to occur while minimizing the number of frame part SKUs, and maintaining the aesthetics of the frame.

[0009] The present invention also addresses the integration of electronic components into an electro-active frame for driving electro-active lenses for one or more of dynamically altering focus, tint or other electronic applications such as by way of example only an electronic display. The invention achieves this objective in a cosmetically pleasing manner that allows for a platform of frame systems to be built from one or more electronic modules.

[0010] These problems have been solved in a simple, convenient, and highly effective way by which to provide an improved electro-active frame having electronic components for driving electro-active lenses in a cosmetically pleasing manner that allows for a platform of frame systems to be built from one or more electronic modules. The present invention discloses controlling an electro-active lens in a deliberate, yet optional hands free control manner that effectively overcomes the aforementioned difficulties and longstanding problems inherent in electro-active eyewear. The invention further allows for the electronic module to control the electronic lens such that if the electronic lens is not in use the electronics are turned off to conserve battery power.

SUMMARY OF THE INVENTION

[0011] According to one aspect of the invention, an eyeglass frame is disclosed comprising a hinged temple. The temple further comprises an electronic module, which is located within a front spatial void of the eyeglass frame anterior to the hinge.

[0012] According to another aspect of the invention, an electronic module is disclosed that contains electronics and a power source for driving an electro-active lens. The module is designed to fit within a spatial void of an eyeglass frame directly connected to the electro-active lens without an intervening hinge.

[0013] According to another aspect of the invention, a method for controlling an electro-active lens is disclosed wherein the lens is activated when the wearer's head moves to a first position angled steeply down relative to the horizon, and wherein the lens, once activated, remains on until such a time as the wearer's head moves to a second position at an angle slightly above the horizon.

[0014] According to another aspect of the invention, a method for turning off the electronics is disclosed wherein after a specified period of time should the sensor sense there is no movement the controller will turn off the electrical power.

[0015] According to another aspect of the invention, a method for setting a time delay such to prevent the eyeglasses from switching their focus as one walks, runs, or moves his or her head while not intending to read at near.

[0016] According to a still further aspect of the invention, an electronic module attached to a rimless eyeglass frame near a rimless spatial void is disclosed wherein the frame has an electro-active lens to which the module is directly connected.

[0017] The method and apparatus of the present invention will be better understood by reference to the following detailed discussion of specific embodiments and the attached figures which illustrate and exemplify such embodiments.

[0018] According to still another aspect of the invention, a hinge-less temple is provided such that the electronic module can be located within the spatial void or any where on the temple including the end piece behind the ear.

DESCRIPTION OF THE DRAWINGS

[0019] A specific embodiment of the present invention will be described with reference to the following drawings, wherein:

[0020] FIG. 1A illustrates a universal frame housing that comprises the electronic module, electronic connectors, and a hinge.

[0021] FIG. 1B is an exploded view of the universal frame housing of FIG. 1A.

[0022] FIG. 1C is the electronic module of FIG. 1A.

[0023] FIG. 2A illustrates another universal frame housing that comprising an electronic module, electronic connectors, and a hinge

[0024] FIG. 2B is an exploded view of the universal frame housing of FIG. 2A.

[0025] FIG. 2C is the electronic module of FIG. 2A.

[0026] FIG. 3A illustrates another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0027] FIG. 3B is an exploded view of the universal frame housing of FIG. 3A.

[0028] FIG. 3C is the electronic module of FIG. 3A.

[0029] FIG. 3D illustrates a manual touch switch extending up though the assembly formed by the front and back electro-active lens frame component pieces.

[0030] FIG. 4A illustrates another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0031] FIG. 4B is an exploded view of the hinge FIG. 4A.

[0032] FIG. 4C is the electronic module of FIG. 4A.

[0033] FIG. 5A illustrates an external side view of another universal frame housing comprising an electronic module, electronic connectors, and a hinge.

[0034] FIG. 5B is an inside or back-view of the universal frame housing of FIG. 5A.

[0035] FIG. 5C is the module of the universal frame housing of FIGS. 5A and 5B.

[0036] FIG. 6 illustrates one embodiment of a fully assembled electronic frame.

[0037] FIG. 7 illustrates another embodiment of a fully assembled electronic frame.

[0038] FIG. 8A illustrates another embodiment of a fully assembled electronic frame having a hinged temple.

[0039] FIG. 8B illustrates another embodiment of a fully assembled electronic frame having a hinge-less temple.

[0040] FIG. 9A illustrates the top view of an electro-active spectacle lenses, rimmed frame and universal frame housings comprising electronic modules, electronic connectors, and hinges.

[0041] FIG. 9B illustrates the embodiment of FIG. 9A, but with a rimless style of lens mounting.

[0042] FIG. 9C illustrates the embodiment of FIG. 9A as worn on a wearer's head and further illustrates the right spatial void and the left spatial void.

[0043] FIG. 10 illustrates an electronic module of another embodiment of the present invention which includes a tilt switch.

[0044] FIG. 11 illustrates a universal frame housing that comprises the electronic module, electrical connectors, and hinge.

[0045] FIG. 12A illustrates a cross section of an embodiment of the electronic module of the present invention without a tilt switch

[0046] FIG. 12B is an isometric view of the module of FIG. 12A.

[0047] FIG. 12C illustrates the module of FIG. 12A in an eyeglass frame behind its frame stem section.

[0048] FIG. 13A illustrates another embodiment of the electronic module of the present invention which contains two batteries.

[0049] FIG. 13B is a cross section of the module of FIG. 13A.

[0050] FIG. 13C illustrates a combined electronic module which includes a tilt switch.

[0051] FIG. 13D illustrate the module of FIG. 13A placed in an eyeglass frame anterior to the hinge and connecting to the lens.

[0052] FIG. 14 illustrates one possible electrical contact into the lens from the frame.

[0053] FIG. 15A illustrates a wearer of an eyeglass frame having a tilt switch looking straight ahead approximately even with the horizon.

[0054] FIG. 15B illustrates a wearer of an eyeglass frame having a tilt switch with his head in a position where he is looking downward at angle α from the horizontal.

[0055] FIG. 15C illustrates a wearer of an eyeglass frame having a tilt switch with his head in a position where he is looking upward at angle β above the horizontal.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0056] The following definitions for elements referred to in this application are set forth below.

DEFINITIONS

[0057] a) Frame: A complete wearable housing that secures both spectacle lenses and aligns them in the proper place relative to the wearer's eyes when being worn.

[0058] b) Hinged temple: The side piece of a frame that connects to the frame front by way of a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0059] c) Hinge-less temple: The side piece of a frame that connects to the frame front without a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0060] d) Temple end piece: The part of the temple that is found farthest away from the frame front. The end piece usually begins behind the ear of the wearer and ends at the end of the temple that is located farthest away from the frame front.

[0061] e) Frame front end piece: The part of the frame front farthest away from the bridge and spatial to the bridge. Each frame has two, frame front end pieces; one on the spatial side of the right lens and/or right eye-wire and one on the spatial side of the left lens and/or eye-wire.

[0062] f) Bridge: The part of the frame front that fits over/superior to the wearer's nose. The bridge is usually found between the eye-wires that holds the right and left lenses, or the right and left lenses themselves.

[0063] g) Hinge: The part of the frame that allows for connecting the frame front and the temples in such away that the frame front and the temple can open and close against the frame front on its posterior side when not being worn.

[0064] h) Eye-wire: The part of the frame front that holds one lens (a right or a left). There are two eye-wires to each frame. However in a completely rimless frame there are no eye wires.

[0065] i) Frame front: The part of the frame to which the temples attach and which holds the lenses and if not a rimless frame front comprises both eye-wires.

[0066] j) Rimless frame: A frame that is designed without eye-wires.

[0067] k) Partially rimless: A frame that has a partial frame front and/or may have a nylon monofilament wire or similar feature that secures the lenses to the frame.

[0068] l) Zyle frame: A frame made out of largely plastic

[0069] m) Metal frame: A frame made out of mostly metal

[0070] n) Right spatial void: The space created where the right frame front that is within the plane of the front of the wearers face turns back to meet the right temple. The angle formed between the right frame front and the right temple is approximately (but not always) 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the right lens or inside right frame front, on a second side by that of an imaginary line that is located in the middle of the right temple not including any electronics affixed thereto, and on a third side which is bounded by the right side of the face and/or head of the wearer.

[0071] o) Left spatial void: The space created where the left frame front that is within the plane of the front of the wearers face turns back to meet the left temple. The angle formed between the left frame front and the left temple is approximately 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the left lens or inside left frame front, on a second side by that of an imaginary line that is located in the middle of the left temple not including any electronics affixed thereto, and on a third side which is bounded by the left side of the face and/or head of the wearer.

[0072] The following preferred embodiment as exemplified by the drawings is illustrative of the invention and is not intended to limit the invention as encompassed by the claims of this application. An electronic module for eyeglass frames containing electro-active lenses is disclosed herein.

[0073] FIGS. **1A-1C** illustrate a specific embodiment of an eyeglass frame containing an electronic module **101**. The module is specifically illustrated as a cylinder and a block section attached to the side of the cylinder in FIG. **1C**. In some embodiments, the cylinder portion of the electronic module may contain both the power source and the drive circuit. The block portion may contain a sensing mechanism, for example a tilt switch. The module may also house an antenna, a receiver, a transmitter, a transceiver, a sensor, a range finder, a micro-processor, and a controller.

[0074] The module **101** is shown housed between an upper electro-active lens frame component piece **102** and a lower electro-active lens frame component piece **103** that contains a receptacle **104** for the module **101**. The lower electro-active lens frame component piece **103** also contains a receptacle **105** for electrical conductors connecting an electro-active lens to the module. The electrical conductors may conduct for example, via a set of conductive wires or a flex circuit. A manual touch switch **106** extends up though the upper electro-active lens frame component piece **102**. In some embodiments, the battery or other electronic components may be accessed via a lower module receptacle cover **107**. The lower module receptacle cover **107** may be threaded and thereby opened and closed with a small screw driver. Screws **109** are used for attaching the upper and the lower electro-active lens frame component pieces together to form an electronic frame piece. The electronic frame piece may be attached to a frame temple **110** with a temple screw **108**, and bonded or otherwise attached to the edge of the eye-wire **111** to complete half of the frame. In a similar manner, the corresponding other half of the frame can be assembled.

[0075] FIGS. **2A-2C** illustrate another embodiment of the present invention wherein the electronic frame contains an electronic module **201**. The module is more particularly illustrated as a cylinder with a block section attached to the back of the cylinder in FIG. **2C**. In some embodiments, the cylinder portion of the module may contain both the power source and the drive circuit. The block portion may contain a sensing mechanism. For example, a tilt switch may be used as a type of sensing mechanism. The electronic module **201** is housed between an upper electro-active lens frame component piece **202** and a lower electro-active lens frame component piece **203** that contains a receptacle **204** for the module **201**. The lower electro-active lens frame component piece **103** also contains a receptacle **205** for electrical conductors connecting electro-active lens to the module. The electrical conductors may conduct for example, via a set of conductive wires or a flex circuit. A manual touch switch **206** extends up though the upper electro-active lens frame component piece **202**. In some embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **207**, which may threaded on the sides and opened and closed with a small screw driver. Screws **209** are used for attaching upper and lower electro-active lens frame component pieces together. The electronic frame piece may be attached to a frame temple **210** with a temple screw **208**, and bonded or otherwise attached to the edge of the eye-wire **111** to complete half of the frame. In a similar manner, the corresponding other half of the frame can be assembled.

[0076] FIGS. **1** and **2** illustrate two possible ways of configuring the electronics to fit them neatly into the frame. Although a cylinder and block arrangement have been spe-

cifically illustrated, other dimensional shapes may alternatively be used to form the module that will be preferably placed in a cavity and perhaps molded therein to form an electronic frame component that is hermetically sealed to prevent water from contacting the electronics.

[0077] FIGS. **3**A-**3**D illustrate another inventive embodiment wherein the electronic frame contains a electronic module **301**. The module is particularly illustrated as a cylinder with a block portion which is, in turn, attached to the back of the cylinder. As with the module of the previous figures, the module may contain a wide variety of similar electronic components and features. The electronic module **301** is housed between a front electro-active lens frame component piece **302** and a back electro-active lens frame component piece **303**. Together, these pieces form a receptacle **304** for the electronics module **301**. The front electro-active lens frame component piece **302** also contains a receptacle **305** for electrical conductors connecting electro-active lens to electronics module via way a set of conductive wires or a flex circuit. A manual touch switch **306** extends up though the assembly formed by the front and back electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **307**. The electronic frame piece is attached to a frame temple **310** with a temple screw **308**. In this embodiment, the electronic frame piece is shown as attached to the frame temple **310** near the edge of the edge of electro-active spectacle lens **311**. A threaded rod **313** is positioned through the front convex surface **312** of electro-active spectacle lens for the rimless mounting of the assembled front and back electro-active lens frame component pieces to an electro-active lens.

[0078] FIGS. **4**A-**4**B illustrate another embodiment of the present invention wherein the frame has an electronic module **401**. The module is illustrated as a cylinder with a block portion attached to the back of the cylinder. As referred to in other embodiments disclosed herein, the module has a cylinder portion and a block portion and may contain a wide variety of similar electronic components and features. The electronic module **401** is housed between a front electro-active lens frame component piece **402** and a back electro-active lens frame component piece **403** that together form a receptacle **404** for the electronics module **401**. The front electro-active lens frame component piece **302** also contains a receptacle **405** for electrical conductors connecting an electro-active lens to the module via way of set of conductive rods or pins. A manual touch switch **406** extends up though the assembly formed by the front and back electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **407**. The electronic frame piece is attached to a frame temple **410** with a temple screw **408**. In this embodiment, the electronic frame piece is shown as attached to the frame temple **410** near the edge of the edge of electro-active spectacle lens **411**. Threaded and electrically conductive rods **413** and **414** are positioned through their respective front convex surfaces the of electro-active lens for rimless mounting of the assembled front and back electro-active lens frame component pieces to the electro-active lens. Application of a first voltage to the electro-active lens through rod **413** and a second voltage through **414** to the respective edges of the electro-active lens is thereby accomplished.

[0079] FIGS. **5**A-**5**C illustrate another embodiment of the present invention. In this embodiment, the electronic frame contains a electronic module **501**. The module has a cylinder portion and a block portion as before described. The module **501** is housed between a front electro-active lens frame component piece **502** and a back electro-active lens frame component piece **503** that together form a receptacle **504** for the module **501**. The front electro-active lens frame component piece **502** also contains a receptacle **505** for electrical conductors connecting electro-active lens to electronics module via way of set of conductive pins or rods. A manual touch switch **506** extends up though the front electro-active lens frame component pieces. As with other embodiments, the battery or other electronic components may be accessed via a lower electronics module receptacle cover **507**, which may be threaded on the sides and opened and closed with a small screw driver. Screws **409** are used for attaching front and back electro-active lens frame component pieces together. The electronic frame piece is attached to a frame temple **510** with a temple screw **508**. In this embodiment the frame piece is attached to the frame temple **510** near the edge of the edge of electro-active spectacle lens **511**. Threaded and electrically conductive rods **513** and **514** are positioned through their respective front convex surfaces the of electro-active lens for rimless mounting of the assembled front and back electro-active lens frame component pieces to the electro-active lens. Application of a first voltage to the electro-active lens through rod **513** and a second voltage through **514** to the respective edges of the electro-active lens is thereby accomplished.

[0080] FIG. **6** illustrates an embodiment of a fully assembled electro-active frame. This frame is constructed from an upper electro-active lens frame component piece **602** and a lower electro active frame component piece **603**. A manual touch switch **606** is shown extending from the upper electro-active lens frame component piece **602**. Two temples **610** are attached the combinations of the upper and lower electro-active lens frame component pieces with temple screws **608**. The temple assemblies are then mounted to the eye wires **611** of the front of the frame that contains the electro-active lenses **612**.

[0081] FIG. **7** illustrates another embodiment of a fully assembled electro-active frame. This frame is constructed from a front electro-active lens frame component piece **702** and a back electro active frame component piece **703**. A manual touch switch **706** is shown extending from the front electro-active lens frame component piece **702**. Two temples **710** are attached the combinations of the upper and lower electro-active lens frame component pieces with temple screws **708**. The temple assemblies are then mounted to directly to the electro-active lenses **712** in a rimless fashion by one of the methods described earlier.

[0082] FIG. **8**A illustrates another embodiment of a fully assembled electro-active frame having a hinged temple. This frame is constructed from a front electro-active lens frame component piece **802** and a back electro active frame component piece **803**. A manual touch switch **806** is shown extending from the front electro-active lens frame component piece **802**. Two temples **810** are attached to the combinations of the upper and lower electro-active lens frame component pieces by a hinge with temple screws **808**. The temple assemblies are then mounted to directly to the electro-active lenses **812** in a rimless fashion by one of the methods described earlier.

[0083] FIG. **8**B illustrates an embodiment similar to the embodiment of FIG. **8**A, but for having a hingless temple. This frame is constructed from a front electro-active lens frame component piece **802** and a back electro active frame component piece **803**. A manual touch switch **806** is shown extending from the front electro-active lens frame component piece **802**. Two temples **810** are directly attached to the combinations of the upper and lower electro-active lens frame component pieces with temple screws **808**. The temple assemblies are then mounted to directly to the electro-active lenses **812** in a rimless fashion by one of the methods described earlier.

[0084] FIG. **9**A illustrates a top view of a electro-active spectacle lenses and rimmed frame. The rimmed frame can be made of zyle, metal, or any combination thereof. Both right front spatial void **910** and left frame front spatial void **920** is shown. Within either or both of these voids, a module may be placed. As particularly shown in FIG. **9**A, modules **930** and **940** are placed on the frame and attached to the frame stems **970** and **980** with temple screws **950** and **960**. The modules are then connected to the eye wires **994** and **995** and are connected to the nose bridge **930**. The eye wires support the electro-active lenses **996** and **998**.

[0085] FIG. **9**B illustrates an embodiment of the electro-active spectacle lenses and frame as similar to that shown in FIG. **9**A but in a rimless style of lens mounting. Rimless right spatial void **910** and rimless left spatial void **920** are shown.

[0086] FIG. **9**C depicts the embodiment of FIG. **9**A worn on the head of a wearer. The spatial voids created by the space between the joint of the frame and temple on the one hand, and the curve of the wearer's head, on the other is clearly shown.

[0087] FIG. **10** illustrates an electronic module **1000** of another embodiment of the present invention. The module includes a flex circuit **1010** with two conductive buses **1020** and **1030** for making electrical contact to the front surface of an electro-active lens. The module includes a drive circuit **1040** placed above a rechargeable battery **1050**. Below the battery is a recharging coil **1060**. The charging coil is used to inductively recharge the battery without direct contact. In this way, the module may be hermetically sealed while still allowing the battery to be recharged without breaking a moisture resistant seal. A tilt sensor **1070** is also attached to the electronic module. A manual switch **1080** is attached to the top of the electronic module and is integrated with a sealing diaphragm **1090**. This module is sealed with an epoxy, silicone, or similar water resistant material to prevent water from contacting the electronic components. This module is shaped to fit into a universal frame electronic component as illustrated in FIG. **11**.

[0088] In FIG. **11**, a universal electronic frame component **1100** is shown. The universal electronic frame component comprises a housing **1110** for holding the electronic module described in FIG. **10**. A set of thread hinge bolt **1120** and **1130** are mounted on the housing for accommodating a wide variety of frame stem styles to be attached to the universal electronic frame component. The top of the housing **1110** has an aperture to allow a manual switch **1140** to extend outward so as to be accessed by the wearer. Extending out of an opening in the housing are two electrical contacts **1150** and **1160** from the buses described in FIG. **10**. Near these contact points, there is a through hole **1170** to allow a mounting pin to pass through the front of the universal electronic frame component for attaching to an electro-active lens.

[0089] The module **1200**, as illustrated schematically FIG. **12**A and in cross section in FIG. **12**B, contains a battery **1230** for powering an electro-active lens and related drive circuitry, a printed circuit board **1220** with drive and control electronics, and a switch **1210**. The module may also contain a membrane switch to allow for manual control of the electro-active lens.

[0090] FIG. **12**C illustrates the module **1200** placed in an eyeglass frame **1250**. The frame has a frame stem section **1240** near the front of the frame but also well in front of a frame hinge **1260** that connects a stem **1280** to the front of the frame. The module is preferably placed behind the frame stem section, provided that the frame is not of a full rimless design. In the event of a full rimless design, the inventive electronic module or modules would fit within or near the space (right spatial void and left spatial void) anterior to the hinge and would then attach to the lens. In certain other inventive embodiments where there is no hinge (hinge-less temples) and eyeglass frames that have a continuous temple that attaches directly to the frame front or directly to the lens, the module would preferably be located within or near the space (right spatial void and left spatial void). In fact, the module can be located anywhere within these two spatial voids.

[0091] Although in most embodiments of the invention, the modules are preferably located interior to that of the frame front or temple and closer to the wearer, there are other inventive embodiments where the module may be located on the side of the frame front, on the temple farthest away from the wearer, on both the inside of the temple closest to the wearer, on the outside of the temple away from the wearer, located within the temple, or any combination thereof.

[0092] When a hinge-less temple is used, the module can be located on or in the temple end piece behind the ear of the wearer. Alternatively, the module may be split such that one module is located behind the ear and another module is located within the right or left temple spatial void that is common to a side of the wearer's head.

[0093] By sizing the module to be no higher than the width of the front of the frame stem section **1240**, the module is completely undetectable by an observer. Power is preferably provided to the lens via a two conductor flex circuit **1270** extending from the module through the frame stem **1240**.

[0094] In some embodiments in which a hinge-less temple is used the hinge-less temple may be made of titanium which is conductive to electrical current. In this case, the titanium may be used as one of the electrical leads. Another lead may be affixed onto or into the frame. A very thin conductor may be adhesively applied to the inside of the temple and sealed by way of a lacquer or polymer that is cured over the thin conductor. In this embodiment, since the temple is hinge-less, the electronics can be located anywhere along or in said temple. The temple itself becomes, in part, a conductor of electrical current from the module or modules to where the hinge-less temple connects to either the lens or to the front of the eyeglass frame.

[0095] FIGS. **13**A and **13**B illustrate another embodiment of the present invention. This embodiment has a module **1240** containing two batteries **1220** and **1230**. In this embodiment, the height of the module may be too large to accommodate the printed circuit board that is used to drive the electro-active lenses. In such cases, a second module will be required to provide for the space required for the printed circuit board.

[0096] FIG. 13C illustrates a module **1370** that combines **1350** and **1300**. The modules **1350** and **1300** may be electrically connected to each other via means of a flex circuit connector, or other means known in the art.

[0097] FIG. 13D illustrates the combined module **1370** placed in the frame **1250** near the front of the frame but behind the frame stem section **1240** of the frame. This arrangement of the electronics in the frame allows for a cosmetically acceptable placement of the electronics and battery that is needed for powering an electro-active lens.

[0098] The module may further include one or more of the following: a manual switch (for example, a touch button, photo-detector, motion detector, capacitive touch sensor), a controller and/or micro-processor, a power source (for example, a small battery), a sensor (for example, one or more miniature or micro tilt switches, accelerometer, micro gyro, range finder, view detector, imager), an antenna, a transmitter, a transceiver or a receiver. The module preferably houses any of the aforementioned electrical components in a substantially water-proof and wear resistant/moisture resistant environment and is preferably hermetically sealed. In the event of a malfunction of one or more of the electronic components housed within the module, the module can be replaced without having to repurchase a complete pair of new electronic eyewear (lenses and frames) or just the frames. It should be pointed out that in certain applications, a single inventive electronic module may be sufficient, and in others, two or more modules may be needed. The embodiments described in FIGS. **12** and **13** allow for modification of any number of existing frames that otherwise were not originally designed to support electronics for driving electro-active lenses.

[0099] FIG. **14** illustrates one possible electrical contact into the lens from the frame. Pins or bolts **1410** and **1420** provide electrical power from the drive circuit into the lens **1400**.

[0100] FIGS. **15**A through **15**C illustrate a method of controlling the electro-active lens using a tilt switch that may be contained in the module. The tilt switch should preferably have a wide angle for making contact and a smaller angle for breaking contact. In particular, FIG. **15**A illustrates the wearer looking on a straight level ahead substantially to the horizon. In this position, the lens would be preferably switched off. As wearer lowers his head passed angle α, the electro-active lens would be deliberately turned off. In this illustration, the angle α may be a large angle, perhaps as large as 45 degrees or more. In preferred embodiments, angle α may be in a range of from about 25 to about 85 degrees, with a most preferred range of 35 to 75 degrees. When the switch has been activated, because the wearer has deliberately moved his head to past angle α, the electro-active lens would remain in its on state until the person raises his head above the angle β, as illustrated in FIG. **15**C. In preferred embodiments, angle β may be in a range of from about 0 to about 45 degrees with a most preferred range of 0 to 25 degrees. By having a tilt switch of an electro-active lens operate in this manner, a person can control his lens without having to manually touch a switch on the frame.

[0101] Although the particular embodiments shown and described above will prove to be useful in many applications in the ophthalmic and the electronic eyewear art to which the present invention pertains, further modifications of the present invention will occur to persons skilled in the art. All such modifications are deemed to be within the scope and spirit of the present invention as defined by the appended claims.

What is claimed is:

1) An eyeglass frame comprising an electronic module, wherein said module is located within a spatial void of the eyeglass frame anterior to the hinge.

2) The eyeglass frame of claim **1**, wherein the eyeglass frame is adapted for housing an electro-active lens and said module contains electronics and a power source for driving the electro-active lens.

3) An electronic module that contains electronics and a power source for driving an electro-active lens, wherein said module is designed to fit within a spatial void of an eyeglass frame directly connected to the electro-active lens without an intervening hinge.

4) A method for controlling an electro-active lens wherein said lens is activated when the wearer's head moves to a first position angled steeply down relative to the horizon, and wherein said lens, once activated, remains on until such a time as the wearer's head moves to a second position at an angle slightly above the horizon.

5) An electronic module attached to a rimless eyeglass frame located within a spatial void, wherein the frame has an electro-active lens to which the module is directly connected.

6) The method of claim **4**, wherein said module is moisture resistant.

7) The module of claim **5**, wherein said module is moisture resistant.

8) The method of claim **4**, wherein said module houses a power source.

9) The module of claim **5**, wherein said module houses a power source.

10) The method of claim **4**, wherein said module houses a switch.

11) The module of claim **5**, wherein said module houses a switch.

12) The frame of claim **1**, wherein said module is sealed from the outside environment.

13) The frame of claim **1**, wherein said module is affixed to a temple.

14) The module of claim **3**, wherein said module is affixed to one of the group comprising rimless, rimmed, and semi-rimless frames.

15) The module of claim **14**, wherein the frame comprises one of the group comprising zyle, metal, a combination of zyle and metal.

16) The frame of claim **1**, wherein said module houses at least one of the group comprising an antenna, a receiver, a transmitter, a transceiver, a sensor, a range finder, a power source, a micro-processor, and a controller.

17) The module of claim **3**, wherein said frame is a hingeless frame.

18) The method of claim **10**, wherein said switch is a tilt switch.

19) The module of claim **11**, wherein said switch is an automatic switch.

20) The method of claim **10**, wherein said switch is a automatic switch.

21) The module of claim **11**, wherein said switch is a manual switch.

22) The method of claim **10**, wherein said switch is a manual switch.

23) The module of claim **19**, wherein said switch is a tilt switch.

24) The method of claim **20**, wherein said switch is a tilt switch.

25) The frame of claim **16**, further comprising a sensor, wherein said controller provides for timing feed back from said sensor, wherein said controller turns off the electronic power if said sensor does not indicate movement within a set period of time.

26) The frame of claim **25**, wherein said sensor is a tilt switch

27) The frame of claim **25**, wherein said sensor is a range finder.

28) The frame of claim **16**, further comprising a sensor, wherein said controller provides for a timing delay after receiving a signal from said sensor.

29) The frame of claim **28**, wherein said sensor is a tilt switch.

30) The frame of claim **28**, wherein said sensor is a range finder.

31) An eyeglass frame, comprising:

a) a hinged temple connected to the frame; and

b) a universal eyeglass frame housing positioned anterior to the hinge, wherein said housing contains an electronic module.

* * * * *

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[54] **WIRELESS ACTIVE EYEWEAR FOR STEREOSCOPIC APPLICATIONS**

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[52] **U.S. Cl.** **351/158**; 351/41; 359/36

[58] **Field of Search** 351/41, 45, 158; 359/36, 85, 88, 257

[56] **References Cited**

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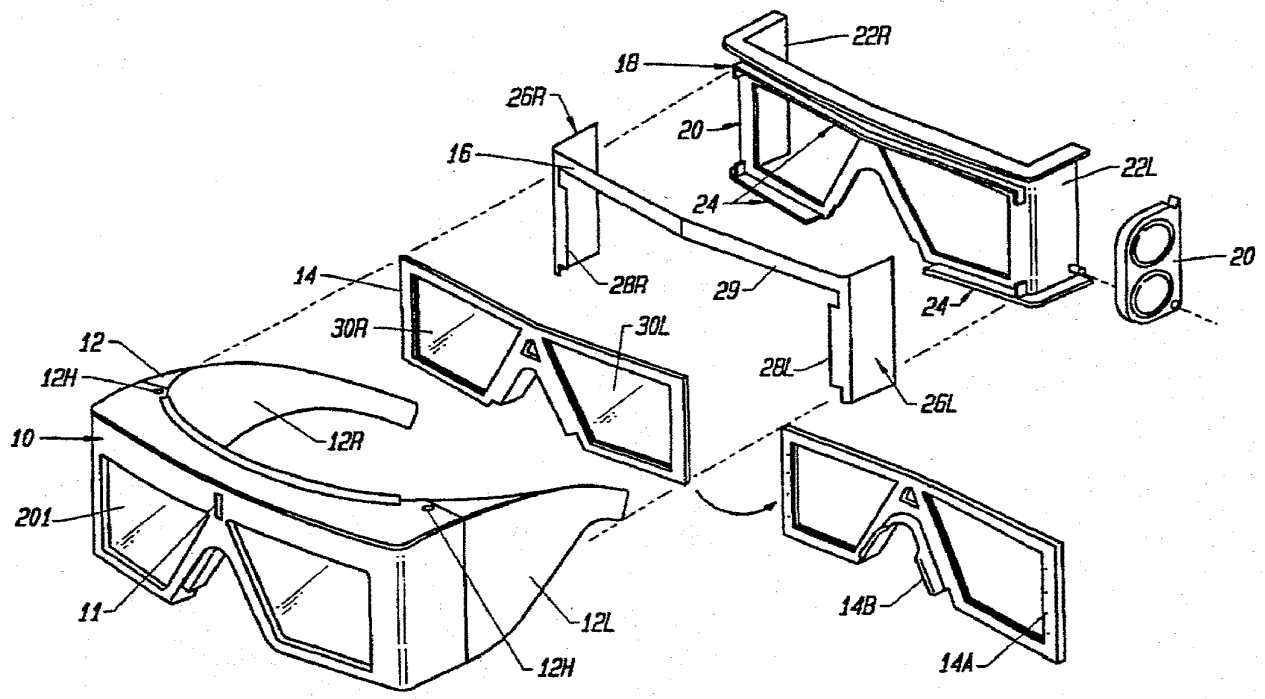
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Primary Examiner—William L. Sikes
Assistant Examiner—Huy Mai
Attorney, Agent, or Firm—Limbach & Limbach

[57] **ABSTRACT**

Wireless active eyewear includes a frame having a front portion and a rear portion. A gasket and shutter assembly and a circuit board are held between the front and rear portions of the frame. The non-conductive gasket has electro-optical shutters integrally formed therewith and includes conductive plugs extending therefrom which electrically contact each of the electro-optical shutters and the circuit board. The frame includes temple arms hingedly attached thereto and an on/off switch which is actuated by opening and closing the temple arms.

13 Claims, 7 Drawing Sheets



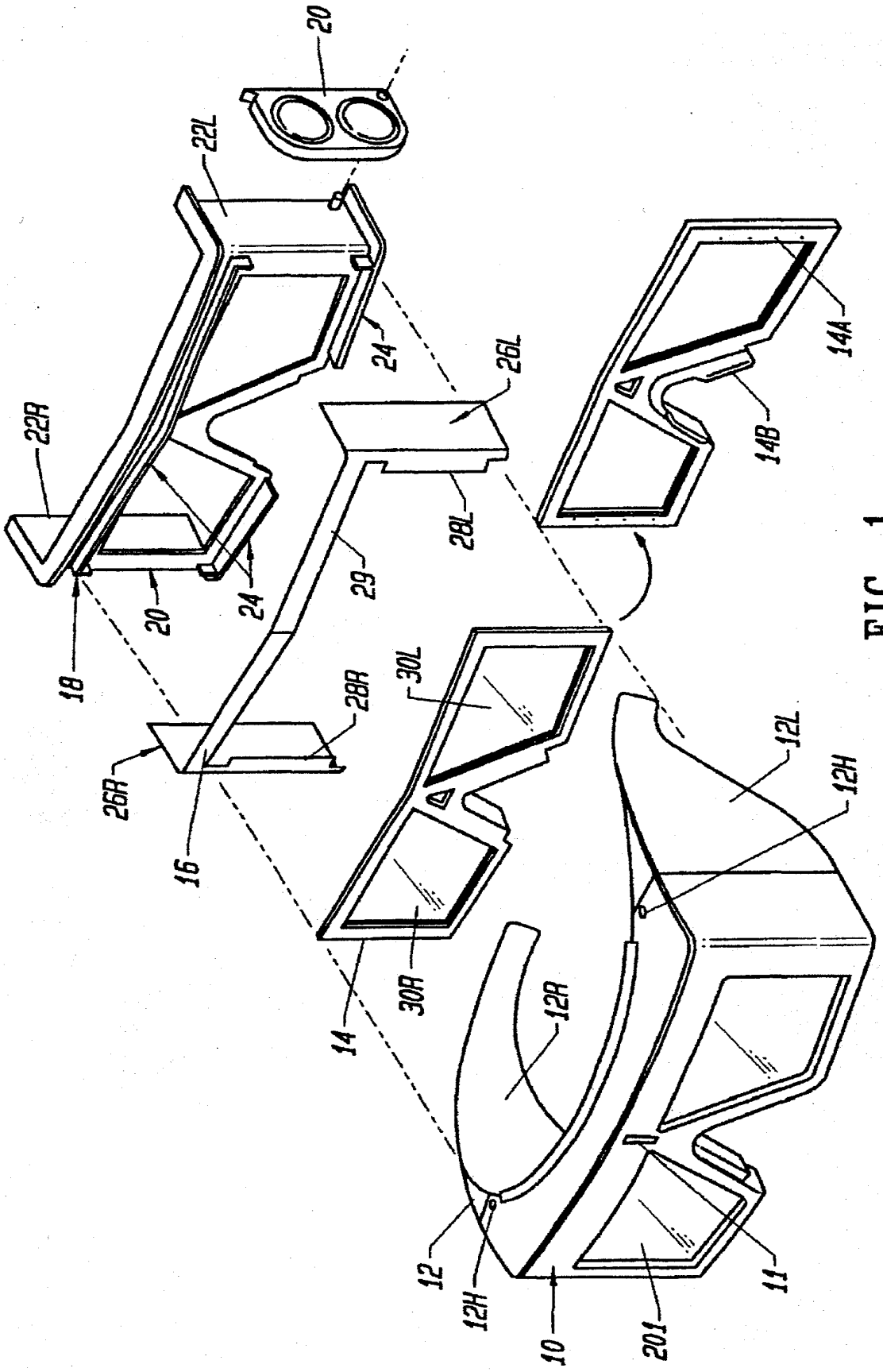

20
22L
24
26L
14A
14B
22R
28L
29
24
20
18
28R
30L
26R
16
12L
12H
14
30R
12R
12
12H
10
201
11

FIG. 1

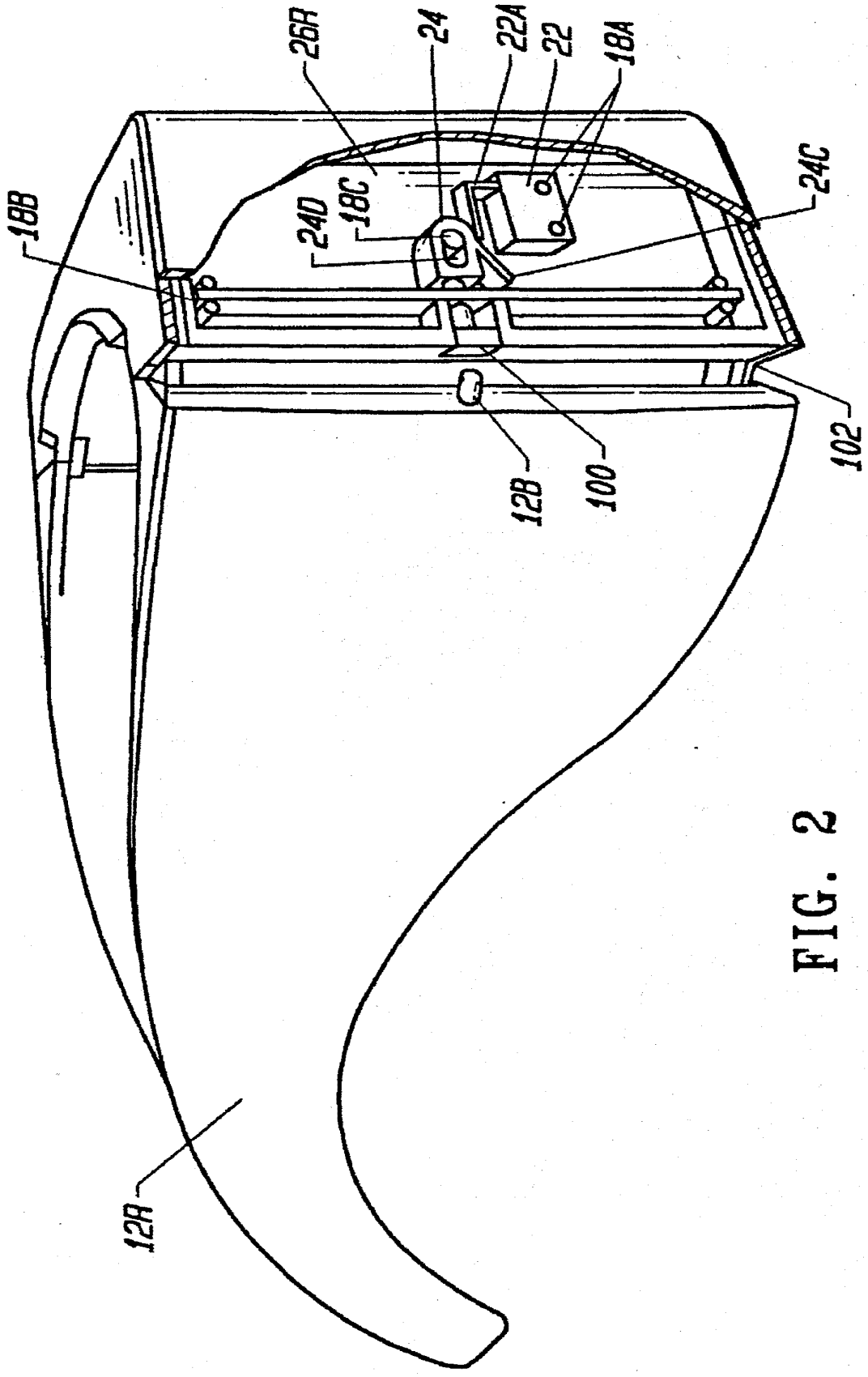


FIG. 2

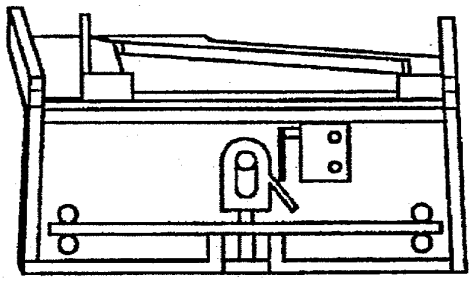


FIG. 3B

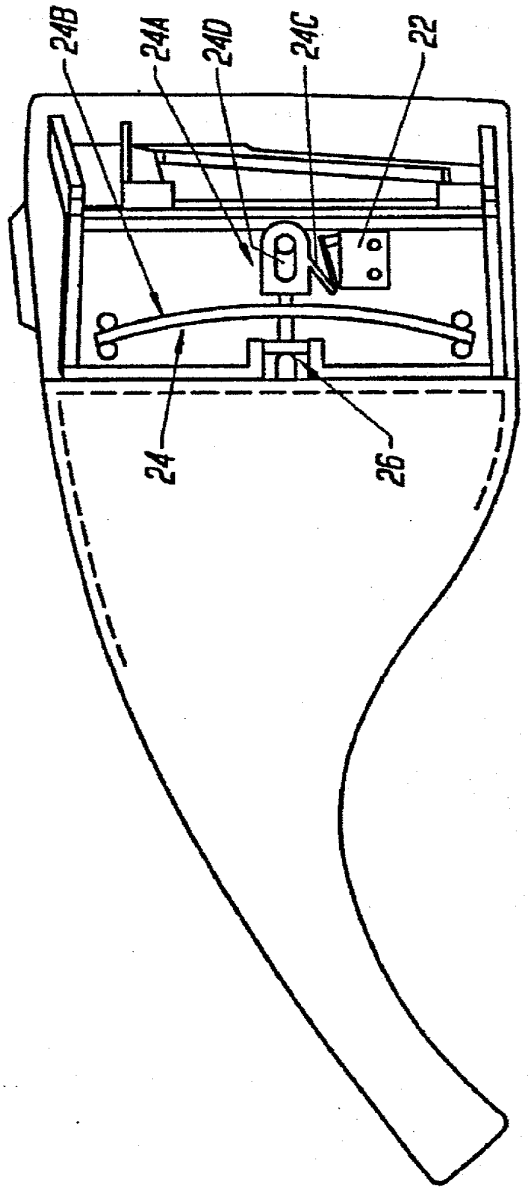


FIG. 3A

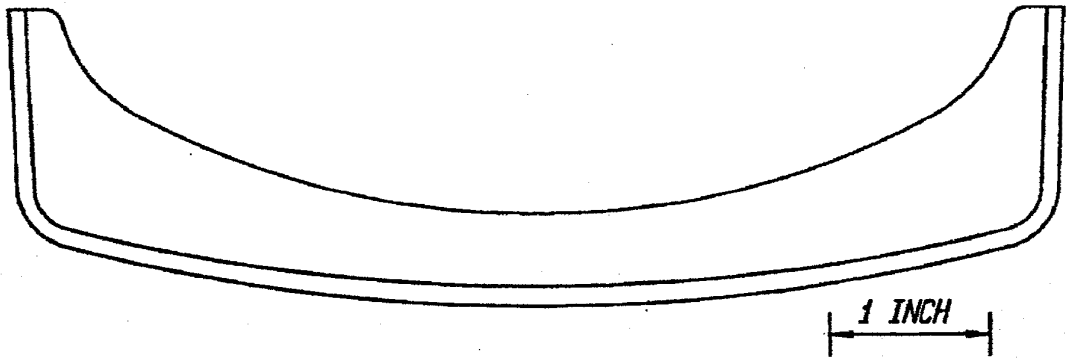


FIG. 4A

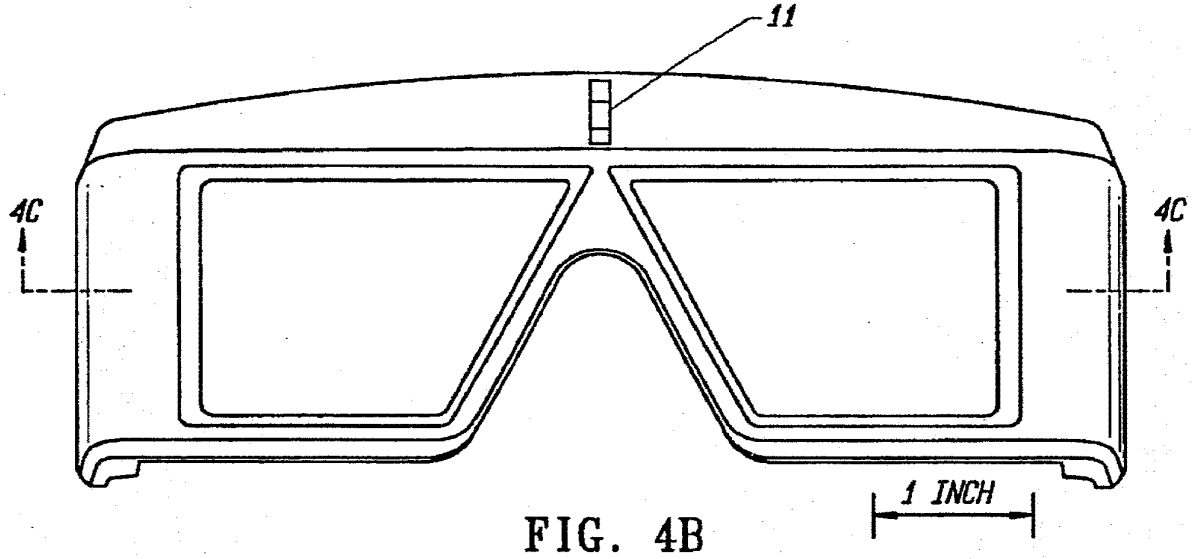


FIG. 4B

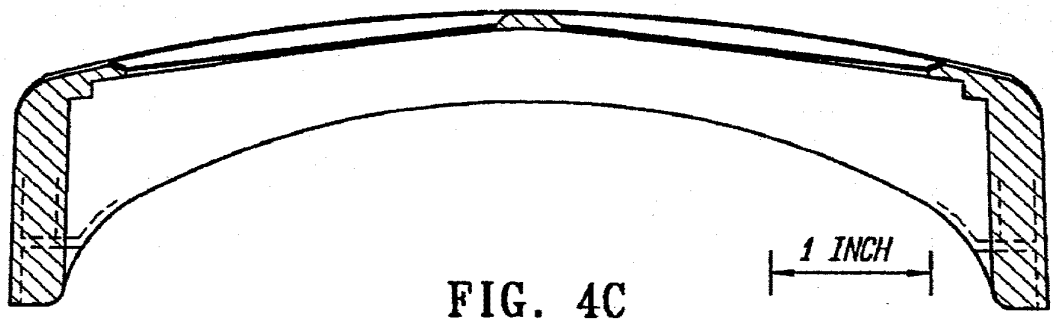


FIG. 4C

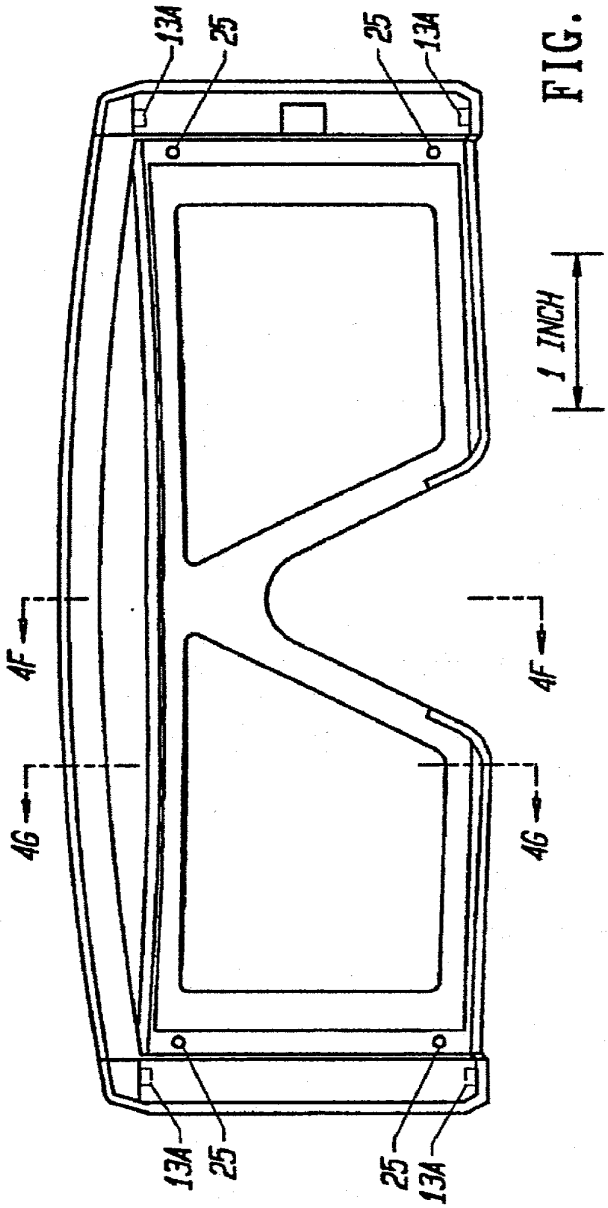


FIG. 4D

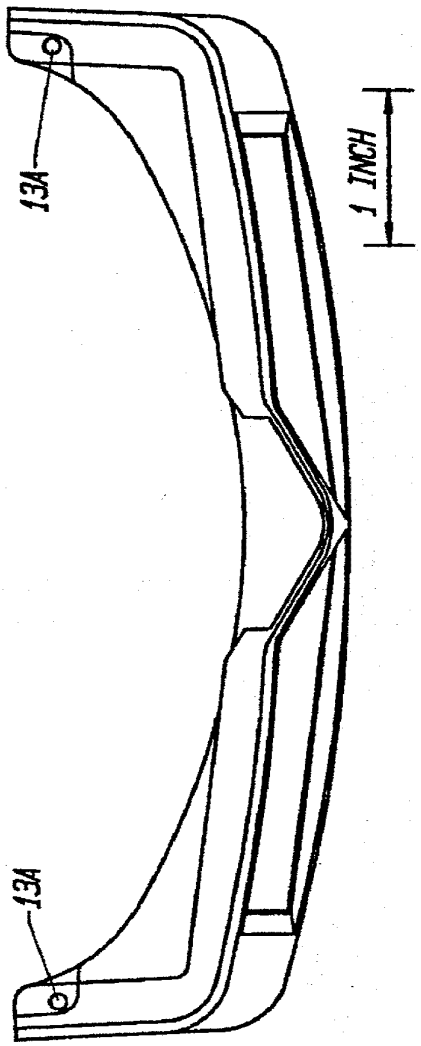


FIG. 4E

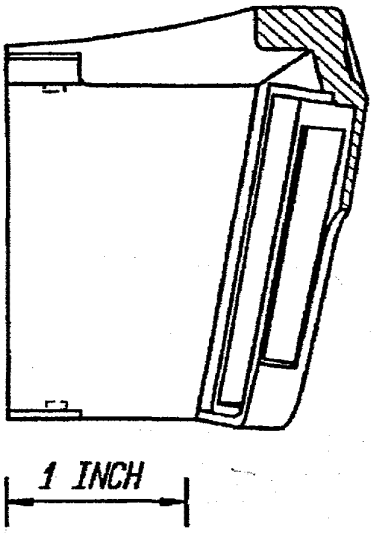


FIG. 4F

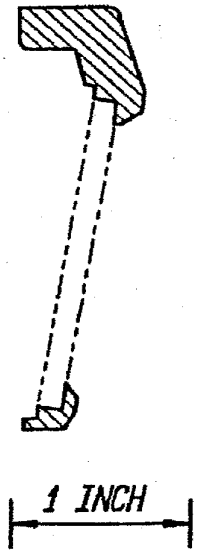


FIG. 4G

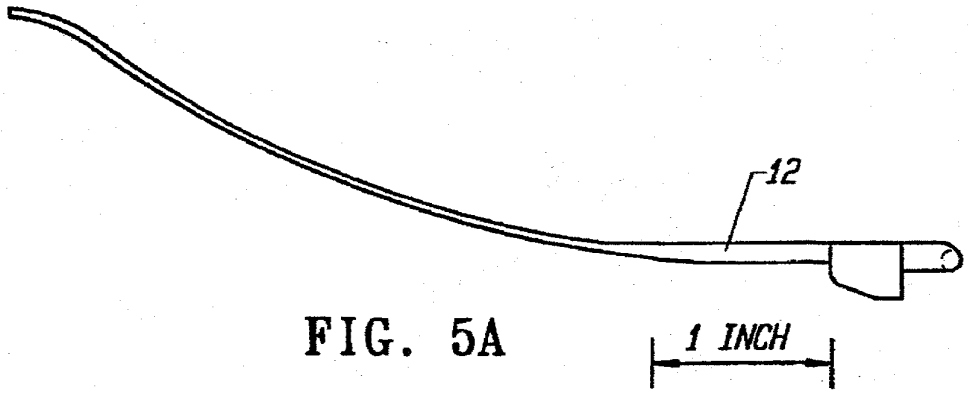


FIG. 5A

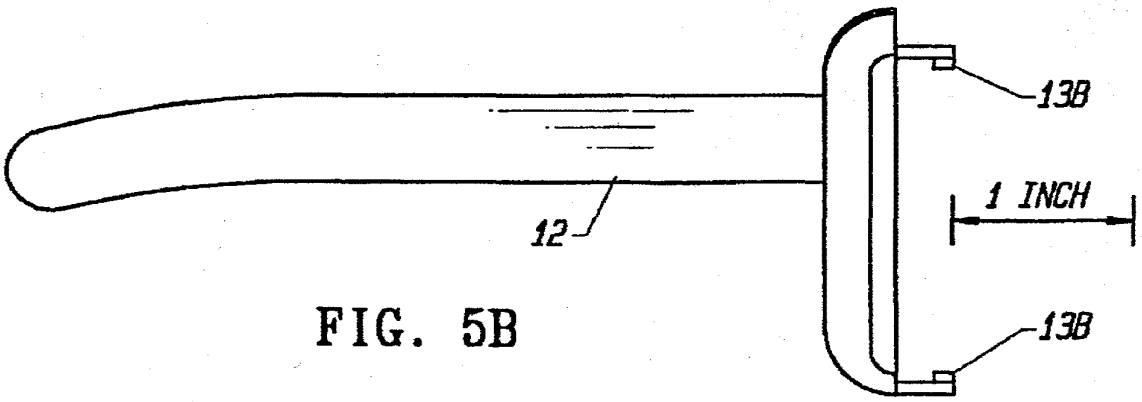


FIG. 5B

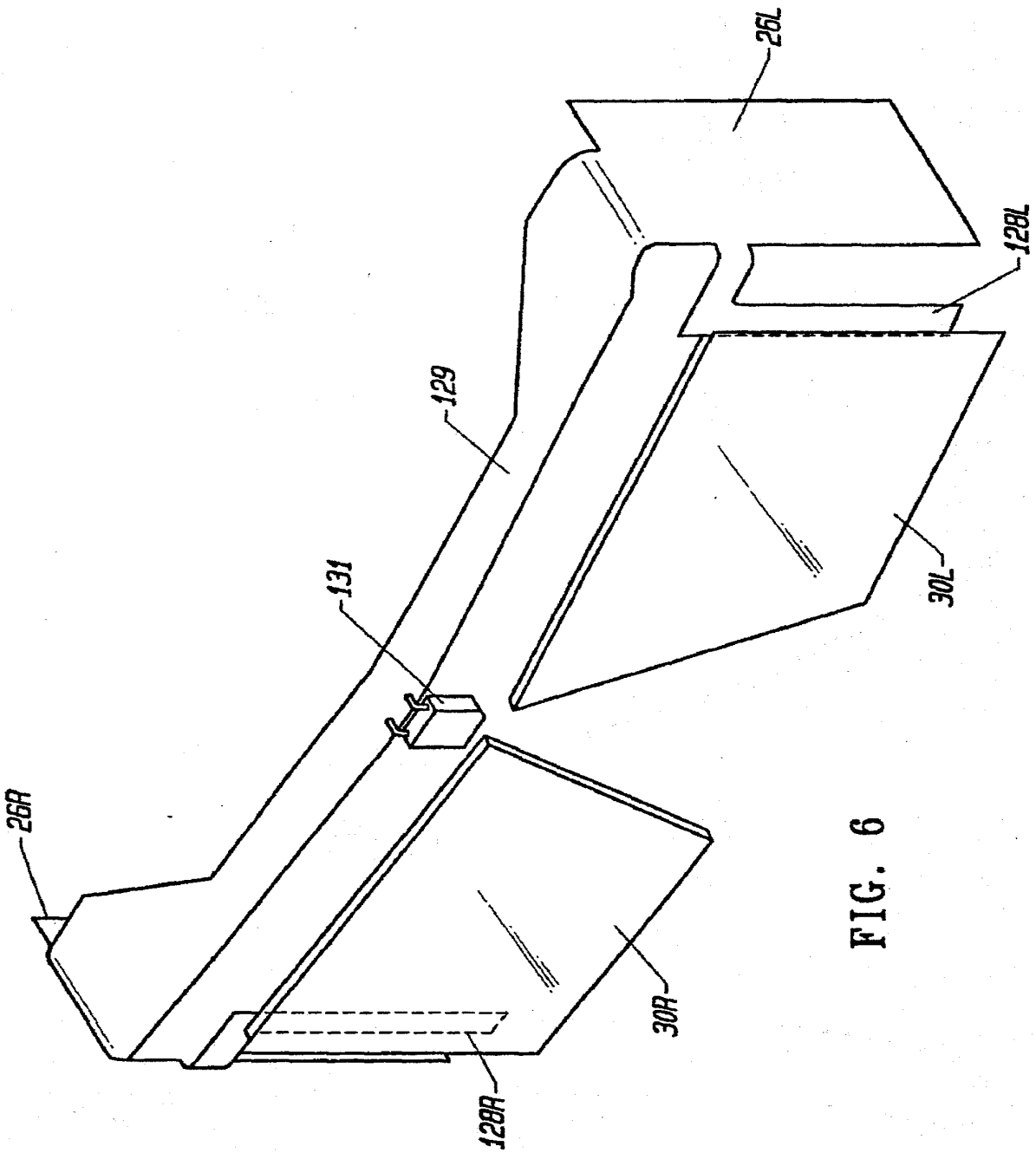


FIG. 6

WIRELESS ACTIVE EYEWEAR FOR STEREOSCOPIC APPLICATIONS

BACKGROUND OF THE INVENTION

The present invention relates to wireless active eyewear for use in viewing field sequential stereoscopic images. Stereoscopic eyewear of this type has been discussed in the following U.S. patents by Lipton et al.: U.S. Pat. No. 4,884,876 (1989) entitled "ACHROMATIC LIQUID CRYSTAL SHUTTER FOR STEREOSCOPIC AND OTHER APPLICATIONS;" U.S. Pat. No. 4,967,268 (1990) entitled "LIQUID CRYSTAL SHUTTER SYSTEM FOR STEREOSCOPIC AND OTHER APPLICATIONS;" U.S. Pat. No. 5,117,302 (1992) entitled "HIGH DYNAMIC RANGE ELECTRO-OPTICAL SHUTTER FOR STEREOSCOPIC AND OTHER APPLICATION;" and U.S. Pat. No. 5,181,133 (1993) entitled "DRIVE METHOD FOR TWISTED NEMATIC LIQUID CRYSTAL SHUTTERS FOR STEREOSCOPIC AND OTHER APPLICATIONS."

Products following the art taught in these above mentioned patents have been manufactured and offered for sale by StereoGraphics Corporation under the CrystalEyes® trademark. Similar products have been offered in the marketplace by IMAX, Tektronix, and others.

Such products have certain basic features in common, in particular, liquid crystal (LC) shutters are driven electrically by on-board circuits and batteries, and synchronization information with regard to the field rate of the video source is received by an infrared (IR) sensor. This synchronization information is used to electrically drive the LC shutters out of phase with each other and in sequence with the video fields. (The term video is used in the generic sense of electronic images which are raster scanned.)

StereoGraphics' experience with manufacturing and marketing the CrystalEyes® product has resulted in a continuous examination of the product design. We believe that improvement is possible in terms of instrumentation and cost of manufacture of such products, and this disclosure will describe several concerns and how they have been addressed.

One concern was the need for turning the eyewear on and off. Presently, an on-off button is used, but people are not used to operating a button when wearing eyewear. It would be desirable if the CrystalEyes product was more like ordinary eyewear in this regard in order to heighten user acceptance and enjoyment of the product, i.e., if it did not need an on/off button. Moreover, if one forgets to turn off the eyewear, battery drain and reduction of battery life result without any user benefit.

The present CrystalEyes product has a circuit that turns off the eyewear after an interval of several minutes, but only if is not left facing the monitor/emitter. The continuous detection of an emitted IR sync signal enables the eyewear such that it will not turn off.

Another area of concern is the fact that the LC shutters are made of thin glass and may be broken on occasion, usually because the eyewear has fallen onto a hard surface. Tektronix and IMAX have both addressed this problem by surrounding the LC shutters with a shock absorbing rubber gasket.

Still another area of concern is the electrical connection between the LC shutters and the circuit board. Both elastomeric connectors and soldered wires have been used. Both have their advantages and disadvantages. A method has been sought to obtain a good electrical contact and to reduce the cost of manufacture of this necessary assembly step.

Yet another area of concern is the nosepiece of the eyewear. For greatest comfort it was felt that a rubber or soft nosepiece should be used. However, the addition of such a nosepiece adds a manufacturing step, and the part itself has some cost.

SUMMARY OF THE INVENTION

The present invention is an improvement in wireless active eyewear of the type used for viewing field-sequential stereoscopic images. In the preferred embodiment, a front frame and a rear frame are made from injection molded plastic and designed to snap-fit together, holding therebetween a gasket and shutter assembly and a printed circuit board. Temple arms are hingedly attached to the front frame.

In one aspect of the invention, an on/off switch is mounted on the frame and is actuated by a post in one of the temple arms when the arm is opened. Closing the arm deactivates the switch.

In another aspect of the invention, the shutters are integrally mounted in a molded, flexible non-conductive gasket. The gasket also includes conductive plugs which are molded so as to be in contact with the shutters and with the circuit board.

A better understanding of the features and advantages of the present invention will be obtained by reference to the following detailed description of the invention and accompanying drawings which set forth an illustrative embodiment in which the principles of the invention are utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an exploded perspective view of wireless active eyewear according to the present invention.

FIG. **2** shows a cutaway view of one side of the eyewear of FIG. **1** showing the on/off switching mechanism.

FIGS. **3**A and **3**B are side plan views of the eyewear showing the switching mechanism in the on position and the off position, respectively.

FIG. 4A is a top plan view of another embodiment of wireless active eyewear according to the present invention.

FIG. 4B is a front plan view of the eyewear shown in FIG. 4A.

FIG. 4C is a sectional view of the eyewear taken across section 4C—4C of FIG. 4B.

FIG. 4D is a rear plan view of the eyewear shown in FIG. 4B.

FIG. 4E is a bottom plan view of the eyewear shown in FIG. 4B.

FIG. 4F is a sectional view of the eyewear taken across section 4F—4F of FIG. 4D.

FIG. 4G is a sectional view of the eyewear taken across section 4G—4G of FIG. 4D.

FIG. 5A is a top plan view of a typical temple arm of the preferred embodiment of wireless active eyewear according to the present invention.

FIG. 5B is a side plan view of the temple arm of FIG. 5A.

FIG. **6** is a perspective view illustrating the circuit board and LC lenses.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates an exploded view of a pair of wireless active eyewear in accordance with the present invention. A front frame **10** has a pair of temple arms **12L**, **12R** attached thereto via hinges **12***h*. The front frame **10** snaps onto the

rear frame **18** and sandwiches lens gasket **14** and circuit board **16** therebetween. An infrared sensor (not shown) is attached to the circuit board **16** for receiving synchronization information through clear plastic window **11**.

According to one aspect of the present invention, an on/off switching mechanism is incorporated into one side of the eyewear in order to be actuated by a folding temple mechanism. This feature is more clearly illustrated in FIGS. **2** and **3**, and will be described in more detail below. Thus, when the temple arms **12** are opened for wearing the eyewear, the glasses turn on. When the temple arms **12** are closed, the glasses turn off.

The front frame **10**, temple arms **12** and rear frame **18** are preferably molded plastic, the front frame and/or rear frame including suitable ribs and bossing to allow the components to be snapped together in a secure fashion without the need for additional fasteners, such as screws or the like.

The rear frame **18** is molded to have a face panel **20** and temple panels **22L** and **22R**. The face panel **20** is framed by various ribs **24** to receive and snugly position the circuit board **16** and other components therein.

The circuit board **16** includes temple pads **26L** and **26R**, LC pads **28L** and **28R**, and bridge **29**. Battery power may be conveniently supplied to one of the temple pads **22L** while the on/off switching mechanism is incorporated in the other temple pad **22R**. The LC pads **28L**, **28R** provide electrical contact for the LC lenses **30L**, **30R** which are sealed in lens gasket **14** as described more fully below. The bridge **29** includes various circuit components (not shown) including an infrared sensor for receiving synchronization information from the video source.

The on/off switching mechanism is illustrated more clearly in FIG. **2**. The switching mechanism is comprised of a switch **22** and an actuator **24**. The switch **22** is soldered to the temple pad **26R** of circuit board **16** and is precisely located for mounting over a pair of posts **18***a* which are molded on the rear frame **18**. The switch **22** includes an actuator arm **22***a* which is positioned to interact with the actuator **24**.

The actuator **24** is a single piece of injection molded plastic having three functional portions, namely a plunger portion **24***a*, a spring portion **24***b*, and a ramp portion **24***c*. This may be clearly seen in FIGS. **3***a* and **3***b*, where the cross-hatching represents the one-piece actuator **24**. The actuator is held in place in two ways: first, the spring portion **24***b* of the actuator **24** is held between four retainer posts **18***b* as shown; second, the plunger portion **24***a* is fitted into opening **10***o* in the front frame **10**. The plunger portion **24***a* includes an elongated slot **24***d* which fits over guide post **18***c*.

When the temple arm **12** is opened (for wearing), the actuating post **12***b* on temple arm **12R** pushes in the plunger portion **24***a* of the actuator **24**, thereby causing the spring portion **24***b* to flex or bow inward and the ramp portion **24***c* to push on the actuator arm **22***a* to thereby activate the switch.

When the temple arm **12** is closed (for storing), the actuating post **12***b* releases the plunger portion **24***a* and the spring force of the spring portion **24***b* will bias the plunger to its normal rest position, thereby disengaging the switch **22**. In one embodiment, the spring force will be sufficient to exert a force on post **12***b* which will bias the temple arm to a slightly closed position. The material and thickness of the switch components should be carefully selected to provide an adequate reaction force, but not so much movement that the part will be susceptible to fatigue failure.

The switch **22** should be capable of switching 6 volts at 1 milliamp. This specification requires clean switching contact, therefore gold contact surfaces should be used. Acceptable results have been achieved using a Cherry DH1C (0.1 inch width) or an Omron D2MQ switch (0.1 inch width).

The plunger **24** is used to accommodate the requirements of the switch **22**. A switch which is small enough to fit within the eyewear necessarily has a narrow mechanical operating range. The plunger should be configured so that the switch is reliably operated over a wide variety of circumstances. For example, the glasses must continue to operate reliably even when being worn by a user who has a particularly small head. Further, a comfortable wearing configuration might not open the temple arm **12** all the way, but the eyewear and its on/off switching mechanism must still function reliably.

This configuration of actuator **24** is advantageous because the reaction forces are provided by the flex of the actuator itself, not by the spring within the switch **22**. Another advantage is that the actuator force is reliably and repeatably defined and limited by the shape of the ramp portion **24***c*. The limited overtravel of the switch can easily be accommodated.

The lens gasket **14** is unique in that it provides three valuable functions in one molded silicon rubber part. It provides a protective mount for the LC lenses for protecting against breakage when the eyewear is dropped or subject to some other form of stress. The gasket **14** includes conductive rubber plugs **14***a* (four per lens) for providing an electrical connection between the LC contact ledges and the circuit board **16**. The lens gasket **14** also includes a soft nosepiece **14***b* that makes the glasses comfortable to wear without requiring an additional part to pad the nose.

A pair of LC lenses **30L** and **30R** are mounted inside gasket **14**. The gasket **14** surrounds the edges of the lenses and traps them in place. The gasket overlaps a small portion of the flat surfaces of the lenses. However, no usable viewing area is lost, as each lens area includes a small seal area. The gasket does not extend beyond the lens seal. The glass of each lens is thus suspended within the gasket.

Front frame **10** snaps into place on rear frame **18**, thus sandwiching the lens and gasket assembly therebetween. Small pressure pads may be molded into the front and rear frames to poke into the gasket **14** in strategic locations around each lens. Thus, the gasket **14** will be held in place but allowed to move a little. This freedom for movement provides protection from impact shock.

A method for making the electrical connection between the lenses **30L** and **30R** and the circuit board **16** is also provided for. Conductive rubber rods **14***a* are molded as part of the gasket **14** and provide contact with the conductive surfaces on the ledges of the LC lenses **30L** and **30R** as well as with the LC pads **28L** and **28R**. Therefore, no elastomeric connectors, soldered wires, or slide on pins are needed. Thus, shock mounting and electric connection is achieved in one step.

The conductive rods **14***a* may be preformed and inserted into the gasket as the gasket is formed, or they can be inserted after the completed gasket has been formed. It is also possible to manufacture a gasket with conductivity in some selected areas by composing it of two different formulations at the same time. Most areas of the gasket would be made of non-conductive material and typically four spots for each lens could be made of conductive material.

The conductive rods could be replaced with a different type of contact, such as a spring, metal clip, or replaced with a conductive film, foil, wrap, or paint, or the like.

The nosepiece could have been included as an element of the front frame **10** or rear frame **18**. However, it is preferred for reasons of both cost and product integrity to eliminate secondary operations and attachments. Thus, a molded nosepiece **14*b*** has been included as part of the molded gasket **14**. The nosepiece **14*b*** is soft and flexible, thereby providing maximum comfort for the wearer.

By going beyond simple shock absorption, the present invention provides substantial benefits. A single part, the gasket, performs three functions: it serves as a shock absorber to protect the glass LC shutters; it provides electrical conductivity from the circuit board to the shutter electrodes to power the shutters; and finally, the gasket also serves as a nosepiece. This design substantially reduces cost of manufacture by reducing the number of parts needed and it also reduces the labor costs involved in assembly.

It should be recognized that many different constructions are possible in order to realize the eyewear of the present invention. As long as the basic functional aspects described above are included, the remaining task is simply to construct a lightweight, comfortable and aesthetically pleasing pair of eyewear. A particularly preferred embodiment that meets this objective is illustrated in FIGS. **4–6**. It is not necessary for the understanding and implementation of eyewear according to the invention to provide detailed measurements of each component. However, the views presented in FIGS. **4–6** provide a basic template for the preferred embodiment, and the approximate dimensions thereof are provided.

The front frame **10** includes small openings **25** on the inside surface thereof into which corresponding bosses (not shown) on the rear frame **18** snap to lock the components securely together. The rear frame **14** also has hinge openings **13*a*** on the top and bottom of each temple for receiving the hinge pins **13*b*** on temple arms **12**.

The circuit board is preferably shaped as shown in FIG. **6**. The temple pads **26** are similar to those described earlier, but the LC pads **128R** and **128L** are slightly modified, as is the bridge strip **129**. This figure also shows the infrared sensor **131** mounted on the bridge strip **129**.

A person skilled in the art will readily understand that there are many possible variations on the embodiments described herein, and the inventors does not wish to limit themselves to these specific implementations where there are obvious variations that fall within the scope of this disclosure.

We claim:

1. In wireless active eyewear of the type used for viewing field sequential stereoscopic images which are generated along with synchronization information by a video source, said eyewear having a frame including a pair of lens openings and a pair of temple arms, a pair of electro-optical shutters mounted in correspondence with respective lens openings, an electrical circuit in contact with the shutters for driving the shutters out of phase with each other in accordance with the synchronization information, and a battery to power the electrical circuit, the improvement comprising the electro-optical shutters being integrally mounted in a soft and flexible molded gasket, said gasket being substantially non-conductive except for a plurality of conductive regions, said conductive regions being in electrical contact with said electro-optical shutters, wherein said gasket provides a protective shock mounting for the electro-optical shutters.

2. The eyewear of claim **1**, the gasket further comprising an integrally molded nosepiece.

3. The eyewear of claim **1**, wherein the conductive regions comprise a first plurality of conductive plugs grouped immediately adjacent to one of the lens openings and in contact with one of the electro-optical shutters and a second plurality of conductive plugs grouped immediately adjacent to the other of the lens openings and in contact with the other of the electro-optical shutters.

4. Wireless active eyewear utilizable for viewing field-sequential stereoscopic images, comprising:

a frame comprising a front portion having an inside surface and a pair of lens openings therein and a rear portion attached to the inside surface of the front portion and having a pair of lens openings therein;

a circuit board attached between the front portion and the rear portion;

a gasket attached between the front portion and the circuit board, said gasket being substantially non-conductive and having a pair of electro-optical shutters integrally mounted therein in correspondence with the lens openings and a plurality of conductive regions which are in electrical contact with the shutters and with the circuit board;

a pair of temple arms each pivotally attached to the frame and foldable toward the inside surface of the front portion, one of said temple arms having an actuation lever; and

a switch positioned in close proximity to the actuation lever, wherein opening the temple arms causes the actuation lever to engage the switch and closing the temple arms causes the actuation lever to disengage the switch.

5. The eyewear of claim **4**, wherein the conductive regions comprise a first plurality of conductive plugs grouped immediately adjacent to one of the lens openings and in contact with one of the electro-optical shutters and a second plurality of conductive plugs grouped immediately adjacent to the other of the lens openings and in contact with the other of the electro-optical shutters.

6. Wireless active eyewear as in claim **4**, wherein the rear portion includes a face panel and a pair of temple panels, wherein the circuit board includes a pair of temple pads which conform to respective temple panels of the rear portion, a connecting strip which conforms to a first portion of the face panel outside of the lens openings and electrically connects the temple pads, and a pair of lens pads which conform to second portions of the face panel immediately adjacent to respective lens openings, wherein the gasket conforms to the face panel and abuts the connecting strip and lens pads of the circuit board such that the plurality of conductive regions are in electrical contact with the lens pads.

7. Active eyewear for stereoscopic applications, comprising:

a frame including a pair of lens openings and a pair of temple arms pivotally connected thereto, wherein a first of said temple arms has a post extending therefrom adjacent to its pivotal connection and the frame has a post opening located in correspondence with the post,

a pair of electro-optical shutters mounted in respective lens openings,

a circuit electronically coupled to the electro-optical shutters and to a controller, including means for receiving synchronization information from the controller and for driving the shutters out of phase with each other in accordance with the synchronization information,

means to power the circuit,

a switch wired in series with the power means and affixed

to the frame proximate to the first temple arm,

an actuator mounted on the frame adjacent to the switch and comprising a ramp portion, a plunger portion and a spring portion, wherein the plunger portion has a first end movably coupled to the frame and a second end movably engaged in the post opening, wherein the ramp portion is connected to the first end of the plunger portion and extends therefrom to contact and activate the switch when the plunger portion is depressed, and wherein the spring portion is connected transversely to the plunger portion and biases the plunger portion toward a deactivated position.

8. Eyewear as in claim **7**, wherein the actuator comprises an integrally molded part.

9. Eyewear as in claim **8**, wherein the frame includes a surface proximate to the pivotal connection having a plurality of pins extending therefrom for positioning the switch and the actuator on the surface.

10. Eyewear as in claim **9**, wherein the switch is mounted over at least one of said pins, and wherein the plunger portion includes an elongated opening on its first end which is mounted over one of said pins, and wherein each end of the spring portion is held in place by two of said pins.

11. Eyewear as in claim **8**, wherein the switch includes contacts having surfaces made from gold.

12. Wireless active eyewear utilizable for viewing field-sequential stereoscopic images, comprising:

a frame having a pair of lens openings and a post opening,

a pair of temple arms pivotally attached to the frame,

a gasket incorporated within the frame, said gasket being substantially non-conductive and having a pair of electro-optical shutters integrally mounted therein in correspondence with the lens openings and a plurality of conductive regions which are in electrical contact with the shutters and with the circuit board,

a circuit incorporated within the frame and electronically coupled to the electro-optical shutters and to a controller, including means for receiving synchronization information from the controller and for driving the shutters out of phase with each other in accordance with the synchronization information, and

means to power the circuit.

13. Eyewear as in claim **12**, further comprising:

a switch wired in series with the power means and affixed to the frame proximate to one of said temple arms, and

an actuator mounted on the frame adjacent to the switch and comprising a ramp portion, a plunger portion and a spring portion, wherein the plunger portion has a first end movably coupled to the frame and a second end movably engaged in the post opening, wherein the ramp portion is connected to the first end of the plunger portion and extends therefrom to contact and activate the switch when the plunger portion is depressed through the post opening by said one of said temple arms, and wherein the spring portion is connected transversely to the plunger portion and biases the plunger portion toward a deactivated position.

* * * * *

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(19) **United States**

(12) **Patent Application Publication**

Agazarova

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(43) **Pub. Date: Dec. 25, 2008**

(54) **FINISHED LEATHER COVERED EYEWEAR DEVICE AND METHOD**

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(21) Appl. No.: **11/820,994**

(22) Filed: **Jun. 21, 2007**

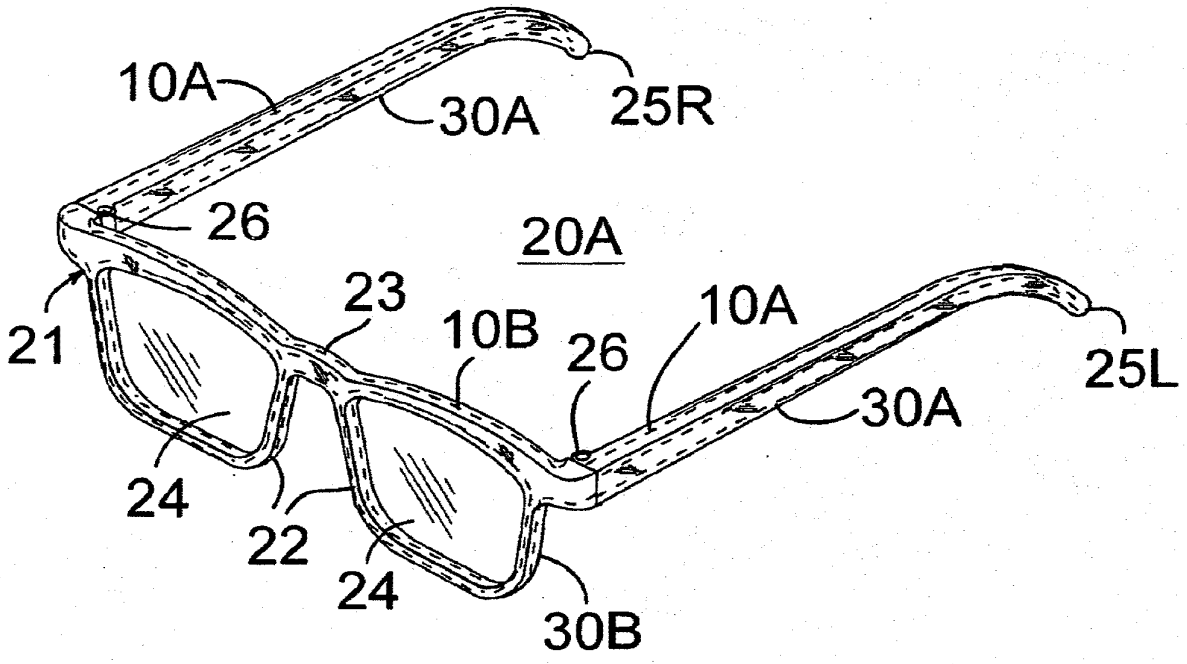
Publication Classification

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(57) **ABSTRACT**

A device and method of making eyewear with distinctive leather style and comfort as well as practicality in custom covered, customer covered, or mass produced eyewear coverings utilizing a zipper, snap, or metal button attaching means or by an insert molding in an injection molding process or compression molding process incorporating a normal structural material as well as a finished leather covering material.



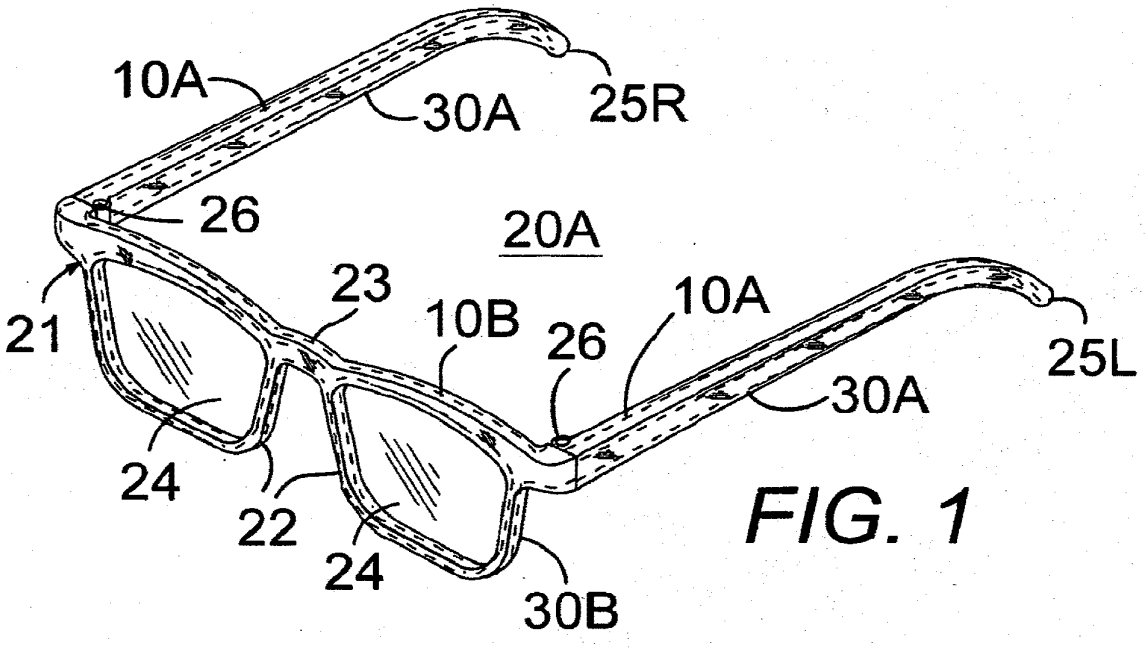


FIG. 1

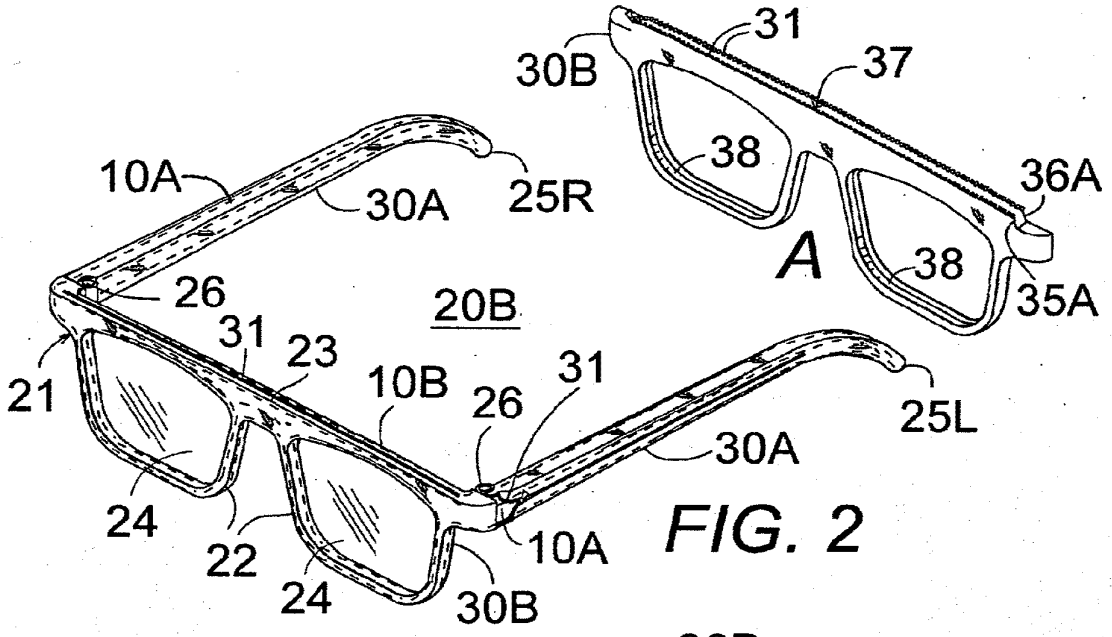

31
30B
37
10A
30A
25R
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36A
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38
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23
21
10B
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31
25L
30A
24
22
24
10A
30B

FIG. 2

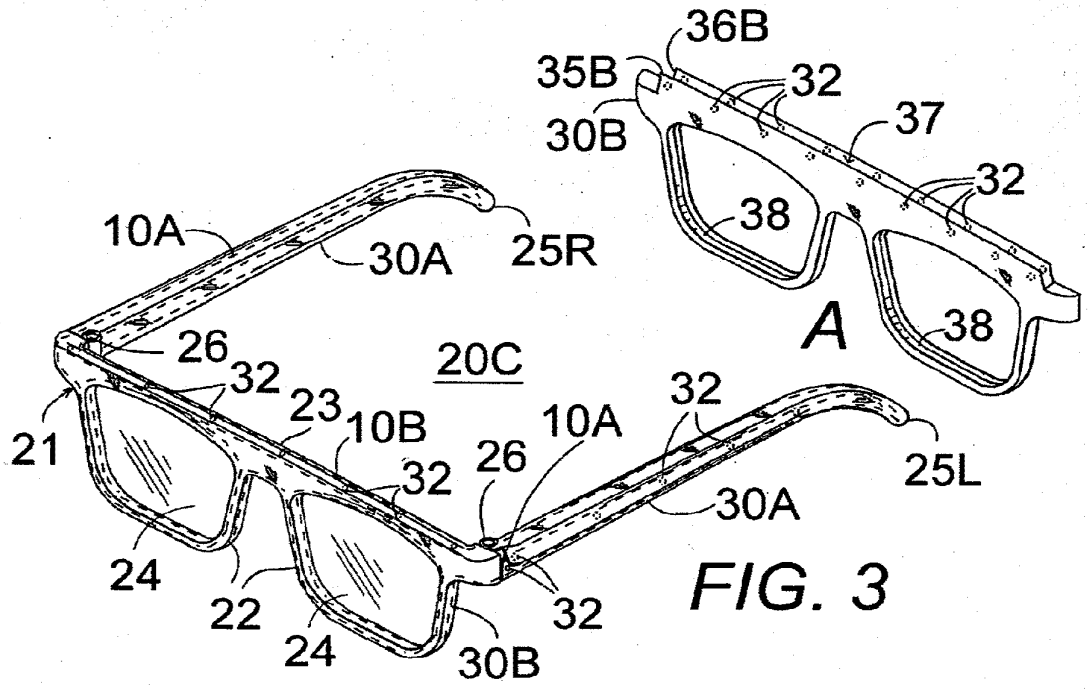

36B
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30B

FIG. 3

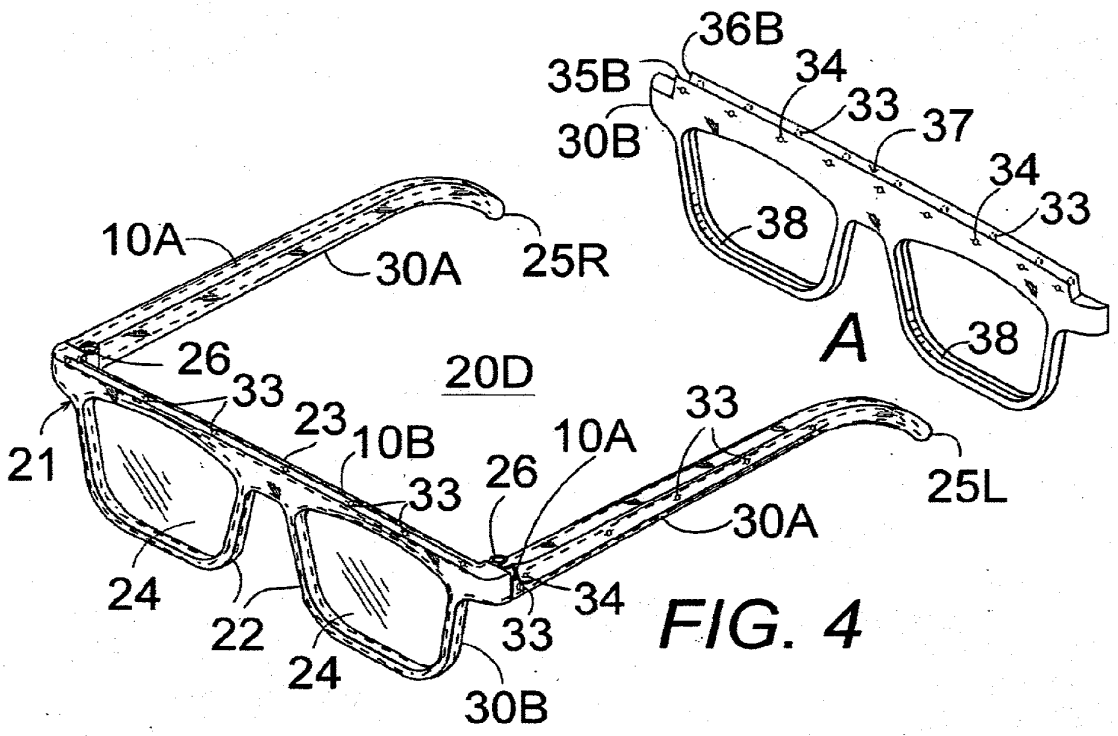

36B
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30B

FIG. 4

FINISHED LEATHER COVERED EYEWEAR DEVICE AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable.

THE NAMES OF THE PARTIES TO A JOINT RESEARCH OR DEVELOPMENT

[0003] Not Applicable.

BACKGROUND OF THE INVENTION

[0004] 1. Field of the Invention

[0005] The present invention relates to eyewear and particularly to a covered eyewear device with a hard structural interior and soft leather finish outer covering, the outer covering comprising a leather finish material sufficiently soft to rest comfortably against the skin of a user and sufficiently smooth on at outer surface to resist moisture and be easily wiped clean to form eyewear having a distinctive finished leather look and comfort on the exterior and a durable inner support structure. leather or patent leather cover for the frame and temple arms for eyewear, which cover may be installed over existing or new eyewear or formed by insert molding in an injection molding or compression **20** molding mass production of eyewear or by installing a covering over existing eyewear.

[0006] 2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 1.98

[0007] Eyewear comes in many styles and with many coverings, coatings, and attachments decorative or functional in purpose. Normally the outer surface of eyewear is hard and smooth being fabricated of a synthetic type of plastic or metal. Some portions of eyewear in prior art devices are formed with a soft outer portion around the parts in contact with the nose of the wearer to soften that contact and the remainder of the eyewear frame and temple arms hard for durability and retention functionality. There were some prior art patents which mention leather covered, fur covered and fabric covered eyewear frames primarily associated with warmth and comfort of the wearer in cold weather. There were also many prior art patents for ways of attaching the coverings and different design components to eyewear.

[0008] Prior art eyewear seems to be lacking a device and methodology for producing eyewear with distinctive style and comfort as well as practicality in mass produced or custom produced or customer attached eyewear coverings.

[0009] U.S. Pat. No. 6,196,681, issued Mar. 6, 2001 to Canavan, discloses a unitary structure made by a two-shot process in a single mold wherein a hard frame member is molded to which a secondary soft material is molded and chemically bonded to form soft contact areas along the inner portion of the brow bar and at the nose portions. In this manner, a soft material is provided to contact the wearer while hard material is provided to engage ratchet adjustment pieces as well as a transparent lens structure adapted to cover the eyes of a wearer.

[0010] U.S. Pat. No. 4,798,453, issued Jan. 17, 1989 to Tokumaru, provides an eyeglass frame and process for injection molding same. The frame of eyeglasses is produced by injection molding of a synthetic resin whose principle material is a polyarylate resin, a decorative coating layer on part or over the entire portion of the surface of the frame of eyeglasses, and a coating film is heat-hardened together with the frame of eyeglasses at about 130 degrees to 150 degrees C.

[0011] U.S. Pat. No. 4,955,706, issued Sep. 11, 1990 to Schmidthaler, shows a composite, integral polymeric spectacle part. The spectacle part includes a first polymer member and a second polymer member. The polymer members are selected to provide desired characteristics for the spectacle part at the location of the spectacle part where the member is incorporated. In a particular embodiment, it is desirable that the first polymeric member be formed from an elastomeric polymer and that the second member be a substantially rigid polymer. The rigid polymer is preferably formed from a thermosetting polymer having a higher melting temperature than the first elastomeric member. The second rigid member is bound to the first polymer member by heat fusion during an injection molding process. In the method of the invention for forming a composite, integral, polymeric spectacle part, a first polymer member is formed into a shape conforming to a portion of the cavity of an injection mold. The entire shape of the injection mold cavity defines the finished spectacle part. After the first polymeric member is inserted into the cavity portion, a second melted polymer, which has been heated to a suitable temperature above its melting temperature, is injected into the injection mold cavity so as to fill the cavity. The first polymer member and the second injected polymer are in abutting relationship in the injection mold cavity. A composite, integral polymeric spectacle part is prepared by activation and fusion of the first preformed polymer member by the heated second polymer.

[0012] U.S. Pat. No. 4,655,564, issued Apr. 7, 1987 to Czech, claims the making of spectacle frames and parts by means of injection molding, in which the plastic is selected from the group consisting of polyetherimide and polyethersulfone.

[0013] U.S. Pat. No. 3,406,232, issued Oct. 15, 1968 to Barker, describes a method for molding eyeglass frames and particularly to a lens frame having a lens holding groove therein.

[0014] U.S. Pat. No. 1,510,001, issued Sep. 30, 1924 to Gunning, discloses the method of making an ophthalmic mounting having a metallic frame enclosed in a cellulose molded frame.

[0015] U.S. Pat. No. 3,649,106, issued Mar. 14, 1972 to Hirschmann, Jr., indicates a manually formable reinforced spectacle temple includes a reinforcing wire enclosed within front a rear sections of plastic of relatively different properties. The front section is hard and resistant to deformation, while the rear section is soft and readily formable manually with the wire to fit the ear and head of the wearer. The two plastic sections are mechanically interlocked, and the rear section may be rotated on the reinforcing wire to accommodate the slope of the portion of the wearer's head with which it is in engagement. To form the temple, a wire is positioned within the mold at its desired location, and a fluid plastic molding compound such as polyvinyl chloride is injected into the cavity.

[0016] U.S. Pat. No. 5,331,355, issued Jul. 19, 1994 to Frank, puts forth a method for manufacturing plastic frames for eyeglasses, wherein a plastic blank is provided with formed portions in the area where protruding parts of the

finished plastic frame are located. Preferably, these formed portions are injection molded onto the plastic blank.

[0017] U.S. Pat. No. 4,265,850, issued May 5, 1981 to Coulon, concerns the process and apparatus for the production of spectacle frame parts of synthetic material, for example, of polyurethane. The faces are molded between two casting half-moulds each comprising a plate having an impression on one surface thereof. Each plate has a substantially equal thickness at every point and is made of a polyolefine. Use of such half-moulds enables the faces of spectacle frames to be directly molded into their final shape.

[0018] U.S. Pat. No. 7,175,270, issued Feb. 13, 2007 to Curci, illustrates a flexible frame assembly for eyeglasses created using a two shot molding process. A novel frame construction for eyeglasses is provided wherein the upper frame member is formed to have greatly enhanced flexibility to increase the overall adjustability, comfort and fit of the eyeglasses. The upper frame member includes areas wherein the material is selectively weakened to create predetermined flex points periodically within the frame member. Additionally, the weakened areas may be filled and/or covered with a second material that is more flexible than the base material used to form the frame member. The enhanced flexibility allows the upper frame member to flex as the temple members of the eyeglasses are stretched outwardly providing a comfortable fit for a wide range of wearers. Further, the top edge of the eyeglass lens may include formations that provide clearance for the deflection of the top frame member.

[0019] U.S. Pat. No. 2,746,087, issued May 22, 1956 to Dolezal, is for a method of manufacturing of spectacle hinges using plastics capable of molecular orientation by cold working, such as polyurethane and polyvinyl chloride.

[0020] U.S. Pat. No. 3,582,193, issued Jun. 1, 1971 to Bogyos, provides athletic eye spectacles having a frame including a lens-holding piece and temples. The frame includes a covering of a coating material which is soft and resilient, while the frame has an inner core of a harder material for properly supporting the lenses. The coating material is sufficiently resilient or soft so that if the spectacles are hit, the wearer will not be injured. nor will the person who strikes the spectacles. The spectacles are made by placing the inner or base frame in a mold, and the coating material is poured into the mold in liquid form and is permitted to set around the base frame. Finally, the temple pieces are also coated and affixed to the lens-holding frame piece.

[0021] U.S. Pat. No. 2,516,373, issued Jul. 25, 1950 to Ehlert, claims a mold for making plastic integral frames and lenses in a single molding operation.

[0022] U.S. Pat. No. 4,729,650, issued Mar. 8, 1988 to Jennings, indicates a pair of removable sunglasses which can be attached to conventional eyeglasses or spectacles. The sunglasses include a pair of lenses joined by a center section which functions as both a hinge and means for attaching the sunglasses to the bridge of the eyeglasses. They also include a pair of opposing side pieces attached to respective lenses by a hinge which are removably attachable to the bows of the eyeglasses. Each side piece is a laminated assembly made of fabric.

[0023] U.S. Pat. No. 3,526,450, issued Sep. 1, 1970 to Berry, is for an ornamental ribbon covering for eyeglasses which is attached to the eyeglasses by elastically embracing the eyeglasses frame. The covering forms an elastic envelope about the associated framework for supporting various ornamental and decorative indicia and characters upon the envelope.

[0024] U.S. Pat. No. 5,181,051, issued Jan. 19, 1993 to Townsend, provides a magnetic removable display for eyeglasses which may be made of a fabric coating to match clothing. A pair of specified metal glasses is provided for displaying removable magnetic printed matter includes a frame for supporting the lens of the pair of glasses. The frame is of a predetermined thickness for displaying removable printed matter thereon. Temples are provided for extending from the frame for supporting the glasses relative to a wearer's ears. The temples are of a predetermined thickness for displaying removable printed matter thereon. A retaining member is provided for temporarily retaining printed matter relative to at least the frame or the temples for predominantly displaying the printed matter for viewing by others. The retaining member may include a plurality of grooves disposed within a thickness of the frame and temples for mating with corresponding projections extending from the removable printed matter. The retaining member may include a plurality of projections extending from the frame and temples for mating with corresponding grooves disposed within a thickness of the removable printed matter. The retaining member may be a specified metal wherein the removable printed matter is attracted to and temporarily retained on the frames and temples of the glasses.

[0025] U.S. Pat. No. 6,139,144, issued Oct. 31, 2000 to Hynansky, shows a cold weather eyeglass system comprising conventional eyeglasses and a cold weather protective shield in either one combined unit or in a removable form. The shield component may be a covering selected from the group consisting of fabric, fur, and fabric-covered and fur-covered materials. The shield component may be integrally attached to the eyeglass frame or be releasably attached to a standard-style eyeglass frame (either of which can be fitted with standard size and shape prescription lenses), to provide protection against cold weather. The preferred embodiment of the removable assembly includes a one-piece member having side retaining members with the member serving as the frame, side retaining members, and a top retaining member.

[0026] Two U.S. patent applications, #20060244901 and #20060244899 published Nov. 2, 2006 by Maling, and one U.S. Pat. No. 7,101,039, issued Sep. 5, 2006 to Maling, all illustrate a durable eyeglasses frame allowing sizing, assembly and disassembly without the need for special training, screws, bolts, or pins, or special tools. Maling mentions the frame could be made of leather.

[0027] U.S. Pat. No. D533,888, issued Dec. 19, 2006 to Murphy, claims the ornamental design for fabric-wrapped sunglasses with attached baseball cap.

[0028] U.S. Pat. No. D534,567, issued Jan. 2, 2007 to Murphy, describes the ornamental design for fabric-wrapped sunglasses with attached sun hat.

[0029] U.S. Pat. No. D534,940, issued Jan. 9, 2007 to Murphy, discloses the ornamental design for a plush sunglasses with attached cap.

[0030] U.S. Pat. No. D503,736, issued Apr. 5, 2005 to Cleary, indicates the ornamental design for a goggle frame covered with leather.

[0031] U.S. Pat. No. D146,237, issued Jan. 14, 1947 to Sills, puts forth the ornamental design for a pair of eyeglasses.

[0032] U.S. Pat. No. 3,140,390, issued Jul. 7, 1964 to Smith, illustrates therapeutic heated appliance having a spectacle-like body with heated rims which are covered with a soft flannel cloth.

[0033] U.S. Pat. No. 3,993,403, issued Nov. 23, 1976 to Brown, is for an insulated fitting sheath for eyeglass temples. Protective, removable, flexible insulated fabric sheaths are employed on heat-softened temples of eyeglasses during fitting of the glasses to the head of the wearer to prevent injury or discomfort to the wearer. The temples are allowed to cool and harden while held in position on the head.

[0034] U.S. Pat. No. 1,524,321, issued Jan. 27, 1925 to Stevens, provides a spectacle temple where flexibility is attained utilizing a flexible reinforcing rod. The rod is covered with a fabric, preferably in the form of a tube, which is slipped over the rod. The fabric is then enclosed in a non-metallic member for aesthetic reasons. The non-metallic member is bored to form a tube, whereby the rod may be extended through the bore to reinforce the fabric and the non-metallic member. The fabric and the reinforcing rod may be bent to the desired shape of the temple either before or after the non-metallic tube is applied.

[0035] U.S. Pat. No. 5,440,355, issued Aug. 8, 1995 to Ross, shows a protective eyeglass cover for the temples and earpieces of a pair of eyeglasses. The protective cover includes a pair of fabric sleeve members with each of the sleeve members having a hollow interior and an opening at a first end extending into the hollow interior. Each of the sleeve members is configured to receive one of the temple and earpieces of the eyeglasses within the hollow interior through the opening. The protective cover increases the comfort to the user as well as tightening the grip of the eyeglasses.

[0036] U.S. Pat. No. 6,789,897, issued Sep. 14, 2004 to Smith, shows a sports theme, hands-free binocular glasses having an eyeglass frame, a binocular device, and an ornamental device, where the ornamental device has an overall shape which is substantially the shape of a sports-related device, and where the ornamental device has an opening which allows light to pass through the opening and into the binocular device. The ornamental device may be hollow and adapted to enclose the binocular device, and may comprise a first design element, where the first design element has a first design element shape which is substantially the shape of an attribute of the sports-related device. The sports theme hands-free binocular glasses may be adapted for use as a hands-free device. Also, hands-free binocular glasses having an eyeglass frame, a binocular device, a decorative element and a design element. The design element may be a sports element made from natural leather, manmade leather, pigskin, plastic, rubber, felt, etc., or may be flocking made from natural or synthetic fur, natural or synthetic feathers, felt and the like.

[0037] Two U.S. Pat. No. 6,957,890 issued Oct. 25, 2005 and U.S. Pat. No. 6,543,894 issued Apr. 8, 2003 to Shapiro, describe eyeglasses that are converted in appearance by a cover clip-on for part of the front portion of the frame of the eyeglasses. A set of eyewear combines the eyeglasses with the cover clip-on. The set may be enlarged by provision of a sunglasses clip-on and/or temple coverlets. A cover clip-on can mask the top and bottom eye rims of the eyeglasses or have a strip form, with top eye rim cover sections, possibly interconnected by a bridge. The strip is assembled with the eyeglasses mechanically and/or magnetically.

[0038] U.S. Pat. No. 3,542,460, issued Nov. 24, 1970 to Smith, is for a snap-together frame permitting a user to exchange one frame for another for decorative reasons.

[0039] U.S. Pat. No. 2,786,391, issued Mar. 26, 1957 to Lutes, provides a lens frame subassembly which is mountable in a larger brow piece assembly, to accomplish a change in fashion from one brow piece assembly to another. The lens frame subassembly is mounted using a pin and socket system.

[0040] U.S. Pat. No. 5,371,554, issued Dec. 6, 1994 to Aspesi, shows an eyeglass frame restyling assembly having grooves arranged in the lens, the grooves receiving a replaceable U-shaped channel for changing the style and or color of a frame around an eyeglass lens. The lenses may have a groove to permit the exchange of a frame portion of the eyeglass assembly.

[0041] U.S. Pat. No. 2,835,063, issued May 20, 1958 to Worthington, claims a removable ornamental brow cover for spectacle frames.

[0042] U.S. Pat. No. 2,743,543, issued May 1, 1956 to Goddard, describes clip-on ornamental attachments for eyeglasses frames.

[0043] U.S. Pat. No. 3,517,415, issued Jun. 30, 1970 to McGrath, discloses a flexible plastic glasses cover which snaps over the spectacle frame

[0044] U.S. Pat. No. 2,482,195, issued Sep. 20, 1949 to Martin, indicates a removably mounted ornamental strip for an eyeglass frame which provides the ability to change color scheme of the glasses.

[0045] U.S. Pat. No. D365,838, issued Jan. 2, 1996 to Moore, puts forth the ornamental design for a style changeable eyewear.

[0046] U.S. Pat. No. D167,526, issued Aug. 19, 1952 to Murphy, concerns the ornamental design for an ornamental clip for eyeglasses.

[0047] U.S. Pat. No. D354,502, issued Jan. 17, 1995 to Mekari, illustrates the ornamental design of an eyeglass frame attachable/detachable glass guard.

[0048] U.S. Pat. No. 4,981,350, issued Jan. 1, 1991 to Vitaloni, is for a sectional moldable spectacle frame. The spectacle frame comprises a hollow U-shaped base structure with bars pivotally mounted at the ends thereof and a pair of lever members pivotally mounted in the middle of the base structure and attachable by snap action to the upside of the base structure. Decorative eyebrow members are attachable by snap action of projections and recesses to the lever members.

[0049] U.S. Pat. No. 3,179,950, issued Apr. 20, 1965 to Gross, provides a spectacle frame with detachable ornamental brow-bars.

[0050] U.S. Pat. No. 2,599,463, issued Jun. 3, 1952 to Lamb, claims an attachment for eyeglasses which comprises a pair of interconnected, detachable, ornamental brow-bars which are friction fit on the eyeglasses.

[0051] U.S. Pat. No. 4,070,103, issued Jan. 24, 1978 to Meeker, discloses a spectacle frame with attachable one-piece slide-on rim which allows the wearer of eye glasses to change a single pair of glasses to match any individual fashion or mood. The basic spectacle unit is a combination of two lens, two lens rims, two temple members and a nose bridge. To complete the combination there are a number of attachable pairs of one-piece lens rim covers of various colors, designs, shapes and materials. The easily slid on lens rim covers are securely held in position by a lip, friction tape, magnetic strips or a snap-on type of friction fitting arrangement. Tinted lens

may be inserted in the individual pairs of lens rim covers in order to transform normal spectacles into sunglasses. In addition, the lens rim covers may be designed to affect a change in the shape of the actual lens itself from, for instance, the standard elliptical shape to a more high fashion octagonal square or rectangular shape.

[0052] What is needed is a device and methodology for producing eyewear with distinctive style and comfort as well as practicality in custom covered, customer covered, or mass produced eyewear coverings utilizing a zipper, snap, or metal button attaching means or by an insert molding in an injection molding process or compression molding process incorporating a normal structural material as well as a simulated fabric covering material, such as an artificial leather or patent leather material.

BRIEF SUMMARY OF THE INVENTION

[0053] An object of the present invention is to provide a device and methodology for producing eyewear with distinctive style and comfort as well as practicality in custom covered, customer covered, or mass produced eyewear coverings utilizing a zipper, snap, or metal button attaching means or by an insert molding in an injection molding process or compression molding process incorporating a normal structural material as well as a simulated fabric covering material, such as an artificial leather or patent leather material.

[0054] Another object of the present invention is to provide a patent leather outer surface on eyewear for a waterproof and weather proof, wipe clean soft and shiny surface with a material appeal and style.

[0055] In brief, a leather or patent leather cover for the frame and temple arms for eyewear, which cover may be installed over existing or new eyewear by a zipper, snap, or metal button or formed by insert molding in an injection molding or compression molding mass production of eyewear.

[0056] An advantage of the present invention is that it provides a distinctive finished leather look and style to eyewear which is comfortably soft on the skin of the wearer and easily wiped clean.

[0057] Another advantage of the present invention is that the finished leather covered eyewear may be custom covered, customer covered, or mass produced.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0058] These and other details of my invention will be described in connection with the accompanying drawings, which are furnished only by way of illustration and not in limitation of the invention, and in which drawings:

[0059] FIG. **1** is a perspective view of the finished leather covered eyewear of the present invention with the form-fit finished leather covering formed by a molding process;

[0060] FIG. **2** is a perspective view of the finished leather covered eyewear of the present invention with the form-fit finished leather covering attached to the eyewear frame and temple arms by zippers;

[0061] FIG. **2**A is a perspective view of the form-fit finished leather covering for the eyewear frame to be attached by a zipper;

[0062] FIG. **3** is a perspective view of the finished leather covered eyewear of the present invention with the form-fit finished leather covering attached to the eyewear frame and temple arms by snaps;

[0063] FIG. **3**A is a perspective view of the form-fit finished leather covering for the eyewear frame to be attached by snaps;

[0064] FIG. **4** is a perspective view of the finished leather covered eyewear of the present invention with the form-fit finished leather covering attached to the eyewear frame and temple arms by metal buttons;

[0065] FIG. **4**A is a perspective view of the form-fit finished leather covering for the eyewear frame to be attached by metal buttons.

DETAILED DESCRIPTION OF THE INVENTION

[0066] In FIGS. **1-4**, a covered eyewear device **20**A-**20**D with a frame **21** and temple arms **25**L and **25**R has a hard structural interior frame **10**B attached by hinges **26** to hard structural interior temple arms **10**A both covered by soft finished leather outer coverings **30**B and **30**A respectively.

[0067] The inner eyewear frame **10**B and pair of temple arms **10**A is formed of structural material to support a pair of lenses **24** attached in the frame and to withstand normal usage in being worn by a user.

[0068] The eyewear frame outer covering **30**B and pair of temple arms outer coverings **30**A comprise a leather finish material sufficiently soft to rest comfortably against the skin of a user and sufficiently smooth on at outer surface to resist moisture and be easily wiped clean to form eyewear having a distinctive finished leather look and comfort on the exterior and a durable inner support structure.

[0069] In FIG. **1**, the leather finish material is formed as the eyewear frame outer covering **30**B and pair of temple arms outer covering **30**A during a mass production molding process to create the eyewear device **20**A. The device molding process comprises at least one molding process taken from the list of molding processes including insert molding, injection molding, and compression molding.

[0070] The eyewear frame and pair of temple arms are fabricated of at least one synthetic material taken from the list of synthetic materials including a molded plastic, an injection molded thermoplastic, a compression molded thermoset plastic, and a molded resin.

[0071] The leather material for the coverings **30**A and **30**B may be insert molded onto the interior plastic eyewear frame **10**B and pair of temple arms **10**A during an injection molding process to create a molded outer finished leather surface thereon. Synthetic leather material for the coverings **30**A and **30**B such as vinyl chloride or polyvinyl chloride may be insert molded over polyurethane interior frame **10**B and interior temple arms **10**A to create a form fitting outer finished leather surface on the eyewear device **20**A.

[0072] The leather material for the coverings **30**A and **30**B may be alternately be laminated onto an interior plastic eyewear frame **10**B and interior pair of temple arms **10**A in a compression molding process to create a form fitting outer finished leather surface thereon. Real patent leather, genuine leather, vinyl chloride, polyvinyl chloride, rayon, acrylics, nylon, or polyester may be compression molded over a thermo-set plastic, such as polypropylene or polystyrene, or metal interior frame **10**B and interior temple arms **10**A to create a form fitting outer finished leather surface on the eyewear device **20**A.

[0073] In FIGS. **2** and **2**A, a finished leather covering, including patent leather or other materials, as a frame covering **30**B or temple arm covering **30**A is attached to an interior eyewear frame **10**B and interior pair of temple arms **10**A by zippers **31**. Outer temple arm sleeve covers **30**A are zipped on by zippers **31**, preferably along the sides, as shown in FIG. **2**, and outer frame sleeve covers **30**B, as shown in FIGS. **2** and **2**A, with form-fitting frame sleeves **34** and a top opening **37** is pulled up over the inner frame **10**B and the two flaps **35**A and **36**A zipped tightly closed by the zipper **31**, preferably along the top of the frame **21**, to create a form fitting outer finished leather surface on the eyewear device **20**B.

[0074] In FIGS. **3** and **3**A, a finished leather covering, including patent leather or other materials, as a frame covering **30**B or temple arm covering **30**A is attached to an interior eyewear frame **10**B and interior pair of temple arms **10**A by snaps **32**. Outer temple arm sleeve covers **30**A are snapped on by snaps **31**, preferably along the outside, as shown in FIG. **3**, and outer frame sleeve covers **30**B, as shown in FIGS. **3** and **3**A, with form-fitting frame sleeves **34** and a top opening **37** is pulled up over the inner frame **10**B and the two flaps **35**B and **36**B snapped tightly closed by the snaps **32**, preferably along the top of the frame **21**, to create a form fitting outer finished leather surface on the eyewear device **20**B.

[0075] In FIGS. **4** and **4**A, a finished leather covering, including patent leather or other materials, as a frame covering **30**B or temple arm covering **30**A is attached to an interior eyewear frame **10**B and interior pair of temple arms **10**A by metal buttons **33** through slotted openings **34**. Outer temple arm sleeve covers **30**A are buttoned by metal buttons **33**, preferably along the outside, as shown in FIG. **3**, and outer frame sleeve covers **30**B, as shown in FIGS. **3** and **3**A, with form-fitting frame sleeves **34** and a top opening **37** is pulled up over the inner frame **10**B and the two flaps **35**B and **36**B buttoned tightly closed by the buttons **33**, preferably along the top of the frame **21**, to create a form fitting outer finished leather surface on the eyewear device **20**B.

[0076] In FIG. **1**, the finished leather coverings **30**A and **30**B are attached to the inner temple arms **10**A and inner frames **10**B during mass production of new eyewear devices **20**A.

[0077] In FIGS. **2-4**, the finished leather coverings **30**A and **30**B may be attached to the inner temple arms **10**A and inner frames **10**B during mass production of new or existing eyewear devices **20**B-**20**D, so that a user may buy just the coverings **30**A and **30**B and attach them to existing eyewear or buy pre-covered eyewear custom made or mass produced.

[0078] The outer covering may comprise at least one of the features taken from a list of features comprising at least one coloring agent, multiple coloring agents, at least one visual pattern, at least one textural pattern, at least one design shape, at least one style feature, and at least one dimensional size feature in addition to the size variations provided by the interior frame, so that the glasses may come in a variety of sizes, styles, colors, multi-colors, designs, patterns, and various other qualities may be made with the present invention on all types of eyewear including designer eyewear and Hollywood style thick glasses and sunglasses.

[0079] In practice, a covered eyewear method for making eyewear with a hard structural interior and soft leather finish outer covering comprises:

[0080] Forming an inner eyewear frame and pair of temple arms formed of structural material to support a pair of lenses attached in the frame and to withstand normal usage in being worn by a user; and

[0081] Forming an outer covering on an exterior of an eyewear frame and pair of temple arms, the outer covering comprising a leather finish material sufficiently soft to rest comfortably against the skin of a user and sufficiently smooth on at outer surface to resist moisture and be easily wiped clean to form eyewear having a distinctive finished leather look and comfort on the exterior and a durable inner support structure.

[0082] The method may comprise forming an outer covering comprising a leather finish material on an exterior of the eyewear frame and pair of temple arms during a mass production molding process.

[0083] The method may comprise forming an outer covering comprising a leather finish material on an exterior of the eyewear frame and temple arms using at least one molding process taken from the list of molding processes including insert molding, injection molding, and compression molding.

[0084] The method may comprise the eyewear frame and pair of temple arms being fabricated of at least one synthetic material taken from the list of synthetic materials including a molded plastic, an injection molded thermoplastic, a compression molded thermoset plastic, and a molded resin.

[0085] The method may comprise insert molding the leather finish material onto an exterior of a synthetic material eyewear frame and pair of temple arms during an injection molding process to create a molded outer leather finish surface thereon.

[0086] The method may comprise laminating a leather finish material onto an exterior of a synthetic material eyewear frame and pair of temple arms in a compression molding process to create a form fitting outer leather finish surface thereon.

[0087] The method may comprise attaching the outer covering, comprising at least one leather finish covering material taken from the list of leather finish cover materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering, to an exterior of a new eyewear frame and pair of temple arms by at least one means for attaching the synthetic leather finish covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

[0088] The method may comprise attaching the outer covering, comprising at least one leather finish covering material taken from the list of leather finish covering materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering, to an exterior of an existing eyewear frame and pair of temple arms by at least one means for attaching the natural finished leather covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

[0089] The method may further comprise forming the outer covering with at least one of the features taken from a list of features comprising at least one coloring agent or multiple coloring agents added during the molding process, at least one visual pattern formed by adding mixtures of color during the molding process, at least one textural pattern formed by the shape of the mold, at least one design shape formed by the shape of the mold, at least one style feature formed by the shape of the mold, and at least one dimensional size feature formed by the dimensions of the mold in addition to the size variations provided by the interior frame, so that the glasses

may come in a variety of sizes, styles, colors, multi-colors, designs, patterns, and various other qualities may be made with the present invention on all types of eyewear including designer eyewear and Hollywood style thick glasses and sunglasses.

[0090] It is understood that the preceding description is given merely by way of illustration and not in limitation of the invention and that various modifications may be made thereto without departing from the spirit of the invention as claimed.

SEQUENCE LISTING

[0091] Not Applicable.

What is claimed is:

1. A covered eyewear device with a hard structural interior and soft leather finish outer covering, the device comprising:

an inner eyewear frame and pair of temple arms formed of structural material to support a pair of lenses attached in the frame and to withstand normal usage in being worn by a user;

an outer covering on an exterior of the eyewear frame and pair of temple arms, the outer covering comprising a leather finish material sufficiently soft to rest comfortably against the skin of a user and sufficiently smooth on at outer surface to resist moisture and be easily wiped clean to form eyewear having a distinctive finished leather look and comfort on the exterior and a durable inner support structure.

2. The device of claim **1** wherein the outer covering comprises a leather finish material formed on an exterior of the eyewear frame and pair of temple arms during a mass production molding process.

3. The device of claim **2** wherein the molding process comprises at least one molding process taken from the list of molding processes including insert molding, injection molding, and compression molding.

4. The device of claim **2** wherein the eyewear frame and pair of temple arms are fabricated of at least one synthetic material taken from the list of synthetic materials including a molded plastic, an injection molded thermoplastic, a compression molded thermoset plastic, and a molded resin.

5. The device of claim **2** wherein the outer covering comprises a leather finish material insert molded onto an exterior of a synthetic material eyewear frame and pair of temple arms during a mass production injection molding process to create a molded outer leather finish surface thereon.

6. The device of claim **2** wherein the outer covering comprises a leather finish material laminated onto an exterior of a synthetic material eyewear frame and pair of temple arms in a compression molding process to create a form fitting outer leather finish surface thereon.

7. The device of claim **2** wherein the outer covering comprises a leather finish material laminated onto an exterior of a metal eyewear frame and pair of temple arms in a compression molding process to create a form fitting outer leather finish surface thereon.

8. The device of claim **1** wherein the outer covering comprises at least one leather finish covering material taken from the list of leather finish cover materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering attached to an exterior of a new eyewear frame and pair of temple arms by at least one means for attaching the synthetic leather finish covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

9. The device of claim **1** wherein the outer covering comprises at least one leather finish covering material taken from the list of leather finish covering materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering, attached to an exterior of an existing eyewear frame and pair of temple arms by at least one means for attaching the natural finished leather covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

10. The device of claim **1** wherein the outer covering comprises at least one of the features taken from a list of features comprising at least one coloring agent, multiple coloring agents, at least one visual pattern, at least one textural pattern, at least one design shape, at least one style feature, and at least one dimensional size feature.

11. A covered eyewear method for making eyewear with a hard structural interior and soft leather finish outer covering, the method comprising:

forming an inner eyewear frame and pair of temple arms formed of structural material to support a pair of lenses attached in the frame and to withstand normal usage in being worn by a user; and

forming an outer covering on an exterior of an eyewear frame and pair of temple arms, the outer covering comprising a leather finish material sufficiently soft to rest comfortably against the skin of a user and sufficiently smooth on at outer surface to resist moisture and be easily wiped clean to form eyewear having a distinctive finished leather look and comfort on the exterior and a durable inner support structure.

12. The method of claim **11** comprising forming an outer covering comprising a leather finish material on an exterior of the eyewear frame and pair of temple arms during a mass production molding process.

13. The method of claim **12** comprising forming an outer covering comprising a leather finish material on an exterior of the eyewear frame and temple arms using at least one molding process taken from the list of molding processes including insert molding, injection molding, and compression molding.

14. The method of claim **12** comprising fabricating the eyewear frame and pair of temple arms of at least one synthetic material taken from the list of synthetic materials including a molded plastic, an injection molded thermoplastic, a compression molded thermoset plastic, and a molded resin.

15. The method of claim **14** comprising insert molding the leather finish material onto an exterior of a synthetic material eyewear frame and pair of temple arms during an injection molding process to create a molded outer leather finish surface thereon.

16. The method of claim **14** comprising laminating a leather finish material onto an exterior of a synthetic material eyewear frame and pair of temple arms in a compression molding process to create a form fitting outer leather finish surface thereon.

17. The method of claim **11** comprising attaching the outer covering, comprising at least one leather finish covering material taken from the list of leather finish cover materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering, to an exterior of a new eyewear frame and pair of temple arms by at least one means for attaching the synthetic leather finish covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

18. The method of claim **11** comprising attaching the outer covering, comprising at least one leather finish covering material taken from the list of leather finish covering materials including a synthetic leather finish covering, a patent leather covering, and a natural finished leather covering, to an exterior of an existing eyewear frame and pair of temple arms by at least one means for attaching the natural finished leather covering taken from the list of means for attaching including zippers, snaps, and metal buttons.

19. The method of claim **11** further comprising forming the outer covering comprises with at least one of the features taken from a list of features comprising at least one coloring agent, multiple coloring agents, at least one visual pattern, at least one textural pattern, at least one design shape, at least one style feature, and at least one dimensional size feature.

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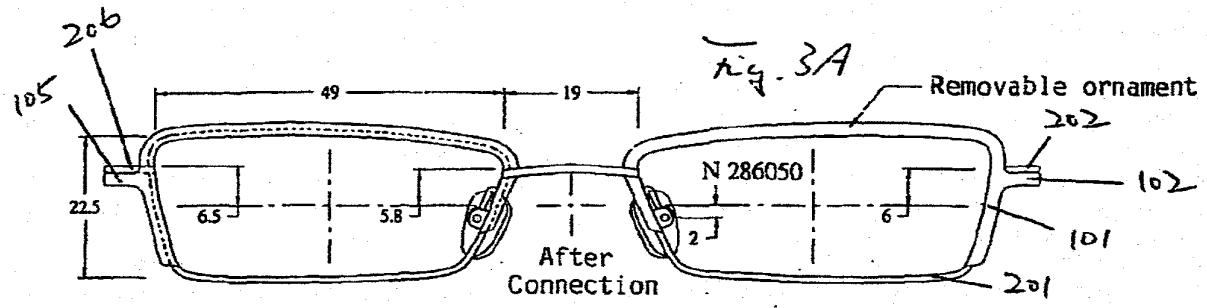
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(54) Ornamentation for eyeglasses

(57) A detachable ornamental device with magnets for eyeglasses. The ornamental partial frame is designed similar to an eyeglass frame without lenses, and includes simply a rim and two magnets each positioned and embedded in a respective extension at the two ends of the rim of the ornament. The detachable ornamental device is attached in front of the primary eyeglasses. The primary eyeglasses are composed of lenses, in which a magnet is embedded in the studs positioned at the two ends of the connecting portions corresponding to the positions of the magnets of the ornamental partial frame. By way of the magnet attracting force, the ornamental device is attracted and secured by magnets to the eyeglasses for either clipping-on or clipping-off the studs.



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Description

Field of the Invention

[0001] This invention relates to a detachable ornamental device with magnets, and more particularly, a pair of eyeglasses having an ornamental partial frame mounted thereon. The partial frame does not have lenses. The partial frame can be easily attached to and detached from an eyeglasses frame.

Background of the Invention

[0002] Nowadays eyeglasses, no matter which frames are made of metal or plastic, sometimes using magnets to attach a pair of auxiliary sunglasses to a pair of primary eyeglasses. This is a very popular and common method for connecting two sets of eyeglasses. These magnetic clip-on or hook-on methods of connection have long been used to transform primary eyeglasses into sunglasses without changing the primary optical eyeglasses. One can simply dispose a pair of clip-on or hook-up auxiliary sunglasses in front of the primary optical eyeglasses. Very often, the attachment is merely a pair of sunglasses and is limited to certain prescriptions of eyeglass frames in order to match with the primary eyeglasses.

[0003] The present invention arises to provide a new and novel configuration to ordinary eyeglasses so as to match with one's taste and sense of fashion.

Summary of the Invention

[0004] In a first aspect of the present invention, a detachable ornamental device with magnets is provided, which comprises an ornamental, partial frame the appearance of which is similar to an eyeglass frame but with no lenses mounted thereon. A magnet is located at both ends of said ornamental partial frame. Eyeglasses composed of lenses and a frame having a magnet at both ends are used with the ornamental partial frame having no temple and lenses attachable to said eyeglasses.

[0005] A second aspect of the present invention is to provide a trendy fashion to eyeglasses in which one may change the pattern of one's primary optical eyeglasses by disposing said ornamental frame in front of the primary frame, whilst said ornamental frame can be made in whatever prescription or color in order to match with one's daily style of fashion. This inventive ornamental frame is different from that of ordinary auxiliary eyeglasses or sunglasses because it is basically an ornament and said ornament cannot be worn by itself in the absence of said ordinary eyeglasses.

This invention includes the following:

Firstly, a pair of primary eyeglasses, either made of metal or plastic materials, including two sides each having a stud on the connecting portion, in which a magnet is embedded, and said ornament for disposing in front of ordinary eyeglasses, wherein said ornament comprises two sides each having an extension extending backward, in which a magnet is embedded and for engaging with the studs of said primary eyeglasses for securing said ornament.

Secondly, this invention is to provide an ornament adapted to be attached to primary eyeglasses in a specific prescription.

Brief description of the drawings

[0006]

FIG. 1A is a plan view of an ornamental device designed similar to an eyeglass frame with a magnet embedded at the two ends of an ornamental partial frame showing one embodiment of the present invention.

FIG. 1B is a front view of FIG. 1A showing the extensions on both ends of the present invention.

FIG. 2A is a plan view of a pair of primary eyeglasses in which a magnet is embedded in the stud positioned at the connecting portion of said primary eyeglasses.

FIG. 2B is a front view of FIG. 2A.

FIG. 3A is a front view showing how said ornamental partial frame is secured to said primary eyeglasses by the magnets according to the present invention.

FIG. 3B is a side view of FIG. 3A.

FIG. 4 is a plan view of another embodiment of said ornament attached to said primary eyeglasses.

FIG. 5A is a front view of an ornamental device attached on a primary frame according to a second preferred embodiment of the present invention.

FIG. 5B is a side view of FIG. 5A.

FIG. 6 is a plan view of an ornamental device and eyeglasses attached together according to the above second embodiment of the present invention.

FIG. 7A is a front view illustrating an ornamental device mounted on the eyeglasses according to a third preferred embodiment of the present invention.

FIG. 7B is a front view of a plastic eyeglass ornament.

FIG. 8A is a front view of an ornamental device mounted on eyeglasses according to a fourth preferred embodiment of the present invention.

FIG. 8B is a front view of a plastic eyeglass ornamental partial frame showing the extension on both ends of the ornamental partial frame according to the above fourth preferred embodiment of the present invention.

FIG. 8C is an exploded view of the right extension of the ornamental partial frame and the right connecting portion of the eyeglasses, illustrating the positioning of the magnets according to the above fourth preferred embodiment of the present invention.

FIG. 9A is a front view of another plastic eyeglass ornamental partial frame.

FIG. 9B is a front view of a plastic eyeglass orna-

mental partial frame mounted on primary eyeglasses according to a fifth preferred embodiment of the present invention.

FIG. 9C is a plan view showing how said ornamental partial frame is secured to primary eyeglasses according to the above fifth embodiment of the present invention.

FIG. 9D is a sectional view taken along line 9D-9D in Figure 9B.

FIG. 10A is a front view of a plastic eyeglass ornamental partial frame mounted on primary eyeglasses according to a sixth preferred embodiment of the present invention.

FIG. 10B is a front view of the plastic ornamental plastic frame according to the above sixth preferred embodiment of the present invention.

FIG. 10C is a perspective view of the extension of the ornamental partial frame illustrating the positioning of the magnet according to the above sixth preferred embodiment of the present invention.

FIG. 11A is a front view of a plastic eyeglass ornamental partial frame having two projecting bend tabs with a magnet located at a terminal end of each bend tab.

FIG. 11B is a front view of the plastic eyeglass ornamental partial frame of FIG. 11A mounted on a pair of primary eyeglasses.

FIG. 11C is a plan view showing how the ornamental partial frame of FIG. 11A is secured to a pair of primary eyeglasses.

FIG. 11D is a perspective view illustrating the bending of the bend tab or projections of the ornamental partial frame of FIG. 11A.

FIG. 12A is a front view of a plastic eyeglass ornamental partial frame mounted on a pair of primary eyeglasses.

FIG. 12B is a front view of the ornamental partial frame shown in FIG. 12A.

FIG. 12C is a partial sectional plan view of the ornamental partial frame of FIG. 12B secured to a pair of primary eyeglasses as shown in FIG. 12A.

FIG. 12D is a sectional view of only the ornamental partial frame of FIG. 12B taken along line 12D-12D as shown in FIG. 12A.

Detailed description of the preferred embodiments

[0007] An eyeglass ornament with magnets of the present invention, referring to FIG. 1A and 1B, includes a device similar to an eyeglass frame 101, connecting portion 101, 105 at two end portion of the device 101 extending rearwardly, each having a stud 103, 106 fixed at the inner side of said connection portions 102, 105. A magnet 104, 107 is embedded in the respective stud 103, 106.

[0008] A pair of eyeglasses, in accordance with the present invention, comprises a primary frame 201, lenses 207, mounted within.the frame, connecting portions 202, 205 at two end portions of the frame 201 extending rearwardly, each having a stud 203, 206 fixed at the inner side of said connection portions 202, 205. A magnet 204, 207 is embedded in the respective studs 203, 206 for supporting the eyeglass ornament 101. The magnets 204, 207 are preferably in a round shape and both sides, upward and downward, may attract another magnet.

[0009] The eyeglass ornament 101, according to the present invention, can be made in any color, and the material employable is not specially limited. An eyeglass ornament 101 is attached to the front of said primary frame 201, namely, as shown in FIGS. 3 and 4, when said eyeglass ornament 101 is disposed in front of said primary frame 201, the magnets 104, 107 of said eyeglass ornament 101 are magnetically connected to the magnets 204, 207 of said primary frame 201. Thus, the appearance of said primary frame 201 can be changed when said eyeglass ornament 101 is put onto said primary frame 201.

[0010] From the above description, it can be understood that the application of the present invention is not limited to eyeglass frames made of metal but is also applicable to plastic eyeglass frames as shown in FIGS. 5 and 6. Referring to FIGS. 8A, 8B and 8C, another preferred embodiment of the present invention is illustrated, wherein a plastic ornamental frame 801 having two extensions 802, 803, 804, 805 at the two ends of said ornamental frame 801 extend backwardly and the two pairs of extensions 802/803, 804/805 parallel to each other form a gap 813, 814 between each other. As shown in FIG. 8C, more particularly, at the upper extension 802, 804 of said ornamental frame, a stud 811 is fixed to the inner side of the extension 802 with a magnet 812 embedded therein. The primary frame 807, having connection portions 805, 806 on both ends of the frame and another stud 808 is fixed to the inner side of the connecting portions 805, 806 with a magnet 812 embedded therein, supports the ornamental frame 801 by means of the magnet force of the interlocking system.

[0011] Referring to FIG. 7A and 7B, there is shown another arrangement that is similar to that of FIG. 8, with the exception that the ornamental frame 701 has one extension 702, 703 on each side and said ornamental frame 701 is mounted on primary frame 704 by attaching the extensions 702, 703 beneath the connecting portions 705, 706 of said primary frame 704.

[0012] Referring to Figures 9A, 9B and 9C, a plastic ornamental partial frame 300 is shown. The two ends 302, 304 of the frame include magnets embedded in the ends in an arrangement similar to that shown in Figures 1A and 1B such that the magnets 306, 308 projecting from a bottom surface of the ends 302, 304 interengage with an upper surface of magnets 310, 312 of a primary pair of eyeglasses 314.

[0013] This is best shown in partial sectional view 9C where the magnet 308 is seen sitting on top of magnet 312 at end 304 of the frame 300. Alternatively, in Figure 9C, the tabs 310, 312 can be made of metal to secure

the magnets 306, 308 to the tabs 310, 312 so as to secure the partial frame 300 to the eyeglasses 314 without the need for magnets in the tabs 310, 312 of the eyeglasses 314.

[0014] In addition, a step-like cut out portion 316 of bridge portion 318 is configured to rest on top of a bridge 320 of the eyeglasses 314. This provides additional support stability to the partial frame 300 mounted on the eyeglasses 314.

[0015] Referring to Figures 10A, 10B and 10C, a plastic ornamental partial frame 350 includes two ends 352, 354. Each of the ends includes a forwardly exposed magnet 356, 358 as shown in greater detail in Figure 10C. The partial frame 350 is positioned on top of a pair of eyeglasses 360 by positioning the portions of the frame including the magnets 356, 358 behind metal tabs 362, 364 so as to secure the magnets 356, 358 to the primary eyeglasses 360.

[0016] Referring to Figures 11A through 11D, a plastic ornamental partial frame 370 is shown having bridge portion 372. Extending from the bridge portion 372 are projecting tabs or projections 374, 376. Each of the tabs 374, 376 terminates in a magnet 378, 380, respectively.

[0017] To mount the partial frame 370 on a pair of primary eyeglasses 382, the tabs or projections 374, 376 are bent as best shown in Figure 11D in the direction of arrows 384 around the bridge portion 386 of the primary eyeglasses 382. The metal bridge portion 386 provides an anchoring of the partial frame 370 due to the attraction of the magnets 378, 380 to the bridge portion 386 of the eyeglasses 382.

[0018] Referring to Figures 12A through 12D, a plastic ornamental partial frame 400 includes a central bridge portion 402. Projecting rearwardly from the bridge portion 402 as shown in Figure 12C are two tabs 404, 406 each including an exposed downwardly surface of a magnet 408, 410, respectively. To mount the partial frame 400 onto a pair of primary eyeglasses 412, the magnets 408, 410 are attracted to a metal bridge portion 414 of the pair of eyeglasses 412. In addition, as was explained with reference to the embodiment of Figures 9A through 9D, the partial frame 400 include a stepped portion 416 which helps interengage the bridge portion 402 of the partial frame 400 with the bridge portion 414 of the pair of primary eyeglasses 412.

[0019] The foregoing description should be considered as illustrative only of the principles of the invention. Since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and, accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

Claims

1. A pair of eyeglasses comprising

   a frame having two opposite ends,
   a pair of lenses installed within and supported by said frame,
   a pair of connecting portions at each opposite end of said frame,
   a pair of studs fixed at an inner side of each of said connecting portions, and
   a pair of magnets, each being embedded within a respective one of said studs of said connecting portions.

2. The eyeglasses as recited in claim 1, wherein said connecting portions and said studs are made of metal.

3. An ornamental frame removably attachable to a pair of eyeglasses, said ornamental frame comprising:

   an at least partial eyeglass frame being made of one of metal and plastic material and being devoid of lenses,
   at least one pair of extensions at each end of said at least partial eyeglass frame,
   a pair of studs fixed at an inner side of each of said extensions, and
   a pair of magnets, each magnet being embedded within a respective one of said studs of said extensions for interengaging with metal portions of a pair of primary eyeglasses so as to aesthetically enhance an appearance of the pair of primary eyeglasses without affecting vision through lenses of the primary eyeglasses.

4. An ornamental frame removably attachable to a pair of eyeglasses, said ornamental frame comprising:

   an at least partial eyeglass frame devoid of lenses,
   two projections extending from the frame, and
   a magnet located in each of said two projections for releasably attaching the frame to a pair of eyeglasses so as to aesthetically enhance an appearance of the pair of eyeglasses without affecting vision through lenses of the pair of eyeglasses.

5. The ornamental frame as claimed in claim 4, wherein said two projections extend from opposite ends of said frame.

6. The ornamental frame as claimed in claim 4, wherein said two projections extend from a bridge portion of said frame.

7. The ornamental frame as claimed in claim 6, wherein said two projections are bendable around a bridge portion of the pair of eyeglasses.

8. The ornamental frame as claimed in claim 7, wherein said magnet is located in a terminal portion of each of said two projections of said frame.

9. The ornamental frame as claimed in claim 5, wherein said two projections are each bifurcated for receipt of a portion of the pair of eyeglasses therebetween.

10. The ornamental frame as claimed in claim 5, wherein said two projections extend under corresponding projections of the pair of eyeglasses.

11. The ornamental frame as claimed in claim 5, wherein said two projections extend behind corresponding projections of the pair of eyeglasses.

12. The ornamental frame as claimed in claim 5, wherein said two projections extend over corresponding projections of the pair of eyeglasses.

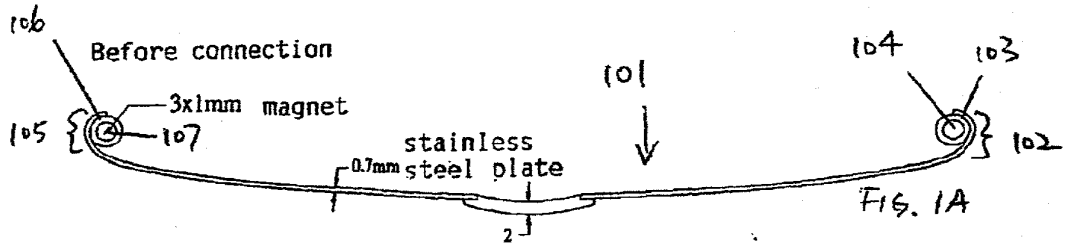


FIG. 1A

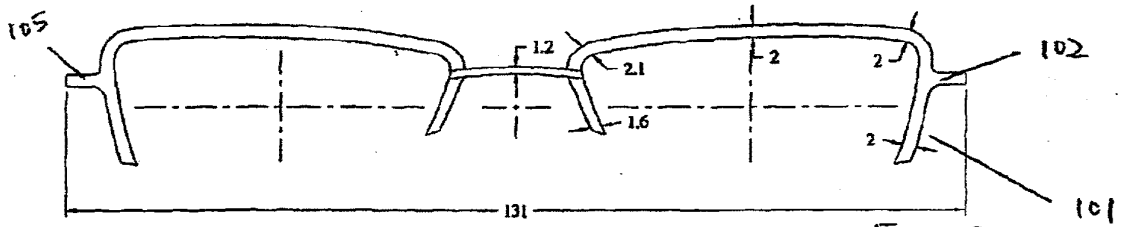


FIG. 1B

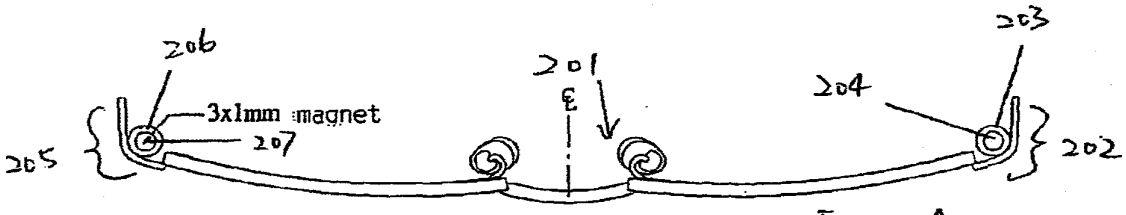


FIG 2A

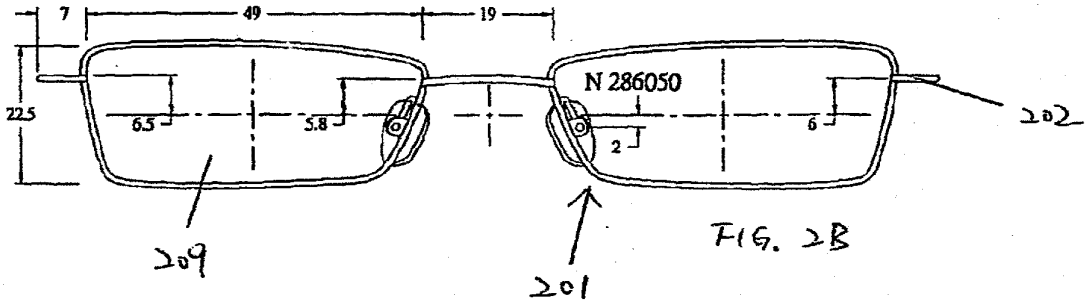


FIG. 2B

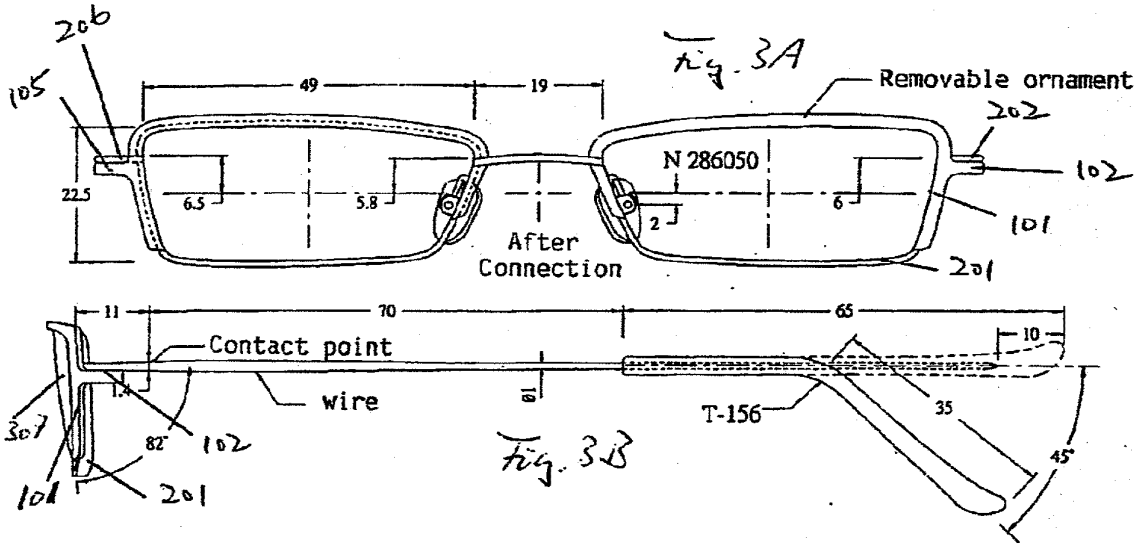


Fig. 3A

Fig. 3B

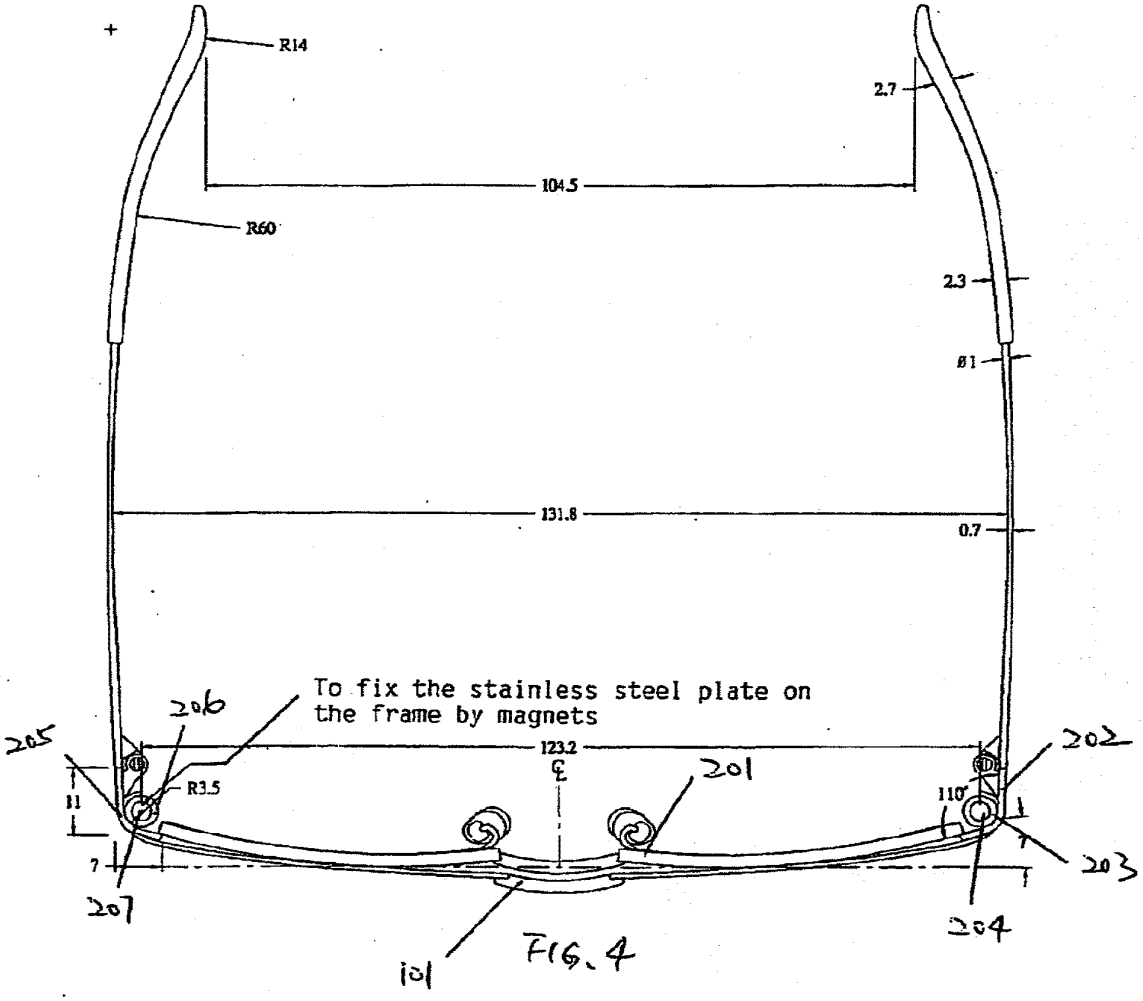


FIG. 4

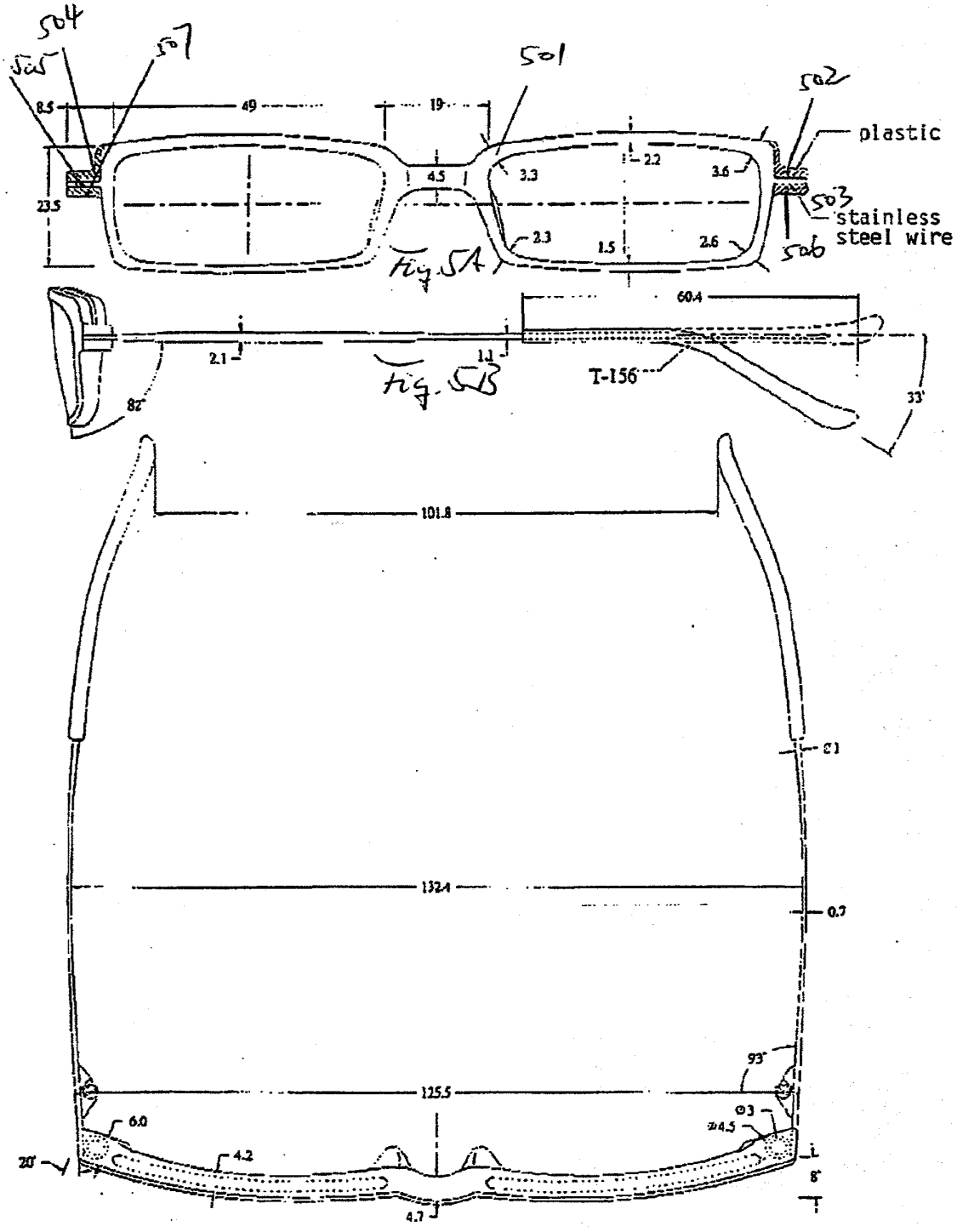


Fig. 5A

Fig. 5B

FIG. 6

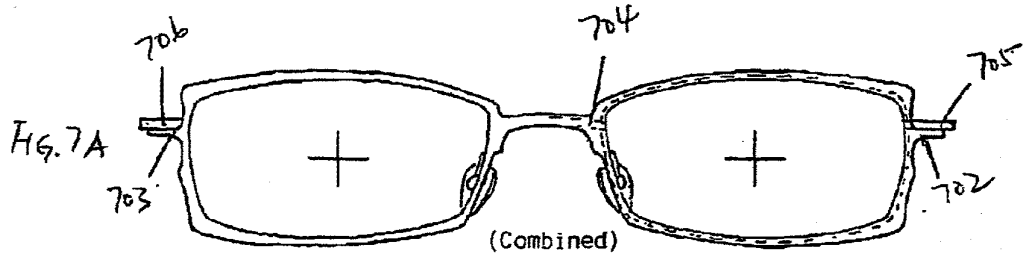


FIG. 7A

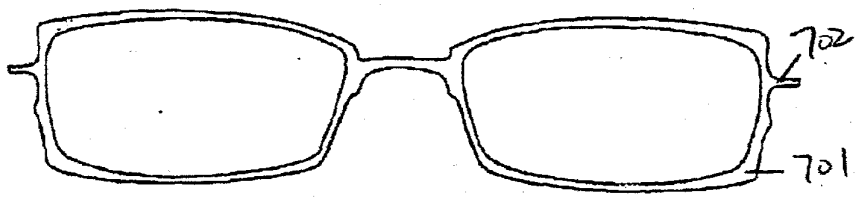


FIG. 7B

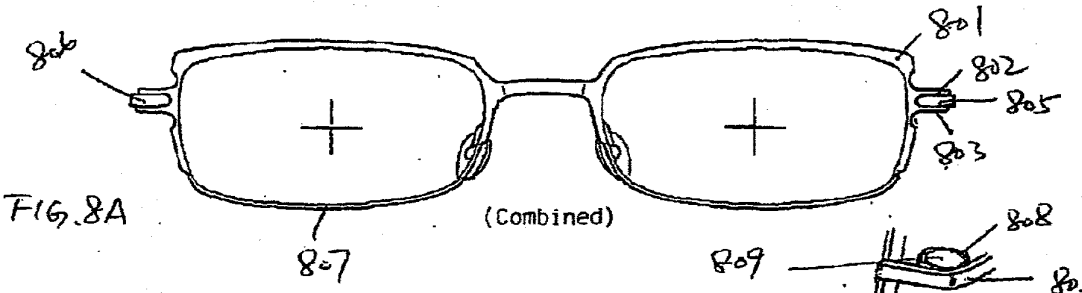


FIG. 8A

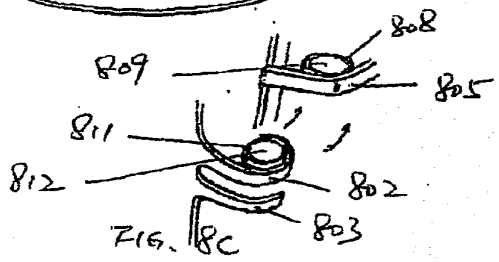


FIG. 8C

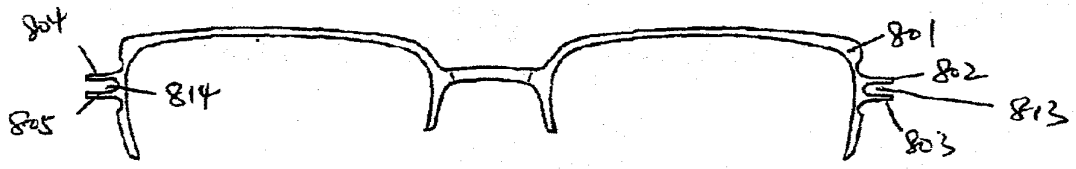


FIG. 8B

FIG. 9

FIG. 9A

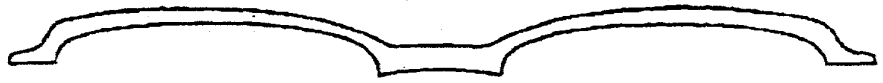
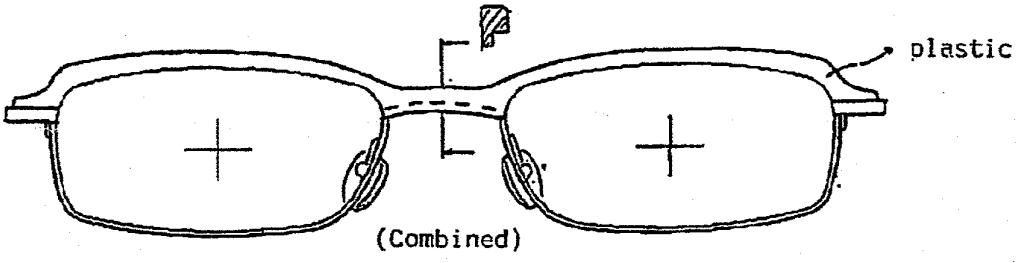


FIG. 9B



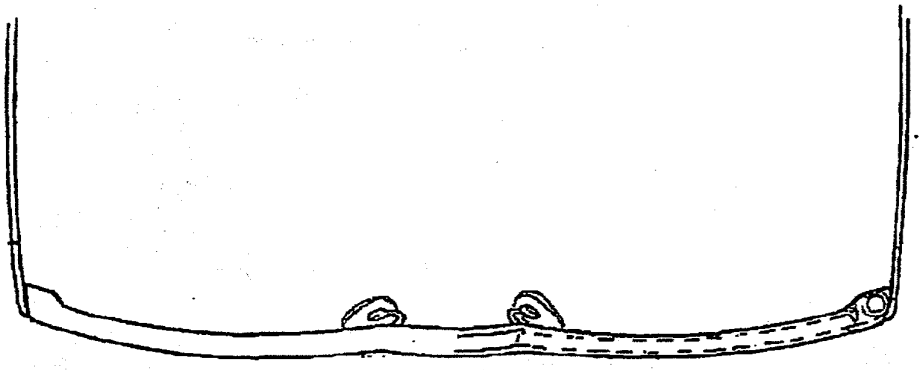


FIG. 9C

FIG. 10

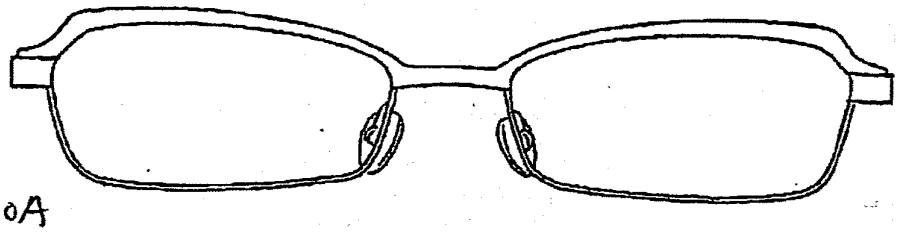


FIG. 10A



FIG. 10B

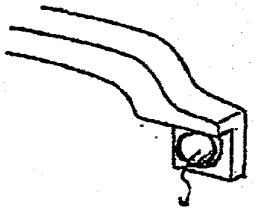


FIG. 10C

FIG. 11

FIG. 11A

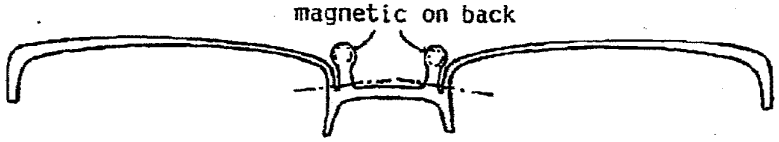


FIG. 11B

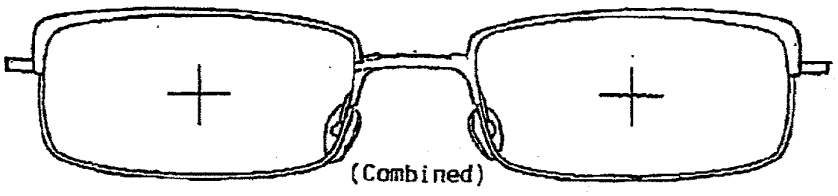


FIG. 11C



FIG. 11D

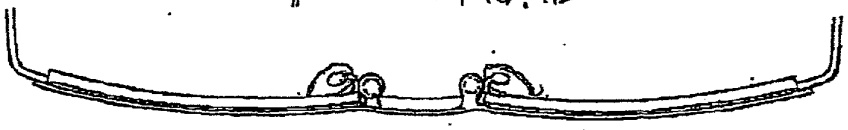


FIG. 12

FIG. 12A

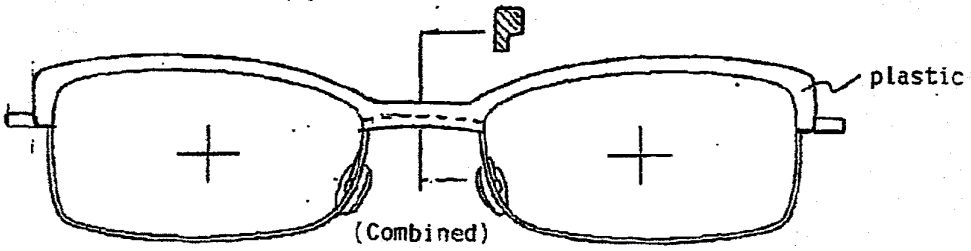
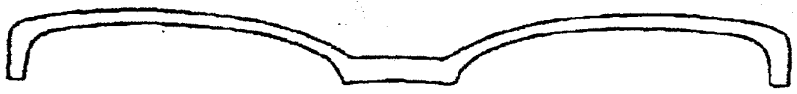


FIG. 12B



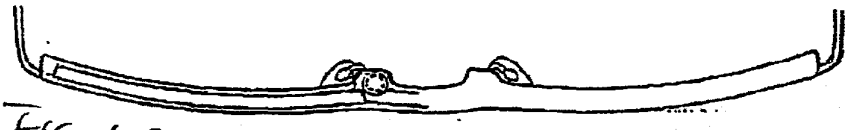


FIG. 12C

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 40 0067

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* page 1, paragraphs 4-7,18,19 * * page 2, paragraphs 27,28 *	6-12	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 December 2005	CALLEWAERT, H

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X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

US005764338A

United States Patent [19]

Mack

[11] Patent Number: 5,764,338

[45] Date of Patent: Jun. 9, 1998

[54] **HOLDER FOR A MASK OR THE LIKE**

[76] Inventor: **Carol Anne Mack**, R.R. #1, Norfolk Rd., Winsted, Conn. 06098

[21] Appl. No.: **679,460**

[22] Filed: **Jul. 9, 1996**

[51] **Int. Cl.**[6] **G02C 1/00**; G02C 11/02; G02C 9/00

[52] **U.S. Cl.** **351/158**; 351/47; 351/52

[58] **Field of Search** 351/44, 47, 51, 351/52, 158; 2/15, 10, 443, 450

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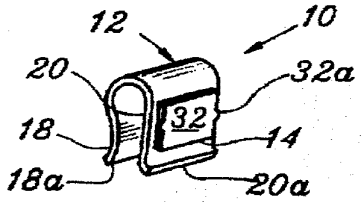
Primary Examiner—Huy Mai

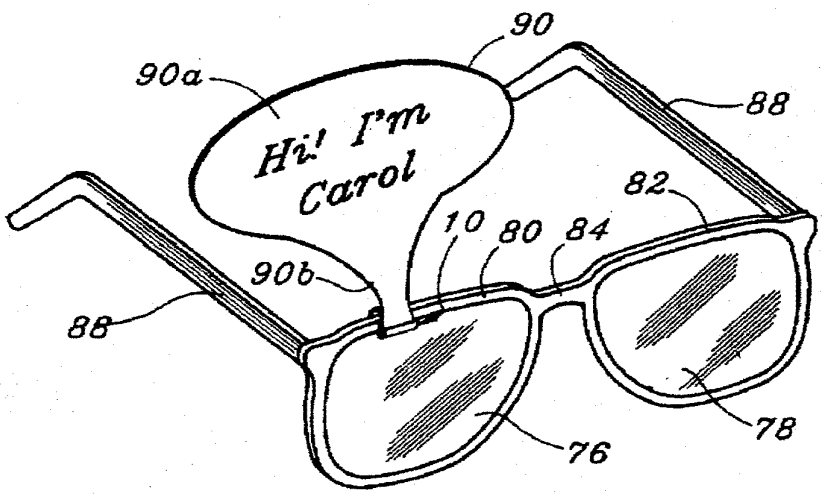
Attorney, Agent, or Firm—William C. Crutcher

[57] **ABSTRACT**

A clip comprising a flexible plastic channel member with attachment device, such as a double sided adhesive pad on one wall of the channel, fits over the top frame of eyeglasses. Used singly, or in pairs, the clips serve to hold various objects in proximity to the face, such as a mask, a visor, a light filter or a display card with a greeting. When used in pairs the adhesive or the clips allow accurate placement and holding of a mask so that the eye openings are aligned with the eyes of the wearer.

20 Claims, 5 Drawing Sheets





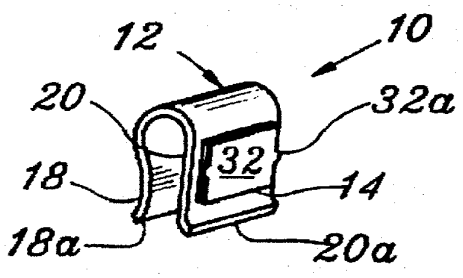


Fig. 1

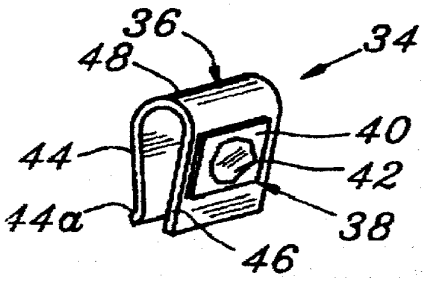


Fig. 4

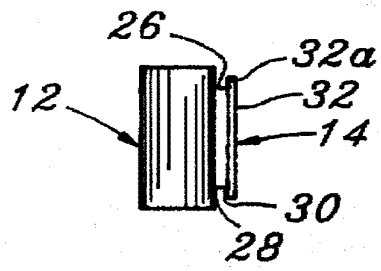


Fig. 2

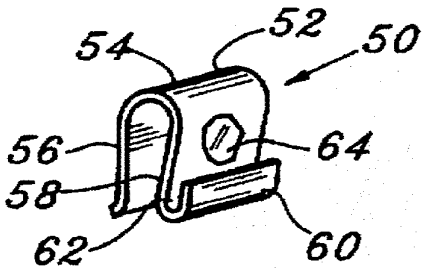


Fig. 5

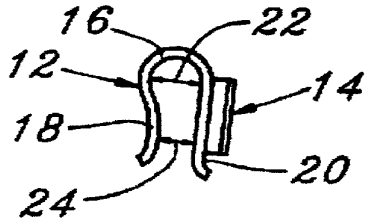


Fig. 3

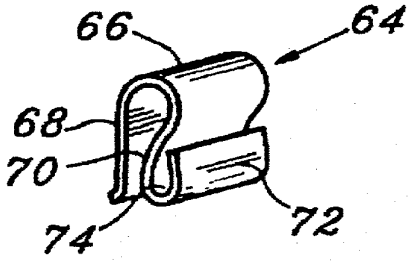


Fig. 6

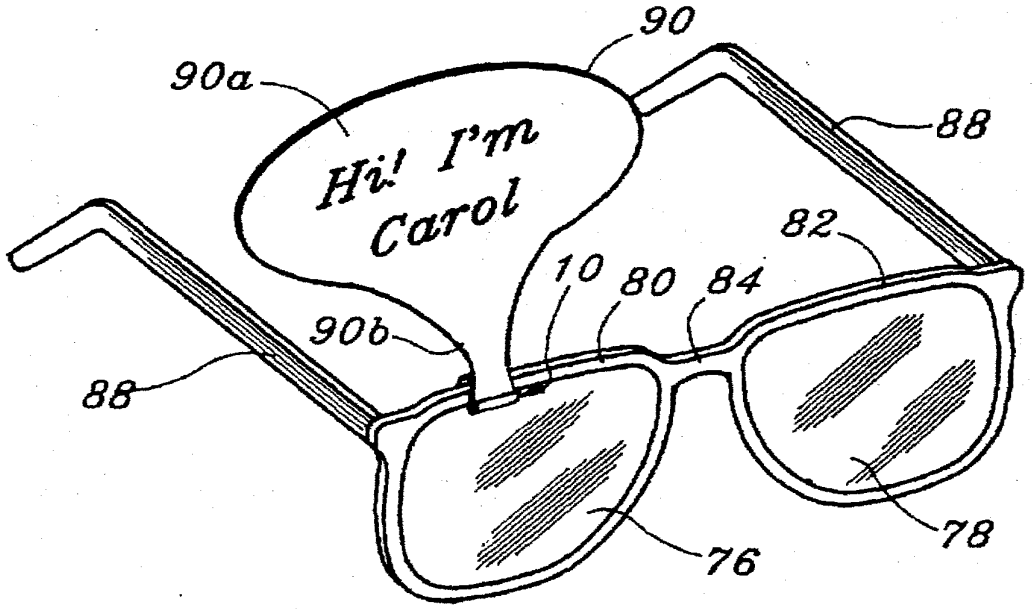


Fig. 7

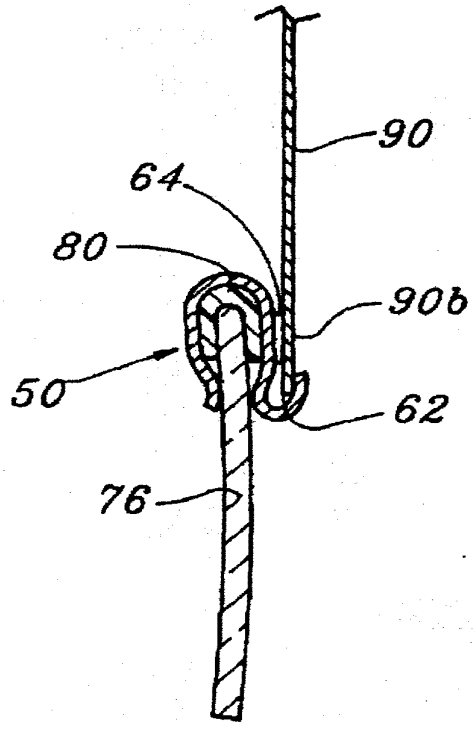


Fig. 8

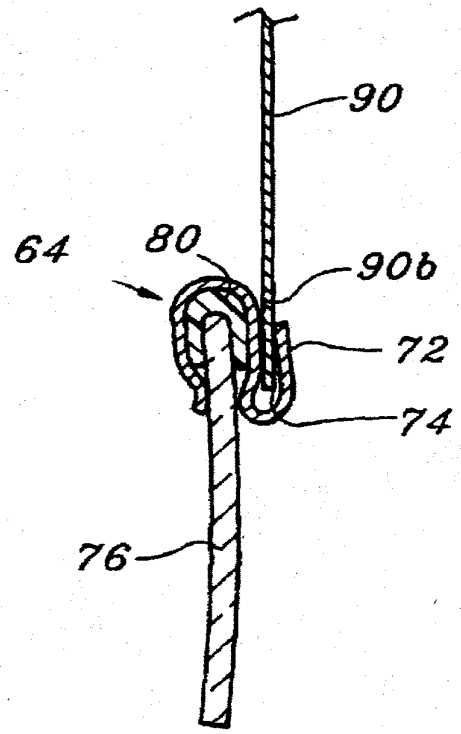


Fig. 9

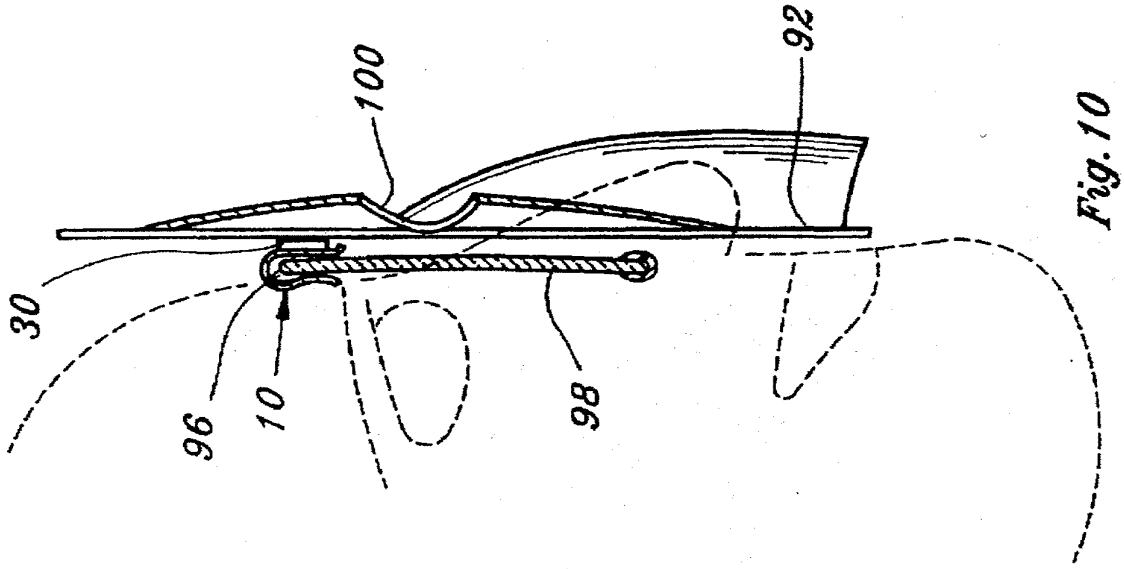


Fig. 10

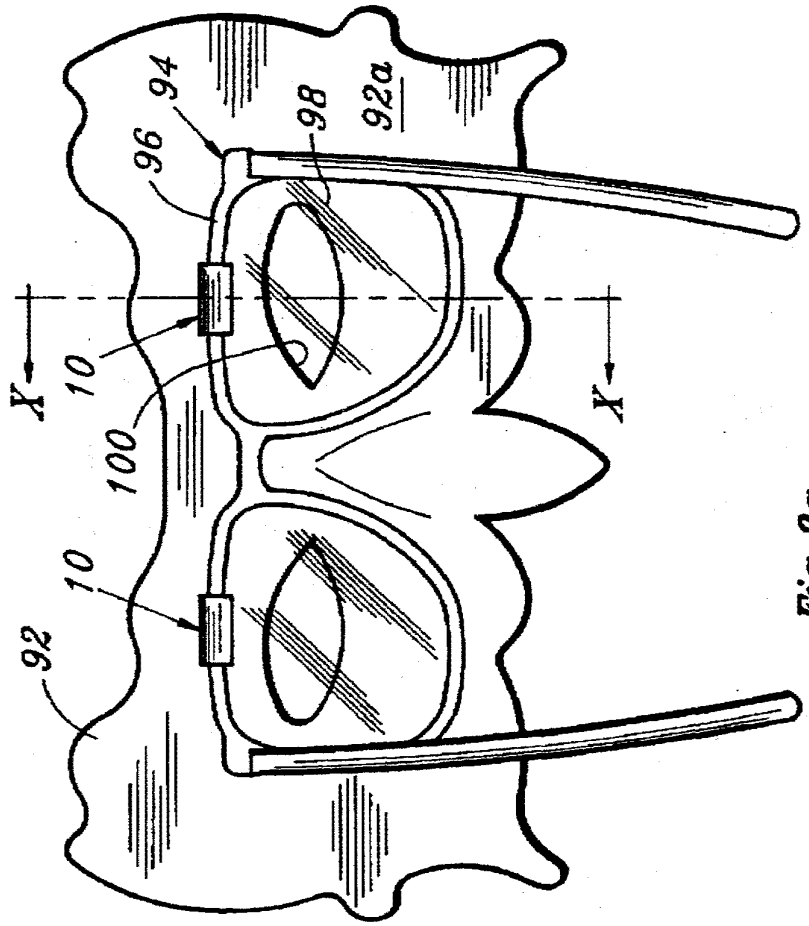


Fig. 8a

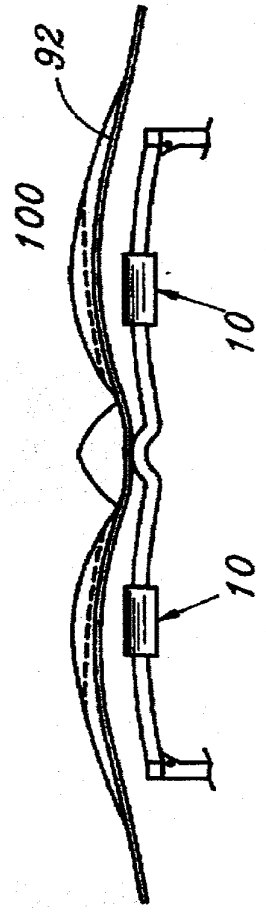


Fig. 9a

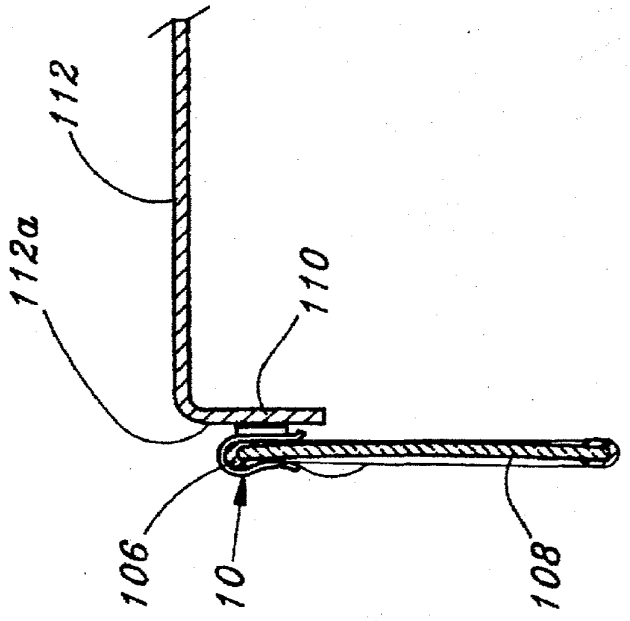


Fig. 13

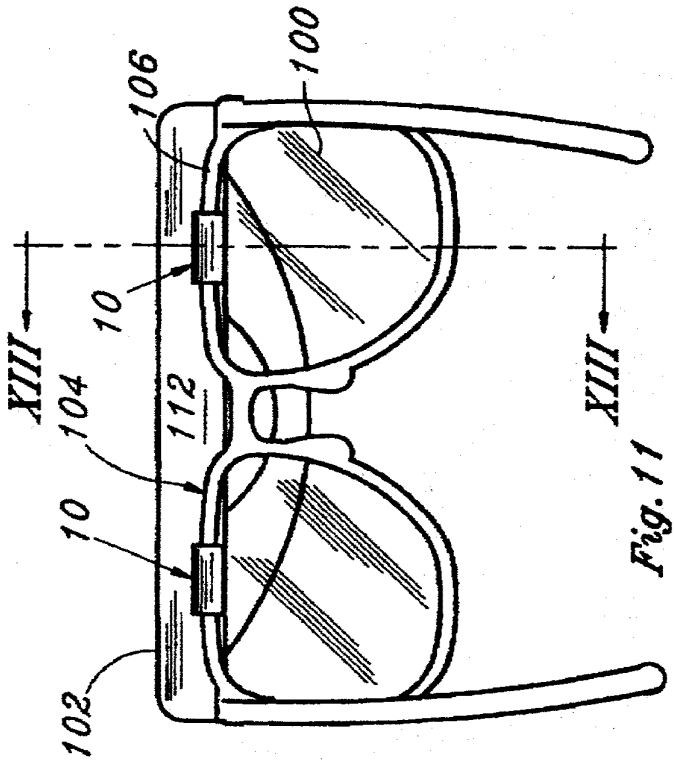


Fig. 11

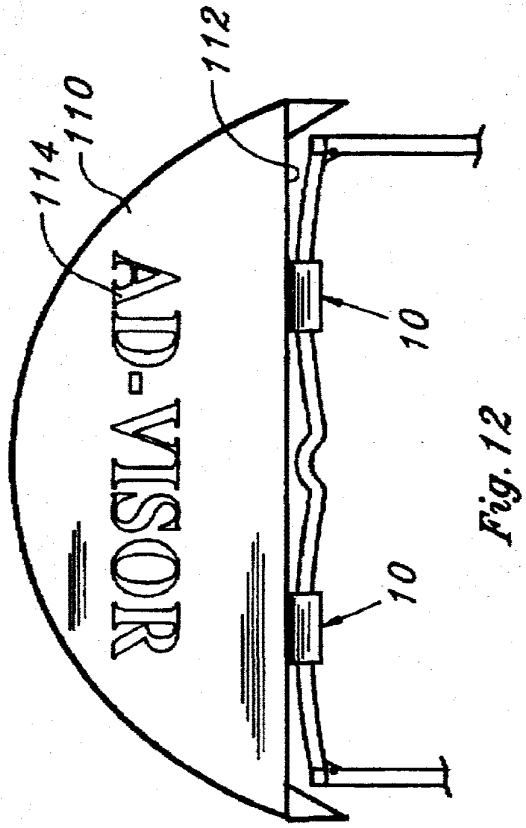


Fig. 12

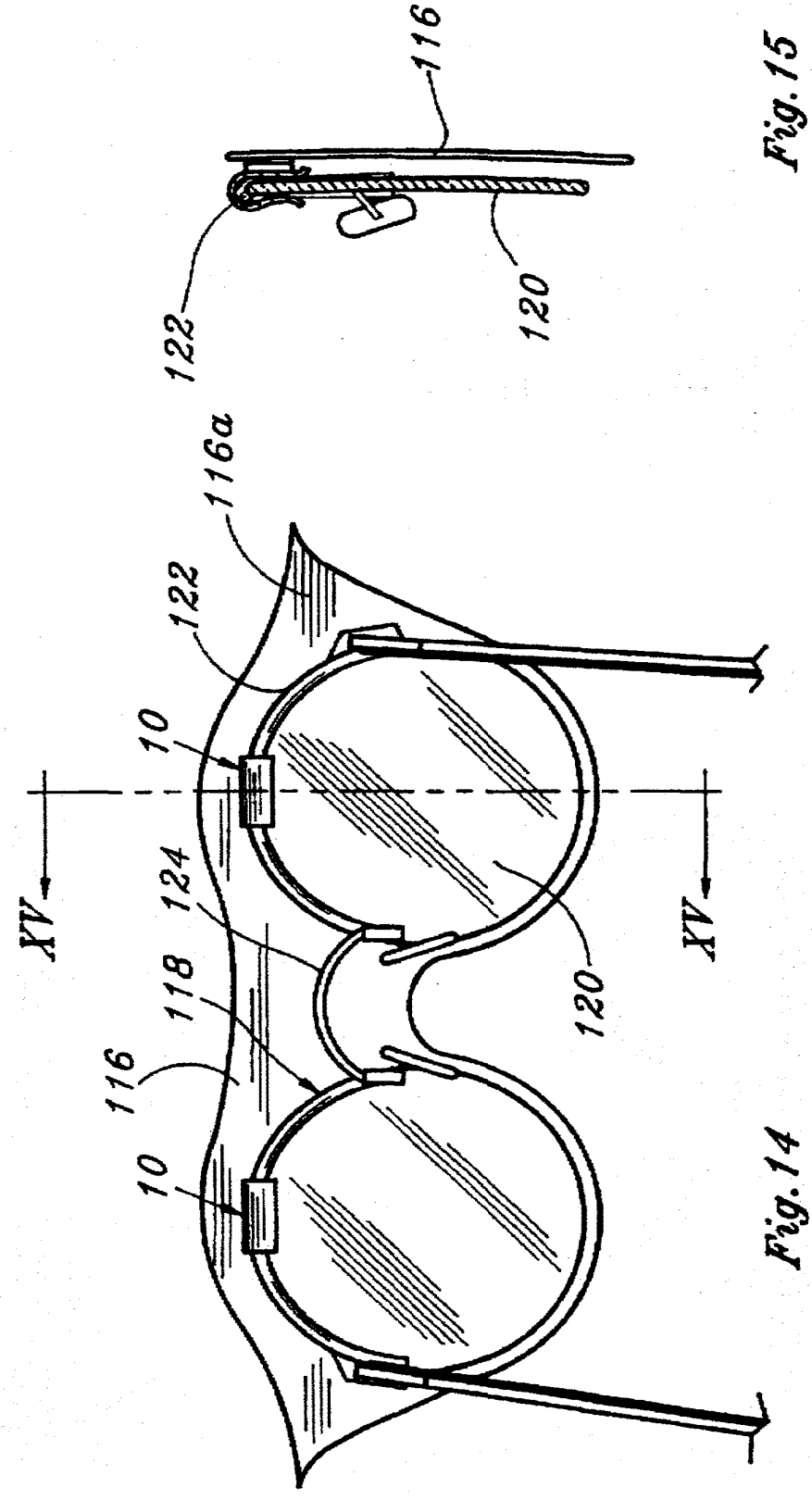


Fig. 14

Fig. 15

HOLDER FOR A MASK OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates generally to devices for holding objects in proximity to the face, such as a mask. More particularly, the invention relates to an accessory for eyeglasses, adapted to hold a variety of objects in proximity to the face, such as a mask, visor, light filter, or display card.

Traditionally, face masks are held in place by elastic cords attached to the sides of the mask and stretched around the head of the wearer. These are cumbersome and uncomfortable when the wearer is also wearing eyeglasses, and sometimes unusable if the wearer wishes also to wear a hat or a cap. If the mask is very large, such as those used in Mardi Gras festivals, it is difficult to locate and hold it properly in relation to the eyes of the wearer, particularly if the wearer also wears eyeglasses. Other types of masks have also utilized elastic cords, such as surgical masks, air filtering masks and eye protecting masks.

Devices have been proposed in the prior art for utilizing spectacles or eyeglass frames as the medium for supporting objects to be held in close proximity with the face of the wearer. For example, in U.S. Pat. No. 3,991,753 issued Nov. 16, 1976 to Viesca, a surgical mask designed to be held over the nose, eyes and mouth of the wearer, is transparent, and is suspended from the frames of eyeglasses by means of wire clips which are permanently attached to the mask by screws. The clips are made of elastic stainless steel wire, which is apt to scratch the lens, and are not provided with any adjustments.

A similar device is shown in U.S. Pat. No. 4,821,340 issued Apr. 18, 1989 to Johnson, in which a dental face shield is adapted to hang from the nosepiece of a pair of eyeglasses without covering the lens, by means of a special plastic clip fitting over the nosepiece. The clip is provided with projections which fit into recessed blisters in the face shield without means for further adjusting or positioning the face shield with respect to the face of the wearer. Eyeglasses have also been utilized to display signs, ornaments, name tags or other items in proximity to the face for attracting attention. Two such attachments are shown in U.S. Pat. No. 5,497,211 issued Mar. 5, 1996 to McNulty in which a small display pennant having indicia thereon is held on the templepiece of a pair of eyeglasses. Also U.S. Pat. No. 4,968,128 issued Nov. 6, 1990 to Mendola describes attachment devices for snapping around the templepiece of eyeglasses to hold ornaments or the like.

There are a number of well-known constructions for providing temporary light filters for eyeglasses by clipping frames with darkened lenses onto eyeglasses, thereby converting them into sunglasses. It is also known that visors for shading the eyes from the sun can be attached to headbands or caps or, in some cases, provided with integral templepieces to hold the visors in place.

Accordingly, one object of the present invention is to provide an improved device for positioning and holding an object in close proximity to the face of a wearer of eyeglasses.

Another object of the invention is to provide an improved device for positioning and holding masks, visors, light filters, display cards and the like.

Another object of the invention is to provide an improved face mask holding and positioning device which eliminates the usual elastic cords passing around the head.

SUMMARY OF THE INVENTION

Briefly stated, the invention comprises an improved device for positioning and holding an object in close proximity to the face of a wearer of eyeglasses, the eyeglasses having a pair of lens and having frame portions encasing the edges of the lens, the device comprising a channel member of flexible plastic material having a base and two spaced sidewalls extending from the base and having terminating edges, the space between the sidewalls proximal to the base having a first dimension sufficient to receive the eyeglass frame portion, the spacing between the sidewalls distal to the base being of a second dimension lesser than the thickness of the eyeglass frame portion for retaining the channel member on the eyeglass frame portion, and attachment means provided on a first one of the sidewalls and adapted for selective engagement with the object for selectively positioning and holding the object with respect to the face of the wearer. In its preferred form, the channel member is longer in the direction along the base than its height in the direction perpendicular to the base. In its preferred form, the attachment means comprises a double sided adhesive pad having one side thereof attached to the device sidewall and the other side thereof adapted for selective adhesive attachment to the object.

The device may be used singly to hold a display card or the like, but in its preferred embodiment, two devices are used in combination with an object to be held, such as a face mask with eye openings, whereby the mask may be selectively positioned so that the adhesive will hold the mask with the eye openings aligned with the eyes of the wearer.

DRAWING

Other objects and advantages of the invention will be better understood by reference to the following description, taken in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view of the improved holding device in a preferred embodiment of the invention,

FIG. **2** is a top plan view thereof,

FIG. **3** is an end elevation view thereof,

FIG. **4** is a perspective view of a modified form of the invention,

FIG. **5** is a perspective view of a further modified form of the invention,

FIG. **6** is a perspective view of a further modified form of the invention,

FIG. **7** is a perspective view of the improved holding device of FIGS. **1**, **2** and **3** in combination with a name tag and used singly,

FIG. **8** is a cross sectional side elevation view through the frame and one lens of an eyeglass utilizing the modification of FIG. **5** to hold a name tag,

FIG. **9** is a view similar to FIG. **8**, utilizing the modification of FIG. **6** to hold a name tag,

FIG. **8A** is an elevational view looking from the face of a wearer toward the back of a face mask utilizing a pair of improved holding devices,

FIG. **9A** is a top plan view of the face mask of FIG. **8A** and portions of a pair of eyeglasses,

FIG. **10** is a side elevational view in cross section of the mask and eyeglasses of FIGS. **8A** and **9A** taken along section X—X,

FIG. **11** is an elevational view looking from the face of the wearer toward a sun visor utilizing a pair of the improved holding devices,

FIG. **12** is a top plan view thereof,

FIG. **13** is a side elevational view in cross section taken along lines XIII—XIII of FIG. **11**,

FIG. **14** is an elevational view looking from the face of a wearer toward a sun screen held by a pair of eyeglasses, and

FIG. **15** is a side elevational view in cross section taken along lines XV—XV of FIG. **14**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1**, **2** and **3** of the drawing, the improved holding device **10**, comprises a channel member shown generally at **12**, together with attachment means shown generally at **14**. Channel member **12** is preferably of a flexible plastic material such as vinyl, a widely commercially available selection of extrudable thermoplastics being suitable for the channel member **12**. The main requisite is that the material be capable of holding its shape and yet being flexible and relatively soft so that it will conform to the shape of the lens and not scratch the lens of eyeglasses. In its preferred form, the channel member **12** is an extrusion, so that devices may be produced in quantity by severing or sawing a long extrusion to proper length. Channel member **12** is best seen in FIG. **3** to comprise a base **16** and two spaced sidewalls **18**, **20**. The length of the extrusion along base **16** in a longitudinal direction is greater than the height in a direction perpendicular to the base, a suitable ration of length to height being 3:2. The spacing between the sidewalls proximal to the base has a first dimension which is sufficient to receive the eyeglass frame portion as will be described, as indicated at reference dimension **22**. The spacing between the sidewalls at a location distal to the base is of a second lesser dimension, which is less than the thickness of the eyeglass frame portion, this dimension being indicated by reference number **24**. Additional holding power will be had by making the second dimension less than the lens thickness so that the channel sidewalls will grip the lens itself. As noted in FIG. **1**, the spaced sidewalls **18**, **20** are flared out from one another before terminating at edges **18***a*, **20***a*, in order to facilitate clipping the channel member over the frame portion.

I have found that a suitable first dimension is about ⅜" (9.6 mm) and a suitable second dimension is about 1/16" (1.6 mm), although variations are possible depending on the flexibility and strength of the plastic material. The length of channel member **12** is preferably between ½" (12.7 mm) and ¾" (19 mm) long. The preferable height is also between ⅜" and ½". A suitable ratio of length to height is 3:2.

Attachment means **14** in its preferred form comprises a double sided adhesive pad, best seen in FIG. **2** to comprise a foam substrate **26** with layers of adhesive **28**, **30** on either side thereof. Such double sided adhesive pads are commercially available, one being available from 3M Company as Scotch™—Foam Tape, catalog number 114 in strips or catalog number 108 in squares. Another commercially available product is available from Parker Metal Corporation as double-faced adhesive mounting strips, catalog number 5818.

One of the adhesive layers **28** is adhered to the exterior of the side wall **20**. The other adhesive layer **30** may be covered with a layer of protective film which is non-adhesive, indicated by reference numeral **32**. Optional tabs **32***a* may be provided to assist in removing the protective layer **32** when it is time for application to an object. Alternatively the strip form of double adhesive tape may be applied to a length of channel extrusion and severed at the same time as the channel carrier is severed.

MODIFIED DEVICES

FIG. **4** illustrates a modification of the holding device shown in FIGS. **1–3**. The device shown generally at **34** includes a channel member **36**, and attachment means **38**. Attachment means **38** consists of a layer of adhesive material **40** adhered to the sidewall with a tacky globule of adhesive putty **42** adhered to it. Two spaced side walls **44**, **46** extend from a base **48**. Sidewall **44** is flared out at the bottom to terminate at an edge **44***a*.

Reference to FIG. **5** illustrates a further modification shown generally as device **50**. A channel member **52** includes a base **54** and two spaced sidewalls **56**, **58** extending from the base **54**. Sidewall **58** is curved around to provide a short flange **60**, which lies in close proximity to the exterior of sidewall **58**, defining a channel **62** serving as part of an attachment means. The remainder of the attachment means comprises a tacky globule of adhesive putty **64** adhered to the sidewall **58**.

The tacky globule of adhesive putty shown in FIGS. **4** and **5** is commercially available from several sources. One such material is available from Paper Art Company known as Partytack™. Another suitable material is available from ITW Brands as Duco® Stick-Tak™.

Lastly, FIG. **6** illustrates a modified holding device **64**, comprising a channel member having a base **66**, spaced sidewalls **68**, **70**, and an extension **72** of sidewall **70** which is curved around to lie in close proximity to the exterior of sidewall **70**, so as to define a holding channel **74** serving as an attachment means without an adhesive.

DESCRIPTION OF PREFERRED EMBODIMENTS

Reference to FIG. **7** illustrates a single holding device as described previously together with the held object, in this case a display card. A pair of eyeglasses is shown comprising a pair of lens **76**, **78** each surrounded by respective frame portions **80**, **82**, joined by a central nosepiece **84** and held in place on the head of a wearer by templepieces **86**, **88**. The type of eyeglasses is immaterial to the present invention, it being well known that there are a variety of forms and styles of eyeglasses with different type frames and lens. The only common element that almost all styles of eyeglasses have, which is material to the present invention, is that there are a pair of lens and that there are frame portions at least passing over the top part of each of the lens and encasing at least the top part of the lens.

In FIG. **7**, a preferred holding device **10** as described in FIGS. **1–3** is clipped over the frame portion **80**. As described previously, the dimension **22** of channel member **16** is sufficiently large to accommodate frame portion **80**, and the dimension **24** of the channel member is less than the thickness of frame portion member **80** so as to retain the holding device **10** in place. An object to be held, in this case a name tag **90** includes a surface **90***a* suitable for carrying indicia such as a name or a message, and having a support leg **90***b*. The protective film **32** has been removed, the name tag **90** positioned with respect to the wearer's face to achieve the proper effect, and the rear surface of the leg **90***b* is shown adhered to the adhesive film **30**. In this manner, object **90** is selectively positioned and held with respect to the face of the wearer.

Reference to FIGS. **8** and **9** illustrate cross sections through eyeglasses such as those shown in FIG. **7**, in which the lens **76** and the frame portion **80** is illustrated in cross section in both figures.

Referring first to FIG. **8**, the modified holding device **50** is illustrated in cross section. The name tag **90** is engaged and held in place in the proper position by inserting the leg **90***b* in the holding groove **62** and then pressing it against the tacky globule of adhesive material **64**.

Referring to FIG. 9, the modified holding device of 64 previously described in FIG. 6, is shown in cross section. In this case, the leg 90*b* is inserted in the holding channel 74 and held by the pressure of extension 72 against the sidewall.

Reference to FIGS. 8, 9 and 10 of the drawings illustrate a pair of holding devices 10 in combination with a mask 92. A pair of eyeglasses 94 include frame portions such as 96 and lens such as 98. Mask 92 includes eye openings 100, which particularly require positioning with respect to the face of the wearer of the mask 92.

FIG. 10 of the drawing illustrates a cross section through lens 98, frame portion 96 and the holding device 10 on one side of the eyeglasses, the other side being identical. Mask 92 has a rear surface 92*a* which is adhered to the adhesive layer 30. The mask 92 has first been carefully positioned so that the eye openings 100 are in line with the eyes of the wearer (indicated in dotted lines) and then adhered to the two holding devices 10 which have previously been placed over the frame portions 96 of the eyeglasses. While the mask is shown with the preferred holders 10, any of the modified forms shown in FIGS. 4 or 5 using an adhesive may be substituted.

Reference to FIGS. 11, 12 and 13 illustrates a pair of holders 10 in combination with a sun visor 102. Sun visor 102 is held on a pair of eyeglasses 104 having frame portions 106 encasing a pair of lens such as 108. The visor is shown in plan view in FIG. 12 to comprise an extended visor 110 and a flange 112 facing the wearer. Flange 112 has a back surface 112*a* facing the wearer. The cross section view of FIG. 13 illustrates the lens 108 and frame portion 106 together with the holding device 10 in cross section. The adhesive layer of holding device 10 is attached to the back surface 112*a* of visor 102 after it is carefully positioned with respect to the eyes of the wearer to achieve the proper effect. The flange 112 may be constructed also as two separate tabs.

The sun visor may be made of inexpensive material such as cardboard or plastic, and may contain an advertising indicia as indicated at 114.

FIGS. 14 and 15 of the drawings illustrate the holding devices 10 in combination with a light filter 116 so as to provide a pair of sunglasses. The eyeglasses, shown at 118 are of a design having a pair of lens such as 120, each with its own frame portion 122 connected by a metal nosepiece 124 in a well-known design. The eyeglasses 118 could be used in connection with the previously described structures, as well, and vice versa. The lens 120 and frame portion 122 is indicated in cross section in FIG. 15. The light filter 116 is a piece of curved plastic treated to reduce the sun's effect on the eyes. It may be shaped in a stylistic manner as indicated by the cusps 116*a*. The sunscreen plastic piece 116 is positioned at the proper location in front of the eyes and then adhered to the two holding devices 10 which position it with respect to the wearer's face. Because there are no other attachments to the sheet of plastic sunscreen 116, it can be inexpensively produced and in a variety of shapes and styles. Alternatively, it can be cut from a sheet of darkened or colored plastic to suit the wearer's own taste in eyewear, and to fit the wearer's own glasses.

OPERATION

The operation of the foregoing devices has been explained in connection with an explanation of the structure. Summarizing the operation, the object to be held is placed in proximity to the face of the wearer of eyeglasses, after one or more of the holding devices have been placed over the frame portion of the eyeglasses and the adhesive is prepared for reception. The object is positioned and then pressed against the adhesive. If there are two or more holding devices used, greater stability results. However one holding device will suffice in some cases, depending upon the object to be held. For the purpose of the present invention, the objects fall into a group consisting of display cards, masks, visors and light filters. The word masks is not intended to be limiting, but includes masks of all types, including Halloween masks, decorative Mardi Gras masks, surgical masks, air filtering masks, and protective masks. The word display cards is not meant to be limiting, but includes name tags, business cards, novelty or comic slogan cards and small signs of all types and shapes adapted to receive messages, advertising names or other indicia thereon. Light filters includes darkened, colored or polarizing plastic sheets. Visors includes sun visors and novelty advertising visors or plastic, cardboard, cloth or heavy paper.

While there has been described preferred embodiments and several modifications, it is desired to secure in the appended claims all modifications which fall within the true spirit and scope of the invention.

I claim:

1. Device for positioning and holding an object in close proximity to the face of a wearer of eyeglasses, the eyeglasses having a pair of lens and having frame portions encasing the edges of said lens, said device comprising:

a channel member of flexible plastic material having a base and two spaced sidewalls extending from the base and having terminating edges, the spacing between said sidewalls proximal to the base having a first dimension sufficient to receive said eyeglass frame portion, the spacing between the sidewalls distal to the base being of a second dimension lesser than the thickness of the eyeglass frame portion for retaining the channel member on the eyeglass frame portion, and

attachment means provided on a first one of said sidewalls and adapted for selective engagement with said object for selectively positioning and holding said object with respect to said face of the wearer.

2. Device according to claim 1, where said attachment means comprises adhesive means attached to the exterior of said first sidewall, and adapted for selective attachment to said object.

3. Device according to claim 2, where the adhesive means comprises a double sided adhesive pad having one side thereof attached to the device sidewall and the other side thereof adapted for selective adhesive attachment to the object.

4. Device according to claim 2, where the adhesive means is a tacky globule of adhesive putty.

5. Device according to claim 1, where the terminating edge of at least one of the sidewalls is flared out from the spaced sidewall so as to facilitate placing the device over the frame portion of the eyeglasses.

6. Device according to claim 1, wherein said attachment means comprises an extension of one of said side walls curled around to define a holding channel with the exterior of said sidewall.

7. Device according to claim 1, wherein the second dimension is less than the lens thickness, whereby the sidewalls will flex to grasp the lens.

8. Device according to claim 1, wherein the length of said channel member along its base is greater than its height in a direction perpendicular to the base.

9. Device according to claim 2, wherein the ratio of length to height is approximately 3:2.

10. Combination of an object to be held in close proximity to the face of a wearer of eyeglasses, the eyeglasses having a pair of lens and having frame portions encasing the edges of said lens, and a device for holding the object, the combination comprising:

an object selected from a group consisting of masks, visors, light filters and display cards, said object having a surface facing the wearer, and

at least one device adapted to hold the object, the device comprising a channel member of flexible plastic material having a base and two spaced sidewalls extending from the base and having terminating edges, the spacing between said legs proximal to the base having a first dimension sufficient to receive said eyeglass frame portion, the spacing between the sidewalls distal to the base being of a second dimension lesser than the thickness of the eyeglasses frame portion for retaining the channel member on the eyeglasses frame portion, and

adhesive means disposed on the exterior of one of said sidewalls and adapted for selective attachment to said surface of said object for selectively positioning and holding said object with respect to said face of the wearer.

11. The combination according to claim 10, wherein there are a pair of said devices, each arranged to fit over the frame portion of one of said lens.

12. The combination according to claim 10, wherein the object comprises a display card adapted for placement of indicia thereon and having a support leg adapted to be attached to the adhesive means.

13. The combination according to claim 10, wherein the object is a mask having portions covering the lens of the eyeglasses.

14. The combination according to claim 13, wherein the mask portions covering the lens have eye openings whereby the adhesive means may hold the mask so that the eye openings are aligned with the eyes of the wearer.

15. The combination according to claim 10, wherein the object is a visor and wherein the visor has an extending front portion, whereby the adhesive means may hold the visor for shading the eyes of the wearer.

16. The combination according to claim 10, wherein the object is a light filter comprising a transparent sheet shaped to cover the pair of lens to modify the light passing therethrough and whereby the adhesive means holds the transparent sheet positioned with respect to the lens.

17. Device according to claim 10, where the adhesive means comprises a double sided adhesive pad having one side thereof attached to the device sidewall and the other side thereof adapted for selective attachment to the object.

18. Device according to claim 10, where the adhesive means is a tacky globule of adhesive putty.

19. Device according to claim 10, where at least one of the terminating edges of the sidewalls is flared out from the spaced sidewall so as to facilitate placing the device over the frame portion of the eyeglasses.

20. Device according to claim 10, wherein the second dimension is less than the lens thickness, whereby the sidewalls will flex to grasp the lens.

* * * * *

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

To:
Lafferty, Patrick M.
Kilpatrick Townsend & Stockton LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)*	3 February 2012 (03-02-2012)
Applicant's or agent's file reference 91904-814220	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US2011/043591	International filing date *(day/month/year)* 11 July 2011 (11-07-2011)
Applicant PIXELOPTICS, INC.	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	LUUKKONEN, Kirsi Tel: +49 (0)89 2399-7957

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
91904-814220		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2011/043591	11/07/2011	09/07/2010
Applicant		
PIXELOPTICS, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☒ **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 14
      ☒ as suggested by the applicant
      ☐ as selected by this Authority, because the applicant failed to suggest a figure
      ☐ as selected by this Authority, because this figure better characterizes the invention
   b. ☐ none of the figures is to be published with the abstract

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/043591

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-7, 13-17, 19-29

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/043591

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02C11/06 G02C7/10 G02C1/06
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)
G02C

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/081542 A1 (PANASONIC CORP [JP]; MATSUI MASATOMO) 2 July 2009 (2009-07-02)	1-7, 13-17, 19-27,29
Y	figures 2-4,18,19 & EP 2 233 964 A1 (PANASONIC CORP [JP]) 29 September 2010 (2010-09-29) figures 2-4,18,19 paragraphs [0035], [0045], [0046], [0048], [0070]	28
X	WO 2009/126946 A1 (PIXELOPTICS INC [US]; HADDOCK JOSHUA N [US]; KOKONASKI WILLIAM [GB]; C) 15 October 2009 (2009-10-15) figures 20B,26A, 26B, 28 page 31, lines 3-4,23-28	1-7, 13-17, 19-27,29

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 2011	03/02/2012

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	de Lajarte, Gilles

4

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 061 002 A1 (DESIL S P A OCCHIALERIA [IT]) 29 September 1982 (1982-09-29)	28
A	figures 1,2	1-7, 13-17, 19,20, 25-27,29

A	JP 2008 083299 A (BIITO KK) 10 April 2008 (2008-04-10)	5,7,14, 15,19, 20, 22-26, 28,29
	figures 1,2	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/043591

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009081542 A1	02-07-2009	EP 2233964 A1	29-09-2010
		US 2010265456 A1	21-10-2010
		WO 2009081542 A1	02-07-2009
WO 2009126946 A1	15-10-2009	EP 2269113 A1	05-01-2011
		JP 2011516927 A	26-05-2011
		KR 20100124841 A	29-11-2010
		US 2009256977 A1	15-10-2009
		WO 2009126946 A1	15-10-2009
EP 0061002 A1	29-09-1982	AU 8057882 A	09-09-1982
		EP 0061002 A1	29-09-1982
		JP 57158613 A	30-09-1982
JP 2008083299 A	10-04-2008	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7, 13-17, 19-29

   Shape of the connection element

   ---

2. claims: 8-12, 18

   Interaction between the conductor and the frame

   ---

3. claims: 30-36

   Hardness of the connection element and its conductivity

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2011/043591	11.07.2011	09.07.2010

International Patent Classification (IPC) or both national classification and IPC
INV. G02C11/06 G02C7/10 G02C1/06

Applicant
PIXELOPTICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	de Lajarte, Gilles Telephone No. +49 89 2399-2697

Form PCT/ISA/237 (Cover Sheet) (July 2009)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

      ☐ on paper

      ☐ in electronic form

   b. (time)

      ☐ in the international application as filed

      ☐ together with the international application in electronic form

      ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of

☐ the entire international application

☒ claims Nos. 8-12, 18, 30-36

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international search *(specify)*:

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no international search report has been established for the whole application or for said claims Nos. 8-12, 18, 30-36

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
- ☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rules 13*ter*.1(a) or (b).

☐ See Supplemental Box for further details

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has, within the applicable time limit:

   ☐ paid additional fees

   ☐ paid additional fees under protest and, where applicable, the protest fee

   ☐ paid additional fees under protest but the applicable protest fee was not paid

   ☒ not paid additional fees

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with

   ☒ not complied with for the following reasons:

   see separate sheet

4. Consequently, this report has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-7, 13-17, 19-29

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	5, 13, 28
	No:	Claims	1-4, 6, 7, 14-17, 19-27, 29
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-7, 13-17, 19-29
Industrial applicability (IA)	Yes:	Claims	1-7, 13-17, 19-29
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item IV

Lack of unity of invention

1 Non unity

It is considered that there are 3 inventions covered by the claims indicated as follows:

- Group 1 (claims 1-7, 13-17, 19-20-29): shape of the connection element.

- Group 2 (claims 8-12, 18): interaction between the conductor and the frame.

- Group 3 (claims 30-36): hardness of the connection element and its conductivity.

The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:

- The subject-matter of independent claim 1 is already known from D1:

D1 discloses a first device (Fig 18, 19), comprising:

a lens comprising at least a first electrical contact (Fig 4, 5; [0045, 0046] or Fig 19, (1); [0070]);

a lens housing holding the lens, wherein the lens housing comprises at least a second electrical contact (Fig 4, (8b); Fig 18, 19, (306a, 306b)); and

a compliant conductive element (Fig 4, (7); [0045] or Fig 18, 19, (308); [0070]) disposed between the first and the second electrical contact, wherein the compliant conductive element electrically connects the first and second electrical contacts.

- The special technical features of each group are:

- Group 1 : specific shapes & dimensions of the conductive element and / or of the groove into which it is located.

- Group 2 : location of the conductor within the frame and material of the frame.

- Group 3: hardness and conductivity values of the conductive element

- The problem solved by these special technical features can therefore be construed as:

  - Group 1: how to achieve a mecanical connection which is stable, small and provides enough contact surface between the conductive element and its corresponding groove

  - Group 2: how to achieve a good connection between the electronic module and the part recieving the conductive element

  - Group 3: how to choose the material properties of the elastomer to obtain the desired properties of deformation, holding strength and conductivity

The requisite unity of invention no longer exists inasmuch as a technical relationship involving one or more of the same or corresponding special technical features does not exist between the subject-matter of the 3 groups of claims.

In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

Since the applicant chosen not to pay for the additional search fees, the following written opinion is given on group 1.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

2 Independent claim 1

The present application does not meet the criteria of Article 33(2) PCT, because the subject-matter of independent claim 1 is not novel.

D1 discloses a first device (Fig 18, 19), comprising:

a lens comprising at least a first electrical contact (Fig 4, 5; [0045, 0046] or Fig 19, (1); [0070]);

a lens housing holding the lens, wherein the lens housing comprises at least a second electrical contact (Fig 4, (8b); Fig 18, 19, (306a, 306b)); and

a compliant conductive element (Fig 4, (7); [0045] or Fig 18, 19, (308); [0070]) disposed between the first and the second electrical contact, wherein the compliant conductive element electrically connects the first and second electrical contacts.

Thus, the electro-active spectacles of D1 discloses the subject matter of claim 1, which is therefore not novel.

Furthermore, D2 (Fig 26A, 26B, 28, (106); P 31, L 23-28) also anticipates the subject matter of claim 1.

2.1 Dependent claims 2-36

Dependent claims 2-36 do not appear to contain any additional features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2, 3) PCT), the reasons being as follows:

- claim 2: conductive rubber (D1, [0045] or [0070]; D2, P 31, L 27),

- claim 3: conductive element between lens housing and lens (D1, Fig 4, (7) or Fig 18, 19, (308); D2, P 31, L 23-28),

- claim 4: conductive element with some undefined shape (any shape can be made with a combination of rectangles and ovals), e.g. rectangle (D1, Fig 4, (7) or Fig 18, 19, (308); D2, P 31, L 23-28),

- claim 5: conductive element **thinner** in the center (not inventive when starting from D1 or D2, as this described one of the standard shape for rubber used to hold eyeglasses in the frame, see for example D3, Fig 1,2 or D4, Fig 1, 2),

- claim 6: conductive element extruded (see clarity objection in paragraph 1 above; implicit or well-known production method for the rubber of D1 (Fig 4, (7) or Fig 18, 19, (308) or D2, P 31, L 27),

- claim 7: conductive element surfaces conform to a surface from lens and from a surface from housing (D1, Fig 4, (7) or Fig 18, 19, (308); implicit from D2, P 31, L 23-28),

- claim 13: semi-rimless (not inventive from D1 combined with D4 (Fig 1) or with general knowledge),

- claims 14, 26: conductive element within lens **groove**, and lens housing **cavity** (D1, Fig 4, (1b)),

- claim 15: conductive element with a bridge connecting two portions (a rectangle could be arbitrarily divided in three, the part in the middle called "bridge"),

- claim 16: shapes of ends of conductive element are either square (D1) or a circle (D4) or circle and rectangle (D3) (the term "comprises" also leaves the possible interpretation open that the shape is a combination with a rectangle and another shape),

- claim 17: conductive element in contact with lens groove (D1, Fig 4, (7) or Fig 18, 19, (308)),

- claim 19: width / depth of first groove between 0.4 and 1 mm (implicit from D1, Fig 4 and D2, or at least within the scope of routine implementation of the person skilled in the art, depending for example on the width of the spectacle lens for a particular user),

- claim 20: width 0.7 mm, depth 0.6 mm (see argumentation for claim 19),

- claim 21: conductive element in contact with lens housing cavity (D1, Fig 4, (7) or Fig 18, 19, (308)),

- claims 22, 24: conductive element compressed between lens groove and housing cavity (D1, Fig 3, [0038, 0040]),

- claim 23: height of conductive element at least 0.75 mm (implicit from D1 or D2 or at least within the scope of routine choices of the person skilled in the art),

- claim 25: full rim (D1, Fig 5, (b); implicit from D2, Fig 20B),

- claim 27: lens with beveled edge (D1, Fig 2-4),

- claim 28: uncompressed width of conductive element smaller than width of cavity (not inventive from D1 in the light of D3 (Fig 2), as to solve the problem of better holding the rubber within the cavity, the person skilled in the art would think about making it thicker and that the rubber would remain in place due to friction,

- claim 29: a portion of the lens extends into the cavity of the rim (D1, Fig 4).

Electronic Acknowledgement Receipt

EFS ID:	12379063
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	20350
Filer:	John P. McGroarty/Aneta Xhiku
Filer Authorized By:	John P. McGroarty
Attorney Docket Number:	91904-817521
Receipt Date:	23-MAR-2012
Filing Date:	17-NOV-2011
Time Stamp:	13:41:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2012_03_23_SIDS_91904-817521.pdf	173956 592130be3d56420285af40c6e0821a6c1a6c6eef	yes	6

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	6	
Warnings:					
Information:					
2	Foreign Reference	WO10080999.pdf	2653291 47ea51b5e572f6a93358f67c79b524b508d8b633	no	62
Warnings:					
Information:					
3	Foreign Reference	EP1647854.pdf	494291 21e114664282b874c68ac68299351fdc75a89ebd	no	14
Warnings:					
Information:					
4	Foreign Reference	WO09098719.pdf	1085712 55e805f44f9dc494574508a4a6387a260a9832b7	no	22
Warnings:					
Information:					
5	Foreign Reference	WO08002388.pdf	601551 a2f75118a95a4bdd1d7a2953289ea5b32f3bb527	no	17
Warnings:					
Information:					
6	Foreign Reference	wo2009081542.pdf	3389446 f58226e4cd2eb4ed8c6f2efd0ede02a4ad5348ab	no	73
Warnings:					
Information:					
7	Foreign Reference	wo2010062504.pdf	803225 403b2ff8727d30ac26e30b4d65dc137da2f083be	no	22
Warnings:					
Information:					
8	Foreign Reference	de2304134.pdf	396244 aa6bfee912bbc7da4fcefc2d62ccefc885751834	no	9
Warnings:					
Information:					

9	Foreign Reference	gb2170613.pdf	390249 14f87ec232f421e4dd8f66a7a3ab29fe80a3f816	no	7
Warnings:					
Information:					
10	Foreign Reference	wo2007142520.pdf	557267 e1ea316dca509535d57e884da50a7f10df948a06	no	14
Warnings:					
Information:					
11	Foreign Reference	ep1916561.pdf	1694506 5c1a97f30bcfcc53bfb66504c0a5fa1a3d514a59	no	33
Warnings:					
Information:					
12	Foreign Reference	ep1727393.pdf	1423506 d030e527dff2f688d810769770396666b018e93b6	no	29
Warnings:					
Information:					
13	Foreign Reference	wo9921400.pdf	677859 265000353a4339ee3499522d351a7cb395fb9cba	no	18
Warnings:					
Information:					
14	Foreign Reference	wo2004028203.pdf	2678013 5b687203e0c09d9fad35b78c3702ebbe1aa697f0	no	52
Warnings:					
Information:					
15	Foreign Reference	wo2008046858.pdf	1884763 e9c18a3fefddb2379c7f55d4c4fce894962caf06	no	29
Warnings:					
Information:					
16	Foreign Reference	jp09294654.pdf	410211 df3a12008f75cf44b17ff7d2c45432faa203c33b	no	17
Warnings:					
Information:					
17	Foreign Reference	wo2009136667.pdf	1793793 7a9d2b04f7594ad597084b92afdcc8b388751685	no	35
Warnings:					
Information:					

18	Foreign Reference	EP2233964.pdf	2659831 32b622c351a6e7d2c6aab6e59f85c7923860c332	no	53
Warnings:					
Information:					
19	Foreign Reference	WO09126946.pdf	3028023 8649634a56c593cae53c2887fb1c9175f60d0562	no	77
Warnings:					
Information:					
20	Foreign Reference	EP61002.pdf	262813 fb64b04f31913ab2d3dd5eb3da198a17a115fdb5	no	7
Warnings:					
Information:					
21	Foreign Reference	JP2008083299.pdf	339131 230d3a79272712e631cc8c5bface40f88967046c	no	9
Warnings:					
Information:					
22	Non Patent Literature	isr1.pdf	94955 9fbdddb792173c37729430404e3f066e4b4f9042	no	2
Warnings:					
Information:					
23	Non Patent Literature	isr2.pdf	205050 aa19d4e53d1f41e9ccd5564ca643308e07e60c41	no	4
Warnings:					
Information:					
24	Non Patent Literature	isr3.pdf	470839 71e855ee1b66b72eb8446505e78eb4126e6a49f2	no	7
Warnings:					
Information:					
25	Non Patent Literature	isr4.pdf	215141 8c34333ac754416b7f7e60c8edd2b0f6b9263376	no	3
Warnings:					
Information:					
26	Non Patent Literature	isr5.pdf	6127312 6de9f15249de153a8754e462d4fce95eef5fdced	no	138
Warnings:					
Information:					

27	Non Patent Literature	isr6.pdf	7686072 e9ee5e15267765e23335172fc0d84454faac9bba	no	148
Warnings:					
Information:					
28	Non Patent Literature	isr7.pdf	666897 d4aea75b684cd6be727c19d06e345fae2b671d0a	no	16
Warnings:					
Information:					
29	Non Patent Literature	EPisr.pdf	224485 9578a40b9bbd6e7d8478933a1e636cb33a2dad64	no	7
Warnings:					
Information:					
30	Non Patent Literature	mojo.pdf	345477 f8d04ba84fda5e3af719945370cb57e5f27bd076	no	5
Warnings:					
Information:					
			Total Files Size (in bytes):	43433909	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on 3/23/12.

KILPATRICK TOWNSEND & STOCKTON LLP

By: Aneta Mihali Xhiku

PATENT
Attorney Docket No.: 91904-817521(008512US)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Ronald D. Blum

Application No.: 13/298,992

Filed: November 17, 2011

For: ELECTRONIC SPECTACLE FRAMES

Customer No.: 20350

Confirmation No.: 1095

Examiner: TBA

Art Unit: 2835

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.97 and §1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

The references cited on attached form PTO/SB/08A and PTO/SB/08B are being called to the attention of the Examiner. Copies of the references [in compliance with the requirements of 37 CFR §1.98(a)(2)] are enclosed. It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

Also enclosed are copies of the International Search Reports corresponding to the related applications.

Copy of the U.S. provisional patent application no. 61/441,817 filed on February 11, 2011 is available on PAIR and is believed to be readily accessible to the Examiner.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement. However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 20-1430. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/John P. McGroarty/

John P. McGroarty
Reg. No. 41,186

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64056449 v1

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	13/298,992
				Filing Date	November 17, 2011
				First Named Inventor	Blum, Ronald D.
				Art Unit	2835
(Use as many sheets as necessary)				Examiner Name	TBA
Sheet	1	of	1	Attorney Docket Number	91904-817521(008512US)

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA	US-4,991,951	2/12/91	Mizuno Mitsuyoshi	

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (*if known*)			Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	AB	GB	1563929		4/2/80	American Cyanamid Co		☐

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	AC	Copy of the International Search Report corresponding to the PCT/US2011/042882 application.	☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kind Codes of U.S. Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

63992792 v1

PATENT SPECIFICATION (11) 1 563 929

1 563 929

(21) Application No. 39174/76 (22) Filed 21 Sept. 1976 (19)
(31) Convention Application No. 625 337 (32) Filed 23 Oct. 1975 in
(33) United States of America (US)
(44) Complete Specification published 2 April 1980
(51) INT. CL.³ G02C 7/10
(52) Index at acceptance
G2F 21C 23E 25A 25C 28M AA
G2J S3A S3X

(72) Inventors DONALD JOSEPH BERETS
and ROBERT HARRISON POSTAL

(54) OPHTHALMIC GLASSES WITH VARIABLE LIGHT TRANSMISSIVE LENSES

(71) We, AMERICAN CYANAMID COMPANY, a corporation organised and existing under the laws of the State of Maine, United States of America, of Berdan Avenue, Township of Wayne, State of New Jersey, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to ophthalmic glasses which contain ophthalmic lenses whose light transmissive properties can be selectively varied by application of electricity.

The prior art, e.g. United States Patents 3,521,941, 3,578,843, 3,704,057, 3,708,220 and 3,829,196, discloses electro-optical devices which exhibit a phenomenon termed in the art as persistent electrochromism. This phenomenon is characterized by the alteration of the electro-magnetic radiation absorption characteristics of the persistent electrochromic material by the influence of an electric field. Such devices commonly are employed in sandwich arrangement, with a persistent electrochromic material layer and an ion-conducting layer sandwiched between two electrodes. Coloration is induced by charging the electrochromic layer negative with respect to the counter-electrode, employing an external potential. The counter-electrode can comprise the same material as the persistent electrochromic material or be different. By reversing the original polarity of the field or by applying a new field, the visible coloration can be erased. This procedure of color induction and erasure is defined as cycling.

Prior methods for reducing light transmission through optical lenses employed as eyeglasses are capable of achieving desirable degrees of light reduction. However, these sunglass lenses generally are not adjustable or variable with regard to their light transmissive properties. Recent developments have produced what is known as a photochromic lens which is self-adjustable. A layer within the lens structure is induced by electromagnetic radiation to alter its light absorption properties. An increasing degree of ambient brightness results in darker coloration of the lens, thereby reducing light transmission through the lens. However, such a system suffers from several inherent disadvantages. Photochromic systems with fast switching speeds tend to be unstable, whereas the most stable systems tend to have slow switching speeds. In particular, erasure upon removing a photochromic ophthalmic lens from bright light to relative darkness is quite slow. Accordingly, the use of photochromic lenses in eyewear may on occasion prove hazardous if the wearer suddenly passes from bright to dim light, for example a person stepping from bright sunlight into a building or a driver passing into a tunnel while wearing photochromic glasses would remain "in the dark" for many critical seconds. Also, since colorless photochromic systems can be activated only by a change in electromagnetic radiation in the UV portion of the spectrum, the system is largely inoperative when the wearer is screened by a UV filter such as a glass window. The light-induced coloration of the lenses is entirely outside the control of the wearer. The degree of light transmission cannot be adjusted and depends solely on the degree of ambient electromagnetic radiation.

Hence, for safety, convenience and efficiency, it would be desirable to provide ophthalmic glasses containing optical lenses whose light transmissive properties can be controlled either automatically or independently, with quick cycling speed, and with selective adjustment of the degree of light transmission.

The present invention provides a pair of ophthalmic glasses comprising first and second lens mounted in a frame, each said lens comprising an optical lens (as herein defined)

BNSDOCID: <GB_____1563929A__I_>

carrying successively, a first transparent electrode layer, a solid persistent electrochromic film of WO_3 or MoO_3, an ion-conducting layer and a second transparent electrode layer, and the glasses further comprising means at least partially disposed within said frame for allowing application of direct current voltage to each pair of electrodes carried by each said lens to create an electric potential across the electrochromic film sandwiched therebetween and a potential of opposite polarity, whereby said electrochromic film can be varied in coloration so as to vary the amount of light transmitted through each said lens.

The term "optical lens" is used herein to refer to any optically transparent substrate whether or not it diffracts the light passing therethrough. It is, of course, quite common for protective glasses such as sunglasses to have lenses which do not alter the convergence of divergence of an incident light beam.

The invention will be further described in conjunction with the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed on illustrating principles of construction:

In the drawings, Figure 1 is a pictorial view of a pair of ophthalmic glasses according to the invention; and

Figure 2 illustrates, in partial cross section, the structure of the lenses employed in the glasses of Fig. 1.

Referring to the drawings, numeral 36 in Figure 1 generally represents a pair of electrochromic eyeglasses which comprises a standard assembly with temple support arms 48 hingedly attached to a lens frame unit 54. The basic appearance of the eyeglasses corresponds to standard commercial eye wear. However, in place of a simple optical lens, a pair of electro-optical lens is inserted. The operation of the variable light transmissive lenses requires the application of an electric field across the electrochromic layer coated on the lens. Miniature battery 34 in the temple support arm provides dc voltage, preferably about 1–5 volts. The battery is connected through conducting wires 42 and 44 to the lens units to control the light absorption thereof. Pushbutton switches 30 and 32 and 50 and 52 are included in the circuit to allow selective operator control of cycling-lens coloration and erasure. Individual sets of pushbutton control switches are provided for each of lenses 38 and 40, so that separate control of each lens is possible. An operator, by depressing the respective coloration or erasure button can readily adjust the light transmission of each lens as desired. Separate controls adapt the glasses to multiple specialized uses. For example, selective darkening of one lens while maintaining maximum transmission to the other eye would prove convenient and beneficial to such as microscopists, photographers and sharpshooters, etc., who are normally required to close or block one eye during operation.

Coloration and erasure also can be accomplished automatically according to ambient light levels by utilization of photocell 46 which is built into the lens frame and integrated into the switching circuitry.

Figure 2 shows a cross section of the layered lens structure which is employed in Fig. 1. Numeral 18 represents the actual optical lens substrate which is coated with light modulating layers. The layers, successively deposited comprise a transparent conductive material 16 such as SnO_2, a persistent electrochromic film 14 of WO_3 or MoO_3, an ion-conducting layer 12 such as SiO_x or β-alumina, and transparent counter-electrode 10 of conductive material such as Au or a transparent oxide. The layers may be deposited by known vacuum deposition techniques. A source of dc potential 22 is coupled to electrodes 16 and 10 through a reversing switch indicated by 20. As shown, with the switch arm in the position to produce coloration, the positive terminal of the source is connected to the outer electrode 10 while the negative terminal is connected to the electrode 16 on the optical lens substrate. Once complete coloration is induced, typically in a matter of seconds, switch 20 may be opened, disconnecting the battery from the device entirely, and the device will remain in its darkened state without further application of power. To erase a previously darkened surface, the switch arm is thrown to the erase contacts, across which is connected a potentiometer 24. As shown, the potentiometer contact or slider is movable from a point at which the electrodes 16 and 10 are short circuited to a point at which full battery voltage, of polarity opposite to the coloration condition, is applied between them. Any number of reverse voltage values may be obtained between the two extremes.

In the position illustrated in the drawing, a "bleach" voltage of a value less than battery voltage is applied across the electrodes, setting up a corresponding electric field. Under the influence of this field, the device returns to its initial uncolored state. The rapidity with which the bleaching occurs is determined by the magnitude of the voltage; the higher the voltage, the faster the bleaching process is completed. At the higher bleaching voltages, it has been found that the bleaching process is even faster than the coloring operation. Once the bleaching is completed, the switch may be opened to disconnect the battery from the device and minimize power drain.

It has also been found that, notwithstanding the absence of an electric field, when the

PNSDOCID: <GB 1563929A | >

potentiometer is in its short circuiting position, certain of the persistent electrochromic materials nevertheless will return completely and positively from the colored to the bleached state. The rate at which the bleaching occurs, however, is somewhat slower than when the material us subjected to an electric field.

The persistent electrochromic materials are employed as films, and the thickness thereof desirably will be in the range of from about 0·1–100 microns. However, since a small potential will provide an enormous field strength across very thin films, the latter, i.e. 0·1–10 microns, are preferred over thicker ones. Optimum thickness will also be determined by the nature of the particular compound being laid down as a film and by the film-forming method since the particular compound and film-forming method may place physical (e.g. non-uniform film surface) and economic limitations on manufacture of the devices.

When tungsten oxide is employed as the electrochromic imaging material and an electric field is applied between the electrodes, a blue coloration of the previously transparent electrochromic layer occurs, i.e. the persistent electrochromic layer becomes absorptive of electromagnetic radiation over a band encompassing the red end of the visible spectrum, thereby rendering the imaging layer blue in appearance. Prior to the application of the electric field, the electrochromic imaging layer was essentially non-absorbent and thus transparent.

The ion-conducting layer should be substantially transparent.

One embodiment employs a solution of H_2SO_4 in glycerin. Other suitable ion-conductors are as disclosed in United States Patents 3,704,057 and 3,708,220.

In a preferred embodiment the ion-conducting layer is an inorganic or other solid material as disclosed in United States Patent 3,521,941, e.g. silicon oxide.

Virtually any material exhibiting electrical conductivity may be used for an electrode. The same material may be used for both electrodes or each electrode may be of a different material, or mixtures or alloys of of different materials. Typical electrode materials are the metals, e.g. gold, silver, aluminium, and conducting non-metals such as carbon, suitably doped tin or indium oxide, and the like. As already indicated, both of the electrodes must be transparent. The negative and positive electrodes must also be in electrical contact with the electrochromic film, and they may be formed by known vacuum deposition techniques, as described above, or they may be conducting layers between which the film is inserted.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various alterations in form and detail may be made therein. For example the circuitry and switching arrangements can be changed to suit ease of operation or cosmetic design. Also, since power application is needed only to color and bleach the device, a source of continuous power within the eyeglass structure is not a necessity. A remote power supply can be utilized to accomplish desired cycling. Such can be portable and, for example, be conveniently incorporated into an eyeglass case. The glasses may take various forms such as welding goggles, laser protective goggles, eyeglasses, sunglasses or special glasses for microscopists, photographers or sharpshooters.

WHAT WE CLAIM IS:—

1. A pair of opthalmic glasses, comprising first and second lens mounted in a frame, each said lens comprising an optical lens (as herein defined) carrying, successively, a first transparent electrode layer, a solid persistent electrochromic film of WO_3 or MoO_3, an ion-conducting layer and a second transparent electrode layer, and the glasses further comprising means at least partially disposed within said frame for allowing application of direct current voltage to each pair of electrodes carried by each said lens to create an electric potential across the electrochromic film sandwiched therebetween and a potential of opposite polarity, whereby said electrochromic film can be varied in coloration so as to vary the amount of light transmitted through each said lens.

2. A pair of glasses according to Claim 1, including a photocell control means adapted to adjust the light transmissive properties of said lenses according to the ambient light.

3. A pair of glasses according to Claim 1 or Claim 2, individual control means for each lens, so that light transmission through each lens can be individually adjusted.

4. A pair of glasses according to any preceding claim, including a direct current power source disposed within said frame.

5. A pair of opthalmic glasses, according to Claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

TREGEAR, THIEMANN & BLEACH,
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and
49/51, Bedford Row, London, WC1C 6RL.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1980
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

BNSDOCID: <GB_____1563929A__I_>

1563929 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

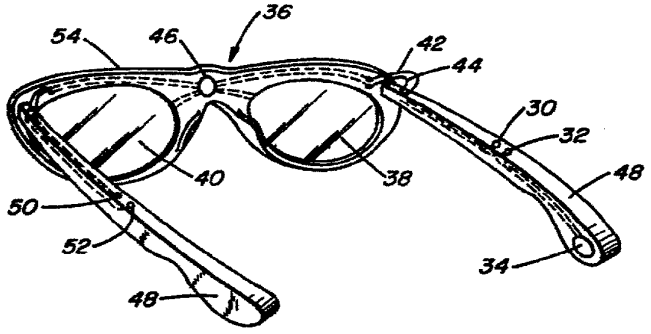


FIG. 1

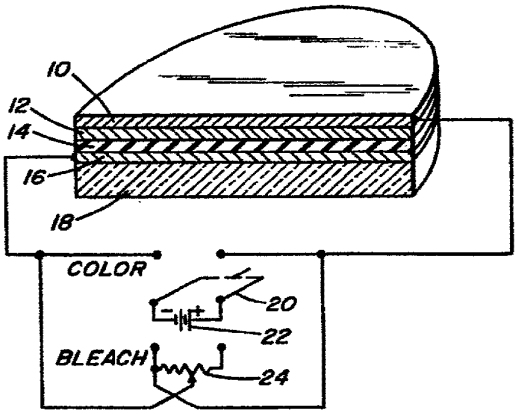


FIG. 2

BNSDOCID: <GB 1563929A >

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Lafferty, Patrick M.
Kilpatrick Townsend & Stockton LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
ETATS-UNIS D'AMERIQUE

INVITATION TO PAY ADDITIONAL FEES
AND, WHERE APPLICABLE, PROTEST FEE

(PCT Article 17(3)(a) and Rule 40.1 and 40.2(e))

Applicant's or agent's file reference 91904-813919	Date of mailing *(day/month/year)* 2 December 2011 (02-12-2011) **PAYMENT DUE** within **ONE MONTH** from the above date of mailing
International application No. PCT/US2011/042882	International filing date *(day/month/year)* 1 July 2011 (01-07-2011)
Applicant PIXELOPTICS, INC.	

1. This International Searching Authority

(i) considers that there are 2 *(number of)* inventions claimed in the international application covered by the claims indicated on an extra sheet:

(ii) therefore considers that **the international application does not comply with the requirements of unity of invention** (Rules 13.1, 13.2 and 13.3) for the reasons indicated on an extra sheet:

(iii) [X] has carried out a partial international search (see Annex) [ ] will establish the international search report on those parts of the international application which relate to the invention first mentioned in claims Nos.:

see extra sheet

(iv) will establish the international search report on the other parts of the international application only if, and to the extent to which, additional fees are paid.

2. Consequently, the applicant is hereby **invited to pay,** within the time limit indicated above, the amount indicated below:

EUR 1.785,00	x	1	=	EUR 1.785,00
Fee per additional invention		number of additional inventions		currency/total amount of additional fees

3. The applicant is informed that, according to Rule 40.2(c), **the payment of any additional fee may be made under protest,** i.e., a reasoned statement to the effect that the international application complies with the requirement of unity of invention or that the amount of the required additional fee is excessive, where applicable, subject to the payment of a protest fee.

Where the applicant pays additional fees under protest, the applicant is hereby invited, within the time limit indicated above, to pay a protest fee (Rule 40.2(e)) in the amount of EUR 790,00 *(currency/amount)*

Where the applicant has not, within the time limit indicated above, paid the required protest fee, the protest will be considered not to have been made and the International Searching Authority will so declare.

4. [ ] Claim(s) Nos. _____ have been found to be unsearchable under Article 17(2)(b) because of defects under Article 17(2)(a) and therefore have not been included with any invention.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	SALAüN, Marion Tel: +49 (0)89 2399-2126

Form PCT/ISA/206 (April 2005)
Registered Mail

INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US2011/042882

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10, 12-18, 21-33

connection structure

1.1. claims: 1-10, 12-18, 21-28

same two connections for two lenses

1.2. claims: 29-33

four connections for two lenses

---

2. claims: 11, 19, 20

material choice for electrical isolation

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.
The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:
The subject-matter of independent claim 1 is already known (see the grounds for this objection below).
The special technical features of each group are:
- Group 1 : structural connection to the electro-active lenses,
- Subgroup 1.1: both lenses each connected to the same two electrical paths,
- Subgroup 1.2: the two lenses are connected with four distinct electrical paths,
- Group 2: choice of materials for improved isolation of the electrical paths.

The problems solved by these special technical features can therefore be construed as:
- Group 1: choice of the electrical structure,
- Group 1.1: how to reduce the number of electronic components,
- Group 1.2: how to improve the controlling of the lenses,
- Group 2: how to improve the isolation of the electrical paths.

The requisite unity of invention no longer exists inasmuch as a technical relationship involving one or more of the same or corresponding special technical features does not exist between the subject-matter of the 3 groups of claims.
In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept.
The application, hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

Annex to Form PCT/ISA/206
COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH

International Application No
PCT/US2011/042882

1. The present communication is an Annex to the invitation to pay additional fees (Form PCT/ISA/206). It shows the results of the international search established on the parts of the international application which relate to the invention first mentioned in claims Nos.:
see 'Invitation to pay additional fees'
2. This communication is not the international search report which will be established according to Article 18 and Rule 43.

3. If the applicant does not pay any additional search fees, the information appearing in this communication will be considered as the result of the international search and will be included as such in the international search report.

4. If the applicant pays additional fees, the international search report will contain both the information appearing in this communication and the results of the international search on other parts of the international application for which such fees will have been paid.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 991 951 A (MIZUNO MITSUYOSHI [JP] ET AL) 12 February 1991 (1991-02-12)	1-10, 12-16, 21-33
A	figures 1-5 column 2, lines 33-38,47 column 2, line 55 - column 3, line 12 column 3, lines 24-3239-45	17,18
X	US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06) figures 1A,4B,5B,14 paragraphs [0067], [0074], [0099] claim 14	1,17,18, 29-33
X	GB 1 563 929 A (AMERICAN CYANAMID CO) 2 April 1980 (1980-04-02) figure 1	1,29-33

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

3

Form PCT/ISA/206 (Annex, first sheet) (July 1992; reprint January 2004)

Patent Family Annex

Information on patent family members

International Application No
PCT/US2011/042882

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4991951 A	12-02-1991	IT 1239773 B	15-11-1993
		JP 2266322 A	31-10-1990
		JP 2817178 B2	27-10-1998
		US 4991951 A	12-02-1991
US 2008273166 A1	06-11-2008	AR 066226 A1	05-08-2009
		TW 200921179 A	16-05-2009
		US 2008273166 A1	06-11-2008
		US 2010271588 A1	28-10-2010
GB 1563929 A	02-04-1980	BE 847562 A1	22-04-1977
		BR 7606988 A	06-09-1977
		CA 1068950 A1	31-12-1979
		CH 608623 A5	15-01-1979
		DE 2644528 A1	05-05-1977
		FR 2328979 A1	20-05-1977
		GB 1563929 A	02-04-1980
		IT 1074718 B	20-04-1985
		JP 52054455 A	02-05-1977
		NL 7611746 A	26-04-1977
		SE 7611791 A	24-04-1977

Electronic Acknowledgement Receipt

EFS ID:	12177279
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	20350
Filer:	John P. McGroarty/Aneta Xhiku
Filer Authorized By:	John P. McGroarty
Attorney Docket Number:	91904-817521
Receipt Date:	28-FEB-2012
Filing Date:	17-NOV-2011
Time Stamp:	14:14:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2012_02_28_SIDS_91904-817521.pdf	151249 5cb5c72b8a708e0a5b1fa6132c06f7c083371211	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:					
Information:					
2	Foreign Reference	gb.pdf	370957 00016711d3c3cc26e995477fab45dc222226a33	no	4
Warnings:					
Information:					
3	Non Patent Literature	isr.pdf	207694 651f7aa758639be2ccbe49573b175cc6c067e225	no	4
Warnings:					
Information:					
		Total Files Size (in bytes):	729900		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on 2/28/12.

KILPATRICK TOWNSEND & STOCKTON LLP

By: Aneta Mihali Xhiku

PATENT
Attorney Docket No.: 91904-817521(008512US)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Ronald D. Blum

Application No.: 13/298,992

Filed: November 17, 2011

For: ELECTRONIC SPECTACLE FRAMES

Customer No.: 20350

Confirmation No.: 1095

Examiner: TBA

Art Unit: 2835

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.97 and §1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

The references cited on attached form PTO/SB/08A and PTO/SB/08B are being called to the attention of the Examiner. Copies of the references [in compliance with the requirements of 37 CFR §1.98(a)(2)] are enclosed. It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

Also enclosed is a copy of the International Search Report corresponding to the PCT/US2011/042882 application.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement. However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 20-1430. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/John P. McGroarty/

John P. McGroarty
Reg. No. 41,186

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San Francisco, California 94111-3834
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JPM:amx
63992792 v1

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/298,992	11/17/2011	Ronald D. Blum	91904-817521

CONFIRMATION NO. 1095

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

POA ACCEPTANCE LETTER

OC00000052609794

Date Mailed: 02/17/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/07/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/rsantos/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/298,992

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						310
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1560

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/298,992	11/17/2011	2835	1690	91904-817521	20	2

CONFIRMATION NO. 1095

UPDATED FILING RECEIPT

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

OC000000052605000

Date Mailed: 02/17/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Ronald D. Blum, Roanoke, VA;
Joshua N. Haddock, Roanoke, VA;
Claudio Dalla Longa, Valdobbiadene-TV, ITALY;
Mark Graham, Leesburg, VA;
Yongping Wang, Philadelphia, PA;

Assignment For Published Patent Application

PixelOptics, Inc., Roanoke, VA

Power of Attorney: The patent practitioners associated with Customer Number 20350

Domestic Priority data as claimed by applicant

This application is a CIP of 13/175,633 07/01/2011
and is a CIP of 13/175,634 07/01/2011
and said 13/175,633 07/01/2011
claims benefit of 61/361,110 07/02/2010
and claims benefit of 61/376,719 08/25/2010
and claims benefit of 61/415,391 11/19/2010
This application 13/298,992
is a CIP of 13/179,219 07/08/2011
which claims benefit of 61/362,877 07/09/2010
This application 13/298,992
claims benefit of 61/481,353 05/02/2011

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If Required, Foreign Filing License Granted: 12/01/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/298,992**

Projected Publication Date: 05/24/2012

Non-Publication Request: No

Early Publication Request: No

Title

ELECTRONIC SPECTACLE FRAMES

Preliminary Class

361

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	13/298,992
				Filing Date	November 17, 2011
				First Named Inventor	Blum, Ronald D.
				Art Unit	2835
(Use as many sheets as necessary)				Examiner Name	TBA
Sheet	1	of	2	Attorney Docket Number	91904-817521(008512US)

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA	US-6,336,250	1/8/02	Takeda et al.	
	AB	US-5,760,869	6/2/98	Mitamura	
	AC	US-5,657,107	8/12/97	Wagner et al.	
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	AG	US-2007/121061	5/31/07	Young	
	AH	US-2008/273166	11/6/08	Kokonaski	

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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	AI	WO 2009/081542	7/2/09	Panasonic Corp.		☐

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	AJ	Copy of the US provisional patent application no. 61/361,110, filed on July 2, 2010	☐
	AK	Copy of the US provisional patent application no. 61/376,719, filed on August 25, 2010	☐
	AL	Copy of the US provisional patent application no. 61/415,391, filed on November 19, 2010	☐

Examiner Signature		Date Considered	

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63986902 v1

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	13/298,992
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				Art Unit	2835
(Use as many sheets as necessary)				Examiner Name	TBA
Sheet	2	of	2	Attorney Docket Number	91904-817521(008512US)

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	BA	Copy of the US non-provisional patent application no. 12/684,490, filed on January 8, 2010	☐
	BB	Copy of the U.S. non-provisional application no. 13/175,633 filed on July 1, 2011	☐
	BC	Copy of the U.S. non-provisional application no. 13/175,634 filed on July 1, 2011	☐
	BD	Copy of the U.S. provisional patent application no. 61/362,877 filed July 9, 2010	☐
	BE	Copy of the US non-provisional patent application no. 13/179,219, filed on July 8, 2011	☐
	BF	Copy of the U.S. provisional patent application no. 61/481,353 filed on May 2, 2011	☐
	BG	Copy of the International Search Report corresponding to the PCT/US2011/042883 application.	☐

Examiner Signature		Date Considered	

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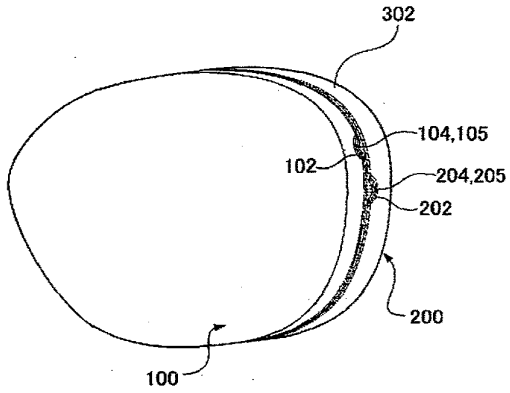
(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

[続葉有]

(54) **Title:** METHOD FOR MANUFACTURING LENS FOR ELECTRONIC SPECTACLES, LENS FOR ELECTRONIC SPECTACLES, AND ELECTRONIC SPECTACLES

(54) 発明の名称: 電子メガネ用レンズの製造方法と電子メガネ用レンズおよび電子メガネ

[図35]



(57) **Abstract:** A lens for electronic spectacles including an electrode pattern which is used for supplying electrical energy to an electric element provided in the lens and has a relatively low resistance and exhibiting an excellent light transmittance. The lens is characteristic in that a first recess (102) in a lower substrate (100) is coated with a conductive ink to form a first auxiliary electrode layer (104), a lower electrode pattern (105) is formed on the first auxiliary electrode layer (104) by vacuum deposition, a second recess (202) in an upper substrate (200) is coated with a conductive ink to form a second auxiliary electrode layer (204), an upper electrode pattern (205) is formed on the second auxiliary electrode layer (204) by vacuum deposition, the lower and upper substrates (100, 200) are joined with an electric element (300) interposed therebetween, the joined body is cut along the multilayer portion of the first auxiliary electrode layer (104) and the lower electrode pattern (105) and the multilayer portion of the second auxiliary electrode layer (204) and the upper electrode pattern (205) to expose the cut surface.

(57) 要約: レンズの内部に設けられて電気素子に電気エネルギーを供給する電極パターンとしての抵抗値を比較的小さくでき、しかも光透過率が良好な電子メガネ用レンズを提供することを目的として、下基板（１００）の第１の凹部（

[続葉有]

WO 2009/081542 A1

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:
— 国際調査報告書

１０２）に導電性インクでコーティングして第１の補助電極層（１０４）を形成し、その上に下部電極パターン（１０５）を蒸着して形成し、上基板（２００）の第２の凹部（２０２）に導電性インクでコーティングして第２の補助電極層（２０４）を形成し、その上に上部電極パターン（２０５）を蒸着して形成し、下基板（１００）と上基板（１００）の間に電気素子（３００）を挟んで貼り合わせ、第１の補助電極層（１０４）と下部電極パターン（１０５）との積層部分、第２の補助電極層（２０４）と上部電極パターン（２０５）との積層部分に掛かる位置でカットして切断面を露出させたことを特徴とする。

明　細　書

電子メガネ用レンズの製造方法と電子メガネ用レンズおよび電子メガネ

技術分野

[0001] 本発明は、電子メガネにおけるレンズ部の電気素子の電気配線に関するものであり、特に電気接続の信頼性を向上させることのできる構造を提案するものである。

背景技術

[0002] 電子メガネは、レンズ表面若しくはレンズ内部にエレクトロクロミック（ＥＣ）素子、液晶素子等の電気素子を形成し、これらの電気素子に電気エネルギーを供給することによりレンズの機能を変化させる電子メガネが提案されている。

[0003] 一例としてはＥＣ素子を用いたものがある。

[0004] この例においては、ＥＣ素子を駆動させるための電極配線方法として、図４３のレンズ断面に示す様に、基板レンズ６０１の上に下部ＩＴＯ透明電極６０２、Ir_2O_3／SnO_2層６０３、Ta_2O_5層６０４、WO_3層６０５、上部ＩＴＯ透明電極層６０６からなるＥＣ素子６０７が形成されており、各電極層からの取り出し電極として２層構造のメッキ層６０８ａ，６０８ｂがレンズ外周部（ヤゲン（薬研）の斜面）に形成されており、それぞれ上部ＩＴＯ透明電極層６０６、下部ＩＴＯ透明電極層６０２と電気的に接触している。一方、メガネのフレームは図４４に示されるよう電流通路を兼用する金属製の上部リム６０９ａ、下部リム６０９ｂから構成されている。上部リム６０９ａ、下部リム６０９ｂを結合する場合には薄いプラスティックシートなどの絶縁体を介して結合する。

[0005] 前記レンズとリムの結合及び制御部とＥＣ素子６０７の結線においては、前記レンズ外周部に形成される電極６０８ａ，６０８ｂと、上部リム６０９ａ、下部リム６０９ｂがそれぞれ接触した状態とし、さらに上部リム６０９

ａ、下部リム６０９ｂ末端にて制御部からの端子を挟み込む形にてリムロック６０９ａ１によって締め込む方法が示されている（例えば、特許文献１参照）。

特許文献1：実開平２－１３８７２０号公報

発明の開示

発明が解決しようとする課題

[0006] しかしながら、従来の構成では、レンズ外周部の電極である下部ＩＴＯ透明電極６０２，上部ＩＴＯ透明電極層６０６が、リムである上部リム６０９ａ、下部リム６０９ｂとの接触によってのみ導通を得ているため、例えばリムロック６０９ａ１を締め込むねじ（図示せず）が緩んだりした場合に導通不良が起こる。

[0007] この導通不良を改善するには、ＩＴＯ透明電極層の膜厚を厚くする必要があるが、蒸着などのドライプロセスでは膜厚を厚くすることが出来ない。そのため、ウェットプロセスを用いてＩＴＯ透明電極層の形成を行う。ところが、ウェットプロセスでは、ＩＴＯ粒子をインク溶媒に分散して塗布するため、ＩＴＯ透明電極層の電気抵抗値が高くなり、レンズ内部の素子の動作特性を損なうという課題を有している。

[0008] 本発明は、前記従来の課題を解決するもので、電子メガネにおけるレンズ内部の素子の動作特性を損なうことなく、レンズ外部の電子回路との電気接続信頼性を高めた電子メガネを提供することを目的とする。また、この電子メガネ用レンズを効率よく製造することができる製造方法を提供することを目的とする。

課題を解決するための手段

[0009] 本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、前記第１の凹部に導電性インクでコーティングして透明の第１の補助電極層を形成し、前記下基板の電気素子形成部と前記第１の補助電極層ならびに電気素子形成部

と前記第１の補助電極層を接続する透明の下部電極パターンを蒸着法にて形成し、上基板の作製は、上基板の前記下基板との対向面にレンズ部電極パッド用の第２の凹部を形成し、前記第２の凹部に導電性インクでコーティングして透明の第２の補助電極層を形成し、前記上基板の前記電気素子形成部に対応する部分と前記第２の補助電極層ならびに前記電気素子形成部に対応する部分と前記第２の補助電極層を接続する透明の上部電極パターンを蒸着法にて形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0010] また、本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、前記下基板の電気素子形成部と前記第１の凹部ならびに電気素子形成部と前記第１の凹部を接続する下部電極パターンを形成し、前記第１の凹部の前記下部電極パターンの上を導電性インクでコーティングして透明の第１の補助電極層を形成し、上基板の作製は、前記上基板の前記電気素子形成部に対応する部分とレンズ部電極パッド用の第２の凹部ならびに前記電気素子形成部に対応する部分と前記第２の凹部を接続する透明の上部電極パターンを蒸着法にて形成し、前記第２の凹部の前記上部電極パターンの上を導電性インクでコーティングして透明の第２の補助電極層を形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0011] 前記下基板と前記上基板を貼り合わせた後に、前記第１，第２の凹部に掛かる位置でカットして、レンズ端部に前記第１，第２の凹部の切断面を露出させることを特徴とする。

[0012] 前記下基板と前記上基板を貼り合わせた後に、前記第１，第２の凹部に掛かる位置でカットして、レンズ端部に前記第１，第２の凹部の切断面を露出させ、露出した前記第１，第２の凹部にそれぞれ導電性ペーストを形成して、第１の補助電極層と下部電極パターンの引き出し電極としてのレンズ部電

極パッド，第２の補助電極層と上部電極パターンの引き出し電極としてのレンズ部電極パッドを形成することを特徴とする。

[0013] 本発明の電子メガネ用レンズは、２枚の基板の間に電気素子を内蔵したレンズであって、前記電気素子に電圧を印加する電極の一端のレンズ部電極パッドがレンズ端部において露出し、かつ前記レンズ部電極パッドが、前記２枚の基板のうちの一方の基板の他方の基板との貼り合わせ面に形成された凹部の内部に、導電性インクで形成した補助電極層と蒸着法で形成した下部電極パターンとの積層によって形成された電極が形成されていることを特徴とする。

[0014] 前記凹部の前記レンズ端部において露出した形状が、曲面に形成されていることを特徴とする。

[0015] また、本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、下基板の前記上基板との対向面に導電性インクでコーティングしてレンズ部電極パッド用の透明の第１の補助電極層を形成し、前記下基板の電気素子形成部と前記第１の補助電極層ならびに電気素子形成部と前記第１の補助電極層を接続する透明の下部電極パターンを蒸着法にて形成し、上基板の作製は、上基板の前記下基板との対向面に導電性インクでコーティングして前記レンズ部電極パッド用の透明の第２の補助電極層を形成し、前記上基板の前記電気素子形成部に対応する部分と前記第２の補助電極層ならびに前記電気素子形成部に対応する部分と前記第２の補助電極層を接続する透明の上部電極パターンを蒸着法にて形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0016] また、本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、前記下基板の電気素子形成部に信号を印加する透明の下部電極パターンを蒸着法にて形成し、前記下部電極パターンの端部の上を導電性インクでコーティングして透明の第１の補助電極層を形成し、上基板の作製は、前記上基板の前記電気

素子形成部に対応する部分に信号を印加する透明の上部電極パターンを蒸着法にて形成し、前記上部電極パターンの端部の上を導電性インクでコーティングして透明の第２の補助電極層を形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0017] 前記下基板と前記上基板を貼り合わせた後に、前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分に掛かる位置でカットして切断面を露出させることを特徴とする。

[0018] 前記下基板と前記上基板を貼り合わせた後に、前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分に掛かる位置でカットして切断面を露出させ、露出した前記前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分にそれぞれ導電性ペーストを形成して、前記第１の補助電極層と前記下部電極パターンの引き出し電極としてのレンズ部電極パッド，前記第２の補助電極層と前記上部電極パターンの引き出し電極としてのレンズ部電極パッドを形成することを特徴とする。

[0019] また、本発明の電子メガネ用レンズは、２枚の基板の間に電気素子を内蔵したレンズであって、前記電気素子に電圧を印加する電極の一端がレンズ端部において露出し、かつ前記電極の一端が導電性インクで形成した補助電極層と蒸着法で形成した下部電極パターンとの積層によって形成されていることを特徴とする。

[0020] また、本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、前記下基板の電気素子形成部に信号を印加する透明の下部電極パターンを蒸着法にて形成し、前記下基板の電気素子形成部と下部電極パターンの上で後に第１の補助電極層が形成される部分を除いて下部絶縁層パターンを形成し、前記下部

絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第１の補助電極層を形成し、上基板の作製は、前記上基板の前記電気素子形成部に対応する部分に信号を印加する透明の上部電極パターンを蒸着法にて形成し、前記上基板の前記電気素子形成部に対応する部分と上部電極パターンで後に第２の補助電極層が形成される部分を除いて上部絶縁層パターンを形成し、前記上部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第２の補助電極層を形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0021] また、本発明の電子メガネ用レンズの製造方法は、下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、下基板の作製は、下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、前記下基板の電気素子形成部と前記第１の凹部ならびに電気素子形成部と前記第１の凹部を接続する下部電極パターンを形成し、前記下基板の電気素子形成部と下部電極パターンの上で後に第１の補助電極層が形成される部分を除いて下部絶縁層パターンを形成し、前記下部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第１の補助電極層を形成し、上基板の作製は、前記上基板の前記電気素子形成部に対応する部分とレンズ部電極パッド用の第２の凹部ならびに前記電気素子形成部に対応する部分と前記第２の凹部を接続する透明の上部電極パターンを蒸着法にて形成し、前記上基板の前記電気素子形成部に対応する部分と上部電極パターンの上で後に第２の補助電極層が形成される部分を除いて上部絶縁層パターンを形成し、前記上部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第２の補助電極層を形成し、前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせることを特徴とする。

[0022] また、本発明の電子メガネは、電気素子を内蔵したレンズをメガネフレームにセットした電子メガネであって、前記レンズは、レンズ端部に前記電気素子に電圧を印加する電極の一端のレンズ部電極パッドが露出しており、前

記メガネフレームは、前記電気素子を制御する制御部に一端が接続され、他端の配線部電極パッドが前記レンズの前記レンズ部電極パッドに対応した位置に配置された電気接続手段を有しており、前記電気接続手段の前記配線部電極パッドと前記レンズの前記レンズ部電極パッドとの間に異方導電性ゴムが介在していることを特徴とする。

[0023] また、前記メガネフレームのリムの内側に前記電気接続手段が位置するリム側ザグリを設け、前記レンズのレンズ端部に前記異方導電性ゴムが位置するレンズ側ザグリを設けたことを特徴とする。

[0024] また、前記電気接続手段を、前記メガネフレームのリムロックの間を通りリムの内側に敷設し、前記メガネフレームの前記リムの内側に配線部電極パッドを設置したことを特徴とする。

発明の効果

[0025] この構成によると、電子メガネ用レンズは、レンズ端部において露出たレンズ部電極パッドが、ＩＴＯインクで形成された補助電極層とＩＴＯをスパッタリングした下部電極パターンとの積層によって形成された電極が形成されているため、電極パターンの電極としての体積抵抗率を比較的小さくでき、しかも光透過率が良好で目障りになるような事態を回避できる。

[0026] また、メガネフレームは、配線部電極パッドがレンズのレンズ部電極パッドに対応した位置に配置された電気接続手段を有しており、前記配線部電極パッドと前記レンズのレンズ部電極パッドとの間に異方導電性ゴムが介在しているため、レンズ締結部の緩みや電気配線のずれによる断線と、漏電によるショート等電気的トラブルを防ぐことができる。

図面の簡単な説明

[0027] [図1]本発明の実施の形態１における電子メガネ要部の拡大図

[図2]同実施の形態における電子メガネ要部の拡大図

[図3]本発明の実施の形態２ザグリを形成した電子メガネ要部の拡大図

[図4]同実施の形態におけるザグリを形成した電子メガネ要部の拡大図

[図5]電子メガネの上面図と利用者の側から見た拡大図

[図6]本発明の実施の形態３における完成したレンズ１を分解して図示したイメージ図

[図7]同実施の形態における下基板の加工の工程を示す斜視図

[図8]同実施の形態における下基板の加工の工程を示す断面図

[図9]同実施の形態における上基板の加工の工程を示す斜視図

[図10]同実施の形態における上基板の加工の工程を示す断面図

[図11]同実施の形態におけるレンズを第１の補助電極層１０４を通る位置で切り欠いた拡大斜視図

[図12]同実施の形態におけるレンズを第１の補助電極層１０４を通る位置で切断した断面図

[図13]同実施の形態における同実施の形態におけるレンズを第２の補助電極層２０４を通る位置で切り欠いた拡大斜視図

[図14]同実施の形態におけるレンズを第２の補助電極層２０４を通る位置で切断した断面図

[図15]同実施の形態におけるレンズをカットする位置を示す平面図

[図16]同実施の形態におけるカットしたレンズのレンズ端面を示す拡大斜視図

[図17]同実施の形態における要部の拡大図

[図18]同実施の形態におけるメガネフレームの概略図とその智の部分の拡大斜視図と構成図

[図19]同実施の形態におけるレンズがメガネフレームにセットされた状態の構成図

[図20]同実施の形態におけるレンズのレンズ端面に銀ペーストを付けた別の実施例の拡大斜視図

[図21]同実施の形態におけるレンズがメガネフレームにセットされた状態の別の実施例の構成図

[図22]本発明の実施の形態４における完成したレンズ１を分解して図示したイメージ図

[図23]同実施の形態における下基板の加工の工程を示す断面図

[図24]同実施の形態におけるレンズを第１の補助電極層１０４を通る位置で切り欠いた拡大斜視図

[図25]同実施の形態におけるレンズを第２の補助電極層２０４を通る位置で切断した断面図

[図26]本発明の実施の形態５における完成したレンズ１を分解して図示したイメージ図

[図27]同実施の形態における下基板の加工の工程を示す斜視図

[図28]同実施の形態における下基板の加工の工程を示す断面図

[図29]同実施の形態における上基板の加工の工程を示す斜視図

[図30]同実施の形態における上基板の加工の工程を示す断面図

[図31]同実施の形態におけるレンズを第１の凹部１０２を通る位置で切り欠いた拡大斜視図

[図32]同実施の形態におけるレンズを第１の凹部１０２を通る位置で切断した断面図

[図33]同実施の形態における同実施の形態におけるレンズを第２の凹部２０２を通る位置で切り欠いた拡大斜視図

[図34]同実施の形態におけるレンズを第２の凹部２０２を通る位置で切断した断面図

[図35]同実施の形態におけるレンズをカットする位置を示す平面図

[図36]同実施の形態におけるカットしたレンズのレンズ端面を示す拡大斜視図

[図37]本発明の実施の形態６における完成したレンズ１を分解して図示したイメージ図

[図38]同実施の形態における下基板の加工の工程を示す断面図

[図39]同実施の形態におけるレンズを第１の凹部１０２を通る位置で切り欠いた拡大斜視図

[図40]同実施の形態におけるレンズを第２の凹部２０２を通る位置で切断し

た断面図

[図41]本発明の実施の形態７における完成したレンズ１を分解して図示したイメージ図

[図42]本発明の実施の形態８における完成したレンズ１を分解して図示したイメージ図

[図43]従来の電子メガネを示す図

[図44]従来の電子メガネを示す図

発明を実施するための最良の形態

[0028] 以下に、本発明の電子メガネの実施の形態を図面とともに詳細に説明する。

[0029] （実施の形態１）

図５（ａ）（ｂ）に電子メガネを示す。

[0030] 図１は図５（ａ）のＡ－Ａ断面図で、本発明の第１の実施の形態におけるレンズ部電極パッドと配線部電極パッドの接続部断面を示す。

[0031] 同様に図２は図５（ｂ）のＢ－Ｂ断面図で、レンズ部電極パッドと配線部電極パッドの接続部のイメージ図を示す。

[0032] 本発明の電子メガネは、メガネフレーム１１と、液晶やエレクトロクロミックなどの電気素子（図示せず）を有し前記メガネフレーム１１のリム８にセットされたレンズ１と、メガネフレーム１１の側に設けられレンズ１の前記電気素子を駆動するために電気信号を発生する制御部５と、メガネフレーム１１の側に設けられ制御部５からの信号を伝達する電気接続手段４と、レンズ１とリム８の間に挟まれた異方導電性ゴム７と、リム８の上下のリムロック９，９を締め込むネジ１０などから構成されている。

[0033] なお、レンズ１はリム８の内側に形成されている溝８ａに嵌め込まれており、レンズ１には、前記電気素子に電気信号を送る電極パターン２ａ，２ｂと、電極パターン２ａ，２ｂの端部で電極パターン２ａ，２ｂの接触面積を向上させるためのレンズ部電極パッド３ａ，３ｂがヤゲン（薬研）１ａに形成されている。

[0034] メガネフレーム１１の側の電気接続手段４の一端部には、電極パッド６ａ，６ｂが形成されており、異方導電性ゴム７によってレンズ部電極パッド３ａ，３ｂと電極パッド６ａと６ｂとの間が電気接続されている。

[0035] 電極パターン２ａ，２ｂはＩＴＯに代表される非常に薄い透明電極により形成されており、その電極パターン２ａ，２ｂはレンズ１の外周側壁部のヤゲン１ａにて外部に露出されている。ここで電極パターン２ａ，２ｂの膜厚は１０ｎｍ～４０ｎｍ程度しかなく、外部へ露出した電極パターン２ａ，２ｂは非常に細い１０ｎｍ～４０ｎｍ程度の線幅のライン状である。そのために異方導電性ゴム７との電気接触がうまく行かない場合が有る。そのためこの実施の形態１では、レンズ１の外部に露出した電極パターン２ａ，２ｂに対して、銀ペーストやナノ粒子などを用い電極部を拡大するためにレンズ部電極パッド３ａ，３ｂをヤゲン１ａの１つの平面上に形成している。

[0036] このとき、電極パターン２ａ，２ｂは、レンズ厚み方向における間隔が前記電気素子の厚さにほぼ等しい数μｍ程度しかなく、レンズ部電極パッド３ａ，３ｂを電極パターン２ａ，２ｂに対し個別に形成するためには、レンズ端部において電極パターン２ａ，２ｂがレンズ厚み方向に重ならないようにしておく必要がある。

[0037] 電源やＩＣ（集積回路）などから構成される制御部５から発生した電気信号は、フレキシブル基板などの電気接続手段４を介してレンズ部電極パッド３ａ，３ｂに対応した形状の配線部電極パッド６ａ，６ｂに伝達され、異方導電性ゴム７を挟んでレンズ部電極パッド３ａ，３ｂに伝達される。

[0038] レンズ部電極パッド３ａ，３ｂと配線部電極パッド６ａ，６ｂ間に設置される異方導電性ゴム７は、側壁面をシリコーンなどのゴム材料にてコートされた一般的な異方導電性ゴムを用いる。異方導電性ゴム７は、リムロック９をねじ１０で締め込みレンズを取り付ける際、弾性体である異方導電性ゴム７が十分に圧縮（変形）し、導通部の露出する面が浮いた状態にならないようにその形状を設定する。

[0039] このように電子メガネを構成することにより、リムロック９のネジ１０に

よる締め込みが多少緩んでも、異方導電性ゴム７の弾性変形があるため電気接続が完全に断線することも無く使用することが可能となる。

[0040] また、レンズ部電極パッド３ａ，３ｂと配線部電極パッド６ａ，６ｂを異方導電性ゴム７の圧縮変形によりシールすることが可能となり、雨などに濡れてもショートすることなく使用することが可能となる。

[0041] （実施の形態２）

レンズ１の外周部は、図２に示す様レンズ外周部にヤゲン１ａといわれる山型の突起が形成され、メガネフレーム１１の側のリム８の内周部には図２にも示した谷状の溝８ａが形成されている。

[0042] レンズ１のメガネフレームへの取り付けは、ヤゲン１ａと溝８ａを係合させて固定する方法が最も一般的で有る。しかしながらこの構造では、リムロック９をねじ１０で締め込む際に異方導電性ゴム７と電気接続手段４に対し斜めに力が加わってしまうこととなり、それぞれが所定位置からずれてしまい組み立て（レンズ嵌め込み）や電気接続うまく出来ないことがある。

[0043] そこで、この実施の形態２では図３と図４に示すように構成することによって、組み立て時に異方導電性ゴム７と電気接続手段４に対し斜め方向の力が作用しないように改善されている。

[0044] 図３は、電子メガネのレンズ部電極パッドと配線部電極パッドの接続部断面のイメージ図で、図５（ａ）に示す上部から見た電子メガネのＡ－Ａ断面に相当するものである。同様に図４は、電子メガネのレンズ部電極パッドと配線部電極パッドの接続部のイメージ図で、図５（ｂ）に示す正面から見た電子メガネのＢ－Ｂ断面に相当するものである。

[0045] 図３と図４に示すように、レンズ１の側のレンズ部電極パッド３ａ，３ｂの周辺部には、異方導電性ゴム７用のレンズ側ザグリ１ｂが形成されている。さらに、メガネフレーム１１の側には、リム８の内側の電気接続手段４が設置される部分にリム側ザグリ８ｂが形成されている。

[0046] このように異方導電性ゴム７と電気接続手段４をそれぞれザグリ部１ｂ，８ｂに設置することによって、リムロック９をネジ１０で締め込んでも異方

導電性ゴム７、電気接続手段４がずれにくく、安定して組み立てることが出来るようになり、電気配線のずれによる断線を防ぐことできる。

[0047] さらに具体的には、レンズ側ザグリ１ｂとリム側ザグリ８ｂの形状を、リムロック９，９をネジ１０で締め込む際にレンズ側ザグリ１ｂ、リム側のザグリ８ｂそれぞれの底面に対し垂直方向に荷重がかかるように形成されており、この構成によると安定して組み立てることができ、電気配線のずれによる断線を防ぐことができる。

[0048] 上記の各実施の形態において、電気接続手段４は一端が制御部５に接続され、他端部の配線部電極パッド６ａ，６ｂがリム８の溝８ａにおいてレンズ部電極パッド３ａ，３ｂに対向する部分に設置されるよう取り回しすればよく、例えばリムロック９やリム８の外周に電気接続手段４を設置するように構成することもできる。

[0049] ここではさらに安定的に電気接続を達成するために、図１，図２，図３，図４に示すように電気接続手段４をリムロック９の間を通し、リム８の内側の溝８ａまたはザグリ８ｂに設置することを例として挙げる。このように電気接続手段４をリムロック間に設置することにより、組み立て時の電気接続手段４の位置ずれを防ぎ、さらに電気接続手段４が外れにくい形とすることが可能である。

[0050] 具体的なリムロック９間への電気接続手段４の取り回しは、リムロック９自身で挟み込んで固定しても良いし、リムロック９に電気接続手段４の溝を形成しても良い。さらにはリムロック９に電気接続手段４の位置決めピンを設ける、またはねじ１０を位置決めピンとして用いたり、溝を形成するものであれば、溝パターン自体を位置決め手段として用いれば電気接続手段４が位置ずれしにくく外れにくい構成とすることができる。

[0051] さらに電気接続手段４をリムロック９の間に通すことによる付加的な効果としては、電気接続手段４が外部に露出しないため見た目にもすっきりしており、メガネ自体のデザイン性を乱すことが無い。

[0052] なお、本実施の形態においては、制御部５の設置位置は限定しないが、メ

ガネを構成するテンプルの内側や、よろいの部分に固定されるようにすれば良く、リムロックの近くであれば電気接続手段４を短くすることができる。

[0053] （実施の形態３）

図６～図１９は電子メガネ用レンズ１の製造方法を示す。

[0054] 図６は製造工程がわかりやすくするために、完成したレンズ１を分解して図示したイメージ図で、下基板１００と上基板２００の間に電気素子としての液晶３００を内蔵している。４００は下基板１００と上基板２００を張り合わせしている接着層である。

[0055] 図７と図８は下基板１００の加工の工程を示している。

[0056] 図７（ａ）では、図８（ａ）に示すように下基板１００の上基板２００との対向面１０１に、後に前記液晶４００が配置される電気素子形成部１０３を形成する。

[0057] 図７（ｂ）では、図８（ｂ）に示すように表面が平滑な下基板１００に導電性インクで部分的にコーティングして第１の補助電極層１０４を形成する。具体的には、導電性インクとしてのＩＴＯインクを使用する。ＩＴＯインクの物性は導電性粒子が分散しており、ＩＴＯスパッタリングで形成した導電膜の体積抵抗率６～２×１０$^{-4}$Ω・ｃｍ程度に比べて体積抵抗率が２．４×１０^{0}Ω・ｃｍ程度と大きい反面、ＩＴＯインクによる１μｍの膜厚の分光透過率とスパッタによる膜厚３０ｎｍのＩＴＯの分光透過率はほぼ同じ値を示している。従って同じ膜厚における透明度はスパッタリングで形成したＩＴＯ導電膜に比べＩＴＯインクで形成した導電膜のほうが優れている。ＩＴＯインクは１μｍの膜厚であっても８０%程度の透過率を得ることができる。ＩＴＯインクのコーティング方法は、インクジェット、ディスペンサーを用いれば良い。また、テープなどによりマスキングした状態にて必要な場所にスピンコートやディッピングすることによっても可能である。ＩＴＯインクで形成する第１の補助電極層１０４の膜厚は１μｍ以上あればよい。

[0058] 図７（ｃ）では、図８（ｃ）に示すように電気素子形成部１０３と第１の補助電極層１０４ならびに電気素子形成部１０３と第１の補助電極層１０４

を接続する下部電極パターン１０５を形成する。具体的には、電気素子形成部１０３と第１の補助電極層１０４をつなぐマスクパターンを用いてＩＴＯスパッタリングを行う。下部電極パターン１０５の膜厚は１０ｎｍ～４０ｎｍ程度である。

[0059] 図７（ｄ）では、図８（ｄ）に示すように電気素子形成部１０３と下部電極パターン１０５の上に下部絶縁層パターン１０６を形成する。具体的には、図７（ｃ）でのＩＴＯスパッタ後、チャンバから下基板１００を取り出すことなく（大気開放することなく）SiO_2を連続的にスパッタする。一つのチャンバ内に複数のターゲットがあるスパッタ装置であれば実施が可能で、特殊な装置ではない。

[0060] 図７（ｅ）では、液晶３００を注入する部分に配向膜１０７を塗布し、ラビング処理を行う。

[0061] 図９と図１０は上基板２００の加工の工程を示している。

[0062] 図９（ａ）のように表面が平滑な上基板２００に、図９（ｂ）では、図１０（ｂ）に示すように導電性インクでコーティングして第２の補助電極層２０４を形成する。コーティング方法は、インクジェット、ディスペンサーを用いれば良い。また、テープなどによりマスキングした状態にて必要な場所にスピンコートやディッピングすることによっても可能である。第２の補助電極層２０４の膜厚は１μｍ以上あればよい。

[0063] 図９（ｃ）では、図１０（ｃ）に示すように下基板１００の側の電気素子形成部１０３に対応する部分２０３と第２の補助電極層２０４ならびに前記部分２０３と第２の補助電極層２０４を接続する上部電極パターン２０５を形成する。具体的には、前記部分２０３と第２の補助電極層２０４をつなぐマスクパターンを用いてＩＴＯスパッタリングを行う。上部電極パターン２０５の膜厚は１０ｎｍ～４０ｎｍ程度である。

[0064] 図９（ｄ）では、図１０（ｄ）に示すように上部電極パターン２０５の上に上部絶縁層パターン２０６を形成する。具体的には、図９（ｃ）でのＩＴＯスパッタ後、チャンバ装置から上基板２００を取り出すことなく（大気開

放することなく）SiO_2を連続的にスパッタする。一つのチャンバ内に複数のターゲットがあるスパッタ装置であれば実施が可能で、特殊な装置ではない。

[0065] 図９（ｅ）では、上部電極パターン２０５のうちの前記部分２０３の上の個所に配向膜２０７を塗布し、ラビング処理を行う。このようにして作製した下基板１００の電気素子形成部１０３と前記上基板２００との間に前記電気素子としての液晶３００を挟んで下基板１００と上基板２００を接着層４００によって貼り合わせる。具体的には、ディスペンサーやインクジェットなどにより液晶３００を注入する。この液晶３００の注入後、外周部分に接着剤（封止剤）を充填し、下基板１００と上基板２００を接着層４００によって貼り合わせる。

[0066] 図１１は貼り合わせた下基板１００と上基板２００を、第１の補助電極層１０４の端部と第２の補助電極層２０４を通る位置で切り欠いた拡大斜視図を示す。図１２は図１１の要部の拡大図である。図１３は貼り合わせた下基板１００と上基板２００を、第２の補助電極層２０４を通る位置で切り欠いた拡大斜視図を示す。図１４は図１３の要部の拡大図である。

[0067] このように張り合わせが完了した下基板１００と上基板２００を、前記メガネフレーム１１のリムの形状に応じて図１５に示すように第１の補助電極層１０４の端部と第２の補助電極層２０４の端部を通る切断線３０１でカットする。このカットによって、レンズ端部３０２に図１６に示すように、第１の補助電極層１０４と下部電極パターン１０５との重ね合わせ部分の端面と、第２の補助電極層２０４と上部電極パターン２０５との重ね合わせ部分の端面とを露出させる。図１７に示すように、下基板１００の側では、第１の補助電極層１０４と下部電極パターン１０５の端面が露出している。上基板２００の側では、第２の補助電極層２０４と上部電極パターン２０５の端面が露出している。

[0068] この図１６のレンズを用いて、図１８と図１９に示すようにしてメガネフレーム１１にレンズ１がセットされた電子メガネを構成できる。

[0069] 図１８（ａ）に示すメガネフレーム１１の智３０４の部分には、電気接続手段４としてのフレキシブル配線３０５ａ，３０５ｂが敷設されている。フレキシブル配線３０５ａ，３０５ｂの一端は前記制御部５に接続され、フレキシブル配線３０５ａ，３０５ｂの他端には配線部電極パッド３０６ａ，３０６ｂが形成されている。この配線部電極パッド３０６ａ，３０６ｂは図１８（ｂ）に示すようにメガネフレーム１１のリム３０７の内部にセットされている。

[0070] このリム３０７にレンズ１をセットする際には、配線部電極パッド３０６ａ，３０６ｂとレンズ１の側の第１の補助電極層１０４と下部電極パターン１０５、第２の補助電極層２０４と上部電極パターン２０５との間に、図１９に示すように異方導電性ゴム３０８を介装した状態にして、ネジ１０を締めてレンズ１をリム３０７で支持することによって、配線部電極パッド３０６ａは異方導電性ゴム３０８を介してレンズ側の下部電極パターン１０５と確実に導通する。また、配線部電極パッド３０６ｂは異方導電性ゴム３０８を介してレンズ側の上部電極パターン２０５と確実に導通する。これは、第１の補助電極層１０４を下部電極パターン１０５上に形成しているため、異方導電性ゴム３０８との間の接触面積が増え、電気的導通が良くなるからである。第２の補助電極層２０４も同様の効果を与える。このようにして、前記制御部５から液晶３００を駆動するに必要な電圧をレンズ１の下部電極パターン１０５と上部電極パターン２０５の間に印加することができる。

[0071] 下部電極パターン１０５の膜厚を厚くして第１の補助電極層１０４を設けない場合、上部電極パターン２０５の膜厚を厚くして第２の補助電極層２０４を設けない場合を、この実施の形態と比較すると、第１，第２の補助電極層１０４，２０４を設けなかった場合には、電極としての抵抗値は小さくできるけれども、電子メガネで重要である光の透過が低下するため、下部電極パターン１０５と上部電極パターン２０５を目視で容易に確認できるようになって目障りになる。これに対して実施の形態３のように下部電極パターン１０５の膜厚を薄くして第１の補助電極層１０４を重ね合わせて膜厚を厚く

し、上部電極パターン２０５の膜厚を薄くして第２の補助電極層２０４を重ね合わせて膜厚を厚くすることによって、電極としての抵抗値を比較的小さくでき、しかも下部電極パターン１０５と上部電極パターン２０５が目障りになるような事態を回避することができるので、第１，第２の補助電極層１０４，２０４の重ね合わせ構造は非常に有効である。

[0072] また、下基板１００と上基板２００に第１，第２の補助電極層１０４，２０４をコーティングしてから下部電極パターン１０５，上部電極パターン２０５を形成する工程を採用した場合には、下部電極パターン１０５，上部電極パターン２０５の上に、下部絶縁層パターン１０６，上部絶縁層パターン２０６を形成する工程を、前述のように、チャンバを大気開放して下基板１００，上基板２００を取り出すことなく連続的にスパッタして実施することができる。

[0073] 具体的には、下基板１００と上基板２００に下部電極パターン１０５，上部電極パターン２０５を形成してから第１，第２の補助電極層１０４，２０４をコーティングする後付け処理工程を採用した場合には、下部電極パターン１０５，上部電極パターン２０５をスパッタ形成して、スパッタ装置を大気開放して下基板１００と上基板２００を取り出しマスクパターンを変更してから下部絶縁層パターン１０６，上部絶縁層パターン２０６を形成することが必要になって、スパッタ装置の真空引きを二度も行うことになって加工プロセスが複雑になる。

[0074] これに対してこの実施の形態３のように第１，第２の補助電極層１０４，２０４を下基板１００と上基板２００に先付け処理で形成した場合は、下基板１００への下部電極パターン１０５の形成と下部絶縁層パターン１０６の形成をスパッタ装置を大気開放することなく実施でき、上基板２００への上部電極パターン２０５の形成と上部絶縁層パターン２０６の形成をスパッタ装置を大気開放することなく実施できるため、加工プロセスの簡略化が可能である。

[0075] さらに、図２０と図２１に示すように導電ペーストを第１の補助電極層１

０４と第２の補助電極層２０４の上に付けると、接触面積が増えるので、さらに良い。つまり、図２０に示すように露出した第１の補助電極層１０４と下部電極パターン１０５との重ね合わせ部分の端面と、第２の補助電極層２０４と上部電極パターン２０５との重ね合わせ部分の端面とにそれぞれ導電性ペーストとしての銀ペースト３０３ａ，３０３ｂを付着させる。レンズ端部３０２に形成された銀ペースト３０３ａは、理想的には下部電極パターン１０５だけでなく第１の補助電極層１０４とも電気的に導通している。この実施の形態では、レンズ端部３０２に薄肉の下部電極パターン１０５が露出しているだけではなく、下部電極パターン１０５に比べて厚肉の第１の補助電極層１０４が露出しているため、レンズ端部３０２での下部電極パターン１０５の露出が不十分であっても、銀ペースト３０３ａは厚肉の第１の補助電極層１０４を介して確実に下部電極パターン１０５と導通することができる。

[0076] 同様に、レンズ端部３０２に形成された銀ペースト３０３ｂは、理想的には上部電極パターン２０５だけでなく第２の補助電極層２０４とも電気的に導通している。この実施の形態では、レンズ端部３０２に薄肉の上部電極パターン２０５が露出しているだけではなく、上部電極パターン２０５に比べて厚肉の第２の補助電極層２０４が露出しているため、レンズ端部３０２での上部電極パターン２０５の露出が不十分であっても、銀ペースト３０３ｂは厚肉の第２の補助電極層２０４を介して確実に上部電極パターン２０５と導通することができる。

[0077] （実施の形態４）

図２２～図２５は本発明の実施の形態４を示す。

[0078] 実施の形態３では、下基板１００に第１の補助電極層１０４をコーティングしてから下部電極パターン１０５を形成し、また、上基板２００に第２の補助電極層２０４をコーティングしてから上部電極パターン２０５を形成したが、この実施の形態４では、第１，第２の補助電極層１０４，２０４を後付けする点だけが異なっている。その他は実施の形態３と同じである。

[0079] 図２２は製造工程がわかりやすくするために、完成したレンズ１を分解して図示したイメージ図である。

[0080] 図２３（ａ）では、下基板１００の電気素子形成部１０３から下基板１００の外周部の近傍の一部分に掛けて下部電極パターン１０５を形成する。

[0081] 図２３（ｂ）では、下部電極パターン１０５の端部の上にだけ導電性インクでコーティングして第１の補助電極層１０４を形成し、次に、電気素子形成部１０３の上と、下部電極パターン１０５から第１の補助電極層１０４の上に下部絶縁層パターン１０６を形成する。更に、図２２に示すように下部絶縁層パターン１０６の上には電気素子形成部１０３の位置に対応して配向膜１０７を形成する。

[0082] この場合の上基板２００も図２３（ａ）（ｂ）と同様に形成する。つまり図２２に示すように、下基板１００の側の電気素子形成部１０３に対応する部分と、上基板２００の外周部の近傍の一部分とに掛けて上部電極パターン２０５を形成し、上基板２００の外周部の近傍の上部電極パターン２０５の上にだけ導電性インクでコーティングして第２の補助電極層２０４を形成する。そして上部絶縁層パターン２０６を形成する。さらに、配向膜２０７を形成する。

[0083] そして、下部電極パターン１０５に第１の補助電極層１０４を後付けした下基板１００と、上部電極パターン２０５に第２の補助電極層２０４を後付けした上基板２００との間に、液晶３００を挟んで接着層４００によって図２３（ｃ）のように貼り合わせる。図２４は貼り合わせた下基板１００と上基板２００を、第１の補助電極層１０４を通る位置で切り欠いた拡大斜視図を示す。図２５は貼り合わせた下基板１００と上基板２００を、上部電極パターン２０５を通る位置で切り欠いた拡大断面図を示す。

[0084] このように第１，第２の補助電極層１０４，２０４を後付けした場合であっても、図１５に示したように切断線３０１でカットすることによって、実施の形態３と同様にレンズ１のレンズ端部３０２に、下基板１００の側では、第１の補助電極層１０４と下部電極パターン１０５の端面が露出し、上基

板２００の側では、第２の補助電極層２０４と上部電極パターン２０５の端面が露出する。その他は実施の形態３と同じである。

[0085] また、下部絶縁パターン１０６と上部絶縁パターン２０６は、全面に形成すれば良いため、マスクを用いずにスパッタにより下部絶縁パターン１０６と上部絶縁パターン２０６を形成できる。

[0086] （実施の形態５）

実施の形態３では下基板１００の平滑な表面に第１の補助電極層１０４を形成し、上基板２００の平滑な表面に第２の補助電極層２０４を形成したが、この実施の形態５では、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第１，第２の補助電極層１０４，２０４をパターニングできるよう、図２６に示すように下基板１００の表面１０１に第１の凹部１０２を形成し、上基板２００の表面２０１に第２の凹部２０２を形成している。

[0087] 図２６～図３６は電子メガネ用レンズ１の製造方法を示す。

[0088] 図２６は製造工程がわかりやすくするために、完成したレンズ１を分解して図示したイメージ図で、下基板１００と上基板２００の間に電気素子としての液晶３００を内蔵している。４００は下基板１００と上基板２００を張り合わせしている接着層である。

[0089] 図２７と図２８は下基板１００の加工の工程を示している。

[0090] 図２７（ａ）では、図２８（ａ）に示すように下基板１００の上基板２００との対向面１０１に第１の凹部１０２と後に前記液晶４００が配置される電気素子形成部１０３を形成する。第１の凹部１０２は、下基板１００を樹脂成形する型に凸部を形成しておき、この凸部を転写することによって形成する。成型後に加工しても形成できる。おおよその寸法は幅０．５ｍｍ～２ｍｍ×長さ１０ｍｍ～２０ｍｍ程度であればよい。第１の凹部１０２の深さは数１０μｍ～数１００μｍ程度である。

[0091] 図２７（ｂ）では、図２８（ｂ）に示すように第１の凹部１０２に導電性インクでコーティングして第１の補助電極層１０４を形成する。第１の補助

電極層１０４の膜厚は１μｍ以上あればよい。具体的には、第１の凹部１０２に導電性インクとしてのＩＴＯインクを充填する。コーティング方法は、インクジェット、ディスペンサーを用いれば良い。下基板１００の表面１０１に形成された第１の凹部１０２の表面をＩＴＯインクでコーティングして第１の補助電極層１０４としているので、濡れ性の高いＩＴＯインクを使用した場合であっても下基板１００の所定位置に第１の補助電極層１０４を正確にパターニングできる。

[0092] また、第１の凹部１０２以外をテープなどによりマスキングした状態にてスピンコートやディッピングすることにより第１補助電極層１０４を形成することもできる。

[0093] 図２７（ｃ）では、図２８（ｃ）に示すように電気素子形成部１０３と第１の補助電極層１０４ならびに、第１の補助電極層１０４の上を覆うように電気素子形成部１０３と第１の補助電極層１０４を接続する下部電極パターン１０５を形成する。具体的には、電気素子形成部１０３と第１の凹部１０２をつなぐマスクパターンを用いてＩＴＯスパッタリングを行う。下部電極パターン１０５の膜厚は１０ｎｍ～４０ｎｍ程度である。

[0094] 図２７（ｄ）では、図２８（ｄ）に示すように電気素子形成部１０３と下部電極パターン１０５の上に下部絶縁層パターン１０６を形成する。具体的には、図２７（ｃ）でのＩＴＯスパッタ後、チャンバから下基板１００を取り出すことなく（大気開放することなく）SiO_2を連続的にスパッタする。一つのチャンバ内に複数のターゲットがあるスパッタ装置であれば実施が可能で、特殊な装置ではない。

[0095] 図２７（ｅ）では、液晶３００を注入する部分に配向膜１０７を塗布し、ラビング処理を行う。

[0096] 図２９と図３０は上基板２００の加工の工程を示している。

[0097] 図２９（ａ）では、図３０（ａ）に示すように上基板２００の下基板１００との対向面２０１に第２の凹部２０２を形成する。第２の凹部２０２は、上基板２００を樹脂成形する型に凸部を形成しておき、この凸部を転写する

ことによって形成する。成型後に加工しても形成できる。おおよその寸法は幅０．５ｍｍ～２ｍｍ×長さ１０ｍｍ～２０ｍｍ程度であればよい。第２の凹部２０２の深さは数１０μｍ～数１００μｍ程度である。

[0098] 図２９（ｂ）では、図３０（ｂ）に示すように第２の凹部２０２に導電性インクでコーティングして第２の補助電極層２０４を形成する。第２の補助電極層２０４の膜厚は１μｍ以上あればよい。具体的には、第２の凹部２０２に導電性インクとしてのＩＴＯインクを充填する。コーティング方法は、インクジェット、ディスペンサーを用いれば良い。上基板２００の表面２０１に形成された第２の凹部２０２の表面をＩＴＯインクでコーティングして第２の補助電極層２０４としているので、濡れ性の高いＩＴＯインクを使用した場合であっても上基板２００の所定位置に第２の補助電極層２０４を正確にパターニングできる。

[0099] また、第２の凹部２０２以外をテープなどによりマスキングした状態にてスピンコートやディッピングすることにより第２の補助電極層２０４を形成することによっても第２の補助電極層２０４を形成できる。

[0100] 図２９（ｃ）では、図３０（ｃ）に示すように下基板１００の側の電気素子形成部１０３に対応する部分２０３と第２の補助電極層２０４ならびに、第２の補助電極層２０４の上を覆うように前記部分２０３と第２の補助電極層２０４を接続する上部電極パターン２０５を形成する。具体的には、前記部分２０３と第２の凹部２０２をつなぐマスクパターンを用いてＩＴＯスパッタリングを行う。上部電極パターン２０５の膜厚は１０ｎｍ～４０ｎｍ程度である。

[0101] 図２９（ｄ）では、図３０（ｄ）に示すように上部電極パターン２０５の上に上部絶縁層パターン２０６を形成する。具体的には、図２９（ｃ）でのＩＴＯスパッタ後、チャンバ装置から上基板２００を取り出すことなく（大気開放することなく）SiO_2を連続的にスパッタする。一つのチャンバ内に複数のターゲットがあるスパッタ装置であれば実施が可能で、特殊な装置ではない。

[0102] 図２９（ｅ）では、上部電極パターン２０５のうちの前記部分２０３の上の個所に配向膜２０７を塗布し、ラビング処理を行う。

[0103] このようにして作製した下基板１００の電気素子形成部１０３と前記上基板２００との間に前記電気素子としての液晶３００を挟んで下基板１００と上基板２００を接着層４００によって貼り合わせる。具体的には、ディスペンサーやインクジェットなどにより液晶３００を注入する。この液晶３００の注入後、外周部分に接着剤（封止剤）を充填し、下基板１００と上基板２００を接着層４００によって貼り合わせる。

[0104] 図３１は貼り合わせた下基板１００と上基板２００を、第１の凹部１０２を通る位置で切り欠いた拡大斜視図を示す。図３２は図３１の要部の拡大図である。図３３は貼り合わせた下基板１００と上基板２００を、第２の凹部２０２を通る位置で切り欠いた拡大斜視図を示す。図３４は図３３の要部の拡大図である。

[0105] このように張り合わせが完了した下基板１００と上基板２００を、前記メガネフレーム１１のリム８の形状に応じて図１５と同様に切断線３０１で下基板１００と上基板２００をカットする。このときには、第１，第２の凹部１０２，２０２に掛かる位置でカットして、レンズ端部３０２に図３５に示すように第１，第２の凹部１０２，２０２の切断面を露出させる。この露出した第１，第２の凹部１０２，２０２の切断面には、図３６に示すように、下基板１００の側では、第１の補助電極層１０４と下部電極パターン１０５の端面が露出している。上基板２００の側では、第２の補助電極層２０４と上部電極パターン２０５の端面が露出している。

[0106] この図３５のレンズを用いて、図１８と図１９に示すようにメガネフレーム１１にレンズ１をセットすることで、電子メガネを構成することが出来る。

[0107] このようにして、前記制御部５から液晶３００を駆動するに必要な電圧をレンズ１の下部電極パターン１０５と上部電極パターン２０５の間に印加することができる。

[0108] また、第１，第２の凹部１０２，２０２に第１，第２の補助電極層１０４，２０４をコーティングしてから下部電極パターン１０５，上部電極パターン２０５を形成する工程を採用した場合には、下部電極パターン１０５，上部電極パターン２０５の上に、下部絶縁層パターン１０６，上部絶縁層パターン２０６を形成する工程を、前述のように、チャンバを大気開放して下基板１００，上基板２００を取り出すことなく連続的にスパッタして実施することができる。

[0109] 具体的には、第１，第２の凹部１０２，２０２に下部電極パターン１０５，上部電極パターン２０５を形成してから第１，第２の補助電極層１０４，２０４をコーティングする後付け処理工程を採用した場合には、第１，第２の凹部１０２，２０２に下部電極パターン１０５，上部電極パターン２０５をスパッタ形成して、スパッタ装置を大気開放して下基板１００、上基板２００を取り出しマスクパターンを変更してから下部絶縁層パターン１０６，上部絶縁層パターン２０６を形成する工法と、第１、第２の凹部１０２，２０２に下部電極パターン１０５上部電極パターン２０５をスパッタにより形成して、スパッタ装置を大気開放して下基板１００、上基板２００を取り出し第１の補助電極１０４、第２の補助電極２０４を形成した後に再びスパッタする工法がある。しかしながらいずれの工法においてもスパッタ装置の真空引きを二度行うことになって加工プロセスが複雑になる。

[0110] これに対してこの実施の形態の第１，第２の補助電極層１０４，２０４を先付け処理では、下基板１００への下部電極パターン１０５の形成と下部絶縁層パターン１０６の形成をスパッタ装置を大気開放することなく実施でき、上基板２００への上部電極パターン２０５の形成と上部絶縁層パターン２０６の形成をスパッタ装置を大気開放することなく実施できため、加工プロセスの簡略化が可能である。

[0111] さらに、図２０と図２１に示した場合と同様に、導電ペーストとしての銀ペースト３０３ａ，３０３ｂを第１の補助電極層１０４と第２の補助電極層２０４の上に付着させると、接触面積が増えるので、さらに良い点について

は、先の各実施の形態と同じである。

[0112] （実施の形態６）

実施の形態４では下基板１００の平滑な表面に第１の補助電極層１０４を形成し、上基板２００の平滑な表面に第２の補助電極層２０４を形成したが、この実施の形態６では、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第１，第２の補助電極層１０４，２０４をパターニングできるよう、図３７に示すように下基板１００の表面１０１に第１の凹部１０２を形成し、上基板２００の表面２０１に第２の凹部２０２を形成している。

[0113] 図３７～図４０は本発明の実施の形態６を示す。

[0114] 実施の形態５では、第１の凹部１０２に第１の補助電極層１０４をコーティングしてから下部電極パターン１０５を形成し、また、第２の凹部２０２に第２の補助電極層２０４をコーティングしてから上部電極パターン２０５を形成したが、この実施の形態６では、第１，第２の補助電極層１０４，２０４を後付けする点だけが異なっている。その他は実施の形態５と同じである。

[0115] 図３７は製造工程がわかりやすくするために、完成したレンズ１を分解して図示したイメージ図である。

[0116] 図３８（ａ）では、下基板１００の電気素子形成部１０３から第１の凹部１０２に掛けて下部電極パターン１０５を形成する。

[0117] 図３８（ｂ）では、第１の凹部１０２をコーティングしている下部電極パターン１０５の上にだけ導電性インクでコーティングして第１の補助電極層１０４を形成し、さらに第１の補助電極層１０４の上と下部電極パターン１０５と電気素子形成部１０３とを覆うように下部絶縁層パターン１０６を形成する。下部絶縁層パターン１０６の上には電気素子形成部１０３の位置に対応して図３７に示すように配向膜１０７を形成する。

[0118] この場合の上基板２００も図３８（ａ）（ｂ）と同様に形成する。つまり図３７に示すように、下基板１００の側の電気素子形成部１０３に対応する

部分と第２の凹部２０２ならびにこの両者をつなぐ部分に上部電極パターン２０５を形成し、その後に、第２の凹部２０２をコーティングしている上部電極パターン２０５の上にだけ導電性インクでコーティングして第２の補助電極層２０４を形成し、さらに第２の補助電極層２０４の上と上部電極パターン２０５とを覆うように上部絶縁層パターン２０６を形成する。さらに、配向膜２０７を形成する。

[0119] そして、第１の凹部１０２に下部電極パターン１０５に第１の補助電極層１０４を後付けした下基板１００と、第２の凹部２０２に上部電極パターン２０５に第２の補助電極層２０４を後付けした上基板２００との間に、液晶３００を挟んで接着層４００によって図３８（ｃ）のように貼り合わせる。図３９は貼り合わせた下基板１００と上基板２００を、第１の凹部１０２を通る位置で切り欠いた拡大斜視図を示す。図４０は貼り合わせた下基板１００と上基板２００を、第２の凹部２０２を通る位置で切り欠いた拡大断面図を示す。

[0120] このように第１，第２の凹部１０２，２０２に第１，第２の補助電極層１０４，２０４を後付けした場合であっても、図３５と同じように前記切断線３０１でカットすることによって、実施の形態５と同様にレンズ１のレンズ端部３０２に、下基板１００の側では、第１の補助電極層１０４と下部電極パターン１０５の端面が露出し、上基板２００の側では、第２の補助電極層２０４と上部電極パターン２０５の端面が露出する。その他は実施の形態５と同じである。

[0121] この実施の形態６の場合には、第１の凹部１０２に設けた下部電極パターン１０５の窪みに第１の補助電極層１０４を形成し、第２の凹部２０２に設けた上部電極パターン２０５の窪みに第２の補助電極層２０４を形成しているので、濡れ性の高いＩＴＯインクを使用した場合であっても下基板１００と上基板２００の所定位置に第１，第２の補助電極層１０４，２０４を正確にパターニングできる。

[0122] また、下部絶縁パターン１０６と上部絶縁パターン２０６は全面に形成す

れば良いため、マスクを用いずにスパッタにより絶縁層を形成できる。

[0123] （実施の形態７）

実施の形態４では下基板１００に第１の補助電極層１０４を形成してから下部絶縁層パターン１０６を形成し、上基板２００に第２の補助電極層２０４を形成してから上部絶縁層パターン２０６を形成したが、下部絶縁層パターン１０６には孔１０６ｂ（図４１を参照）を形成し、上部絶縁層パターン２０６には孔２０６ｂ（図４１を参照）を形成するとともに、第１の補助電極層１０４よりも下部絶縁層パターン１０６を先に形成し、第２の補助電極層２０４よりも上部絶縁層パターン２０６を先に形成する点だけが異なっている。

[0124] この実施の形態７では、下部電極パターン１０５の上に形成された下部絶縁層パターン１０６の孔１０６ｂに導電性インクを入れて下部電極パターン１０５の一部をコーティングするので、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第１の補助電極層１０４をパターニングできる。同様に、上部電極パターン２０５の上に形成された上部絶縁層パターン２０６の孔２０６ｂに導電性インクを入れて上部電極パターン２０５の一部をコーティングするので、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第２の補助電極層２０４をパターニングできる。その他は実施の形態４と同じである。

[0125] （実施の形態８）

実施の形態６では下基板１００に第１の補助電極層１０４を形成してから下部絶縁層パターン１０６を形成し、上基板２００に第２の補助電極層２０４を形成してから上部絶縁層パターン２０６を形成したが、下部絶縁層パターン１０６には孔１０６ｂ（図４２を参照）を形成し、上部絶縁層パターン２０６には孔２０６ｂ（図４２を参照）を形成するとともに、第１の補助電極層１０４よりも下部絶縁層パターン１０６を先に形成し、第２の補助電極層２０４よりも上部絶縁層パターン２０６を先に形成する点だけが異なっている。

[0126] この実施の形態８では、下部電極パターン１０５の上に形成された下部絶縁層パターン１０６の孔１０６ｂに導電性インクを入れて下部電極パターン１０５の一部をコーティングするので、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第１の補助電極層１０４をパターニングできる。同様に、上部電極パターン２０５の上に形成された上部絶縁層パターン２０６の孔２０６ｂに導電性インクを入れて上部電極パターン２０５の一部をコーティングするので、濡れ性の高いＩＴＯインクを使用した場合であっても正確に所定位置に第２の補助電極層２０４をパターニングできる。その他は実施の形態６と同じである。

[0127] 上記の実施の形態５，実施の形態６，実施の形態８では、第１，第２の凹部１０２，２０２を設けたため、濡れ性の高いインクを所定位置にパターニングすることができ、上下基板の貼り合わせ面へ導電性インクとしてのＩＴＯインクがはみ出さないようにできる。

[0128] さらに、実施の形態３，実施の形態４，実施の形態７のように第１，第２の凹部１０２，２０２を設けずに下基板１００，上基板２００の面に直接にパターニングを行った場合には、導電性インクとしてのＩＴＯインクの膜厚のために上下基板の貼り合わせにおいてギャップが発生しレンズ１の歪みを発生させてしまうが、実施の形態５，実施の形態６，実施の形態８ではより歪み少ない良好なレンズ１を作製できる。

[0129] 実施の形態５，実施の形態６，実施の形態８において、第１，第２の凹部１０２，２０２の断面形状が平面により構成される場合は、面と面の交わる直線部にインクが溜まりやすく、平面部分よりインク膜厚が厚い部分が形成されてしまう。このような液の溜まり易い部分においては、乾燥状態の相違からか導電性インクとしてのＩＴＯインク膜の表面に割れ（クラック）が発生しやすく、ＩＴＯインクにより形成される透明導電膜の抵抗値を増加させる要因となる。この問題を解決するために、実施の形態５，実施の形態６，実施の形態８の第１，第２の凹部１０２，２０２の断面形状を曲面に形成している。第１，第２の凹部１０２，２０２の断面形状を曲面に形成せずに面

と面の接合で形成する場合には、面と面の交わる部分にはR加工を行うことによって、ほぼ同様の効果を期待できる。

[0130] 上記の実施の形態３～実施の形態８では、透明の第１，第２の補助電極層１０４，２０４を導電性インクとしてのＩＴＯインクのコーティングによって形成し、透明の下部電極パターン１０５と上部電極パターン２０５をスパッタリングで形成したが、下部電極パターン１０５と上部電極パターン２０５の形成方法は、スパッタリング以外の蒸着方法であっても同様に実施できる。スパッタリング以外の蒸着方法としては、抵抗加熱蒸着，電子ビーム蒸着，分子線エピタキシー法（Molecular Beam Epitaxy），イオンメッキ（ion plating），イオンビームデポジションなどのＰＶＤ（Physical Vapor Deposition）や、熱ＣＶＤ（thermal Chemical Vapor Deposition），プラズマＣＶＤ（plasma-enhanced chemical vapor deposition），光ＣＶＤ，エピタキシャルＣＶＤ，アトミックレイヤーＣＶＤなどのＣＶＤを挙げることができる。

[0131] また、透明な第１，第２の補助電極層１０４，２０４、下部電極パターン１０５，上部電極パターン２０５の材料として、ＩＴＯ（酸化インジウムスズ）の場合を例に挙げて説明したが、チタンを主成分としてインジウムを含まないニオブ添加二酸化チタン（$Ti_{1-x}Nb_xO_2$：ＴＮＯ）、ＺｎＯなどをＩＴＯ代替透明電極材料として使用することもできる。

[0132] 上記の実施の形態３～実施の形態８では、下部絶縁層パターン１０６と上部絶縁層パターン２０６が設けられていたが、接着層４００の単独によって下部電極パターン１０５と上部電極パターン２０５との電気絶縁を維持することができる場合には、下部絶縁層パターン１０６と上部絶縁層パターン２０６の少なくとも一方を省くことができる。

産業上の利用可能性

[0133] 本発明にかかる電子メガネは、電気回路の接続を確実に行い、その信頼性を向上するものであり、液晶素子、エレクトロクロミック素子などの電気素子が用いられるメガネ、サングラスなどに有用である。

請求の範囲

[1] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、

前記第１の凹部に導電性インクでコーティングして透明の第１の補助電極層を形成し、

前記下基板の電気素子形成部と前記第１の補助電極層ならびに電気素子形成部と前記第１の補助電極層を接続する透明の下部電極パターンを蒸着法にて形成し、

上基板の作製は、

上基板の前記下基板との対向面にレンズ部電極パッド用の第２の凹部を形成し、

前記第２の凹部に導電性インクでコーティングして透明の第２の補助電極層を形成し、

前記上基板の前記電気素子形成部に対応する部分と前記第２の補助電極層ならびに前記電気素子形成部に対応する部分と前記第２の補助電極層を接続する透明の上部電極パターンを蒸着法にて形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[2] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、

前記下基板の電気素子形成部と前記第１の凹部ならびに電気素子形成部と前記第１の凹部を接続する下部電極パターンを形成し、

前記第１の凹部の前記下部電極パターンの上を導電性インクでコーティン

グして透明の第１の補助電極層を形成し、

上基板の作製は、

前記上基板の前記電気素子形成部に対応する部分とレンズ部電極パッド用の第２の凹部ならびに前記電気素子形成部に対応する部分と前記第２の凹部を接続する透明の上部電極パターンを蒸着法にて形成し、

前記第２の凹部の前記上部電極パターンの上を導電性インクでコーティングして透明の第２の補助電極層を形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[3] 前記下基板と前記上基板を貼り合わせた後に、前記第１，第２の凹部に掛かる位置でカットして、レンズ端部に前記第１，第２の凹部の切断面を露出させる

請求項１または請求項２記載の電子メガネ用レンズの製造方法。

[4] 前記下基板と前記上基板を貼り合わせた後に、前記第１，第２の凹部に掛かる位置でカットして、レンズ端部に前記第１，第２の凹部の切断面を露出させ、

露出した前記第１，第２の凹部にそれぞれ導電性ペーストを形成して、第１の補助電極層と下部電極パターンの引き出し電極としてのレンズ部電極パッド，第２の補助電極層と上部電極パターンの引き出し電極としてのレンズ部電極パッドを形成する

請求項１または請求項２記載の電子メガネ用レンズの製造方法。

[5] ２枚の基板の間に電気素子を内蔵したレンズであって、

前記電気素子に電圧を印加する電極の一端のレンズ部電極パッドがレンズ端部において露出し、かつ前記レンズ部電極パッドが、前記２枚の基板のうちの一方の基板の他方の基板との貼り合わせ面に形成された凹部の内部に、導電性インクで形成した補助電極層と蒸着法で形成した下部電極パターンとの積層によって形成された電極が形成されている

電子メガネ用レンズ。

[6] 前記凹部の前記レンズ端部において露出した形状が、曲面に形成されている

請求項５記載の電子メガネ用レンズ。

[7] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

下基板の前記上基板との対向面に導電性インクでコーティングしてレンズ部電極パッド用の透明の第１の補助電極層を形成し、

前記下基板の電気素子形成部と前記第１の補助電極層ならびに電気素子形成部と前記第１の補助電極層を接続する透明の下部電極パターンを蒸着法にて形成し、

上基板の作製は、

上基板の前記下基板との対向面に導電性インクでコーティングして前記レンズ部電極パッド用の透明の第２の補助電極層を形成し、

前記上基板の前記電気素子形成部に対応する部分と前記第２の補助電極層ならびに前記電気素子形成部に対応する部分と前記第２の補助電極層を接続する透明の上部電極パターンを蒸着法にて形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[8] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

前記下基板の電気素子形成部に信号を印加する透明の下部電極パターンを蒸着法にて形成し、

前記下部電極パターンの端部の上を導電性インクでコーティングして透明の第１の補助電極層を形成し、

上基板の作製は、

前記上基板の前記電気素子形成部に対応する部分に信号を印加する透明の

上部電極パターンを蒸着法にて形成し、

前記上部電極パターンの端部の上を導電性インクでコーティングして透明の第２の補助電極層を形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[9] 前記下基板と前記上基板を貼り合わせた後に、前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分に掛かる位置でカットして切断面を露出させる

請求項７または請求項８記載の電子メガネ用レンズの製造方法。

[10] 前記下基板と前記上基板を貼り合わせた後に、前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分に掛かる位置でカットして切断面を露出させ、

露出した前記前記第１の補助電極層と前記下部電極パターンとの積層部分、前記第２の補助電極層と前記上部電極パターンとの積層部分にそれぞれ導電性ペーストを形成して、前記第１の補助電極層と前記下部電極パターンの引き出し電極としてのレンズ部電極パッド，前記第２の補助電極層と前記上部電極パターンの引き出し電極としてのレンズ部電極パッドを形成する

請求項７または請求項８記載の電子メガネ用レンズの製造方法。

[11] ２枚の基板の間に電気素子を内蔵したレンズであって、

前記電気素子に電圧を印加する電極の一端がレンズ端部において露出し、かつ前記電極の一端が導電性インクで形成した補助電極層と蒸着法で形成した下部電極パターンとの積層によって形成されている

電子メガネ用レンズ。

[12] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

前記下基板の電気素子形成部に信号を印加する透明の下部電極パターンを蒸着法にて形成し、

前記下基板の電気素子形成部と下部電極パターンの上で後に第１の補助電極層が形成される部分を除いて下部絶縁層パターンを形成し、

前記下部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第１の補助電極層を形成し、

上基板の作製は、

前記上基板の前記電気素子形成部に対応する部分に信号を印加する透明の上部電極パターンを蒸着法にて形成し、

前記上基板の前記電気素子形成部に対応する部分と上部電極パターンで後に第２の補助電極層が形成される部分を除いて上部絶縁層パターンを形成し、

前記上部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第２の補助電極層を形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[13] 下基板と上基板の間に電気素子を内蔵したレンズを作製するに際し、

下基板の作製は、

下基板の前記上基板との対向面にレンズ部電極パッド用の第１の凹部を形成し、

前記下基板の電気素子形成部と前記第１の凹部ならびに電気素子形成部と前記第１の凹部を接続する下部電極パターンを形成し、

前記下基板の電気素子形成部と下部電極パターンの上で後に第１の補助電極層が形成される部分を除いて下部絶縁層パターンを形成し、

前記下部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第１の補助電極層を形成し、

上基板の作製は、

前記上基板の前記電気素子形成部に対応する部分とレンズ部電極パッド用の第２の凹部ならびに前記電気素子形成部に対応する部分と前記第２の凹部

を接続する透明の上部電極パターンを蒸着法にて形成し、

前記上基板の前記電気素子形成部に対応する部分と上部電極パターンの上で後に第２の補助電極層が形成される部分を除いて上部絶縁層パターンを形成し、

前記上部絶縁層パターンの孔に導電性インクを入れてコーティングして透明の第２の補助電極層を形成し、

前記下基板の電気素子形成部と前記上基板との間に電気素子を挟んで前記下基板と前記上基板を貼り合わせる

電子メガネ用レンズの製造方法。

[14] 電気素子を内蔵したレンズをメガネフレームにセットした電子メガネであって、

前記レンズは、レンズ端部に前記電気素子に電圧を印加する電極の一端のレンズ部電極パッドが露出しており、

前記メガネフレームは、前記電気素子を制御する制御部に一端が接続され、他端の配線部電極パッドが前記レンズの前記レンズ部電極パッドに対応した位置に配置された電気接続手段を有しており、

前記電気接続手段の前記配線部電極パッドと前記レンズの前記レンズ部電極パッドとの間に異方導電性ゴムが介在している

電子メガネ。

[15] 前記メガネフレームのリムの内側に前記電気接続手段が位置するリム側ザグリを設け、

前記レンズのレンズ端部に前記異方導電性ゴムが位置するレンズ側ザグリを設けた

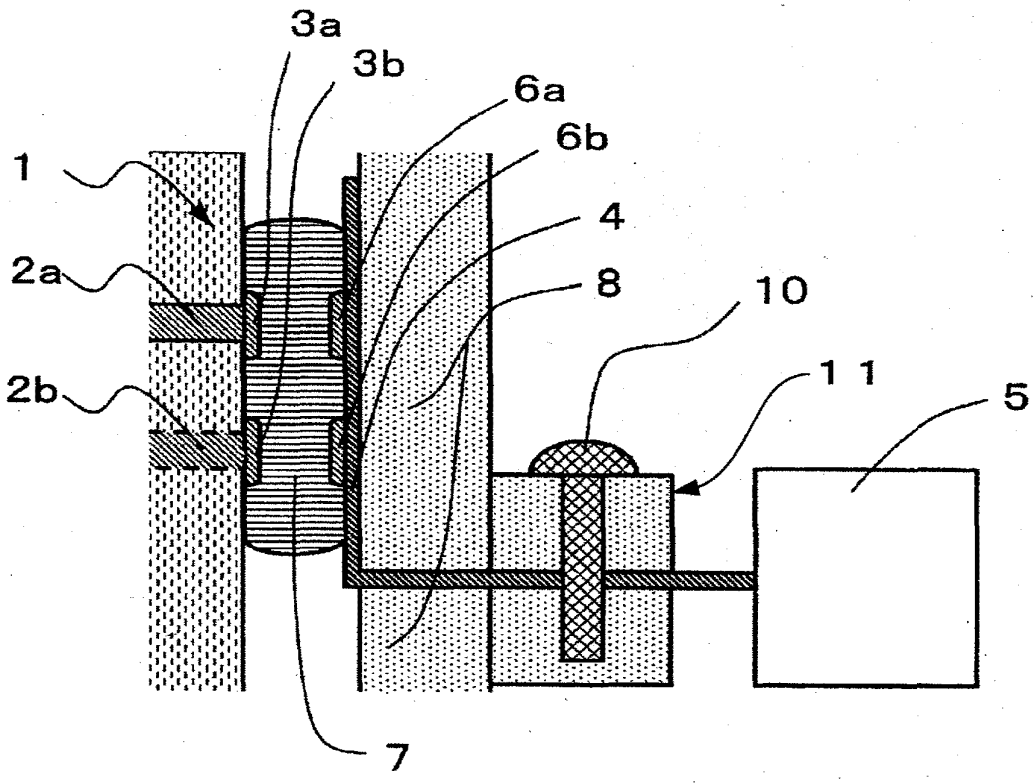
請求項１４記載の電子メガネ。

[16] 前記電気接続手段を、前記メガネフレームのリムロックの間を通りリムの内側に敷設し、

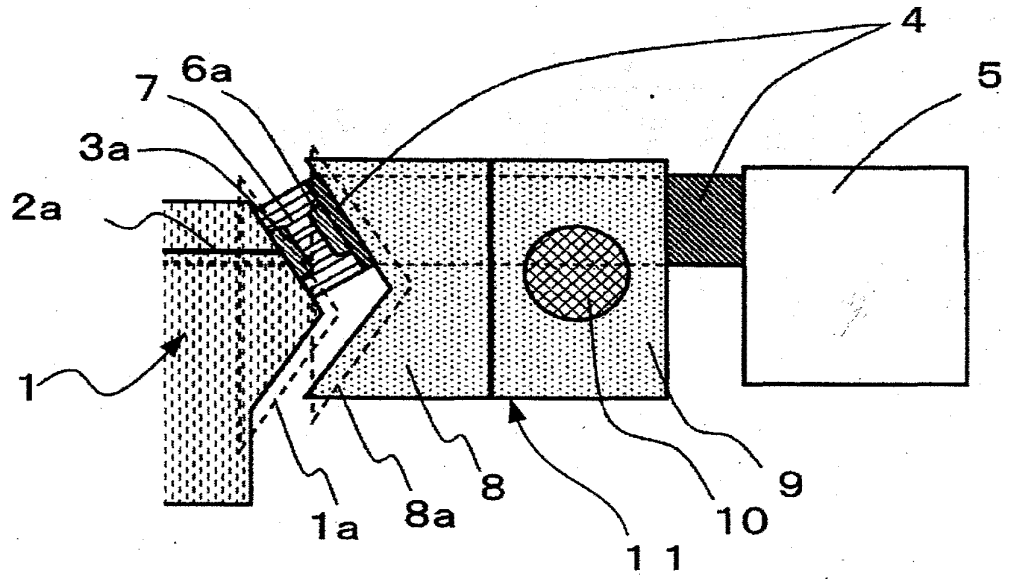
前記メガネフレームの前記リムの内側に配線部電極パッドを設置した

請求項１４または請求項１５記載の電子メガネ。

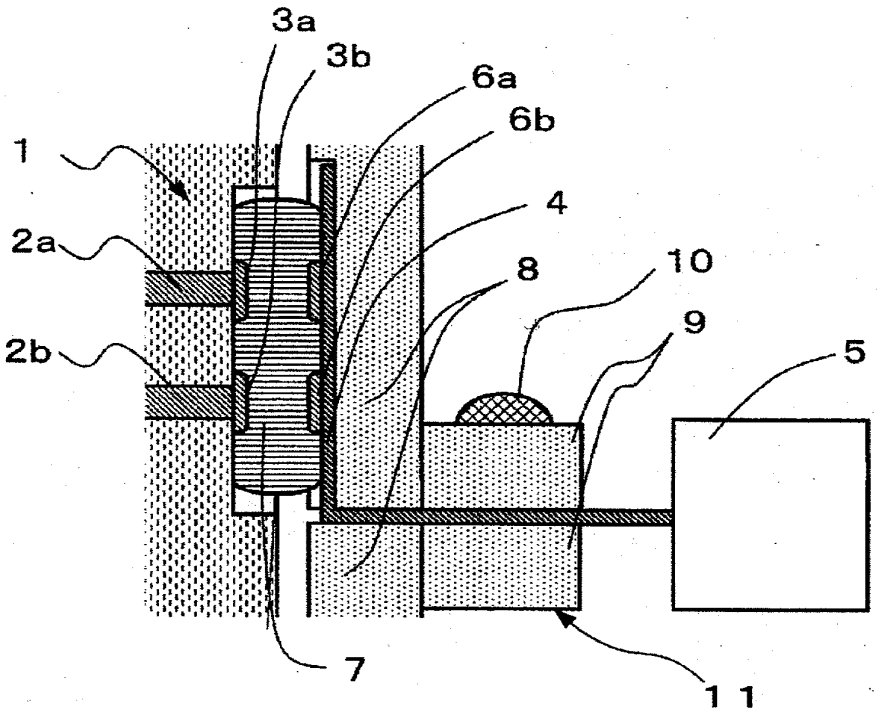
[図1]



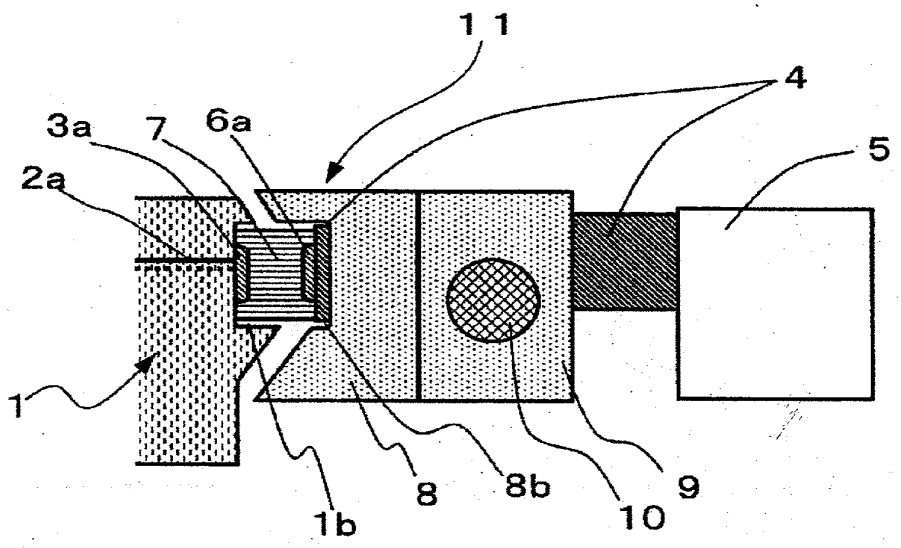
[図2]



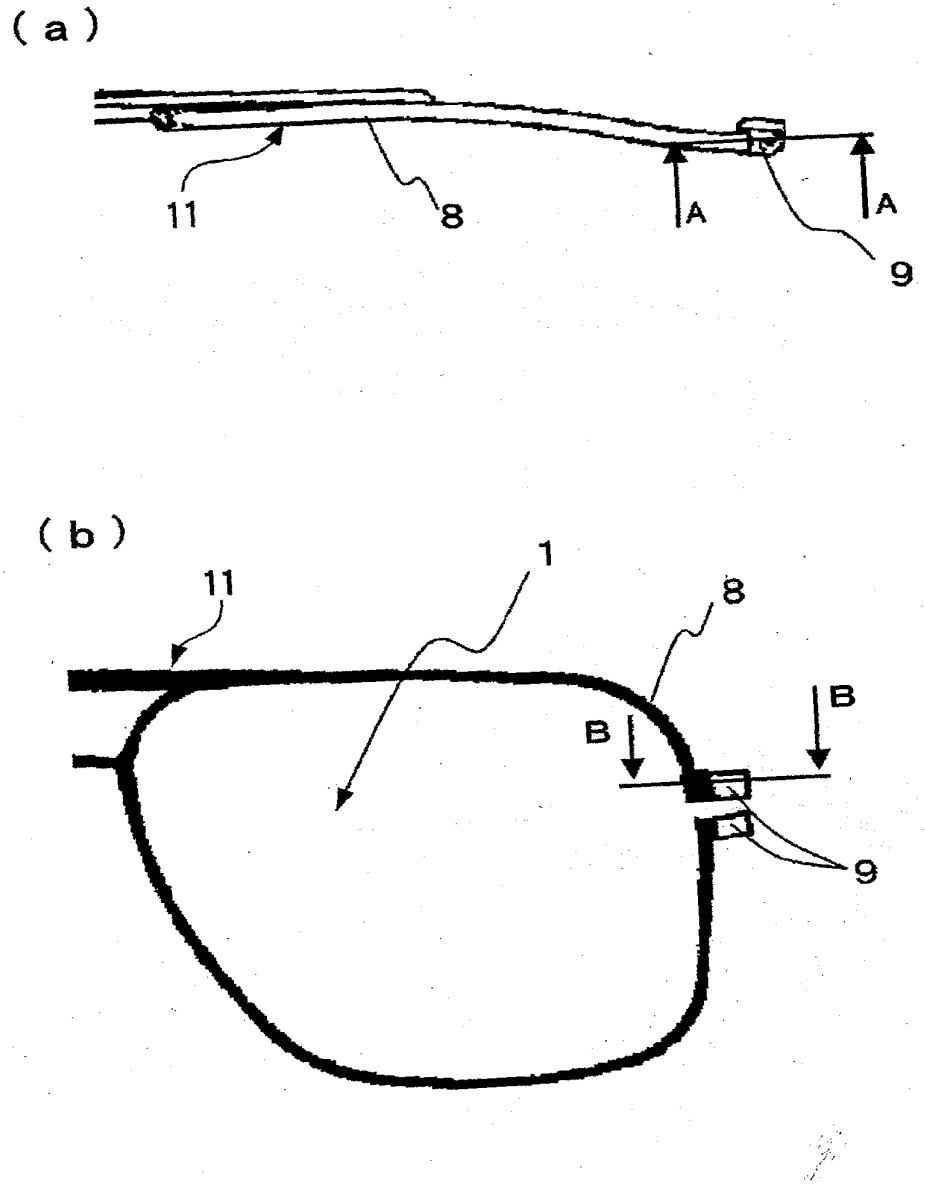
[図3]



[図4]

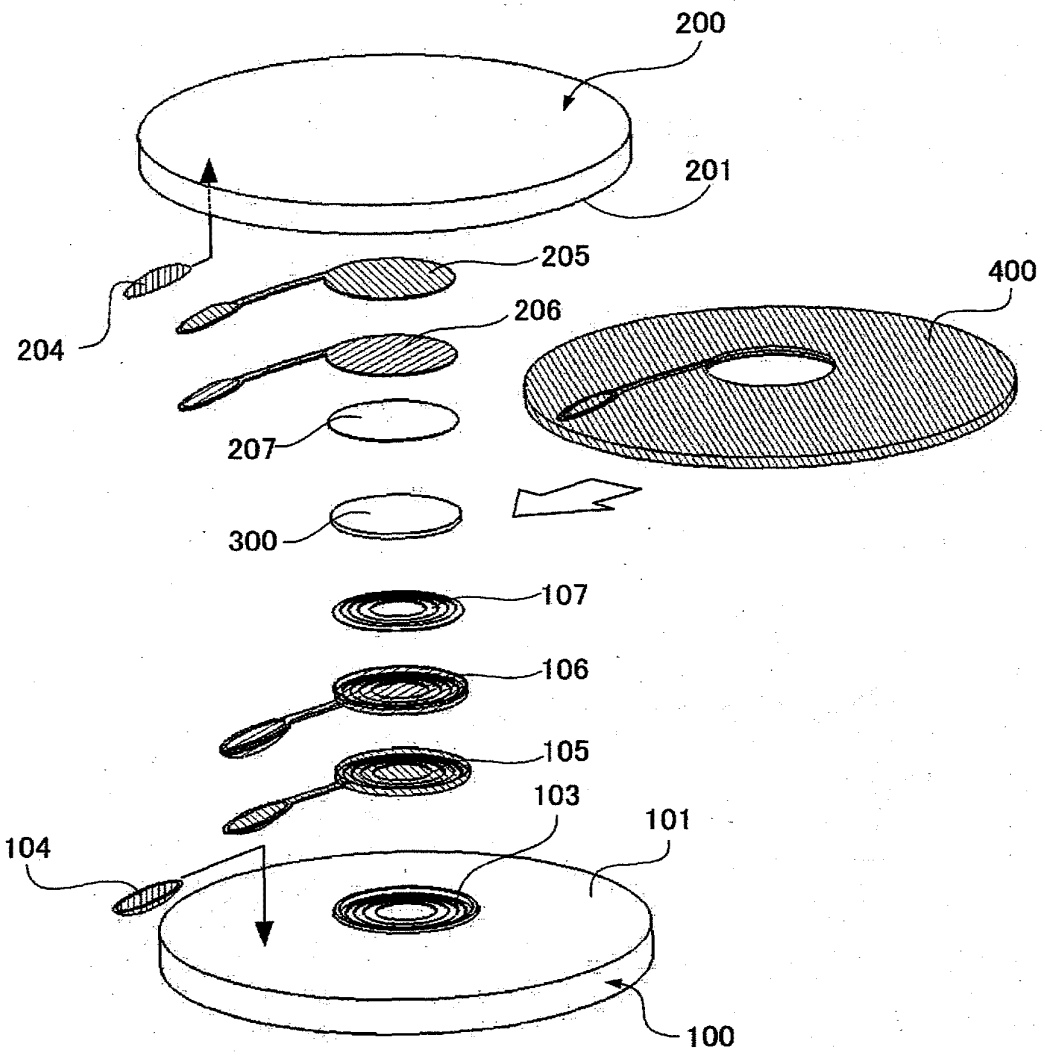


[図5]

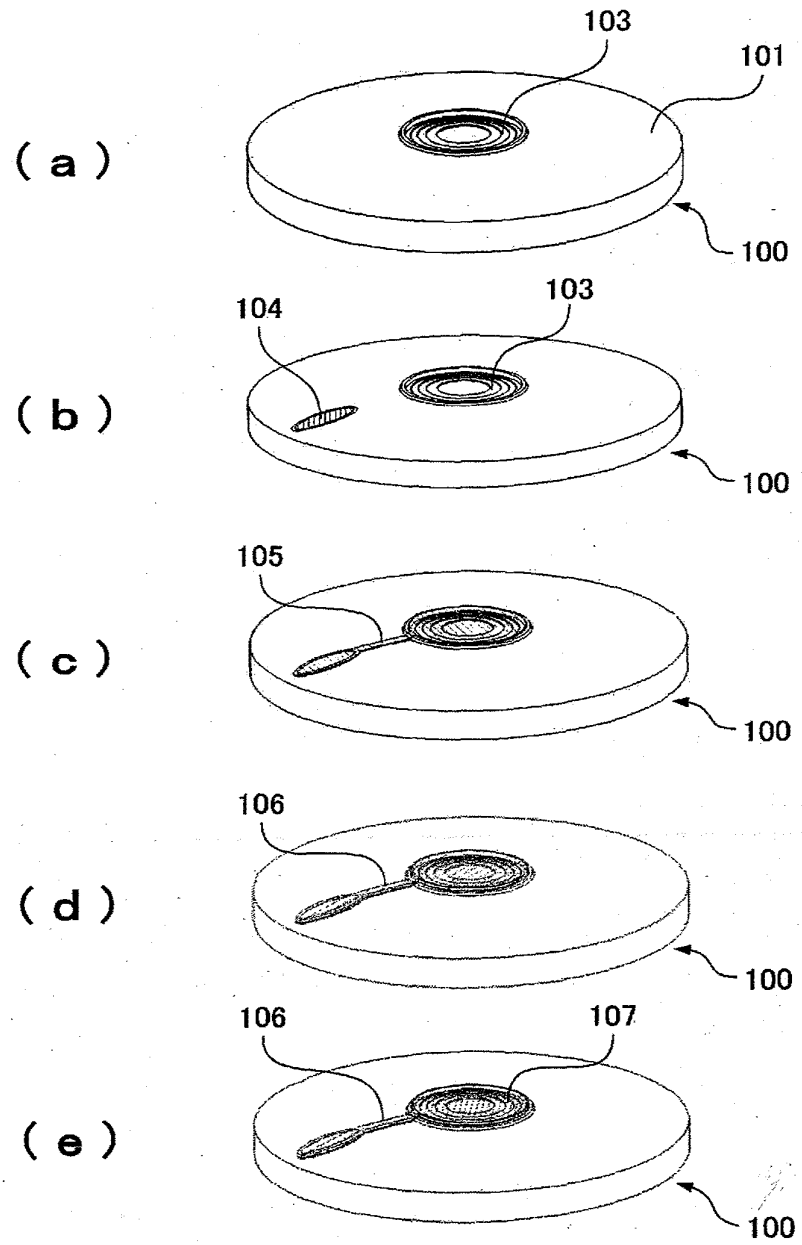


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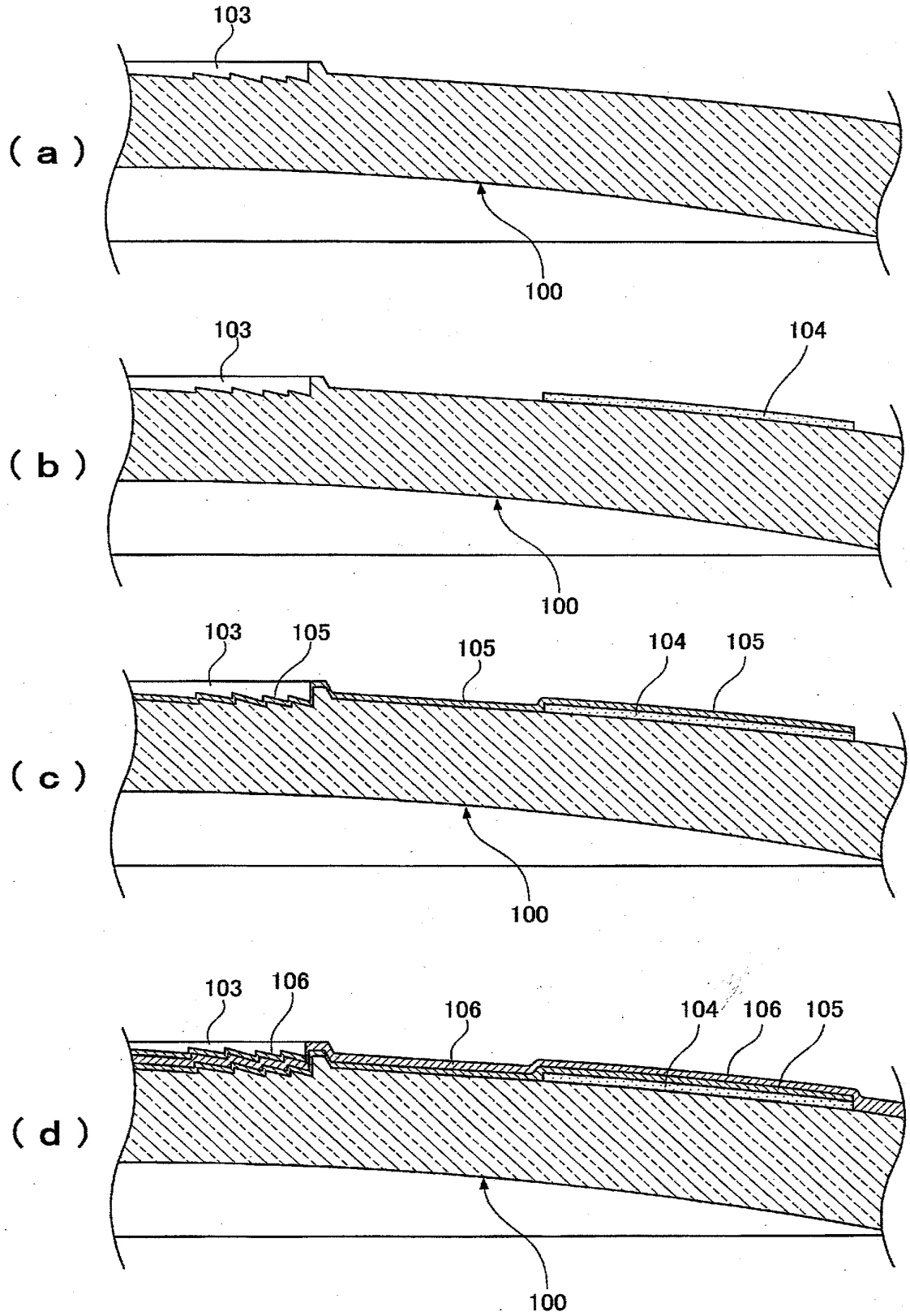
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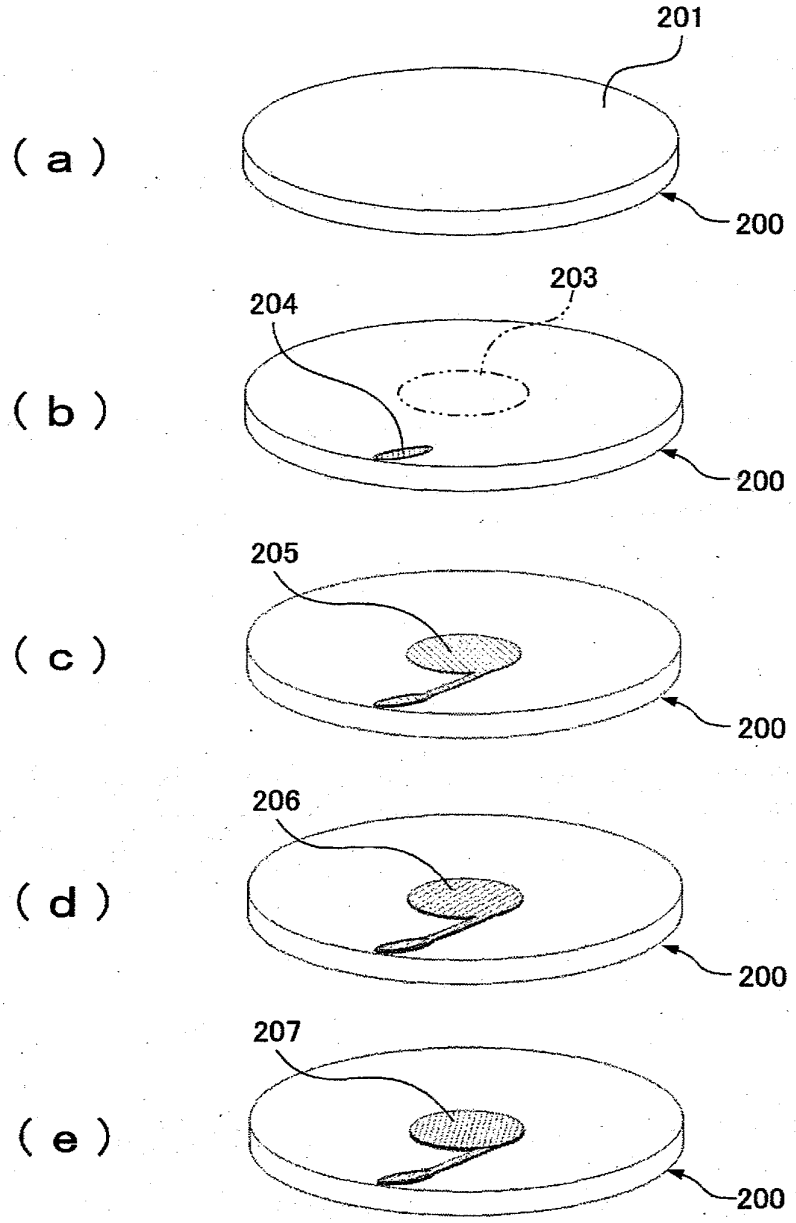
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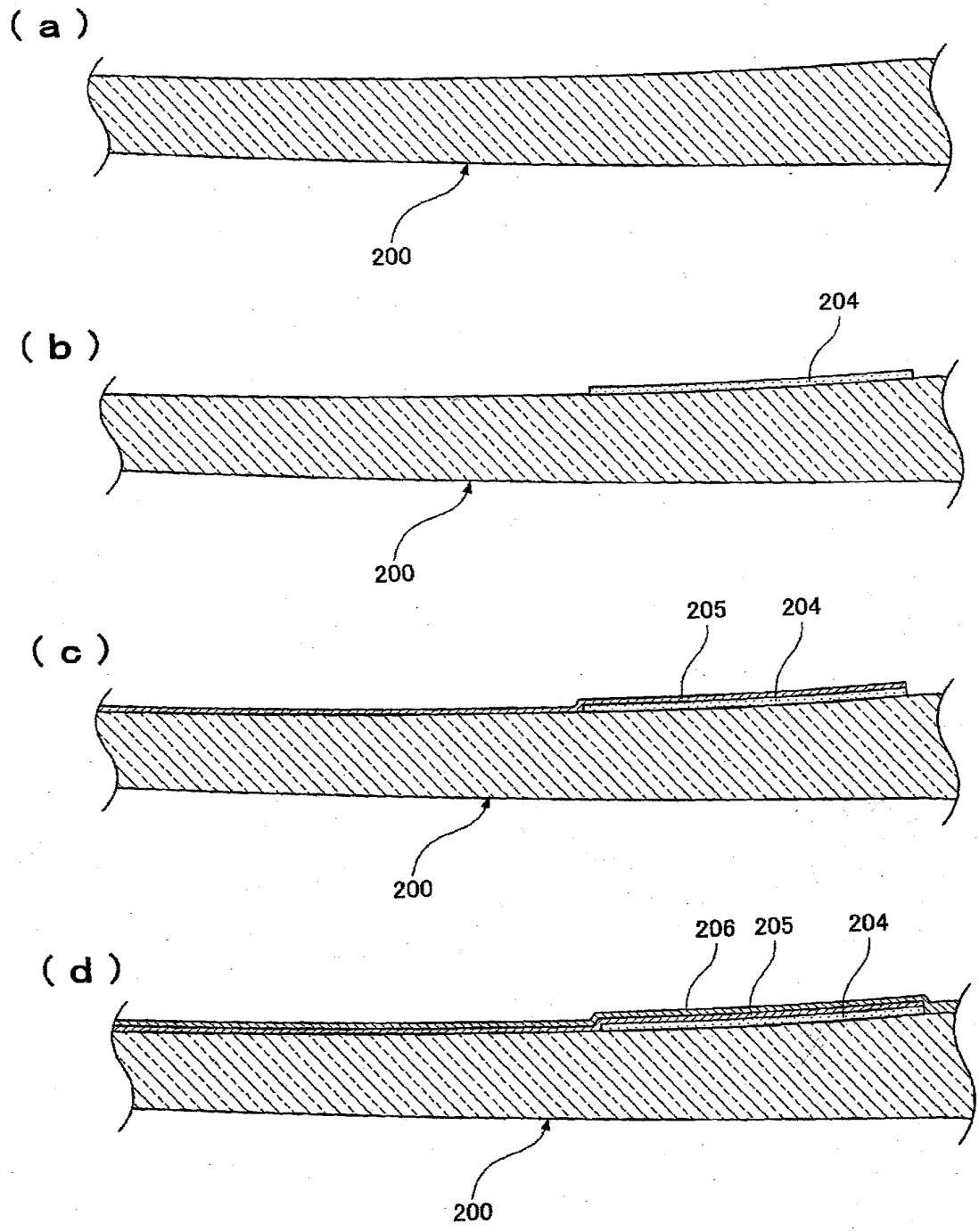
[図8]


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[図9]

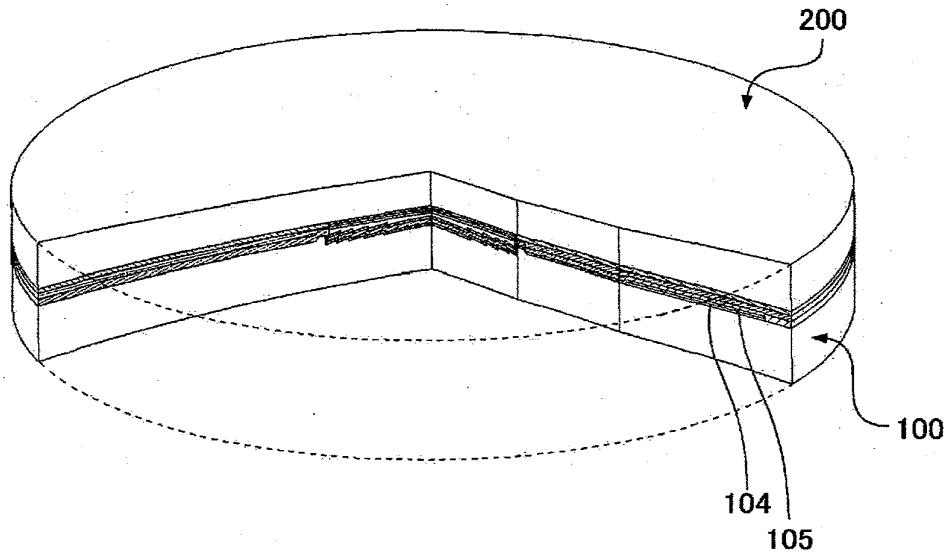


[図10]

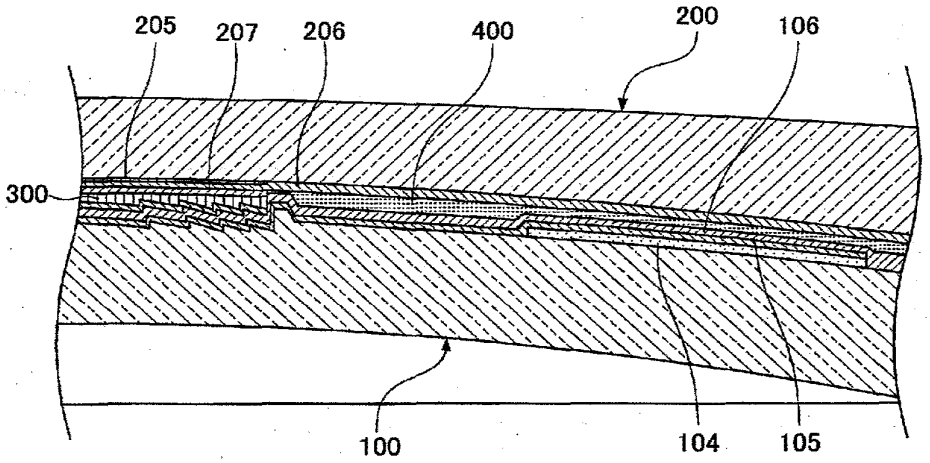


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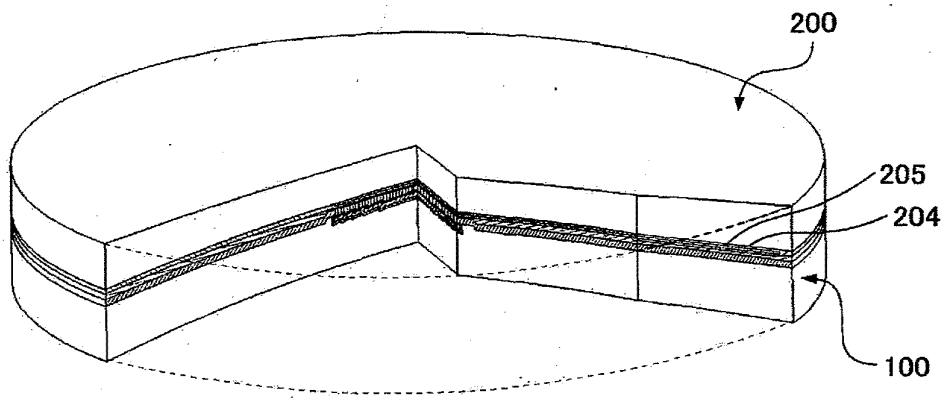
[図11]


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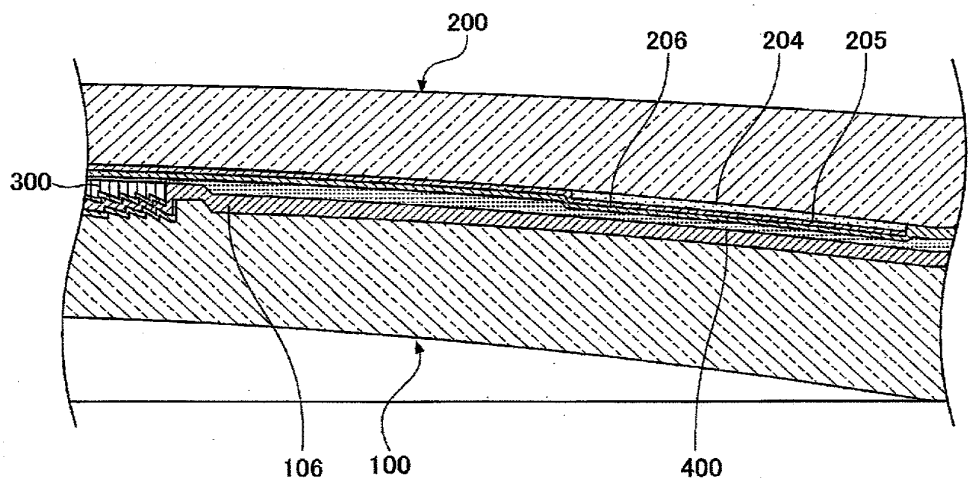
[図12]


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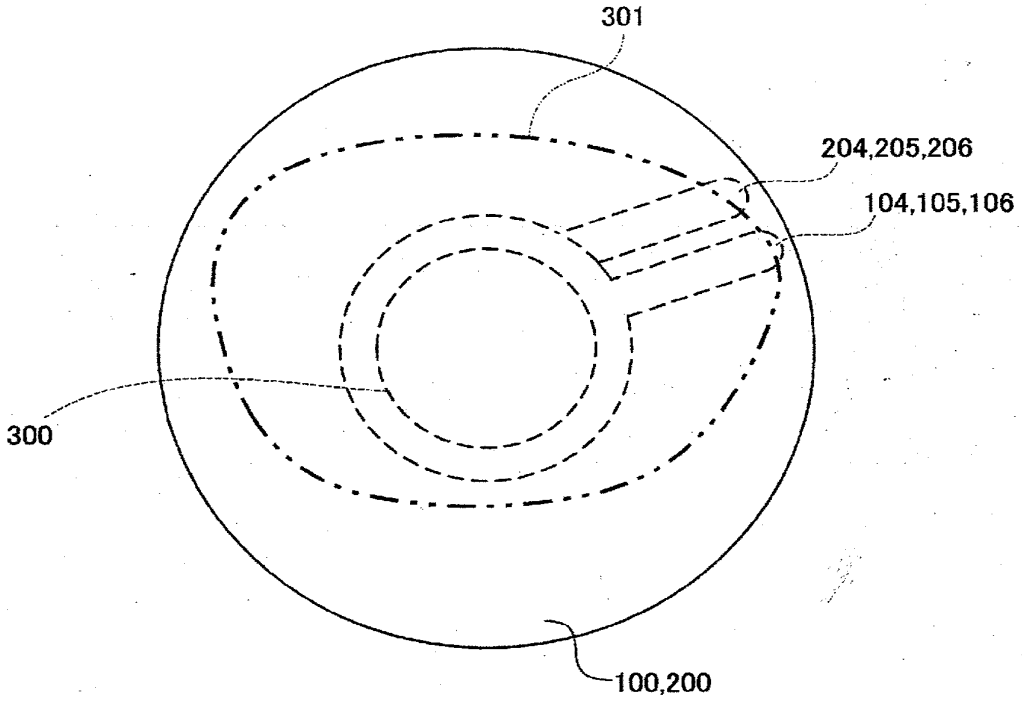
[図13]


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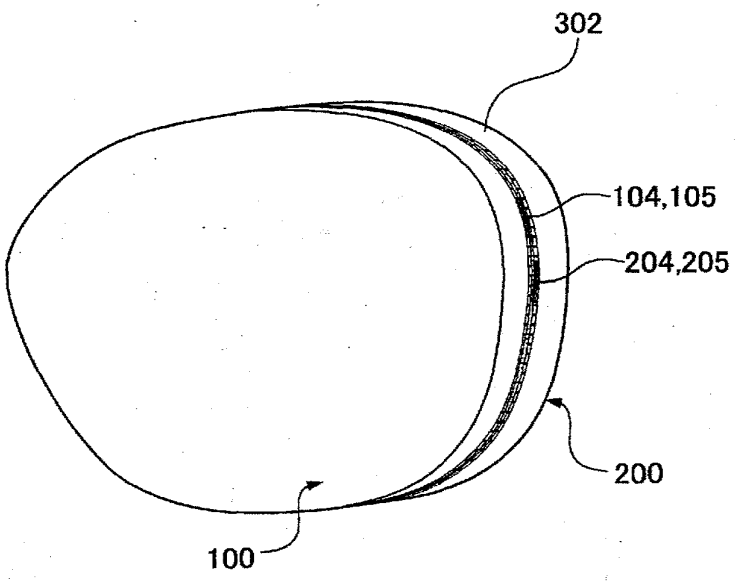
[図14]


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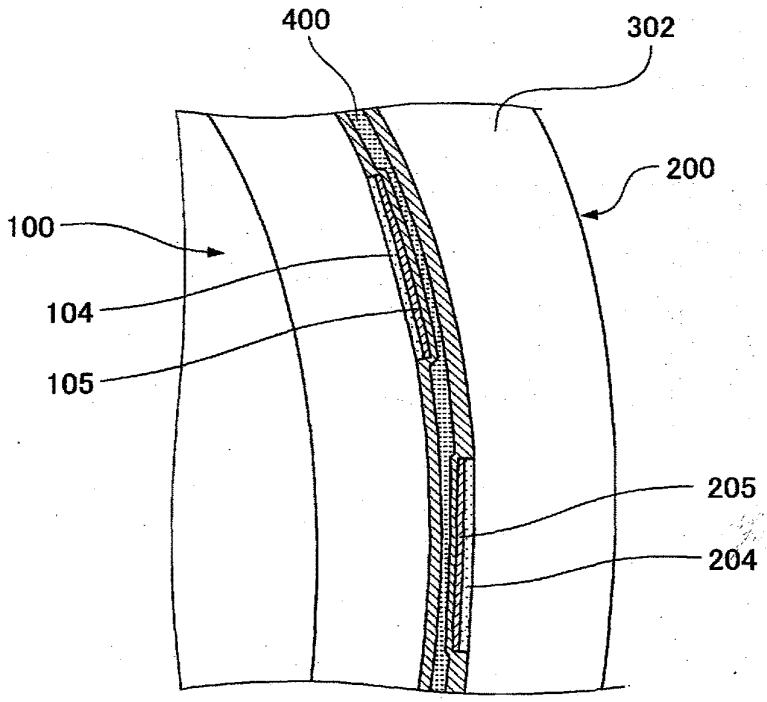
[図15]


301
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100,200

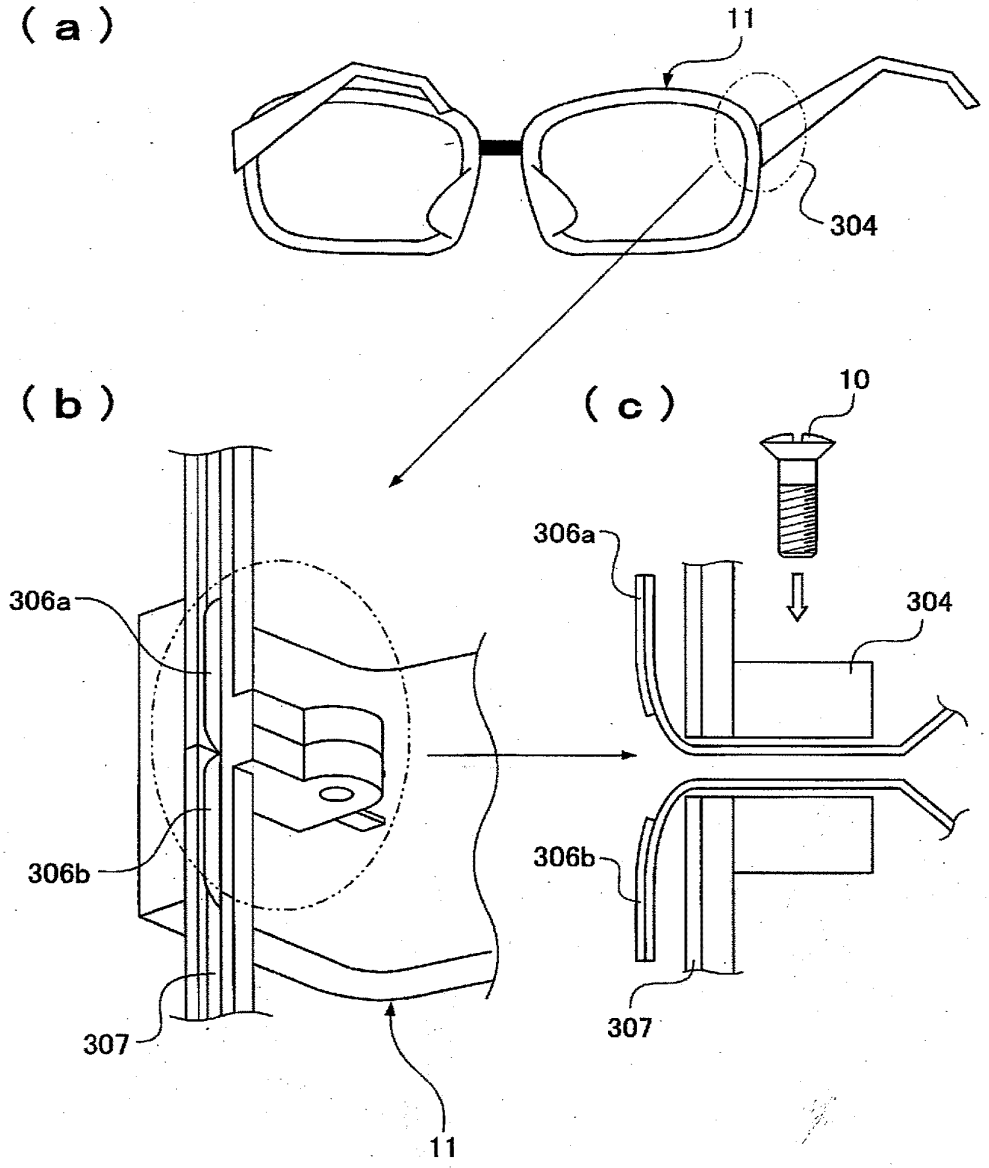
[図16]



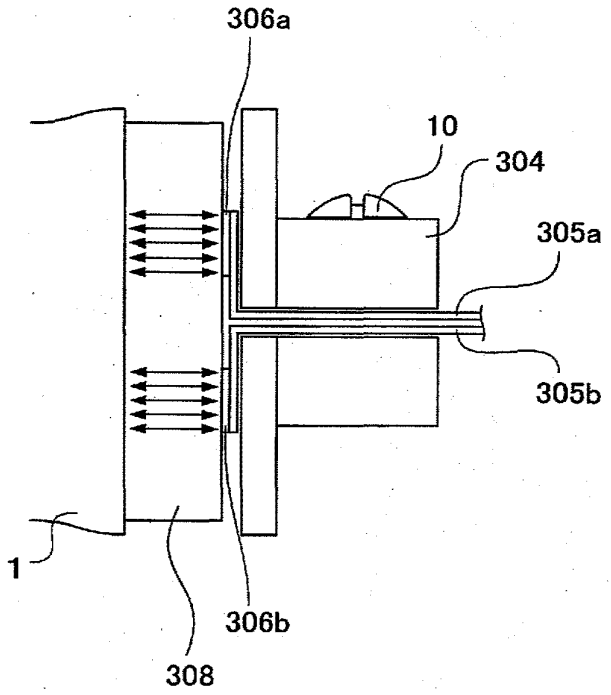
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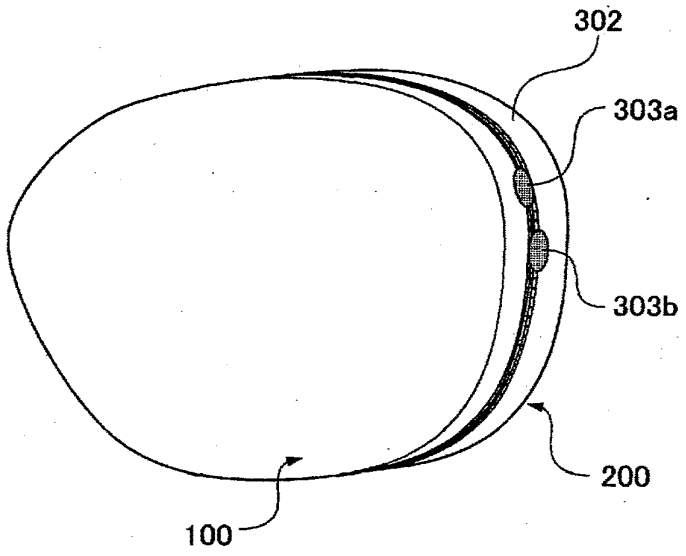
[図18]



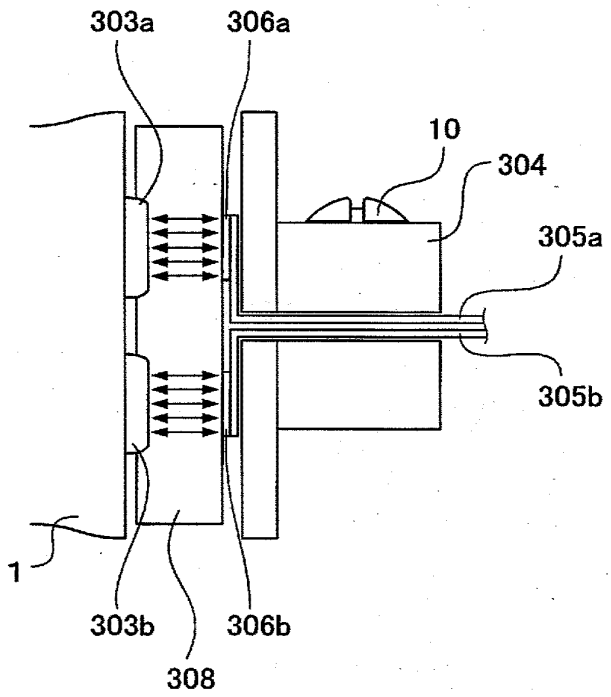
[図19]



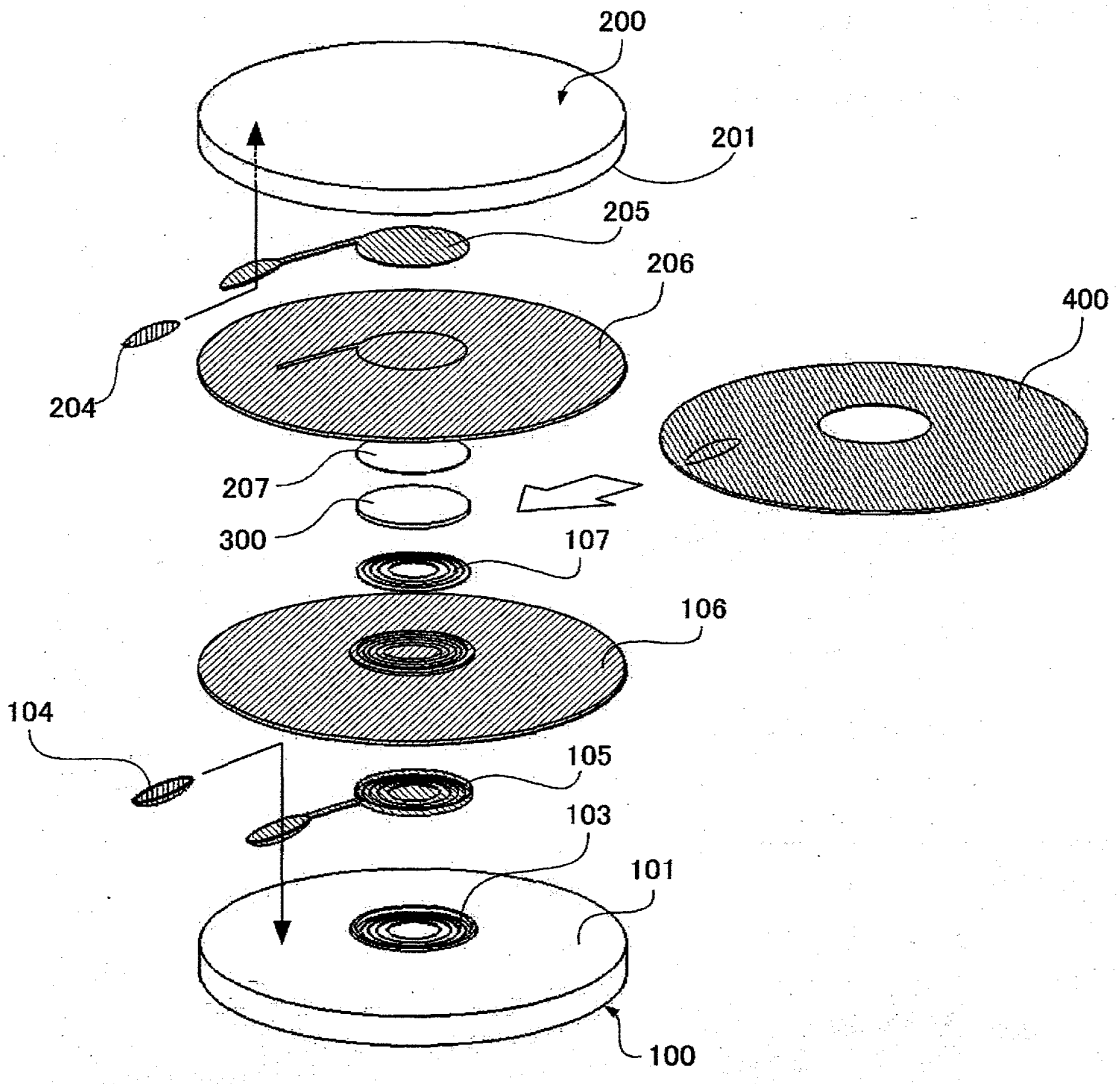
[図20]



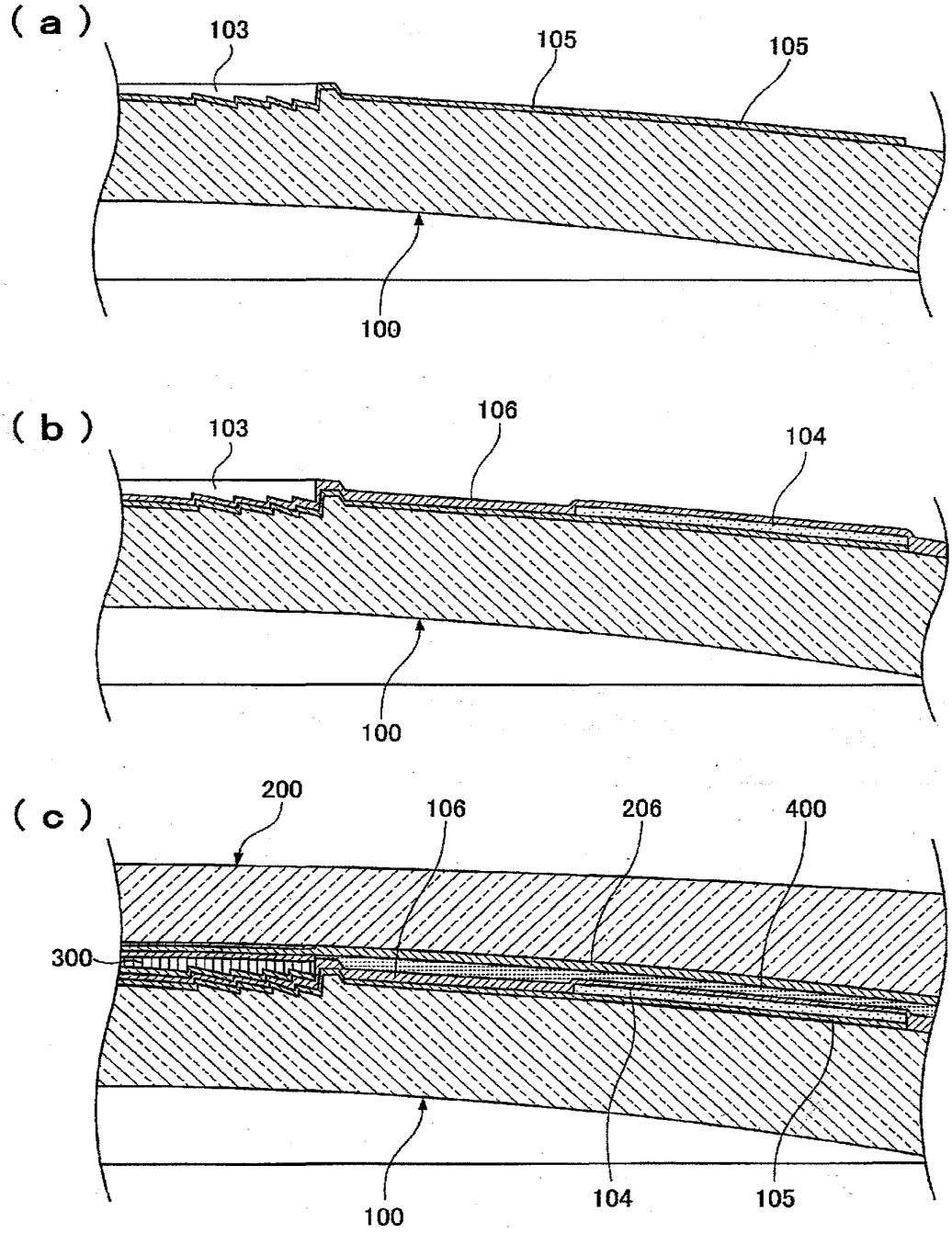
[図21]



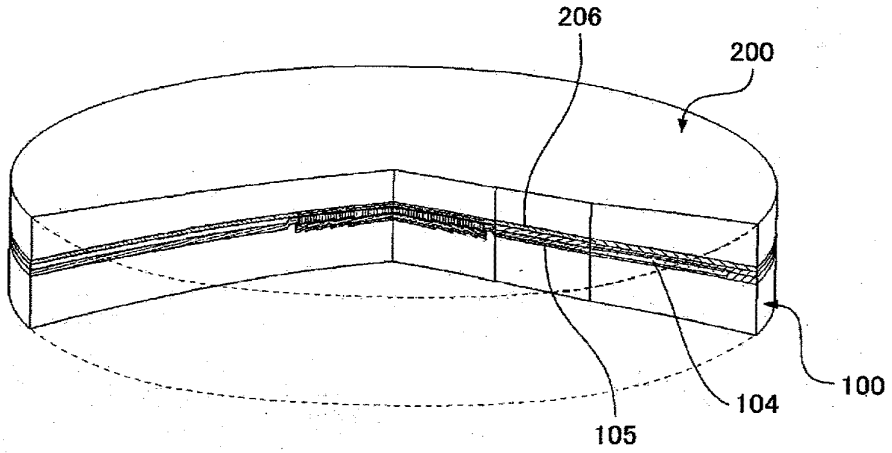
[図22]



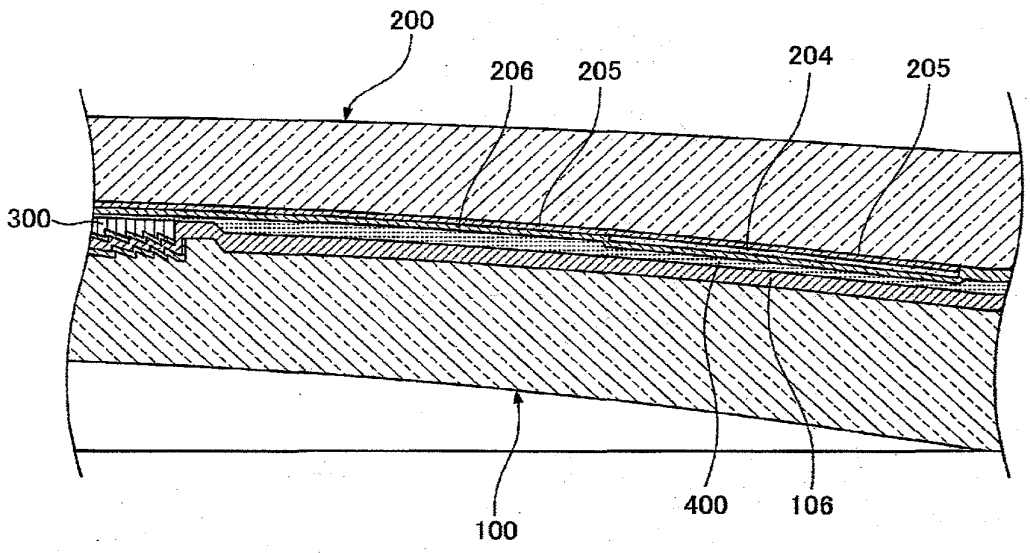
[図23]


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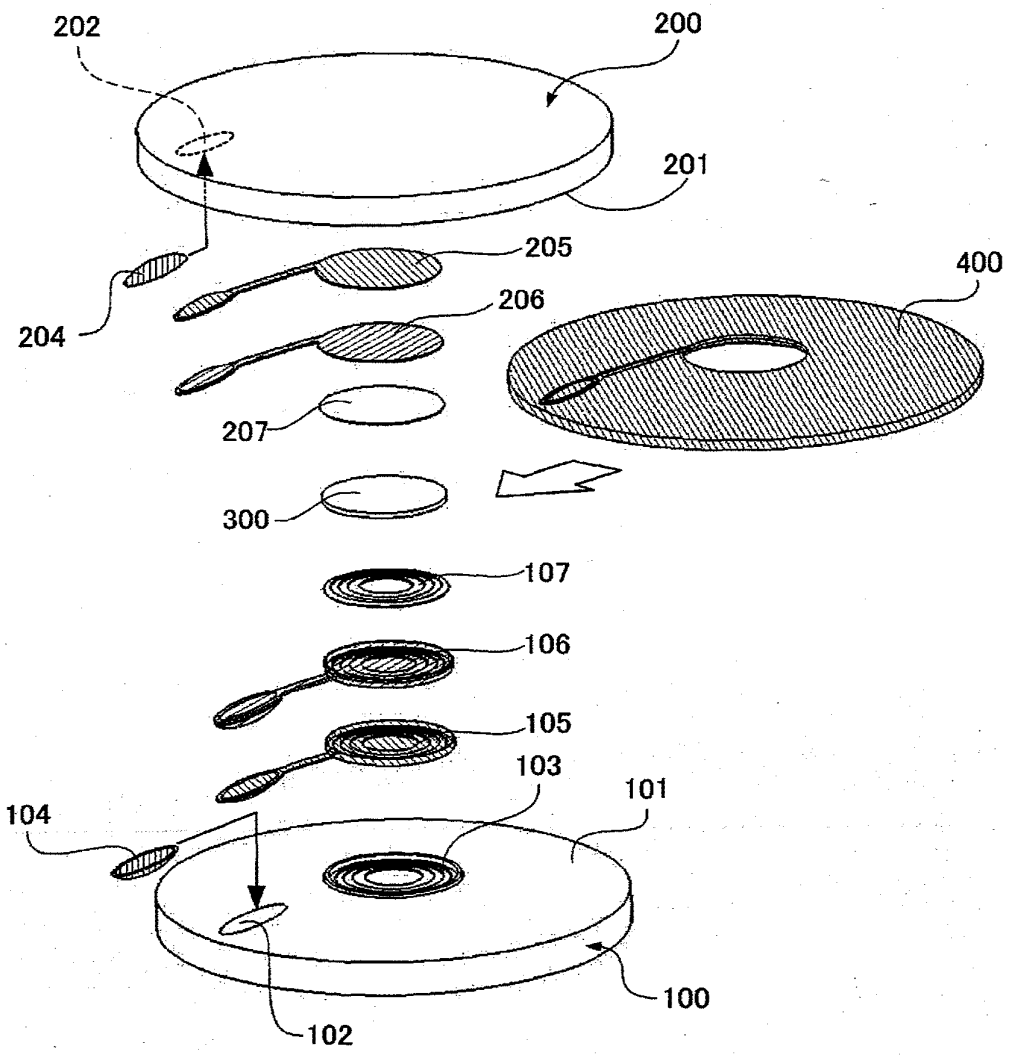
[図24]



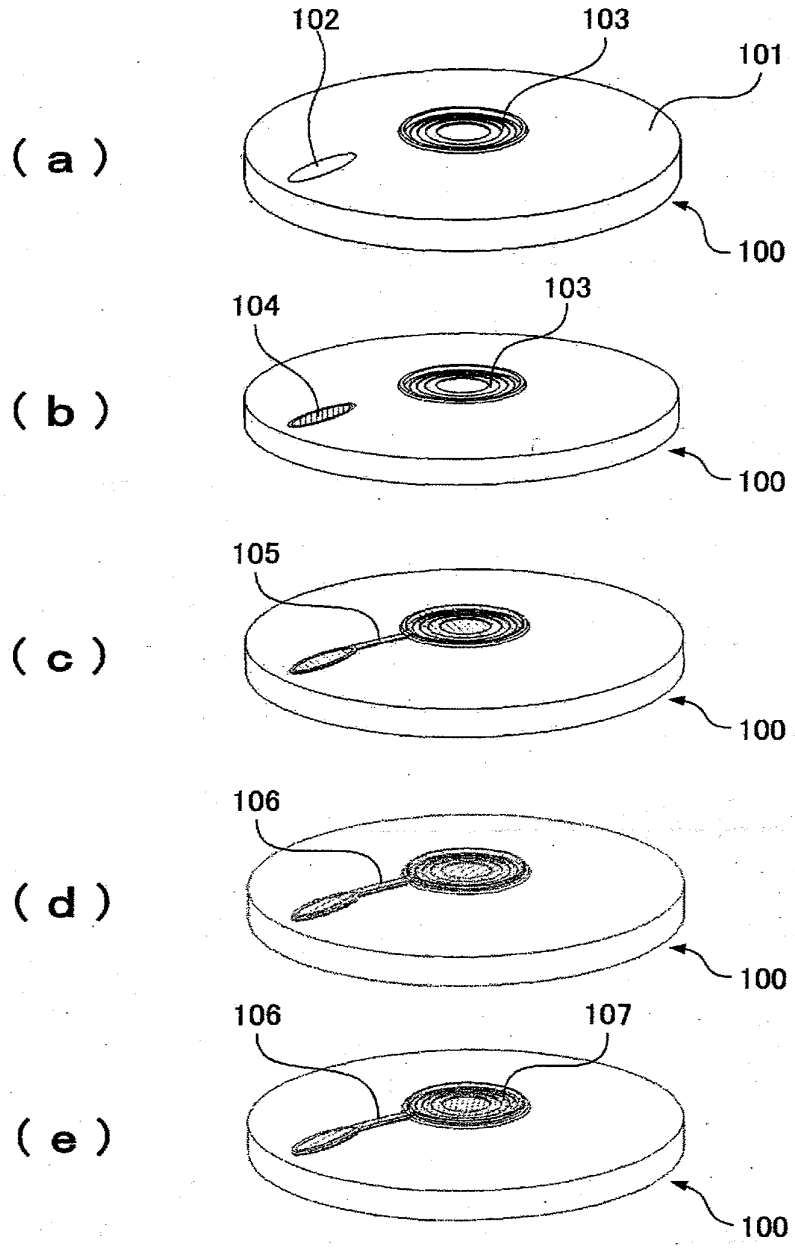
[図25]



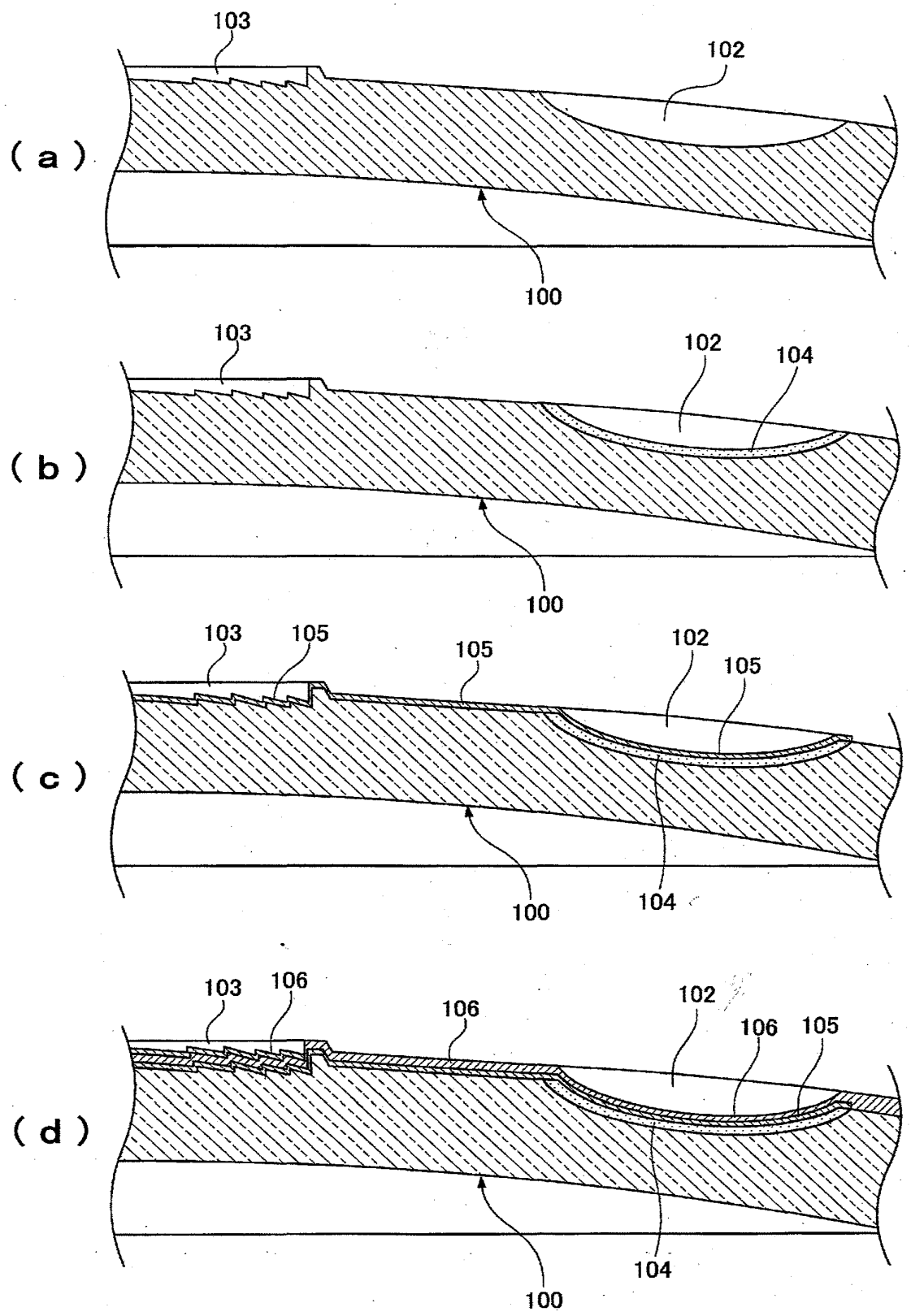
[図26]


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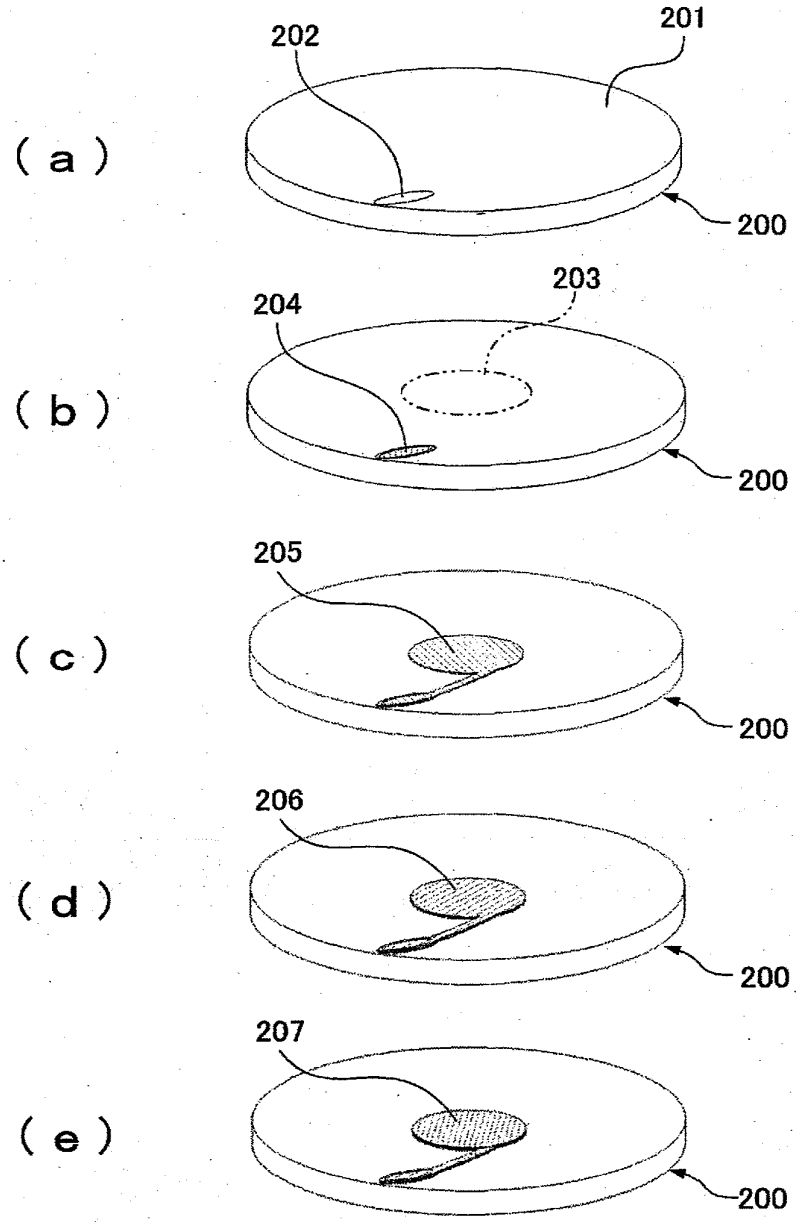
[図27]



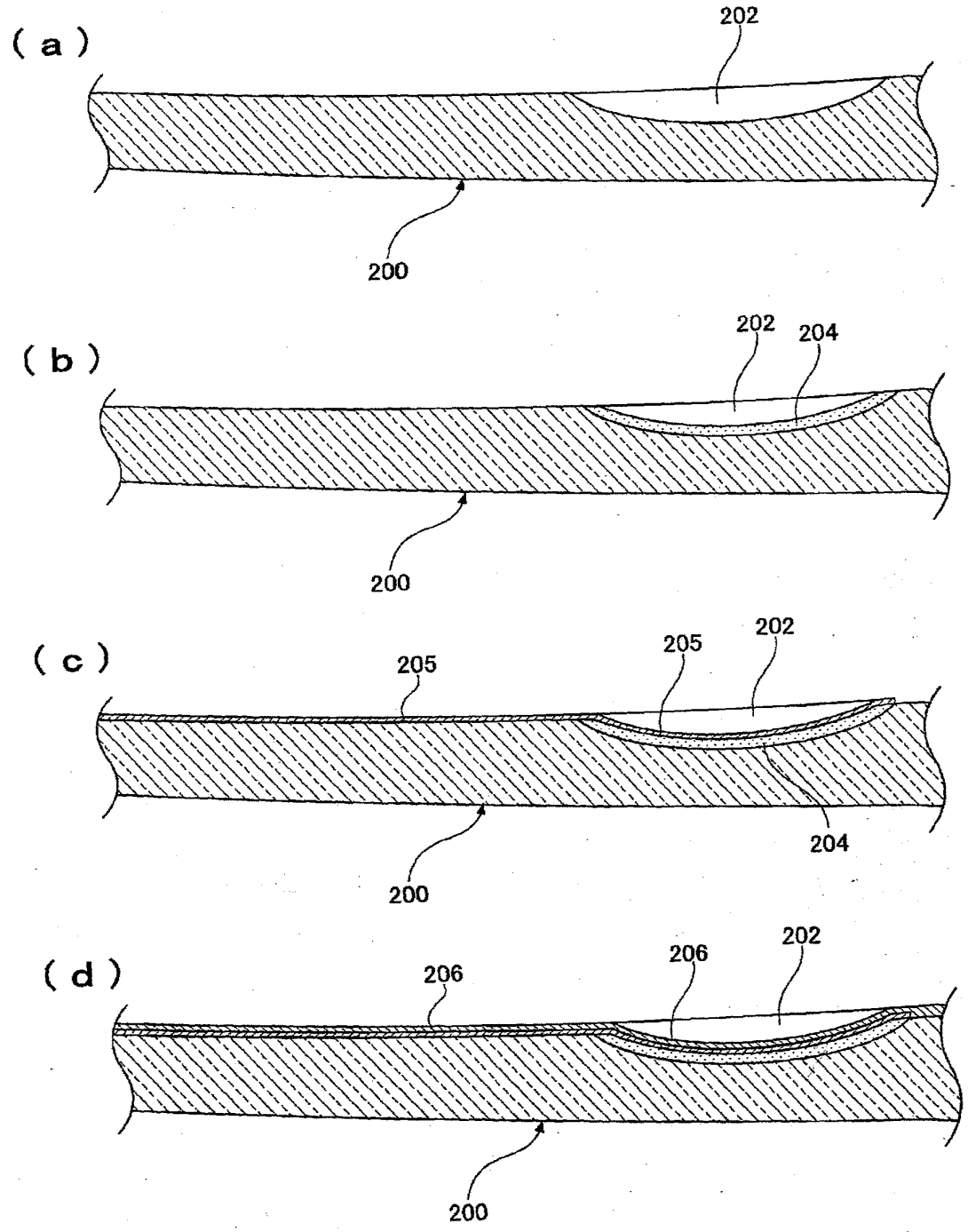
[図28]


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[図29]

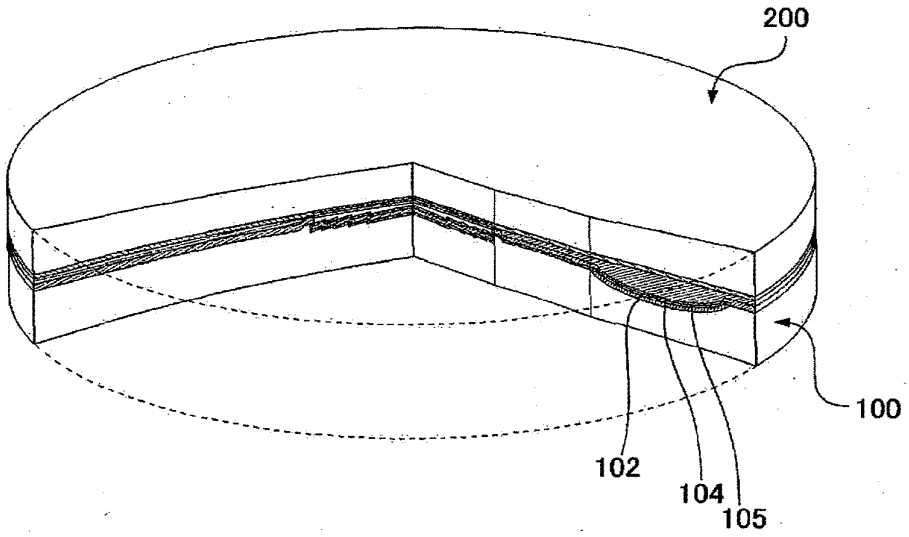


[図30]

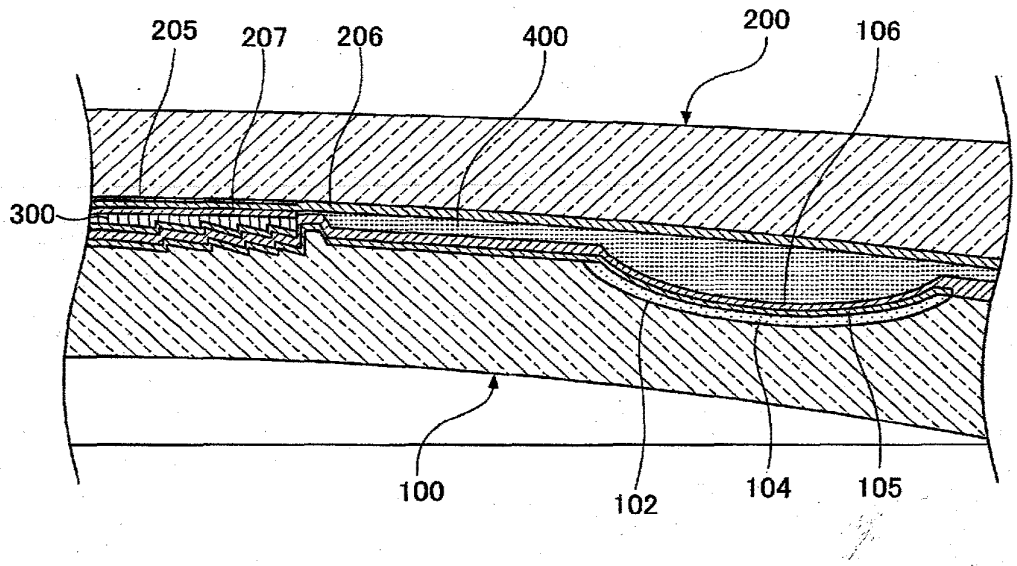


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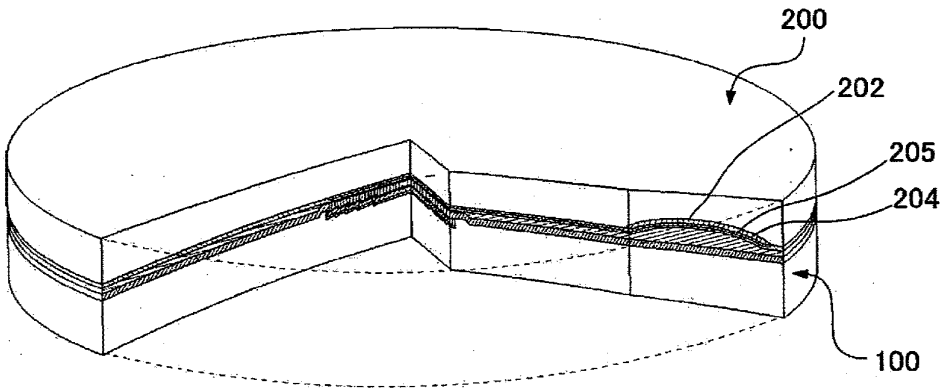
[図31]



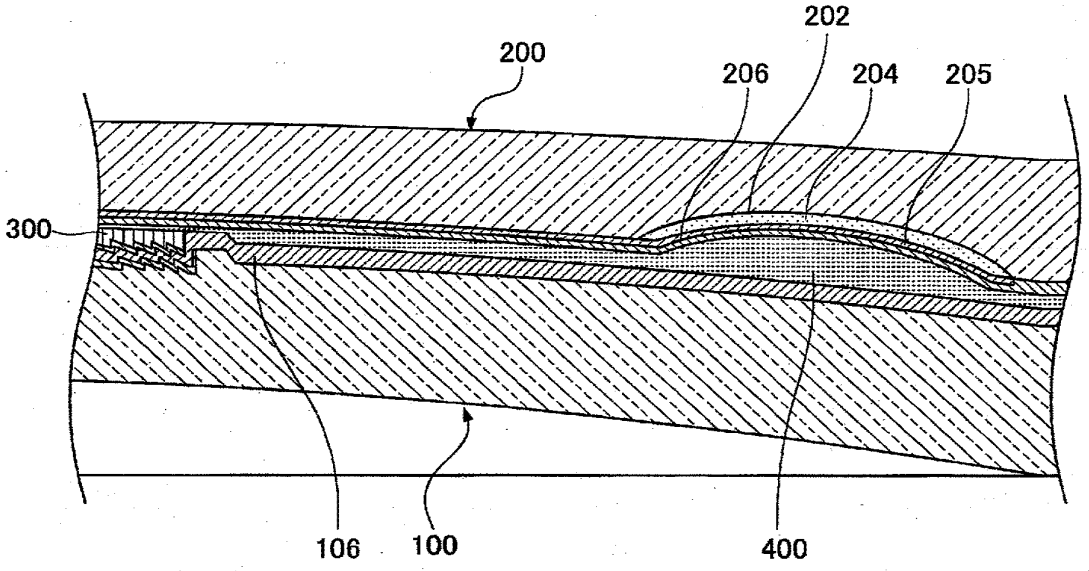
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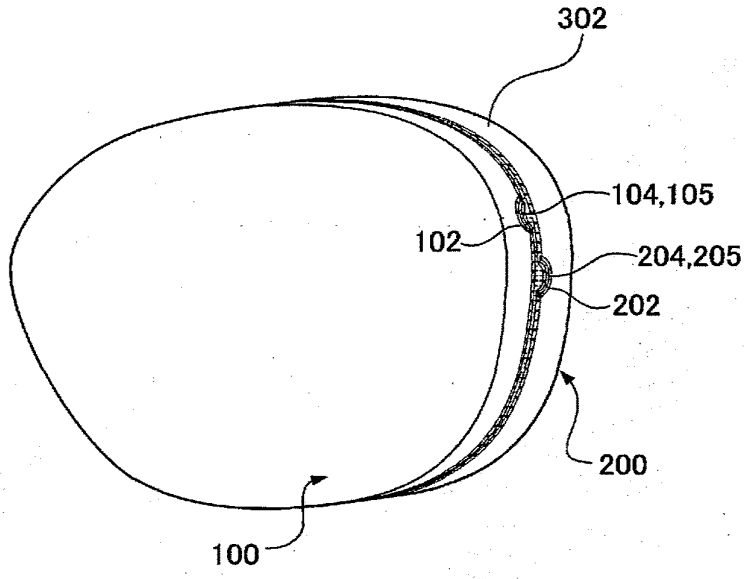
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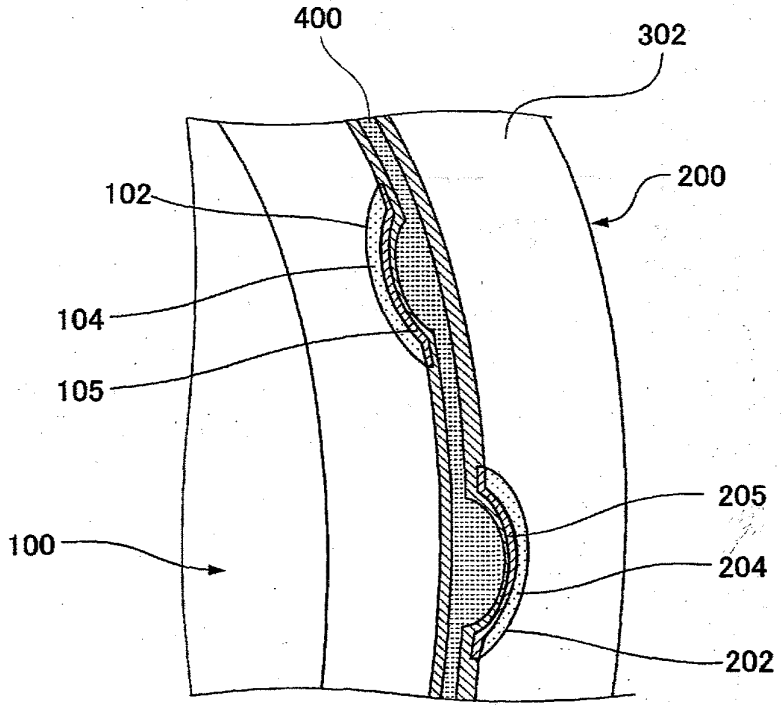
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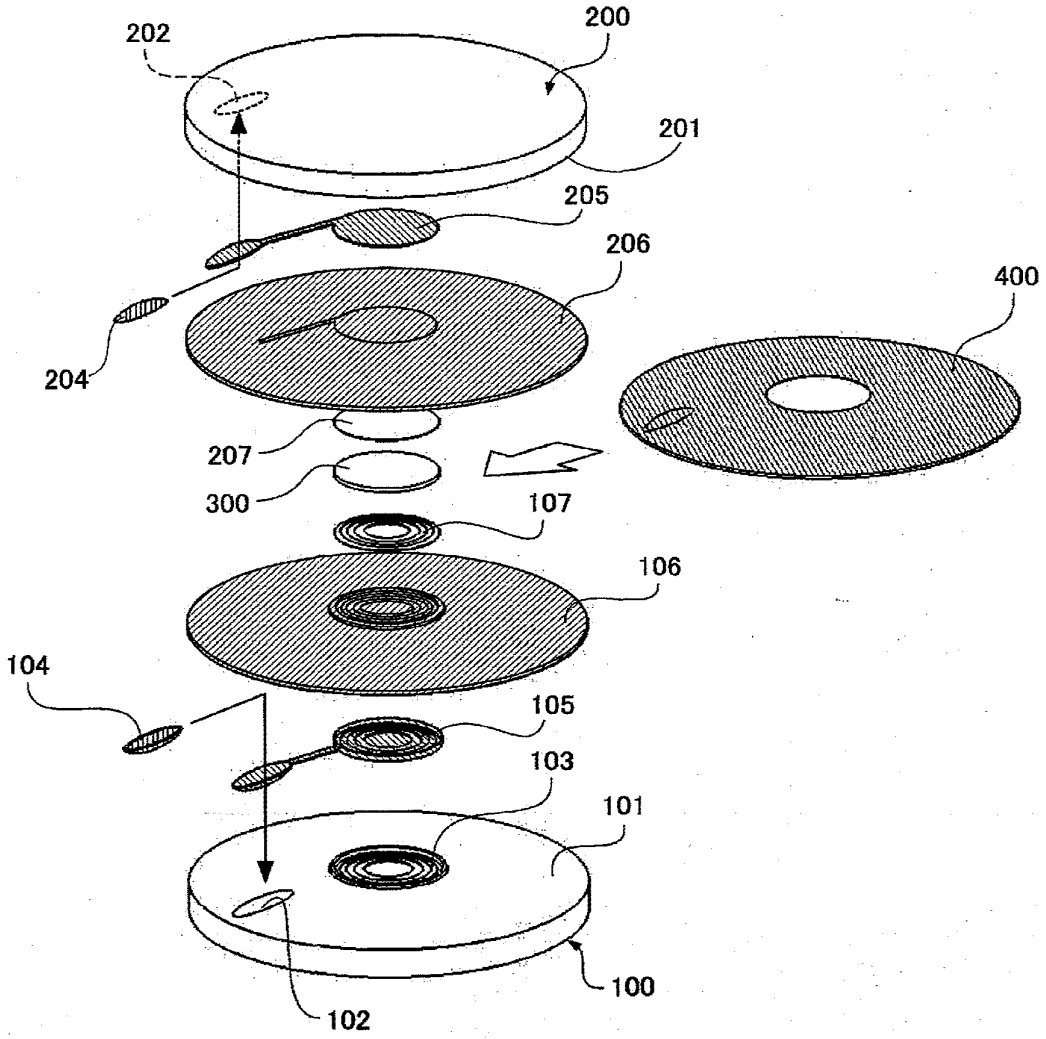
[図35]


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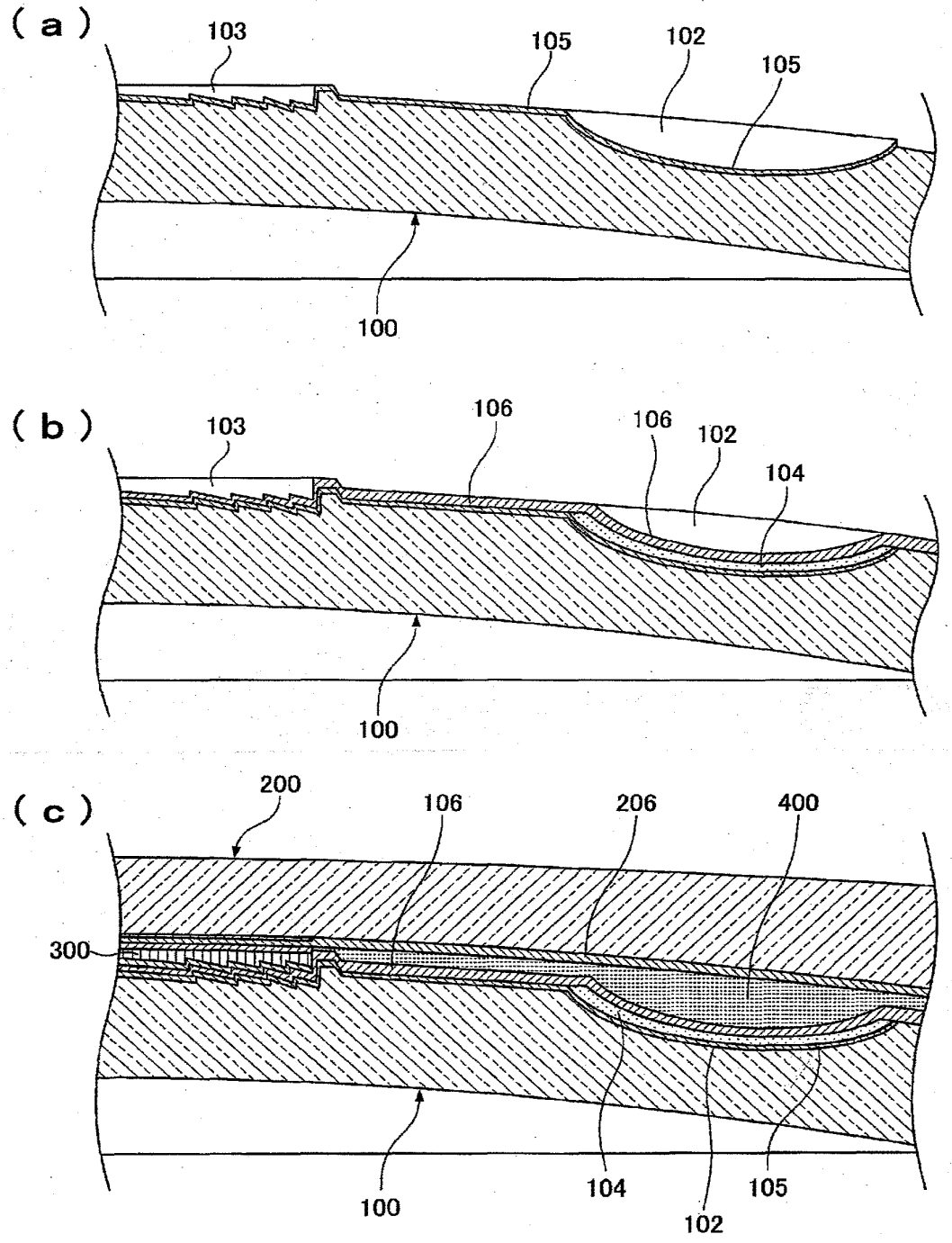
[図36]


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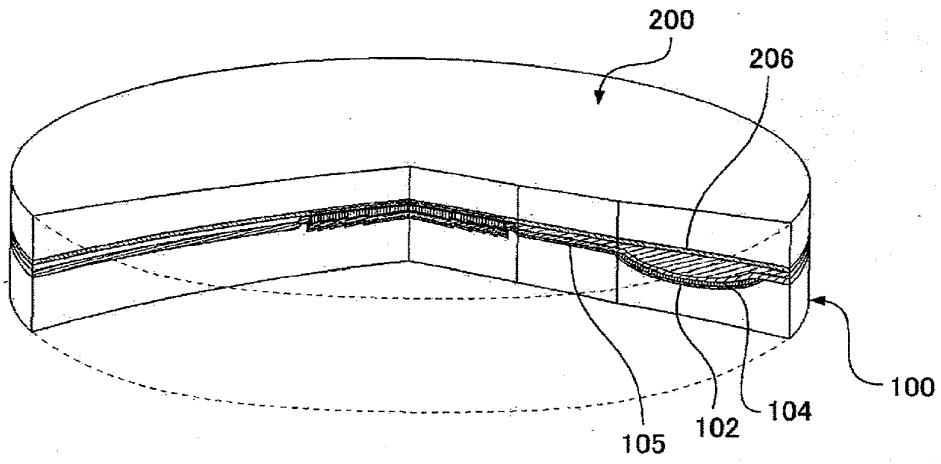
[図37]


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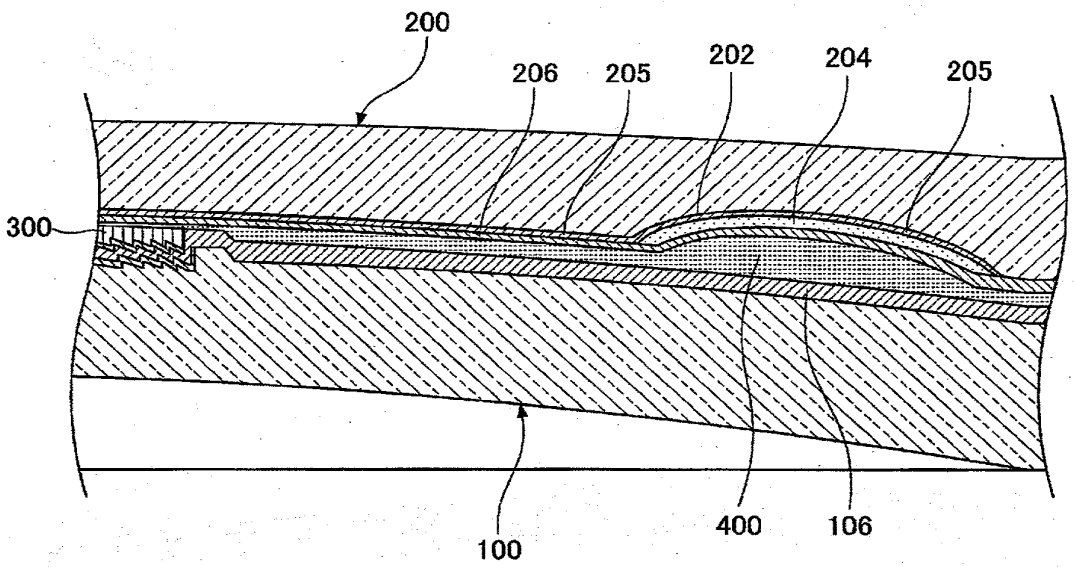
[図38]


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(c)
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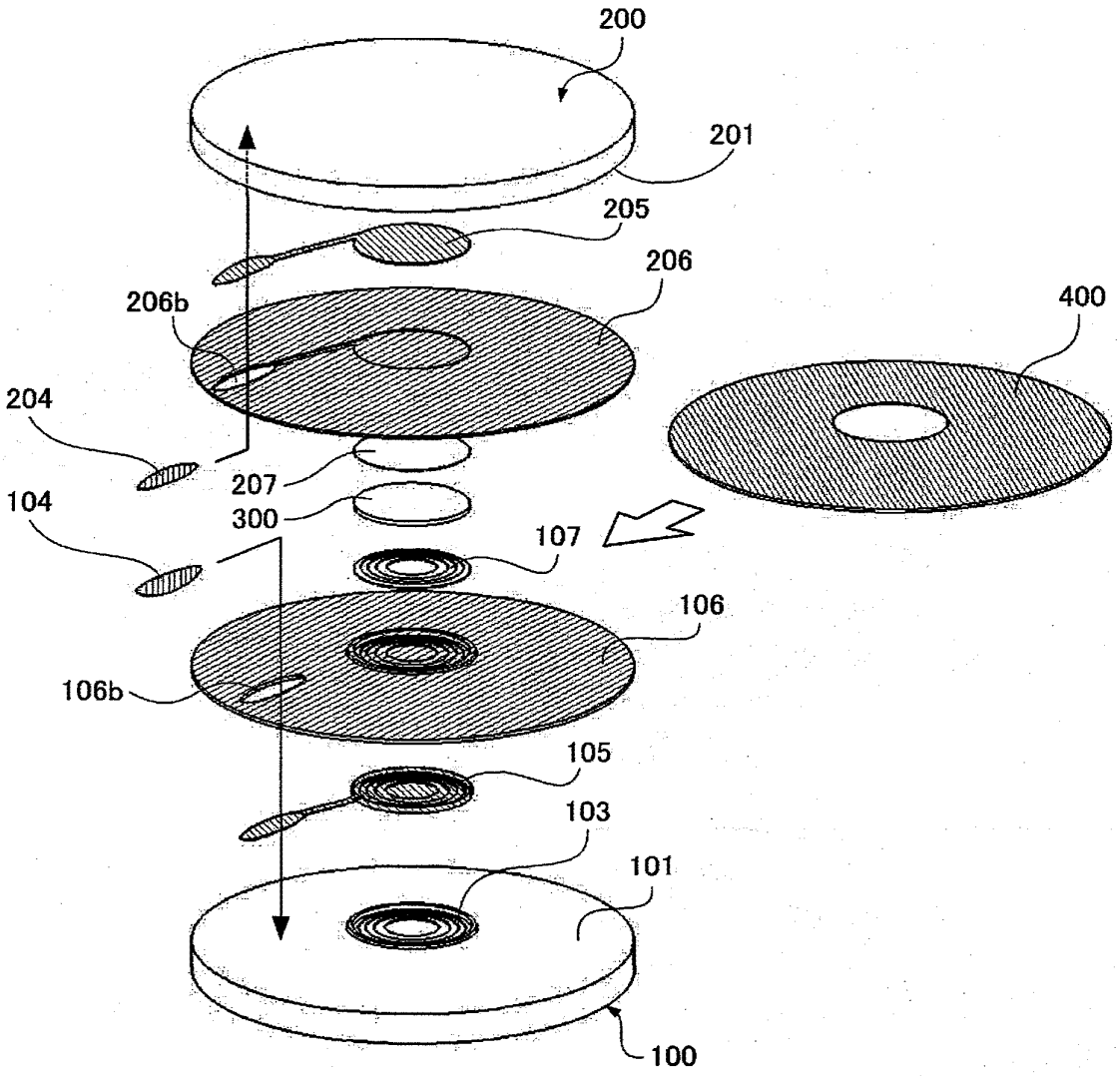
[図39]



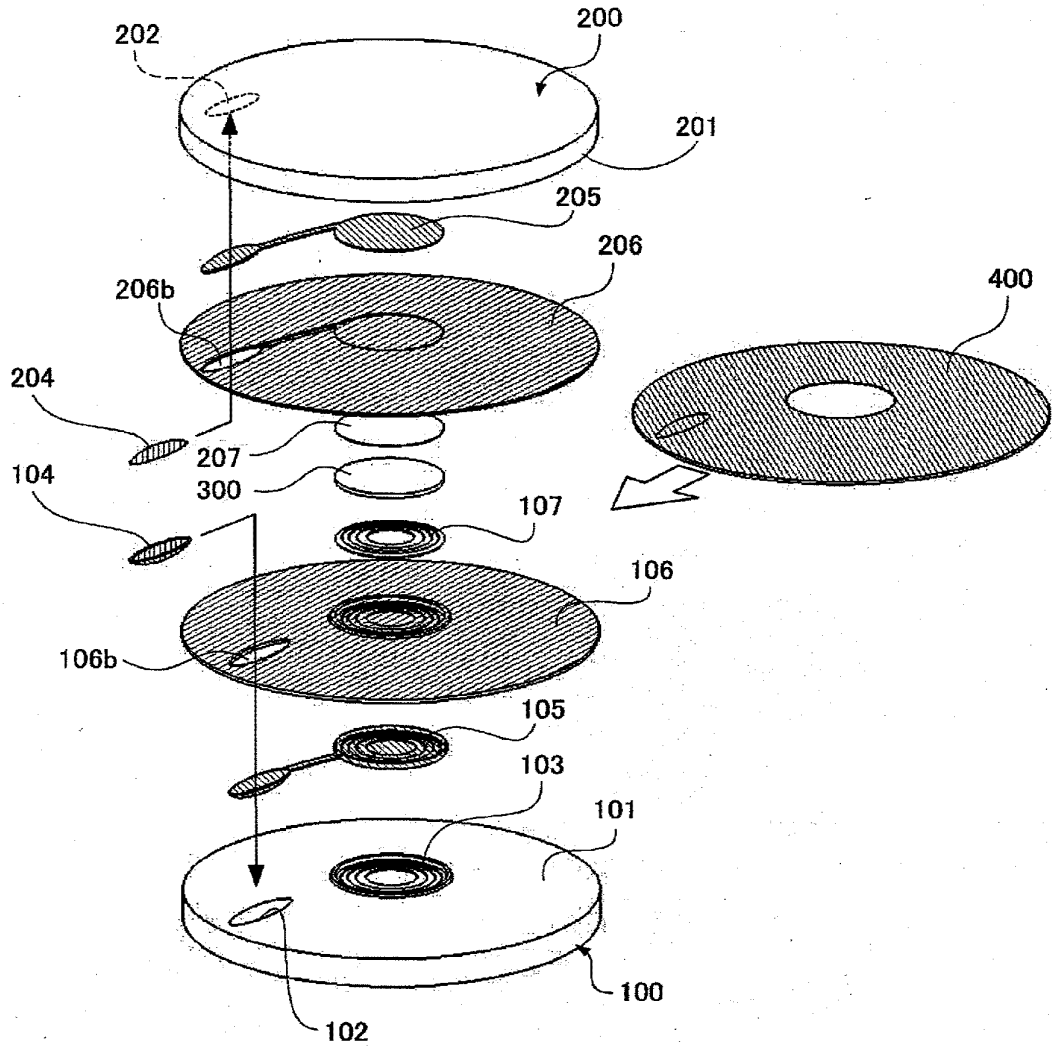
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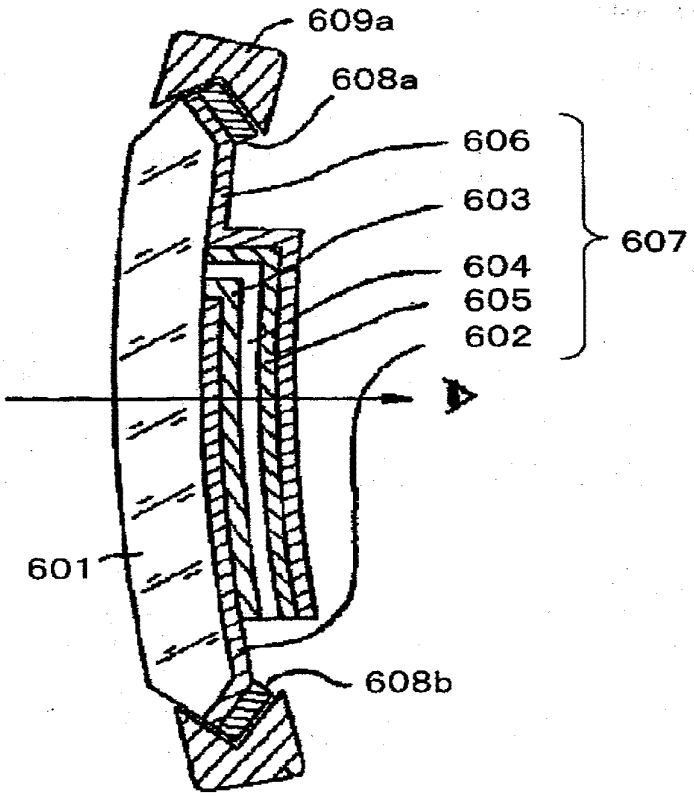
[図41]


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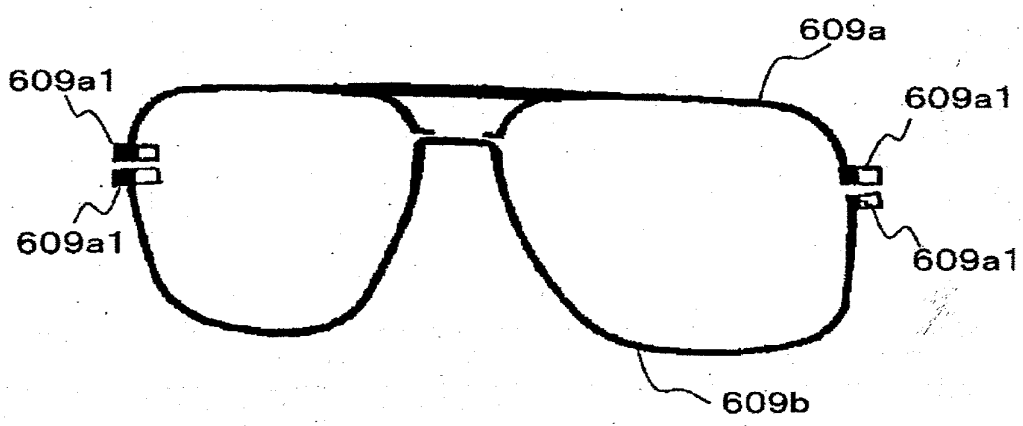
[図42]


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[図43]


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608b

[図44]


609a
609a1
609a1
609a1
609a1
609b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/003799

A. CLASSIFICATION OF SUBJECT MATTER
G02C7/02(2006.01)i, *G02C1/00*(2006.01)i, *G02F1/13*(2006.01)i, *G02F1/1345*(2006.01)i, *G02F1/15*(2006.01)i

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)
G02C7/02, G02C1/00, G02F1/13, G02F1/1345, G02F1/15

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 109554/1988(Laid-open No. 30921/1990) (Nikon Corp.), 27 February, 1990 (27.02.90), Full text; all drawings (Family: none)	1-16
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 106972/1989(Laid-open No. 45515/1991) (Seiko Epson Corp.), 26 April, 1991 (26.04.91), Full text; all drawings (Family: none)	1-16

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 March, 2009 (24.03.09)	07 April, 2009 (07.04.09)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

BNSDOCID: <WO_____2009081542A1_I_>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/003799

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 185147/1987(Laid-open No. 88927/1989) (Seiko Epson Corp.), 12 June, 1989 (12.06.89), Full text; all drawings (Family: none)	1-16

BNSDOCID: <WO_____2009081542A1_I_>

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２００８／００３７９９

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.　G02C7/02(2006.01)i, G02C1/00(2006.01)i, G02F1/13(2006.01)i, G02F1/1345(2006.01)i, G02F1/15(2006.01)i

Ｂ．　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.　G02C7/02, G02C1/00, G02F1/13, G02F1/1345, G02F1/15

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	１９２２－１９９６年
日本国公開実用新案公報	１９７１－２００９年
日本国実用新案登録公報	１９９６－２００９年
日本国登録実用新案公報	１９９４－２００９年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	日本国実用新案登録出願63-109554号（日本国実用新案登録出願公開2-30921号）の願書に添付した明細書及び図面の内容を撮影したマイクロフィルム（株式会社ニコン）1990.02.27，全文、全図（ファミリーなし）	１－１６
A	日本国実用新案登録出願1-106972号（日本国実用新案登録出願公開3-45515号）の願書に添付した明細書及び図面の内容を撮影したマイクロフィルム（セイコーエプソン株式会社）1991.04.26，全文、全図（ファミリーなし）	１－１６

☑　Ｃ欄の続きにも文献が列挙されている。　　☐　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの
「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「Ｏ」口頭による開示、使用、展示等に言及する文献
「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「＆」同一パテントファミリー文献

国際調査を完了した日 ２４．０３．２００９	国際調査報告の発送日 ０７．０４．２００９
国際調査機関の名称及びあて先 日本国特許庁（ＩＳＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員）　２Ｏ　９２２５ 藤岡　善行 電話番号　０３－３５８１－１１０１　内線　３２７１

様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（２００７年４月）

BNSDOCID: <WO_____2009081542A1_I_>

Ｃ（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	日本国実用新案登録出願62-185147号（日本国実用新案登録出願公開1-88927号）の願書に添付した明細書及び図面の内容を撮影したマイクロフィルム（セイコーエプソン株式会社）1989.06.12，全文、全図（ファミリーなし）	１－１６

BNSDOCID: <WO____2009081542A1_I_>

Annex to Form PCT/ISA/206
COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH

International Application No
PCT/US2011/042883

1. The present communication is an Annex to the invitation to pay additional fees (Form PCT/ISA/206). It shows the results of the international search established on the parts of the international application which relate to the invention first mentioned in claims Nos.:
see 'Invitation to pay additional fees'
2. This communication is not the international search report which will be established according to Article 18 and Rule 43.

3. If the applicant does not pay any additional search fees, the information appearing in this communication will be considered as the result of the international search and will be included as such in the international search report.

4. If the applicant pays additional fees, the international search report will contain both the information appearing in this communication and the results of the international search on other parts of the international application for which such fees will have been paid.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 930 857 A (ELEANOR HOLLINGSWORTH) 29 March 1960 (1960-03-29) figures 16,18,31 column 6, lines 9-36 column 11, lines 71-73 column 12, lines 16-26,39-47,55-64,74-75	1-5, 12-21, 28-33
A	US 2007/121061 A1 (KIM YOUNG H [KR]) 31 May 2007 (2007-05-31) figure 6	12
A	WO 2009/081542 A1 (PANASONIC CORP [JP]; MATSUI MASATOMO) 2 July 2009 (2009-07-02) figures 15, 18 & EP 2 233 964 A1 (PANASONIC CORP [JP]) 29 September 2010 (2010-09-29) figures 15, 18	18
A	US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06) paragraph [0090]	21

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

2

Form PCT/ISA/206 (Annex, first sheet) (July 1992; reprint January 2004)

Patent Family Annex

Information on patent family members

International Application No
PCT/US2011/042883

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2930857 A	29-03-1960	NONE	
US 2007121061 A1	31-05-2007	CN 1975512 A	06-06-2007
		DE 102006048590 A1	21-06-2007
		JP 2007156428 A	21-06-2007
WO 2009081542 A1	02-07-2009	EP 2233964 A1	29-09-2010
		US 2010265456 A1	21-10-2010
US 2008273166 A1	06-11-2008	AR 066226 A1	05-08-2009
		TW 200921179 A	16-05-2009
		US 2010271588 A1	28-10-2010

Electronic Acknowledgement Receipt

EFS ID:	12107009
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	20350
Filer:	John P. McGroarty/Aneta Xhiku
Filer Authorized By:	John P. McGroarty
Attorney Docket Number:	91904-817521
Receipt Date:	17-FEB-2012
Filing Date:	17-NOV-2011
Time Stamp:	16:51:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2012_02_17_IDS_91904-817521.pdf	153482 c41e4e3eb8e93b773d461e6ec3d1e7953f0bea03	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	4

Warnings:					
Information:					
2	Foreign Reference	wo.pdf	3394828 f4b61f48c1ff751be59c2ade4a232d1621f33ec4	no	73
Warnings:					
Information:					
3	Non Patent Literature	isr.pdf	106254 fbbe9b7da61608792adc929180985ba88b269265	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3654564		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on 2/17/12.

KILPATRICK TOWNSEND & STOCKTON LLP

By: Aneta Mihali Xhiku

PATENT
Attorney Docket No.: 91904-817521(008512US)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Ronald D. Blum

Application No.: 13/298,992

Filed: November 17, 2011

For: ELECTRONIC SPECTACLE FRAMES

Customer No.: 20350

Confirmation No.: 1095

Examiner: TBA

Art Unit: 2835

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.97 and §1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

The references cited on attached form PTO/SB/08A and PTO/SB/08B are being called to the attention of the Examiner. Copies of the references [in compliance with the requirements of 37 CFR §1.98(a)(2)] are enclosed. It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

Also enclosed is a copy of the International Search Report corresponding to the PCT/US2011/042883 application.

Copies of the US non-provisional patent application no. 12/684,490, filed on January 8, 2010, U.S. non-provisional application no. 13/175,633 filed on July 1, 2011, U.S. non-provisional application no. 13/175,634 filed on July 1, 2011, US non-provisional patent application no. 13/179,219, filed on July 8, 2011, US provisional patent application no. 61/361,110, filed on July 2, 2010; US. provisional patent application no. 61/376,719, filed on August 25, 2010; US provisional patent application no. 61/415,391, filed on November 19, 2010, U.S. provisional patent application no. 61/362,877 filed July 9, 2010 and U.S. provisional patent application no. 61/481,353 filed on May 2, 2011, are available on PAIR and are believed to be readily accessible to the Examiner.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement. However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 20-1430. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/John P. McGroarty/

John P. McGroarty
Reg. No. 41,186

KILPATRICK TOWNSEND & STOCKTON LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 202-481-9900
Fax: 202-481-3972
JPM:amx
63986902 v1

Electronic Acknowledgement Receipt

EFS ID:	12020048
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	20350
Filer:	Patrick M. Lafferty/Joan Soll
Filer Authorized By:	Patrick M. Lafferty
Attorney Docket Number:	91904-817521
Receipt Date:	07-FEB-2012
Filing Date:	17-NOV-2011
Time Stamp:	16:22:11
Application Type:	Utility under 35 USC 111(a)

02/15/2012 MNGUYEN 00000006 201430 13298992
01 FC:1081 310.00 DA

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1380
RAM confirmation Number	3405
Deposit Account	201430
Authorized User	KILPATRICK TOWNSEND & STOCKTON, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS		
	Application Number	13/298992
	Filing Date	November 17, 2011
	First Named Inventor	Blum, Ronald D.
	Title	ELECTRONIC SPECTACLE FRAMES
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket	91904-817521

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: **20350**

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

I further authorize any of the above-identified practitioners to execute a Statement Under 37 CFR 3.73(b) on my/our behalf to certify the chain of title and establish my/our ownership in the application identified above.

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number:

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96 submitted herewith or filed on _____.

SIGNATURE of Applicant or Assignee of Record

Signature	Evelyn Blake	Date	11/28/11
Name	Evelyn Blake	Telephone	
Title and Company	Secretary, PixelOptics, Inc.		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

63844702 v1

Attorney Docket No. 91904-817521

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Ronald D. Blum

Application No./Patent No.: 13/298992 Filed/Issue Date: November 17, 2011

Titled: ELECTRONIC SPECTACLE FRAMES

PixelOptics, Inc., a corporation
(Name of Assignee) (Type of Assignee: corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____%); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet (s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Patrick M. Lafferty/ February 7, 2012
Signature Date

Patrick M. Lafferty, Reg. No. 63,000 _____
Printed or Typed Name Title

63964394 v1

Attorney Docket No.: 91904-817521

ASSIGNMENT OF PATENT APPLICATION

JOINT

WHEREAS, Ronald D. Blum of 5320 Silver Fox Road, Roanoke, VA 24018; Joshua N. Haddock of 17 Church Avenue, SW, Apt. 202, Roanoke, VA 24011; Claudio Dalla Longa of VIA Ponteggio, 33A, Valdobbiadene-TV, 31049 Italy; Mark Graham of 228 Connery Terrace, Leesburg, VA 20175; and Yongping Wang of 2601 Pennsylvania Avenue, Room 945, Philadelphia, PA 19130, hereinafter referred to as "Assignors," is the inventor of the invention described and set forth in the below-identified application for United States Letters Patent:

Title of Invention: ELECTRONIC SPECTACLE FRAMES

Filing Date: November 17, 2011

Application No.: 13/298992; and

WHEREAS, PIXELOPTICS, INC., located at 5241 Valleypark Drive, Roanoke, VA 24019, hereinafter referred to as "ASSIGNEE," is desirous of acquiring an interest in the invention and application and in any U.S. Letters Patent and Registrations which may be granted on the same;

For good and valuable consideration, receipt of which is hereby acknowledged by Assignors, Assignors have assigned, and by these presents do assign to Assignee all right, title and interest in and to the invention and application and to all foreign counterparts (including patent, utility model and industrial designs), and in and to any Letters Patent and Registrations which may hereafter be granted on any patent application claiming priority from the same in the United States and all countries throughout the world, and to claim the priority from the application as provided by the Paris Convention. The right, title and interest is to be held and enjoyed by Assignee and Assignee's successors and assigns as fully and exclusively as it would have been held and enjoyed by Assignors had this Assignment not been made, for the full term of any Letters Patent and Registrations which may be granted thereon, or of any division, renewal, continuation in whole or in part, substitution, conversion, reissue, prolongation or extension thereof.

Assignors further agree that Assignors will, without charge to Assignors, but at Assignee's expense, (a) cooperate with Assignee in the prosecution of U.S. Patent applications and foreign counterparts on the invention and any improvements, (b) execute, verify, acknowledge and deliver all such further papers, including applications and instruments of transfer, and (c) perform such other acts as Assignee lawfully may request to obtain or maintain Letters Patent and Registrations for the invention and improvements in any and all countries, and to vest title thereto in Assignee, or Assignee's successors and assigns.

IN TESTIMONY WHEREOF, Assignors have signed their names on the date indicated.

Dated: 12/9/11

Ronald D. Blum

Dated: 12/9/2011

Joshua N. Haddock

Dated: 12/12/11

Claudio Dalla Longa

Dated: 12/13/11

Mark Graham

Dated: 12/13/11

Yongping Wang

63844918 v1

Electronic Patent Application Fee Transmittal

Application Number:	13298992
Filing Date:	17-Nov-2011
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Filer:	Patrick M. Lafferty/Joan Soll
Attorney Docket Number:	91904-817521

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	1051	1	130	130
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1380**

Electronic Acknowledgement Receipt

EFS ID:	12020048
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	20350
Filer:	Patrick M. Lafferty/Joan Soll
Filer Authorized By:	Patrick M. Lafferty
Attorney Docket Number:	91904-817521
Receipt Date:	07-FEB-2012
Filing Date:	17-NOV-2011
Time Stamp:	16:22:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1380
RAM confirmation Number	3405
Deposit Account	201430
Authorized User	KILPATRICK TOWNSEND & STOCKTON, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2012_02_07_MISSINGPARTS_91904-817521.pdf	226640 c8cfbcf2b0c25695f7de58cba5aa1ea4bf26b48b	yes	14

Multipart Description/PDF files in .zip description

Document Description	Start	End
Applicant Response to Pre-Exam Formalities Notice	1	2
Preliminary Amendment	3	3
Claims	4	7
Applicant Arguments/Remarks Made in an Amendment	8	8
Oath or Declaration filed	9	10
Power of Attorney	11	11
Assignee showing of ownership per 37 CFR 3.73(b).	12	14

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	36900 05f1f7ee55dae9887f981b5513059a3b913b49ce	no	2

Warnings:

Information:

Total Files Size (in bytes):	263540

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on February 7, 2012.

KILPATRICK TOWNSEND & STOCKTON LLP

By: /Joan R. Soll/

PATENT
Attorney Docket No.: 91904-817521

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No.: 1095
Ronald D. Blum	Examiner: TBD
Application No.: 13/298992	Art Unit: TBD
Filed: November 17, 2011	TRANSMITTAL LETTER – RESPONSE TO NOTICE OF MISSING PARTS
For: ELECTRONIC SPECTACLE FRAMES	
Customer No.: 20350	

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Pursuant to the Notice to File Missing Parts of Nonprovisional Application, dated December 7, 2011, enclosed are the following to be made of record in the above-identified application:

1) Executed Declaration
2) Power of Attorney and Certificate of Assignee Under 37 C.F.R. § 3.73(b)
3) Preliminary Amendment

The following fees are being charged to a credit card:

Large Entity:	(a)	Utility Filing Fee	$380
	(b)	Utility Search Fee	$620

(c)	Utility Examination Fee		$250
(d)	Application Size Fee		$0
(e)	Excess Claims Fees (§ 1.16(b), (c)):		
	-20	x $60 =	$0
	-3	x $250 =	$0
(f)	Multiple Dependent Claims		
(g)	Missing Parts Surcharge		$130
TOTAL FEES TO BE CHARGED			$1380

The Commissioner is hereby authorized to charge any additional fees associated with this paper or during the pendency of this application, or credit any overpayment, to Deposit Account No. 20-1430.

Respectfully submitted,

/Patrick M. Lafferty/

Patrick M. Lafferty
Reg. No. 63,000

Customer No. 20350

KILPATRICK TOWNSEND & STOCKTON LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 202-481-9900
Fax: 415 576-0300
PML/js6

63880620 v1

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on February 7, 2012.

KILPATRICK TOWNSEND & STOCKTON LLP

By: /Joan R. Soll/

PATENT
Attorney Docket No.: 91904-817521

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No. 1095
Ronald D. Blum	Examiner: TBD
Application No.: 13/298992	Technology Center/Art Unit: 2835
Filed: November 17, 2011	PRELIMINARY AMENDMENT
For: ELECTRONIC SPECTACLE FRAMES	
Customer No.: 20350	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Prior to examination of the above-referenced application, please enter the following amendments and remarks:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. – 47. (Cancelled)

48. (New) A first device, comprising:

a frame comprising a first temple and a second temple, wherein the frame comprises a housing module coupled to a structural member;

a first lens and a second lens coupled to the frame; and

an electronics module, wherein the electronics module is located within the housing module; and wherein the electronics module comprises at least any two of:

a power source;

a controller; and

a sensing mechanism.

49. (New) The first device of claim 48, wherein an insulating layer is disposed between one or more electronic components located within the electronics module and the frame of the first device.

50. (New) The first device of claim 49, wherein the housing module comprises the insulating layer.

51. (New) The first device of claim 50, wherein the electronics module comprises a conductive material.

52. (New) The first device of claim 49,

wherein the housing module comprises a conductive material; and

wherein the insulating layer is disposed between at least a portion of the housing module and the electronics module.

53. (New) The first device of claim 49, wherein the insulating layer comprises a portion of the electronics module.

54. (New) The first device of claim 53, wherein the housing module comprises a conductive material.

55. (New) The first device of claim 48, wherein the electronics module is removably coupled to the housing module.

56. (New) The first device of claim 55, wherein the electronics module is adapted to be removed and recoupled to the housing module.

57. (New) The first device of claim 48,

wherein the housing module comprises a first end, a second end, and a body disposed between the first end and the second end;

wherein the first end comprises an opening; and

wherein the electronics module is configured to be inserted into the opening.

58. (New) The first device of claim 57, wherein the electronics module is pressure fitted to the housing module.

59. (New) The first device of claim 57, wherein the electronics module is located within the body of the housing module.

60. (New) The first device of claim 48,

wherein the structural member comprises a cavity in the first temple; and

wherein the housing module is configured to be selectively placed within the cavity.

61. (New) The first device of claim 48, wherein the housing module further comprises an aperture disposed on an outer side of the housing module.

62. (New) The first device of claim 61, wherein the sensing mechanism comprises a touch sensitive switch exposed substantially through the aperture.

63. (New) The first device of claim 62, wherein the touch sensitive switch is a capacitance switch.

64. (New) The first device of claim 48, wherein the structural member comprises the first temple.

65. (New) The first device of claim 64, wherein the first temple comprises a first portion and second portion, and wherein the housing module comprises the first portion of the first temple.

66. (New) The first device of claim 48, wherein the housing module has a thickness that is less than or equal to approximately .7 mm.

67. (New) A method of fabricating a device,

wherein the device comprises

a frame having a first temple and second temple; and

a housing module comprising:

a first end and a second end, wherein the first end comprises an opening; and

a body disposed between the first and second end, wherein the body comprises a cavity;

wherein the method comprises inserting an electronics module into the opening of the first end of the housing module such that the electronics module is disposed in the cavity of the body of the housing module.

REMARKS/ARGUMENTS

By this amendment, Claims 1-48 are cancelled and Claims 49-67 are added. The amendments introduce no new matter.

Entry of the amendments prior to examination of the application is respectfully requested.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Further, the Commissioner is hereby authorized to charge any additional fees or credit any overpayment in connection with this paper to Deposit Account No. 20-1430.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 202-481-9900.

Respectfully submitted,

/Patrick M. Lafferty/

Patrick M. Lafferty
Reg. No. 63,000

KILPATRICK TOWNSEND & STOCKTON LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 202-481-9900
Fax: 415-576-0300
Attachments
P2L:js6
63964452 v1

Attorney Docket No.: 91904-817521
Client Ref. No.:

PTO/SB/01A (07-07)

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	ELECTRONIC SPECTACLE FRAMES

As the below named inventor(s), I/we declare that:

This declaration is directed to:

☐ The attached application, or

☒ Application No. 13/298992, filed on November 17, 2011,

☐ as amended on _____ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

All statements made herein of my/our own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR(S)

Inventor one: Ronald D. Blum — Date: 11/28/11

Signature: _____ — Citizen of: United States

Inventor two: Joshua N. Haddock — Date: 11/28/2011

Signature: _____ — Citizen of: United States

☒ Additional inventors or a legal representative are being named on 1 additional form(s) attached hereto.

63844881 v1

Attorney Docket No.: 91904-817521
Client Ref. No.:

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76) – ADDITIONAL INVENTOR(S)
Supplemental Sheet 1 of 1

FULL NAME OF INVENTOR(S)	
Inventor three: Claudio Dalla Longa	Date:
Signature:	Citizen of: Italy 13-01-2012
Inventor four: Mark Graham	Date: 12/19/11
Signature:	Citizen of: United States
Inventor five: Yongping Wang	Date: 12/20/11
Signature:	Citizen of: United States
Inventor six:	Date:
Signature:	Citizen of:
Inventor seven:	Date:
Signature:	Citizen of:
Inventor eight:	Date:
Signature:	Citizen of:
Inventor nine:	Date:
Signature:	Citizen of:
Inventor ten:	Date:
Signature:	Citizen of:
Inventor eleven:	Date:
Signature:	Citizen of:
Inventor twelve:	Date:
Signature:	Citizen of:

63844881 v1

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/298,992

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	47 minus 20 =	* 27			OR	x 60 =	1620
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 250 =	250
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						310
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	3430

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/298,992	11/17/2011	2835	0.00	91904-817521	47	4

CONFIRMATION NO. 1095

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

FILING RECEIPT

OC000000051258079

Date Mailed: 12/07/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Ronald D. Blum, Roanoke, VA;
Joshua N. Haddock, Roanoke, VA;
Claudio Dalla Longa, Valdobbiadene-TV, ITALY;
Mark Graham, Leesburg, VA;
Yongping Wang, Philadelphia, PA;

Assignment For Published Patent Application

PixelOptics, Inc., Roanoke, VA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 13/175,633 07/01/2011
and is a CIP of 13/175,634 07/01/2011
and said 13/175,633 07/01/2011
claims benefit of 61/361,110 07/02/2010
and claims benefit of 61/376,719 08/25/2010
and claims benefit of 61/415,391 11/19/2010
This application 13/298,992
is a CIP of 13/179,219 07/08/2011
which claims benefit of 61/362,877 07/09/2010
This application 13/298,992
claims benefit of 61/481,353 05/02/2011

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 12/01/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/298,992**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

Title

ELECTRONIC SPECTACLE FRAMES

Preliminary Class

361

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/298,992	11/17/2011	Ronald D. Blum	91904-817521

CONFIRMATION NO. 1095

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FORMALITIES LETTER

OC000000051258080

Date Mailed: 12/07/2011

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit $**380** to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of $**1870** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $**130** for a non-small entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $**3560** for a non-small entity
- $**380** Statutory basic filing fee.
- $**130** Surcharge.
- The application search fee has not been paid. Applicant must submit $**620** to complete the search fee.

- The application examination fee has not been paid. Applicant must submit $**250** to complete the examination fee for a non-small entity.
- The specification and drawings submitted electronically contain the equivalent of more than 100 pages. Applicant owes $**310** for **23** pages in excess of **100** pages for a non-small entity.
- Total additional claim fee(s) for this application is $**1870**
  - $**250** for **1** independent claims over 3.
  - $**1620** for **27** total claims over 20.

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Application Data Sheet

Application Information

Application number::	
Filing Date::	
Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R??::	
Number of CD disks::	
Number of copies of CDs::	
Sequence Submission::	
Computer Readable Form (CRF)?::	
Number of copies of CRF::	
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Attorney Docket Number::	91904-817521
Request for Early Publication::	No
Request for Non-Publication::	No
Suggested Drawing Figure::	
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Latin name::	
Variety denomination name::	
Petition included?::	No
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Licensed US Govt. Agency::	
Contract or Grant Numbers One::	
Secrecy Order in Parent Appl.::	No

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Correspondence Information

Correspondence Customer Number::	20350

Representative Information

Representative Customer Number::	20350

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This application	C-I-P	13/175,633	July 1, 2011
This application	C-I-P	13/175,634	July 1, 2011

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		61/376,719	August 25, 2010
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This application 13/179,219	C-I-P	13/179,219	July 8, 2011
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Foreign Priority Information

Country::	Application number::	Filing Date::

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Submitted by:

Signature /Patrick M. Lafferty/ Date Nov. 17, 2011

Printed Name Patrick M. Lafferty Registration Number 63,000

ELECTRONIC SPECTACLE FRAMES

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. Application No. 13/175,633 filed on July 1, 2011 and U.S. Application No. 13/175,634 filed on July 1, 2011, which applications claim the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application No. 61/361,110 filed on July 2, 2010; U.S. Provisional Patent Application No. 61/376,719 filed on August 25, 2010; and U.S. Provisional Patent Application No. 61/415,391 filed on November 19, 2010. This application is also a continuation-in-part of U.S. Application No. 13/179,219 filed on July 8, 2011, which application further claims the benefit under 35 U.S.C. § 119(e) to U.S. Provisional Patent Application No. 61/362,877 filed July 9, 2010 and U.S. Provisional Patent Application No. 61/481,353 filed on May 2, 2011. The entire disclosure of each of the above mentioned applications is incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0002] In today's world, spectacle eyeglass frames are very fashionable. While the trend for the eyeglass lenses is to make them thinner, lighter, and less visible, at the same time, it is the eyeglass frame that makes the fashion statement for the eyeglass wearer.

[0003] Concurrent with these trends is another concerning including electronics into spectacle eyewear. The trend of utilizing electronics in eyewear appears to be accelerating and the applications being developed by others are expanding. As theses trends continue, it is becoming important to find ways to incorporate electronics into eyewear without harming the aesthetics and functionality of the eyewear. Some of the challenges may be to not limit the fashion design of the eyeglass frame or limit the materials which the eyeglass frame can be made of, maintain as few completed eyeglass frames or eyeglass frame components (frame fronts, bridges, temples) stock keeping units (SKUs) as possible, allow for robust placement of the electronics, and in a way that can be manufactured so that it remains affordable, and aesthetically desirable.

BRIEF SUMMARY OF THE INVENTION

[0004] Embodiments may provide electronic (*i.e.* electro-active) spectacle frames that comprise a housing module that may be coupled (*e.g.* attached) to a structural component of the electronic frames and which may house (*e.g.* contain, encapsulate, surround a portion of, etc.) one or more electronic components (and/or an electronics module) of the electronic spectacles.

Some embodiments may also comprise a spring hinge and an electrical path from a temple to a lens. Some embodiments may also comprise a conductive compliant material that provides part of an electrical path between the electronic components *(e.g.* components in an electronics module) and electronics located on the electronic spectacle frames and/or electro-active lenses. Some embodiments may also comprise a single electronics module or multiple electronics module. Some embodiments may also comprise a façade coupled to the front of the electronic lens frames.

[0005] In some embodiments, a first device is provided. The first device includes a frame having a first temple and a second temple. The frame also comprises a housing module coupled (*e.g.* attached) to a structural member. The first device further includes a first lens and a second lens coupled to the frame. The first device may include an electronics module that may be located within the housing module. The electronics module may further include at least any two of: a power source; a controller; and/or a sensing mechanism.

[0006] In some embodiments, in the first device as described above, an insulating layer may be disposed between one or more electronic components located within the electronics module and the frame of the first device. In some embodiments, in the first device as describe above that comprises an insulating layer, the housing module may comprise the insulating layer. In some embodiments, the electronics module may comprise a conductive material, such as a metal.

[0007] In some embodiments, in the first device as describe above that comprises an insulating layer, the housing module may comprise a conductive material and the insulating layer may be disposed between at least a portion of the housing module and the electronics module.

[0008] In some embodiments, in the first device as describe above that comprises an insulating layer, the insulating layer may comprise a portion of the electronics module. In some embodiments, the housing module may comprise a conductive material, such as a metal.

[0009] In some embodiments, in the first device as described above, the housing module is removably coupled to the first temple. In some embodiments, in the first device as described above, the housing module is removably coupled to the first temple such that it is adapted to be removed and recoupled to the first temple.

[0010] In some embodiments, in the first device as described above, the housing module comprises a first end, a second end, and a body disposed between the first end and the second

end. The first end may comprise an opening and the electronics module may be configured to be inserted into the opening. In some embodiments, the electronics module may be pressure fitted to the housing module. In some embodiments, the electronics module is located within the body of the housing module. In some embodiments, the housing module comprises nylon or carbon fiber.

[0011] In some embodiments, in the first device as described above, the structural member comprises a cavity in the first temple and the housing module is configured to be selectively placed within the cavity. In some embodiments, the housing module is coupled to the first temple using at least one of a screw or a two face adhesive tape. In some embodiments, the housing module may be selectively removed. In some embodiments, the housing module is pressure fitted to the cavity in the first temple.

[0012] In some embodiments, in the first device as described above, the first lens is electrically connected to the electronics module. In some embodiments, the controller is configured to generate a time varying signal to supply to the first lens from the power source. In some embodiments, the sensing mechanism is configured to provide an input to the controller for determining when to supply the time varying signal to the first lens. In some embodiments, the power source comprises a battery. In some embodiments, the controller comprises firmware. In some embodiments, the controller comprises a voltage multiplier. In some embodiments, the controller is configured to provide at least one of: a zero DC biased sine wave or a zero DC biased square wave to the first lens.

[0013] In some embodiments, in the first device as described above, the housing module further includes an aperture disposed on an outer side of the housing module. In some embodiments, the aperture has an area that is approximately within the range of 1 cm^2 to 5 cm^2. In some embodiments, the sensing mechanism comprises a touch sensitive switch exposed substantially through the aperture. The touch sensitive switch may, in some embodiments, include a capacitance or a membrane switch.

[0014] In some embodiments, in the first device as described above, the structural member includes the first temple. In some embodiments, the first temple includes a first portion and second portion. In some embodiments, the first portion is located closer to the first lens than the second portion and the housing module is coupled to the first portion of the first temple. In some embodiments, the housing module is the first portion of the first temple.

[0015] In some embodiments, in the first device as described above, the housing module may comprise a conductive material. In some embodiments, in the first device as described above, the housing module may comprise a non-conductive material. In some embodiments, in the first device as described above, the electronics module may comprise a non-conductive material. In some embodiments, in the first device as described above, the electronics module may comprise a conductive material.

[0016] In some embodiments, in the first device as described above, the structural member may comprise a non-conductive material. In some embodiments, the structural member may comprise any one of, or some combination of, a plastic or nylon material. In some embodiments, the structural member may comprise acetate.

[0017] In some embodiments, in the first device as described above where the housing module may comprise a non-conductive material, the structural member may comprise a conductive material. In some embodiments, the housing module may be configured or positioned so as to electrically isolate the electronics module from the structural member. In some embodiments, the structural member may comprise a metal.

[0018] In some embodiments, in the first device as described above, the first device may further include a first lens having a first electrical contact and a conductive path in electrical contact with the first electrical contact of the first lens. The electronics module may also have a first electrical contact. The conductive path may be in electrical contact with the first electrical contact of the electronics module. In some embodiments, the conductive path includes at least one pogo pin. In some embodiments, the conductive path includes a spring hinge. In some embodiments, the conductive path includes a compliant conductive element.

[0019] In some embodiments, in the first device as described above, the housing module may have a thickness that is less than or equal to approximately .7 mm. In some embodiments, the housing module may have a thickness that is less than or equal to approximately .5 mm. In some embodiments, the housing module may have a thickness that is less than or equal to approximately .3 mm.

[0020] A first method may also be provided. The first method may comprise a method of manufacturing or fabricating a device that includes a frame having a first temple and second temple, and a housing module that includes a first end; a second end, a body disposed between

the first and second end, and a cavity disposed within the body. The first end may include an opening. The first method may further comprise inserting an electronics module (or electronic components) into the opening of the housing module such that the electronics module is disposed in the cavity of the housing module.

[0021] In some embodiments, the first method as described above may further comprise removing the electronics module (*i.e.* a first electronics module) from the cavity through the opening of the housing module (and/or temple), and inserting an electronics module (*i.e.* a second electronics module) into the opening of the housing module such that the second housing module is disposed in the cavity of the housing module. In some embodiments, the first electronics module and the second electronics module are the same electronics module (*e.g.* they are the same module or they comprise the same components). In some embodiments, the first electronics module and the second electronics module are different electronics modules.

[0022] A second method may also be provided. The second method may comprise a method of manufacturing or fabricating a device that includes a frame having a first temple and second temple. The first temple may include a first end; a second end, a body disposed between the first and second end, and a cavity disposed within the body. The first end may include an opening. The first method may further comprise inserting an electronics module (or electronic components) into a housing module and inserting the housing module into the opening of the temple such that the housing module is disposed in the cavity of the first temple.

[0023] In some embodiments, the second method as described above may further comprise removing the housing module (*i.e.* a first housing module) from the first cavity through the opening of the temple, and inserting a housing module (*i.e.* second housing module) into the opening of the temple such that the second housing module is disposed in the cavity of the first temple. In some embodiments, the first housing module and the second housing module are the same housing module (*i.e.* they comprise the same materials in the same propositions). In some embodiments, the housing module and the second housing module are different housing modules. In some embodiments, the electronics module (or electronic components) may be removed with the housing module. In some embodiments, where the electronics module (or electronic components) is removed with the housing module, a second electronics module (or electronic components) may be inserted into the cavity in conjunction with the second housing module.

[0024] In some embodiments, the second method as described above may further include removing the housing module from the first cavity through the opening of the temple without removing the electronics module.

[0025] In some embodiments, in the second method as described above, the step of inserting the electronics module into the housing module comprises coupling the housing module to the electronics module. In some embodiments, in the second method as described above, the housing module may be inserted into the opening of the temple prior to the electronics module being inserted in the housing module.

[0026] In some embodiments, a first device may be provided. The first device may include a lens that comprises at least a first electrical contact and a lens housing holding the lens, where the lens housing comprises at least a second electrical contact. The first device may further include a conductive material disposed between the first and the second electrical contact, where the conductive material electrically connects the first and second electrical contacts. A barrier layer may be included that is disposed so as to cover at least a portion of the conductive material.

[0027] It should be understood that, after reading the disclosure provided herein, a person of ordinary skill in the art may understand that various combinations of the devices described above may be made such that some or all of the features described with regards to one device may be combined with some or all of the features of another device.

[0028] Embodiments may provide a housing module that houses (*e.g.* contains, surrounds, surrounds a portion, encapsulates, substantially encapsulates, and/or is coupled to) one or electronic components (and/or an electronics module) of an electronic spectacle frame. The electronics module may comprise any suitable material, which may be chosen in part based on the materials and configuration of other components of the electronic spectacles (such as the frames). In some embodiments, electronics for the electronic spectacles may be placed inside the housing module such that some or all of the components are covered by a portion of the housing module. The housing module may then be placed inside the electronic frames (such as within a cavity in one of the temples). In this manner, the electronics (*e.g.* in an electronics module) may be coupled to (*e.g.* attached to) the electronic frames. The housing module may, in some embodiments, electrically isolate the electronic components from the frame (or outside components) and/or provide structural support for the frames around the electronics of the electronic spectacles. In some embodiments, the housing module may also provide a mechanism

for a user of the electronic frames to interact with the electronics therein (for instance, through the use of a touch switch, such as a capacitive switch or a membrane switch).

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Fig. 1 is an illustration of spectacle frames.

[0030] Figs. 2(a) and (b) are cross sectional diagrams of devices in accordance with some embodiments.

[0031] Fig. 3 shows an exploded view of components of a portion of an exemplary device in accordance with some embodiments.

[0032] Fig. 4 shows an exploded view of components of a portion of an exemplary device in accordance with some embodiments.

[0033] Fig. 5 shows an exploded view of components of a portion of an exemplary device in accordance with some embodiments.

[0034] Fig. 6 shows a portion of an exemplary device in accordance with some embodiments.

[0035] Fig. 7 shows components of an exemplary device in accordance with some embodiments.

[0036] Fig. 8 shows an exemplary portion of an exemplary device with components coupled therein.

[0037] Fig. 9 shows an exemplary portion of an exemplary device with components coupled therein from a different angle.

[0038] Fig. 10 shows a close-up view of an exemplary portion of an exemplary device with components coupled therein.

[0039] Fig. 11 shows an exemplary embodiment of a device in accordance with some embodiments.

[0040] Fig. 12 shows an exemplary design mask in accordance with some embodiments.

[0041] Fig. 13 shows an exemplary temple of an electronic spectacle frame in accordance with some embodiments.

[0042] Fig. 14 shows an exemplary embodiment of a device in accordance with some embodiments.

[0043] Fig. 15 shows an exemplary embodiment of a device in accordance with some embodiments.

[0044] Fig. 16 shows an exploded view of components that may comprise an exemplary embodiment of a device in accordance with some embodiments.

[0045] Fig. 17 shows an exemplary embodiment of a device in accordance with some embodiments.

[0046] Figs. 18(a) and (b) show an exemplary embodiment of a device in accordance with some embodiments.

[0047] Figs. 19 (a) and (b) show an exemplary embodiment of a device in accordance with some embodiments.

[0048] Figs. 20 (a), (b), and (c) show exemplary embodiments of components of a device in accordance with some embodiments.

[0049] Fig. 21 shows an exemplary embodiment of a device in accordance with some embodiments.

[0050] Fig. 22 shows an exemplary embodiment of a device in accordance with some embodiments.

[0051] Figs. 23(a) – (e) show exemplary embodiments of a device in accordance with some embodiments.

[0052] Fig. 24 shows an exemplary embodiment of a device in accordance with some embodiments.

[0053] Fig. 25 shows an exemplary embodiment of a device in accordance with some embodiments.

[0054] Fig. 26 shows an exemplary embodiment of a sensing mechanism in accordance with some embodiments.

[0055] Fig. 27 shows an exemplary embodiment of an electronic frame comprising a housing module in accordance with some embodiments.

[0056] Fig. 28 shows a top view and a front view of an exemplary embodiment of an electronic frame comprising a façade in accordance with some embodiments.

[0057] Fig. 29 shows a rear view of an exemplary embodiment of an electronic frame comprising a façade in accordance with some embodiments.

[0058] Fig. 30 shows an exemplary barrier layer coupled to electronic spectacles in accordance with some embodiments.

DETAILED DESCRIPTION OF THE INVENTION

[0059] The following disclosure provides exemplary devices comprising electronic (*i.e.* electro-active) spectacles. Before discussing specific embodiments, some descriptions of some specific terms are provided below.

[0060] As used herein, a "frame" may refer to a complete wearable housing that secures both spectacle lenses and aligns them in the proper place relative to the wearer's eyes when being worn. The frame may comprise elements such as a first and second temple, as well as the lens housing that is configured to support the spectacle lenses.

[0061] As used herein, a "hinged temple" may refer to a side piece of a frame that connects to the lens housing (or directly to the lens) by way of a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0062] As used herein, a "hinge-less temple" may refer to a side piece of a frame that connects to the lens housing (or directly to the lens) without a hinge attachment mechanism, and further provides stability by resting on the wearer's ears when worn.

[0063] As used herein, a "temple end piece" may refer to a part of the temple that is found farthest away from the lens housing. The temple end piece usually begins behind the ear of the wearer and ends at the end of the temple that is located farthest away from the lens housing, but this is not required.

[0064] As used herein, a "lens housing end piece" may refer to a part of the lens housing farthest away from the bridge and spatial to the bridge. Each frame typically has two lens

housing end pieces: one on the spatial side of the right lens and one on the spatial side of the left lens.

[0065] As used herein, a "bridge" may refer to a part of the frame that fits over/superior to the wearer's nose. The bridge is usually found between the portion of the lens housing that supports the right lens and the portion of the lens housing that supports the left lens, or is between the right and left lenses themselves. In some embodiments, the bridge may comprise a portion of the lens housing.

[0066] As used herein, the term "comprising" is not intended to be limiting, but may be a transitional term synonymous with "including," "containing," or "characterized by." The term "comprising" may thereby be inclusive or open-ended and does not exclude additional, unrecited elements or method steps. For instance, in describing a method, "comprising" indicates that the claim is open-ended and allows for additional steps. In describing a device, "comprising" may mean that a named element(s) may be essential for an embodiment, but other elements may be added and still form a construct within the scope of a claim. In contrast, the transitional phrase "consisting of" excludes any element, step, or ingredient not specified in a claim.

[0067] As used herein, a "hinge" may refer to the part of the frame that allows for connecting the lens housing and the temples in such away that the lens housing and the temple can open and close against the lens housing on its posterior side when not being worn. In some embodiments, the hinge may connect directly to the lens.

[0068] As used herein, "eye-wire" may refer to the rim that surrounds the lens of a spectacle frame. Eye-wire may comprise a portion of the lens housing that holds one lens (a right or a left) in a full rimmed or semi-rimless frame. There may be two eye-wires to each lens housing. However in a completely rimless frame there are no eye wires.

[0069] As used herein, a "lens housing" may refer to a part of the frame that is configured or adapted to support or hold the first and the second lenses in place (preferably firmly in place). The lens housing may also comprise the part of the frame to which the temples attach. The lens housing may comprise any component or material adapted to support the lenses, including, for example, screws, nylon monofilament, eye-wire, etc. or any combination thereof. The lens housing may comprise any material, including metal or plastic. A lens housing may be included in any type of frame design, including fully rimmed, semi-rimless, and rimless. In some

embodiments, the lens housing may also include the bridge, such as when the lens housing comprising a single component or two components that support both the first and the second lens. Moreover, as used herein, reference to a "lens" also includes any suitable optic or optical component. That is, the lens housing may hold any optical component, and need not necessarily comprise a lens that has a focal point (*e.g.* a lens could include a piece of glass or plastic that may serve any purpose). For example, a "lens" as used herein may refer to optical components that may project or maintain an imaginary image perceivably by viewer and/or be used in heads-up displays, video games, checking electronic mail, and/or any other suitable manner.

[0070] As used herein, an "electronics module" may refer to a housing or container that comprises a plurality of electrical components. For instance, an electronics module may comprise a power source (such as a battery), a sensing mechanism (such as a capacitance switch, which may activate or deactivate the electronics) and/or a controller (such as a microprocessor).

[0071] As used herein, an "electronic component" may refer to any electronic device, including a power source, a controller (such as a microprocessor), a sensing mechanism (such as a touch switch), etc. that may be coupled to an electro-active frame.

[0072] As used herein, a "rimless frame" may refer to a frame that is designed having a lens housing that does not comprise eye-wires. That is, for instance, the lens housing does not comprise eye wires but may comprise, for instance, nylon monofilament wire, screws, or other material to hold the lenses in place.

[0073] As used herein, a "semi-rimless frame" may refer to a frame that has a lens housing that comprises partial rim (*i.e.* eye-wire that does not completely encapsulate or encircle the lens) and/or may have a nylon monofilament wire or similar feature that secures the lenses to the frame.

[0074] As used herein, a "full rimmed frame" or "fully rimmed" may refer to a frame that comprises a lens housing having a complete rim that encapsulates or encircles the first and second lens (*i.e.* the lens housing comprises full eye-wires).

[0075] As used herein, a "Zyle frame" may refer to a frame that comprises mostly plastic

[0076] As used herein, a "metal frame" may refer to a frame that comprises mostly metal

[0077] As used herein, a "right spatial void" may refer to the space created where the right portion of the lens housing that is within the plane of the front of the wearers face turns back to meet the right temple. The angle formed between the right portion of the lens housing and the right temple is approximately (but not always) 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the right lens or inside right portion of the lens housing, on a second side by that of an imaginary line that is located in the middle of the right temple not including any electronics affixed thereto, and on a third side which is bounded by the right side of the face and/or head of the wearer.

[0078] As used herein, a "left spatial void" may refer to the space created where the left portion of the lens housing frame front that is within the plane of the front of the wearers face turns back to meet the left temple. The angle formed between the left portion of the lens housing and the left temple is approximately 90 degrees. This space is further defined as that which is bounded on three sides: On a first side by an imaginary line that is provided on the inside back surface of the left lens or inside left portion of the lens housing, on a second side by that of an imaginary line that is located in the middle of the left temple not including any electronics affixed thereto, and on a third side which is bounded by the left side of the face and/or head of the wearer.

[0079] As used herein, "coupled" may refer to any manner of connecting two components together in any suitable manner, such as by way of example only: attaching (*e.g.* attached to a surface), disposing on, disposing within, disposing substantially within, embedding within, embedded substantially within ,etc.. "Coupled" may further comprise fixedly attaching two components (such as by using a screw or embedding a first component into a second component during a manufacturing process), but does not so require. That is, two components may be coupled temporarily simply by being in physical contact with one another. Two components are "electrically coupled" or "electrically connected" if current can flow from one component to another. That is, the two components do not have to be in direct contact such that current flows from the one component directly to the other component. There may be any number of other conductive materials and components disposed electrically between two components "electrically coupled" so long as current can flow there between.

[0080] As used herein, a "conductive path" refers to a continuous path for which electrons (*i.e.* current) may flow from one point to another. The conductive path may comprise one component, or more than one component. For instance, a conductive path may comprise portions of a lens housing, a temple, a hinge, a lens, and/or conductive material disposed between some or all of the components.

[0081] As used herein, "electro-active spectacles," "electronic spectacles," "electro-active spectacle frames," "electronic spectacle frames," "electro-active eyeglasses," "electro-active eyeglass frames," "electro-active frames," "electro-active lenses" or any permutation of "electro-active" or "electronic" may broadly refer to any eyeglass frame or lens that comprises an electronic component or components. The electrical components can be coupled to any part of the electro-active (*e.g.* electronic) frames or lenses. This may comprise, for instance, any and all uses where by the eyeglass frames house some, most, or all of the electronics and the lens comprises a component or components that may be activated and/or deactivated by an electrical current or voltage, such as by way of example only, electronic focusing eyeglasses, electro-chromic eyeglasses, electronic tinted eyeglasses, eyeglasses comprising a micro-display allowing for viewing a digital image in space, eyeglasses comprising an electronic heads up display, eyeglasses that comprise an antistatic element to keep the eyeglass lenses clean, electronic shutter eyeglasses for viewing 3D images, electronic eyeglasses that comprise an occlusion control for vision training; electronic eyeglasses for myopia control, eyeglasses that comprise a component of a telescope or the complete telescope, eyeglasses that comprise a microscope, eyeglasses that comprise a camera, eyeglasses that comprise a directional microphone, eyeglasses that comprise a rangefinder, eyeglasses that comprise an image intensifier, eyeglasses that comprise a night vision enhancement feature, occupation eyeglasses, gaming eyeglasses; eyeglasses that may comprise electronic components to provide a user with functionality for receiving input from a wearer and performing a specific operation in response, such as providing information to the wearer – *e.g.* a virtual personal assistant (that is,. eyeglasses that may comprise electronic components such as an input device (*e.g.* a microphone) for receiving signals (*e.g.* commands or questions) from a wearer; a micro-processor that may process the input received from the wearer and determine an approiate action or response; a memory or other storage device that may store associations between input received and predetermined functions; voice recognition software for identifying the information in an input received from a wearer; an output device (*e.g.* a speaker) for communicating or signaling information to a wearer, etc.).

Additional functionality and electrical components that may comprise portions of electro-active or electronic spectacles may be utilized, including those that are discussed in more detail below.

[0082] As used herein, reference to a "first" or a "second" does not limit the referenced component to a particular location unless expressly stated. For instance, reference to a "first temple" may comprise the temple located on either the left side or the right side of a wearer's head.

[0083] As used herein, the term "approximately" may refer to plus or minus 10 percent, inclusive. Thus, the phrase "approximately 10 mm" may be understood to mean from 9 mm to 11 mm, inclusive.

[0084] Electro-Active Frames Comprising a Spring Mechanism

[0085] Some embodiments of electro-active spectacle frames provided herein may include a spring mechanism. The spring mechanism may, for instance, be disposed on the frame of the spectacles (such as on the temple, embedded within the temple, coupled to the temple and the lens housing, etc.) and may provide a force that causes the temple member to apply pressure in a direction substantially perpendicular to, and in the direction of, a wearer's head. In this manner, the spectacle frames may fit tightly on a person's head, regardless of the size or shape. This may provide for a more comfortable fit and reduce the risk that the eyeglasses could become dislodged or accidentally fall off of the wearer's head. Moreover, the use of a spring mechanism for an electro-active frame may provide the additional benefit of conserving power when the frames are not in use by severing an electrical connection between electronics located on the lens housing (or in the lens) and a power source located on the temple. That is, for instance, the spring mechanism may, by moving the temple of the frame away from the lens housing, separate two conductors such that current cannot flow from the temple to the lens housing (or any other separation).

[0086] The use of springs (*e.g.* spring hinges) for non-electro-active lenses is well known in the art. Examples of such spring hinges are provided in the following references, which are hereby incorporated by reference in their entireties:

U.S. Pat. No.: 6,336,250 to Takeda entitled "Spring hinge for Eyeglasses."

U.S. Pat. No. 5,760,869 to Mitamura entitled "Eyeglasses Frame with Spring Hinges."

U.S. Pat. No. 5,657,107 to Wagner et al. entitled "Spring Hinge for Eyewear"

U.S. Pat. No. 4,991,258 to Drlik entitled "Eyeglass Spring Hinges."

[0087] To date, there has not been a similar approach used for electro-active eyeglasses. In addition to some of the benefits provided by a spring mechanism (including those noted above, such as a tighter fit and the ability to conserve power by disconnecting components), there are additional considerations that the inventors have identified related to the use of such devices in electro-active frames. For instance, electro-active eyeglass frames may require that an electrical path be provided from a temple to the lens housing, which is not utilized on traditional (*i.e.* non-electro-active frames) frames. However, the use of spring devices (such as spring hinges) in electro-active eyeglass frames may cause the temple and lens housing to form an angle that is less than 90 degrees, even when the frames are in use. This could cause a disruption in electrical connectivity between electronics or a power source located on a temple with any electronics located on the lens housing (or in the lens itself). Fig. 1 illustrates this situation.

[0088] As shown in Fig. 1, a typical position of the temple relative to the lens housing (*e.g.* when the frames are being worn) is for the first **101** and/or the second temple **102** to form approximately a ninety degree angle with the lens housing **103**. In practice, this angle may be slightly smaller or greater (depending on factors such as the wearer's head size and shape, the size of the frame, etc.). In this position, a conductive path may connect components on the first **101** or second temple **102** to components disposed on the lens housing **103**. However, the use of a spring mechanism that applies force in the direction of a wearer's head may cause this angle **104** to be substantially less than ninety degrees (for instance, it may be 85 degrees or less), which could cause a separation in the conductive path between the first **101** or second **102** temple and the lens housing **103**. For example, if a portion of the conductive path from the first temple **101** to the lens housing **103** comprises electrical contacts located at the respective ends of each of these components (such that, for example, when the first temple **101** and lens housing **103** are worn, there is a direct connection between the electrical contacts), then this connection may be broken as the angle **104** between the components is reduced. As noted above, the use of springs or similar devices in eyeglass frames to provide continuous pressure is likely to create such angles, and therefore such springs and similar devices have not been used with electro-active frames.

[0089] Provided herein is an electro-active frame that comprises a spring mechanism. As used herein, a "spring mechanism" may refer to an elastic object that may be used to store mechanical energy. It may comprise a spring and/or other components such as conductors located within the spring or disposed alongside the spring (or within the coils of a coil spring). When compressed or stretched, the first spring mechanism may exert a force on one or more of the components of a device, such as the temple or the lens housing of an electro-active frame. The first spring mechanism may provide a continuous force (either variable or constant) in a direction substantially perpendicular to the head of a wearer when the first device (*e.g.* an electro-active frame) is worn. The first spring mechanism may, in some embodiments, also conduct electricity and thereby form a part of a conductive path using a spring (or components thereof) or a conductor coupled to or disposed therein. In some embodiments, the conductor may be embedded within the spring mechanism, be coupled to the spring mechanism, and/or encircled by the spring mechanism. As used herein, a spring mechanism may also comprise additional components, such as a hinge that may be coupled to the temple and/or the lens. The spring mechanism may comprise any suitable material, including metal, plastic, or some combination thereof. Figs. 2 (a) and (b) show two examples of electro-active frames comprising spring mechanisms.

[0090] A first device is provided that comprises a frame that includes a lens housing adapted to support a first lens and a second lens. The first device also comprises a first temple movably coupled to the lens housing, and a second temple movably coupled to the lens housing. That is, the first and second temples may be coupled to the lens housing such that each may be moved relative to the lens housing so that the angle between them (*e.g.* angle **104** in Fig. 1) may change. In this regard, the lens housing and the temples may be coupled in any suitable manner that allows for this movement, including, by way of example, through the use of a hinge or a screw.

[0091] The first device further comprises a first spring mechanism coupled to the first temple and the lens housing. As defined above, this does not require that the spring mechanism be permanently attached to both components. For example, the spring mechanism may be fixed to the first temple and apply force to the lens housing when the first temple and lens housing (or components thereof, such as the end pieces) are within a certain distance of one another (*i.e.* the angle **104** between the components is close to ninety degrees (*e.g.* within five degrees), or some other suitable value). When the first temple and the lens housing are moved sufficiently apart

the spring mechanism may no longer be in physical contact with the lens housing. An example of this situation is provided in Fig. 2(b) and described in detail below. Although defined above, it is worth noting that the spring mechanism need not be in the form of a coil spring, but may take any suitable shape and may be located in any suitable location on the frame. Such locations, as will be described below, may include disposed on, or embedded within, the lens housing and/or on the first temple. An example of a spring mechanism embedded within the first temple is shown in Fig. 2(a), which will be described below.

[0092] The first device also comprises a first conductive path from the first temple to the lens housing for at least one position of the first temple relative to the frame. That is, as defined above, electrons (in the form of current) may be distributed (*i.e.* conducted), or be capable being distributed (*i.e.* conducted), from the first temple to the lens housing. In so doing, the first device may, for example, comprise an electro-active frame that has some electronic components (such as a power source, controller, sensing mechanism, etc.) located on the first temple, and other electronic components (such as those described below) disposed on the lens housing and/or on (or within) the lenses themselves.

[0093] As defined above, the first conductive path may be provided by any suitable component or components. For instance, the conductive path could comprise the first temple, the spring mechanism, and the lens housing themselves (*i.e.* each could comprise conductive material) or some or all of these components could comprise conductive components disposed on (or embedded within) them that form a part of the conductive path. As indicated above, the conductive path need not always be present, but may be provided for at least one position of the first temple relative to the lens housing. With reference again to Fig. 1, the first temple **101** may be moved to a plurality of positions relative to the lens housing **103**, each of which may have a different angle **104**. Preferably, the first conductive path is provided when the first temple and the lens housing are in a position corresponding to when the first device is being worn by a wearer. In some embodiments, this position may have an angle corresponding to approximately ninety degrees. However, embodiments are not so limited and the angle may depend on many factors, as described above. It should also be understood that the conductive path may be provided for a plurality of positions.

[0094] In some embodiments, in the first device as described above, the first conductive path is provided by the first spring mechanism. That is, for example, the first spring mechanism may

provide some (or all) of the first conductive path between the first temple and the lens housing. This may be due, in part, to the fact that the spring mechanism may be located between (or substantially between) both the first temple and the lens housing. In some embodiments, the first spring mechanism comprises a spring that provides the first conductive path. The spring of the spring mechanism need not comprise a traditional coil spring, but may comprise any elastic material that stores mechanical energy, such as when the spring is displaced. An example of a non-coil spring is provided with reference to Fig. 2 (a). As noted above, the spring may comprise any conductive material when providing at least a portion of the first conductive path. Preferable, the spring mechanism comprises metal.

[0095] By utilizing the spring mechanism to form a part of the conductive path, some embodiments may provide the advantage of reducing the number of components that are required to be coupled to the frame. Moreover, in some embodiments, the use of the spring mechanism to serve as part of the conductive path may be one way in which the conductive path can be selectively provided (*e.g.* the conductive path may be available when the first device is being worn and unavailable when the first device is not being worn). For instance, the spring mechanism may be permanently coupled (*i.e.* fixedly, such as through the use of a screw, adhesive, etc.) to only the first temple, and be selectively coupled (*i.e.* temporally, such as coming into physical contact, but not being adhered to, screwed together, etc.) to the lens housing such that the spring mechanism is in physical contact with the lens housing in some but not all positions of the first temple relative to the lens housing. In embodiments where the first spring mechanism provides some or all of the conductive path, then in positions where the first spring mechanism is no longer contacting the lens housing, the conductive path may not be provided. This may be one way of providing a selectively available conductive path between the first temple and the lens housing.

[0096] In some embodiments, in the first device as described above, the first spring mechanism comprises a spring and a first conductor. The conductor may comprise any suitable material and may have any suitable shape. There need not be any physical contact between the spring and the conductor. For instance, in some embodiments, the spring is disposed substantially around the first conductor. By "substantially around," it is meant, for example, that the spring may encircle or surround some (but not necessarily all) of the conductor. This is illustrated in the exemplary embodiment shown in Fig. 2(a). For instance, if the spring comprises a coil spring, then the

conductor may be located within the coils of the spring. In some embodiments, the conductor may be disposed within (*e.g.* embedded in) the spring, such that the spring may comprise both the conductor (or more than one conductors) and an insulating material. The insulating material may electrically insulate the conductors that are within the spring such that the a plurality of conductive paths are provided by the spring (*i.e.* through the embedded conductors). This may allow for multiple signals to be transmitted from the first temple to the lens housing, for a signal and power to be transmitted, etc. In some embodiments, the spring is coupled to the first conductor. That is, the spring may be attached or disposed on the conductor. Each of the spring and/or the conductor may comprise a part of the conductive path. In some embodiments, the spring is disposed along a side of the first conductor. By "along side," it is meant that the spring and the conductor may be substantially parallel and located no more than 3 cm apart at any given point. Preferable, the spring and the conductor are no more than 1 cm apart such that the spring mechanism may have a small profile (*i.e.* for aesthetic reasons). Again, embodiments are not so limited, and the conductor may be located in any suitable location. Thus, in some embodiments, the first conductive path or a portion thereof may be provided by the first conductor.

[0097] In some embodiments, in the first device as described above, the first conductive path further comprises pogo pins. A "pogo pin" may comprise a device that establishes a (usually temporary) connection between two components. An illustration of an embodiment that utilizes pogo pins is shown in Figs. 3-10. The pogo pins may be disposed within the first temple, but embodiments are not so limited and the pogo pins may be located in other locations, such as disposed on the first temple, on the lens housing (or embedded therein) and/or coupled to the first spring mechanism. In some embodiments, the first device further comprises a second spring mechanism that may press the pogo pins against electrical contacts on the lens housing for a plurality of positions of the first temple. The use of the second spring mechanism may provide the ability to maintain the conductive path between the first temple and the lens housing for some or all of the positions of the first temple relative to the lens housing. That is, as the distance between the portion of the lens housing comprising the electrical contacts and the first temple increases (*i.e.* as the angle **104** in Fig. 1 decreases), the second spring mechanism may lengthen the conductive path (*i.e.* cause the pogo pins to extend) so as to maintain the electrical contact (and thereby the conductive path). When the angle **104** is then increased, the lens housing and/or first temple may apply force to the second spring mechanism such that it contracts (*i.e.* the pogo pins contract), but such that the electrical contact is still maintained. By providing a force on the

pogo pins so as to press against the electrical contacts of the lens housing (or congruently, against the first temple) for some, but not all, of the position of the temple, embodiments may provide the ability to selectively provide a conductive path between the first temple and the lens housing.

[0098] In some embodiments, in the first device as described above, the first spring mechanism may include a spring hinge. That is, the spring mechanism may comprise a fixed portion that is coupled to both the lens housing and the first temple (*i.e.* the hinge) that allows for the relative movement between the two components so as to change the angle **104**. The spring may be coupled to either or both of the lens housing and the first temple, and may provide a force that may move the first temple to one of a plurality positions and/or presses the first temple against a wearer's head. In some embodiments, in the first device as described above, an electronics module is further provided. The electronics module may, for example, comprise at least one of: a power source, a controller, and a sensing module. The use of an electronics module may, in some embodiments, provide the ability to more readily fabricate electro-active spectacles, as the electronics may be manufactured separately and inserted into a plurality of frame designs. The electronics module may be coupled to the first temple or in another suitable location (note that some embodiments may dispose the electronics module or components thereof, for instance, on the lens housing). For example, the electronics module could be embedded or substantially embedded in the first temple (as is described below with reference to the exemplary embodiments shown in Figs. 3-10). In some embodiments, the first conductive path may be electrically connected to the electronics module. That is, a conductive path may be provided from the electronics module to the lens housing and may comprise a number of components, such as the first spring mechanism or components thereof.

[0099] In some embodiments, in the first device as described above, the first conductive path conducts electricity from the first temple to the lens housing when the first temple is in a first position. The first conductive path does not conduct electricity from the first temple to the lens housing when the first temple is in a second position. As was described above, the first and second positions may correspond to relative positions between the first temple and the lens housing. The first position, in which the conductive path conducts electricity, may correspond to a position of the first temple when the first device is in use (*e.g.* when the first device is worn) and the second position may correspond to a position of the first temple when the device is not in

use (*i.e.* when the device is not worn). As noted above, the conductive path may be provided by any of the components of the first device, such as the first spring mechanism, lens housing, first temple, etc.. Embodiments that selectively (*i.e.* in some instances but not all) provide the conductive path from the lens housing to the first temple may provide some or all of the advantages described above, which may include power conservation and efficiency related to some or all of the electronic components of the first device not operating when the first device is not in use (*e.g.* any electronics disposed on the lens housing will not be electrically connected to electronic components on the first temple).

[0100] In some embodiments, where the first conductive path conducts electricity from the first temple to the lens housing when the first temple is in a first position and the first conductive path does not conduct electricity from the first temple to the lens housing when the first temple is in a second position, the lens housing comprises a first electrical contact and the first spring mechanism forms an electrical connection with the first electrical contact in the first position. In some embodiments, the first spring mechanism does not form an electrical connection with the first electrical contact in the second position. That is, in embodiments wherein the first conductive path or a portion thereof includes the spring mechanism (or a component thereof), the spring mechanism may directly connect to (*i.e.* physically contact) the electrical contacts disposed on the lens housing. In this manner, the conductive path provided at least in part by the spring mechanism may be selectively provided by contacting and not contacting the electrical contacts on the lens housing.

[0101] In some embodiments, in the first device as described above, the first spring mechanism is coupled to the first lens. This may be the case, for instance, when the first device comprises rimless eyeglass frames. The spring mechanism may provide some or all of the same functionality as in full rimmed or semi-rimless embodiments, such as by applying a force such that the first temple applies pressure on the wearer's head. The spring mechanism may also be coupled to the lens housing, even in rimless embodiments (such as when a screw or hinge is coupled to the lens). In some embodiments, the lens includes a first electrical contact, and the first spring mechanism forms an electrical connection with the first electrical contact when the frame is in the first position. That is, the spring mechanism may form a portion of the conductive path that drives current to the lens (and may power and/or control any electronics therein) from the first temple. As noted above, in some embodiments, the spring mechanism

may directly connect to the lens, and thereby may also form a direct electrical connection with the electrical contacts disposed thereon. The spring mechanism may itself comprise conductive components (including in some embodiments a conductive spring) that may form the connection. In such embodiments, the spring mechanism may be fixedly coupled to the lens, but the conductive components of the spring mechanism may selectively contact the electrical contacts of the lens.

[0102] In some embodiments, in the first device as described above, the first spring mechanism is housed within the first temple. As used herein, the term "housed within" may refer to when the first spring mechanism is coupled to the first temple in such a way that a portion of the first spring mechanism (such as a spring or a conductor) is within the structure of the first temple. However, the first spring mechanism may have some components exposed outside of the structure of the first temple, such as to make electrical connections with other components such as the lens housing. Embodiments that include the spring mechanism embedded within the temple may provide aesthetic value (that is, the electro-active frames may present a more favorable outward appearance), as it may provide a more finished look with components covered or contained within the overall structure of the device. In addition, embedding the first spring mechanism in the first temple (or any component, such as the lens housing) may also provide a more durable or reliable device, as the first temple may protect the spring mechanism from ambient conditions as well as physical damage that spectacle frames are typically subjected to on a regular basis.

[0103] In some embodiments, in the first device as described above, the first spring mechanism is in electrical contact with the electronics module. As defined above, electrical contact does not require direct physical contact. There may be any number of conductors located between two components that are in electrical contact. The spring mechanism may be disposed between the electronics module and the electronic components that it controls and/or provides power to, and therefore it may be efficient in some embodiments that the spring mechanism electrically connect to the electronics module. This connection may be made regardless of the position of the first temple, particularly in embodiments whereby the first spring mechanism is disposed on the first temple. In some embodiments, the first spring mechanism is in direct electrical contact with the electronics module. That is, there are no other conductors disposed between the

electronics module and the electrical connector. Some exemplary embodiments are illustrated in Figs. 3-10.

[0104] In some embodiments, where the first conductive path conducts electricity from the first temple to the lens housing when the first temple is in a first position and the first conductive path does not conduct electricity from the first temple to the lens housing when the first temple is in a second position, the first spring mechanism maintains electrical contact with the electronics module in both the first position and the second position. This may be the case, for instance, for embodiments on which the spring mechanism is disposed on the first temple. As the first temple is moved (*e.g.* by the spring mechanism) from the first position (where the spring mechanism may be electrically connected to the lens housing) to the second position, the electrical contact between the first spring mechanism and the lens housing may be severed (*e.g.* the spring mechanism and the lens housing may no longer be physically coupled). This may provide the selective conductive path discussed above. Embodiments may provide the advantage that only one electrical contact may be required to be connected/disconnected (*i.e.* only one electrical switch) so as to activate and deactivate the electronics on the lens housing.

[0105] In some embodiments, in the first device as describe above, the first spring mechanism is in a first condition when the first temple is in a first position and a second condition when the first temple is in a second position. By "condition," it is meant that any characteristic of the spring mechanism (including the position of the spring mechanism, its size, shape, or length, and/or the conductivity of the spring mechanism) may change. In some embodiments, this change in condition may provide the change in electrical connectivity. For instance, the shape of the first spring mechanism may change so as to provide (or not provide) physical contact between the spring mechanism (or components thereof) and the lens housing. In some embodiments, the spring mechanism may, for example, maintain electrical contact with the lens housing and the first temple by changing its length or shape (*e.g.* as the distance between the first temple and the lens housing increases, the spring mechanism may increase in length to maintain contact). In this regard, the first spring mechanism may have a first length when the first temple is in a first position and a second length when the first temple is in a second position. The first length and the second length are different. By "length" it is meant that the dimension of the electrical connector in a direction that is substantially parallel to the largest dimension of the temple (preferably when the first device is worn).

[0106] In some embodiments, in the first device as described above where the first conductive path conducts electricity from the first temple to the lens housing when the first temple is in a first position, and the first conductive path does not conduct electricity from the first temple to the lens housing when the first temple is in a second position, the first position is an open position. By "open position," it is meant that the first temple is in a position that is substantially perpendicular to the first and/or second lens such as when the frame is positioned on a wearer's head. However, it need not be exactly perpendicular, as in some cases there may be embodiments where the angle between the temple and the lens is less than ninety degree. The angle is shown in Fig. 1 by the angle **104**. The angle **104** may vary based on both the shape and size of the wearer's head as well as the size and shape of the frames. For instance, in some embodiments, the first position may comprise the first temple and the lens housing being positioned such that the angle **104** between them is between 60 degrees and 110 degrees. Preferably, the angle **104** between the temple and the lens housing in the first position is between 80 degrees and 90 degrees. This typically corresponds to the angle **104** for when the first device is being worn, and thereby the electronics of the first device may be used.

[0107] In some embodiments, in the first device as described above where the first conductive path conducts electricity from the first temple to the lens housing when the first temple is in a first position, and the first conductive path does not conduct electricity from the first temple to the lens housing when the first temple is in a second position, the second position is a closed position. By "closed position," what is meant which is that the temple and the lens form an angle **104** that is significantly less than ninety degrees. This may correspond, for instance, to a situation in which the device is not in a position on a wearer's head and therefore any frame electronics may not need to be activated. In some embodiments, the second position comprises the first temple and the lens housing being positioned such that there is an angle **104** between them of between 0 degrees and 60 degrees. Preferable, the second position comprises the first temple at an angle **104** between 0 degrees and 45 degrees with the lens housing. Again, these angles may correspond to when the first device is not in use.

[0108] Figs. 2(a) and 2(b) illustrate two exemplary embodiments of spring mechanisms that could be used in the first device. First, with reference to Fig. 2(a), a spring **202** is provided that is disposed between the lens housing **200** and the first temple **201**. In this exemplary embodiment, a portion of the spring **202** is shown as being embedded in the first temple **201**.

The spring **202** is illustrated as a coil spring, and a conductor **203** is shown disposed within the spring **202** (*i.e.* the spring substantially encircles the conductor). In some embodiments, the conductor and spring may comprise the spring mechanism. A hinge **204** is shown coupled to both the lens housing **200** and the first temple **201**. The hinge **204** permits the first temple to move relative to the lens housing **200**. A conductive path is shown by the dotted lines **205** (within the spring mechanism), **206** (within the lens housing **200**) and **207** (within the first temple). The conductive path could comprise an embedded conductor within these elements (*e.g.* a wire or embedded conductive material) or it could represent the components themselves (*e.g.* the lens housing **200,** spring mechanism (*i.e.* spring **202** and/or conductor **203**), and/or the first temple **201** could comprise conductive material). However, embodiments are not so limited, and the conductive path need not be provided by the spring mechanism or a component thereof. The spring **202** may apply a force to the first temple **201** such that the first temple **201** applies pressure on a wearer's head.

[0109] With reference to Fig. 2(b), another exemplary spring mechanism for use in an electro-active frame is provided. The spring **212** is not a coil spring, but may comprise elastic material such that when the first temple **211** is moved close to the lens housing **210**, the spring **212** becomes depressed. Because of the nature of the material of the spring **212**, as it becomes compressed (*i.e.* it is displaced toward the lens housing **210**) it provides an opposing force. This force may separate the lens housing **210** and the first temple and/or, for example, apply force to maintain the first device tightly on a wearer's head. The hinge **213** (which is shown as comprising conductive material) couples the lens housing **210** and the first temple **211** such that they may move relative to one another. A conductive path is shown by the dotted lines **214** (within the lens housing) and **215** (within the first temple). The conductive paths **214** and **215** may be connected (and thereby form a single conductive path) when the first temple **211** is positioned close to the lens housing **210** (*e.g.* when the spring **212** is sufficiently compressed). Although as illustrated, the conductive path is provided through the conductive hinge **213**, embodiments are not so limited. That is, a portion of the conductive path (*e.g.* between conductive paths **214** and **215**) may be provided by any suitable component, such as through the spring **212**.

[0110] For example, the lens housing **210** and the first temple **211** could comprise electrical contacts at the interface where each may contact the spring **212**. When the spring is compressed,

there may be formed electrical contacts between the lens housing **210**, the spring **212** and the first temple **211**. In some embodiments, the conductive path **214** may connect directly to the spring **212** (which, for example, may itself comprise conductive material) such that an electrical contact need only be formed (selectively) with the conductive path **215** in the first temple **211**. For instance, when the first temple is moved to contact **212**, but prior to fully compressing **212** to contact the lens housing **210**, an electrical path from the first temple **211** to the lens housing **210** may be established. This exemplary embodiment may provide the ability to have the conductive path at angles **216** that are less than ninety degrees (which may be beneficial, for instance, to prevent connection problems when the electro-active frames are worn and the pressure applied by the spring causes an angle less than ninety degrees). It should be understood that the spring could, in some embodiments, be located on the first temple and the principles discussed herein would apply equally.

[0111] With reference to Figs. 3-10, an exemplary embodiment of a first device is provided for illustration purposes only. The components that comprise the exemplary embodiment in Figs. 3-10 include: a first temple **300**; electrical connectors **301** to connect to the pogo pins; pogo pins comprising a spring **302** and conductive portion **303** (*e.g.* stainless steel cable); vertebrae **304**; an end piece **305**; a spring box cover **306**; an electronics module **307**; a cavity **308** in the first temple for housing the electronics module **307**; and electrical connectors to the electronics module **310**. It should be noted that this is for illustration purposes only, and is provided to demonstrate an exemplary embodiment in which pogo pins embedded or coupled to the first temple **300** may be used to maintain an electrical contact with the lens housing throughout a plurality of positions (*i.e.* angles) between the first temple **300** and the lens housing. Pogo pins may be used with or without a spring mechanism, but when combined with the use of a spring mechanism, embodiments may provide the benefit of maintaining the conductive path when the electro-active frames are worn despite the creation of an angle between the lens housing and the first temple that is less than ninety degrees.

[0112] Fig. 3 shows an exploded view of the components comprising a portion of an exemplary device in accordance with embodiments provided herein. The device comprises an electronics module **307** embedded in a cavity **308** of the first temple **300**. The electronics module is electrically connected to pogo pins that comprise a spring **302** and a conductor **303**. The pogo pins may be used to maintain a connection as the distance (and/or relative positions)

between two electrical contacts increases or decreases, because the spring **302** applies force to maintain the electrical contact with the conductor **303**. Thus, for instance, embodiments may provide that as the first temple **300** is moved relative to the lens housing, the pogo pins may maintain electrical contact with the lens housing and thereby provide a portion of a conductive path from the first temple **300** to the lens housing. The vertebrae **304** allow the first temple **300** to move relative to the lens housing, while covering the pogo pins. The end piece **305** may comprise a hinge such that the first temple **300** and the lens housing are coupled together, but may move relative to each other. The spring box **306** covers and protects the pogo pins and/or provides aesthetic value be given a finished look to the frames.

[0113] Fig. 4 shows the same components described above with reference to Fig. 3 from an alternative angle. It should be noted that end piece **305**, spring box cover **306**, and electronics module **307** may be coupled to the first temple **300** using any suitable method (such as adhesive, two sided tape, a screw, etc.).

[0114] Fig. 5 shows a close-up view of the first temple **300** of the exemplary device. As shown, the pogo pins (and in particular the end of the pogo pins comprising the spring **302**) may form an electrical connection with electrical connectors **301**. The electrical connectors **301** are embedded within a cavity in the first temple **300**. Also shown are connectors **310** that may form an electrical connection with the connectors **301** and the electronics module **307**. Thus, the electrical connectors **301** and **310** form a conductive path from the pogo pins to the electronics module (not shown) in the cavity **308**. In some embodiments, the connectors **301** and **310** may comprise a single electrical conductor.

[0115] Fig. 6 shows the components described above coupled together with (or disposed within) the first temple **300**. As shown, the vertebrae **304** cover a portion of the conductor **303** of the pogo pins. The electrical connector **301** is shown in physical contact with the pogo pins, and the pogo pins are embedded substantially within the first temple **300**.

[0116] Fig. 7 shows an isolated view of the connections formed between the electronics module **307** and the pogo pins. As shown, the electrical connectors **301** are coupled to the electronics module **307** and are in physical (and electrical) contact with a portion **302** of the pogo pins. In this manner, a conductive path is provided from the electronics module **307** to the pogo pins. The pogo pins (via conductor **303)** may further form an electrical connection with a portion of the lens housing. In so doing, a conductive path may be provided from the first temple

300 (*e.g.* from the electronics module **307**) to the lens housing. In this manner, the electronics module **307** may provide, for example, power and/or control signals to electronics housed on the lens housing and/or in the lens. Further, as described above, the use of the pogo pins may be beneficial, for example, with the use of a spring mechanism as they may continue to provide a portion of a conductive path between the electronics module **307** and the lens housing for a plurality of positions of the first temple **300** relative to the lens housing (*e.g.* a number of angles formed there between, as described above).

[0117] Figs. 8 and 9 show views of the first temple **300** with each of the identified components coupled together where appropriate. The exemplary embodiment may provide a finished look (which may be aesthetically pleasing), as each of the internal components (such as the pogo pins, the electrical connectors, and even the electronics module) are relatively concealed or masked with the first temple.

[0118] Fig. 10 shows a close up of the end piece **305** of the exemplary device. As shown the conductor **303** of the pogo pins are partially exposed so as to be capable of forming an electrical connection with the lens housing. The vertebra **304** cover a portion of the pogo pins, and also provide the ability for the first temple **300** to move relative to the lens housing, while remaining coupled thereto.

[0119] The above description is illustrative and is not restrictive. Many variations of the invention will become apparent to those skilled in the art upon review of the disclosure. The scope of the invention should, therefore, be determined not with reference to the above description, but instead should be determined with reference to the pending claims along with their full scope or equivalents.

[0120] Some embodiments provided herein may thereby convey some of the advantages of utilizing a spring mechanism on eyeglass frames to embodiments comprising electro-active frames. For example, the use of the spring mechanism may provide for a better and/or more comfortable fit for the wearer, while providing the first conductive path from the first temple to the lens housing may allow for embodiments to utilize electronic components located on either or both of the lens housing (and/or the lens) and the temple. In addition, some embodiments may also provide the advantage of conserving power (and/or the lifetime of the electronics) by providing a conductive path from the temple to the lens housing for some positions of the temple

relative to the lens housing, while not providing the conductive path in one ore more other positions.

[0121] Exemplary Embodiments Comprising Separate Conductive Paths

[0122] Some embodiments disclosed herein may provide for electro-active frames comprising multiple conductive paths that are electrically isolated from one another. As more sophisticated electronics are provided on electro-active frames, it may be necessary to provide for additional electrical connections between multiple components. To function properly, these electrical connections (and the conductive paths that provide the electrical signals and current) must be separated (*i.e.* electrically isolated) to properly control multiple components (or, if an electrical component must be supplied power and control signals, this may also require multiple electrically isolated paths as well). Often times, electrical components are located in the temple of the electro-active frames (typically because there may be more space to dispose such components therein in an aesthetically acceptable manner). Housing electronic components in the temple may require that electrical connections are made between these components in the temple and any electrical components coupled to the lens housing (which may include the lenses themselves).

[0123] Embodiments may provide that these conductive paths from the temple to the lens housing of an electro-active frame are provided by frame elements of electro-active frames. As used herein, a "frame element" is any structural component of a frame (including the frame itself) or a component embedded therein such as a wire, conductor (such as metal), or conductive rubber. Thus, for instance, a frame element may include a temple, a bridge, a lens housing (*e.g.* rim wire for full rimmed or semi-rimless frames, hinges that connect to the lens housing and the temple, and/or other lens housings such as screws, nylon monofilament, etc) or portions thereof. A frame element does not comprise exterior components attached to the frame, such as a wire that runs along an outer surface. In this manner, by providing the conductive paths in a frame element or elements, the electro-active frames may remain aesthetically pleasing by not having bulky cords or other connections running across the frames or in locations where they may be visible.

[0124] Electro-active frames, and in particular electro-active frames that have electrical components in one or both lenses, often comprise multiple electronic components such as driving and control components (*e.g.* one for each lens). This can result in expensive devices with

duplicative components. The inventors have found that by, for instance, providing multiple isolated electrical paths using frame elements, is may be possible to reduce the number of duplicative electrical components and thereby significantly decrease the costs of such devices (*e.g.* by only a single electronics module that may control both of the lenses). That is, the electronic components (such as the power supply, the controller (such as a micro-processor), and the sensor mechanism (such as a switch that can activate the device) are often the components that are of the greatest expense (or are at least are relatively expensive in comparison to some of the other components of the frames). By reducing the number of components in each device, the inventors have provided the benefit of decreasing the costs associated with fabrication materials and decreasing the complexity and time of manufacture. Moreover, frame designs may be lighter and more structurally durable, as there are less components disposed thereon.

[0125] Described below are exemplary embodiments of devices comprising conductive paths provided by one or more frame elements (or components thereof) from the temple of a device to the lens housing. The embodiments described below are for illustration purposes only and are not thereby intended to be limiting. After reading this disclosure, it may be apparent to a person of ordinary skill that various components as described below may be combined or omitted in certain embodiments, while still practicing the principles described.

[0126] A first device is provided that comprises a frame. The frame further includes a lens housing adapted to support a first lens and a second lens, a first temple coupled to the lens housing, and a second temple coupled to the lens housing. The first device further comprises a first conductive path provided by one or more frame elements from the first temple to the lens housing and a second conductive path provided by one or more frame elements from the first temple to the lens housing**.** That is, the first device, through the use of two conductive paths, may provide, for instance, multiple electrical connections between two devices (*e.g.* one connection that provides power and the other that provides a control input), or between a plurality of devices (*e.g.* a control module or power supply that provides a signal or current to two different components, such as to two electro-active lenses)**.** In this regard, the first conductive path is electrically isolated from the second conductive path. Embodiments may thereby provide the ability to send separate signals (for instance, power and a control signal) from electronics that are housed in the temple to those located on the lens housing. It should be noted that an electrical component need not be located on the lens housing (for instance, an

electrical component may be located in a lens of the device). The device in some embodiments need only provide a conductive path from the temple (*i.e.* any part of the temple or a component thereon) to the lens housing. The conductive path may further extend to the lenses or to another component disposed thereon (or it may even extend through the lens housing and to the other temple).

[0127] It is often desirable (and/or necessary) for electrical components to be located or disposed on the lens housing to serve their intended purposes. For instance, if an electronic component displays an image to the viewer, changes the refractive index of the lens, or otherwise provides functions related to the wearer's vision, then these components may need to be located on (or near) the lenses. However, as noted above, the lens housing (or the lenses themselves) often does not have adequate space for the additional electrical components that may be required to activate and/or utilize the electronic components located on the lens housing or lenses (such as a power source, controller, or sensing module). In addition, these components may be aesthetically unpleasing and noticeable if disposed on the lens housing (or the lenses themselves). It may therefore be desirable in some embodiments to locate some or all of these additional electrical components on (or within) the temples of the frame. The temples typically have space available on which the additional electronic components may be disposed on and/or hidden or masked so as to remain aesthetically appealing.

[0128] However, as noted above, it may be necessary to provide a conductive path between the components in the temple and those located on the lens housing (or on the lenses). By using the frame element (*e.g.* the components themselves or conductors embedded therein), the inventors have developed embodiments of a device that may provide the necessary conductive paths to the lens housing, while maintaining the aesthetics of the device. Moreover, by electrically isolating the components so as to provide separate conductive paths, the inventors have developed embodiments of a device that may provide multiple inputs and connections to electrical components that may be coupled to the lens housing.

[0129] In some embodiments, the first device as described above further comprises at least one electrical insulator disposed between at least a portion of the first conductive path and the second conductive path. By "at least a portion" it is meant that electrical insulator need not be disposed along the entire first or second conductive paths (or along an entire interface between the two paths). Embodiments may provide different ways of electrically isolating the two conductive

paths that may, for instance, combine the use of the insulator with other components or features (such as by providing an air gap between the two conductive paths in a region) and/or may utilize multiple insulating materials.

[0130] The electrical insulator may be made of any suitable material, and may in some embodiments (such as embodiments where the conductors are embedded within a frame element) comprise a part of a frame element (such as when the frame element comprises a plastic material). For instance, in some embodiments, the electrically insulating material may comprise an injection moldable or similarly formed plastic material. In some embodiments, the electrically insulating material comprises nylon. The electrical insulator may be utilized in some embodiments in which the frame element comprises conductive material, and thereby two electrical paths may utilize the insulating materials to form the two conductive paths (although as described below, other methods may also be used when the frame elements comprise conductive material to isolate two conductive paths - such as by separating the paths using an air gap). Additional exemplary embodiments related to similar embodiments are shown in Figs. 11-12. In addition, embodiments may comprise multiple electrical insulators (for instance multiple pieces of the same material or different material) and the insulating material may be located along different portions of the electrical paths (for instance, a portion of the insulating material may be located in the temple and another portion of the insulating material may be located in the lens housing).

[0131] In this regard, in some embodiments, the first device further comprises a first hinge coupled to the first temple and the lens housing. The first hinge may connect the temple to the housing, and allow the temple to move relative to the housing. The electrical insulator may be located at least within the first hinge. For instance, in some embodiments, a portion of the electrical path or paths may comprise the hinge (that is, the hinge may comprise conductive material or conductive material may be embedded therein). The hinge may comprise a portion of the conductive paths in some embodiments because it is coupled to both the lens housing (or comprises a part of the lens housing) and the temple, and thereby may provide a conductive path between the two frame elements. An example of a hinge comprising a portion of a conductive path is shown in Figs. 2(a) (*e.g.* path **205-206**) and (b) (*e.g.* path **214-215**). The hinge may, for example comprise conductive material, and an insulator may be disposed therein so as to define two electrically isolated conductive paths. However, as noted above, the electrical insulator may

be located in any suitable location, or in multiple locations, as needed. For instance, in some embodiments, the electrical insulator is located at least within the first temple. In some embodiments, the electrical insulator is located at least within the lens housing. This may be preferred, for example, in embodiments of semi-rimless frames wherein a partial eye-wire (which may be used to mask or hide an embedded conductor or conductors) is present only over one portion of the lenses (*e.g.* the top or the bottom of the lenses). The two conductive paths may be located in the partial eye wire, and the electrical insulator may be used to separate the two paths.

[0132] In some embodiments, the first device as described above further comprises an electronics module that is coupled to the first temple of the frame. As noted above, the electronics module and other components may be preferably located on the temple in some embodiments for both practical and aesthetic reasons. The electronics module may comprise, for example, a controller, a power source, and/or a sensing mechanism. Some or all of these components may be used to operate electrical components located on the lens housing, which may thereby require an electrical contact between the electronics module and the component. In this regard, the first and second conductive paths may be electrically connected to the electronics module. In this manner, the electronics module (or the components therein) may be electrically connected to components coupled to the lens housing (such as those located in the lenses for the first device). In some embodiments, the use of frame elements to provide portions of the conductive paths, in addition to the electronics module being embedded in the first temple, results in a device that may appear to an observer to be an ordinary (non-electro-active) frame. Furthermore, in some embodiments, the electronic components (*e.g.* coupled to an embedded electronics module) and the conductive paths (comprising a fame element or elements) may be protected from the elements, and may, for example, reduce the likelihood that a short may occurs from an outside charge or force.

[0133] In some embodiments, the first device as described above further comprises a first lens having a first electrical contact and a second lens having a second electrical contact. That is, some embodiments of the first device may comprise electro-active lenses (such as lenses that perform different function when current is supplied to them or a component therein). To provide current to the electro-active lens or components therein, the lenses may comprise one or more electrical contacts. In some embodiments, the first conductive path electrically connects to the

first electrical contact of the first lens and the second conductive path electrically connects to the second electrical contact of the second lens. That is, the first conductive path may electrically connect to the first lens and the second conductive path may electrically connect to the second lens. In this manner, for example, embodiments may provide that a single electrical component (or electronics module) that is coupled to both the first and the second conductive paths may provide signals and/or current to the first and second lens of the device separately. For instance, embodiments may provide for the first and second lens to be controlled separately utilizing the electrically isolated conductive paths. Rather than a single electrical component (or electronics module), the first lens and the second lens may be individually controlled by separate electrical components (*i.e.* the first and second conductive path may, but need not, electrically connect to a single component).

[0134] In some embodiments, in the first device as described above that comprises a first lens having a first electrical contact that is electrically connected to the first conductive path, and a second lens having a second electrical contact that is electrically connected to the second conductive path, the first lens may further include a second electrical contact and the second lens may further include a first electrical contact. That is, the first and the second lenses may each comprise a first and a second electrical contact such that each may receive a plurality of signals or currents from one or more electrical components. In some embodiments, the first conductive path may electrically connect to the first electrical contact of the second lens and the second conductive path may electrically connect to the second electrical contact of the first lens. In this regard, the first lens and second lens may each be electrically connected to both the first and second conductive paths. Such embodiments may, but need not, provide for simultaneously controlling both the first and the second lens using a single electronics module or other components. Embodiments may thereby utilize, for example, a single electronics module that is electrically connected to both the first and second lenses.

[0135] As was described above, the use of a single electronics module and/or electrical components (such as those that may be coupled to the first temple of the device) to control a plurality of electrical components (such as those that are coupled to the lens housing and/or electro-active lenses of the first device) may provide several benefits. This includes, for example, removing redundant electrical components, and thereby reducing the manufacturing costs and complexity of the first device without sacrificing functionality. Such embodiments

may also remove the need to synchronize the first and second lenses. That is, for example, if the first and second lenses are electro-active lenses and are controlled using two different electronics modules (or components therein), the operation of each may have to be matched with the other (otherwise, a wearer may become distorted or receive conflicting functionality from the lenses). Synchronizing the lenses could require additional electrical components and further add to the cost and the complexity of the first device.

[0136] Indeed, in some embodiments, the second temple or the second lens does not comprise an electronics module coupled thereto. In this manner, the electro-active frames may comprise less redundant features by utilizing a single electronics module (or the components therein) electrically connected to both the first and second lenses (or other components coupled to the lens housing). In some embodiments, the use of two electrical connections (*i.e.* via the first and second conductive paths) may be the minimal number of electrical contacts needed for electrical components located on the lens housing or the electro-active lenses (*e.g.* the first and second lenses) to function properly.

[0137] In some embodiments, in the first device as described above, the lens housing comprises a non-conductive material and the frame element providing the first conductive path (or a portion thereof) comprises a conductive material embedded in the lens housing. That is, the conductive path may comprise material embedded in the lens housing. This may provide the benefit that the lens housing material itself may electrically isolate the first conductive path from other components (such as the second conductive path). Also, utilizing a non-conductive material for the lens housing (rather than a conductive material) may prevent short faults with the electronic components, or false signals generated by outside sources (such as by static electricity). In some embodiments, the frame element providing the second conductive path (or a portion thereof) comprises a conductive material embedded in the lens housing. In such embodiments, the frame elements providing the portions of the first and second conductive paths may be embedded within the lens housing such that a sufficient amount of non-conductive material (*e.g.* the material that comprises the lens housing) is disposed between the two conductive paths such that they remain electrically isolated. In some embodiments, additional electrical insulation may be provided and embedded within the lens housing as well. In some embodiments, the lens housing comprises acetate. Acetate is one of the more common materials

that eyeglass frames comprise. It is non-conductive and it may therefore be preferable to use this material for some of the embodiments described above utilizing non-conductive materials.

[0138] In some embodiments, in the first device as described above where the first device comprises a first and second lens having first and second electrical contacts, where the first conductive path electrically connects to the first contact of the first and second lens, and where the second conductive path electrically connects to the second contact of the first and the second lens, the lens housing may comprise a conductive material. A first portion of the lens housing may provide at least a part of the first conductive path. That is, a portion of the lens housing that comprises a conductive material may form an electrical connection between the first electrical contact of each of the first and second lenses. An exemplary embodiment of this is shown in Figs. 11 and 12, and described in detail below. In some embodiments, at least a part of the second conductive path is provided by a second portion of the lens housing. That is, for example, the lens housing may be separated into a plurality of electrically isolated portions. This may be done in any manner, such as by having two separate conductive pieces that are shaped appropriately (*e.g.* shaped into the mold of the lens housing portions such that when coupled to the first device, the first and second portions may support the lenses) and coupling the two portions to the first device (such as by coupling the portions to hinges or the temples) so that the portions remain are physically separate (*i.e.* electrically isolated).

[0139] In this manner, some embodiments may offer some advantages over other designs for providing electrically isolated conductive paths such as, by way of example, providing a less complicated manufacturing process. That is, for embodiments where the lens housing itself comprises conductive material, there may be no need to provide conductive material embedded within the lens housing (which could be a complex and intricate process, particularly when attempting to define multiple electrically isolated conductive paths. By utilizing a more macro approach such as physically separating the large conducting components of the frame to form the conductive paths (*e.g.* a top portion **1101** and a bottom portion **1102** that are separated at the ends **1104** and **1105** where they may be coupled to the temples (or a hinge) of the first device and in the center **1103** by an air gap or insulation), embodiments may provide a readily achievable and commercially feasible design for providing the electrically isolated conductive paths.

[0140] Continuing with these exemplary embodiments, wherein the first device comprises a first and second lens having first and second electrical contacts, where the first conductive path electrically connects to the first contact of the first and second lens, where the second conductive path electrically connects to the second contact of the first and the second lens, where the lens housing comprises a conductive material, where a first portion of the lens housing provides at least a part of the first conductive path, and where at least a part of the second conductive path is provided by a second portion of the lens housing, the first portion of the lens housing and the second portion of the lens housing may be separated by at least one of an air gap or insulating material. This may again be illustrated with reference to the exemplary embodiments in Fig. 11 and 12, where the electrical isolation between the first **1101** and the second **1102** conductive paths is an air gap at the bridge **1103**. Other points of electrical isolation are provided at the edges of the lens housing **1104** and **1105** where the first portion **1101** and second portion **1102** of the lens housing are coupled to the temples at different locations. In some embodiments, rather than an air gap at the bridge **1103**, electrical insulation may be used. This may provide an advantage over the air gap embodiments because the portions **1101** and **1102** above and below the air gap are likely to, at some point, be misshaped such that the electrical isolation may be compromised (particularly when considering the daily abuse that eyeglasses may be subject to). In contrast, if insulation is used at **1103**, even if the portions **1101** and **1102** change shape, there may still be insulation disposed between the two portions, thereby potentially maintaining the electrical isolation. As noted above, in some embodiments, the bridge **1103** includes the first portion **1101** and the second portion **1102** of the lens housing (or portions thereof) and the air gap may be formed there. In some embodiments, the air gap has a maximum distance of at least approximately 10 mm. This distance for the air gap may provide enough separation between the first **1101** and second portion **1102** that the air gap is unlikely to be compromised during everyday use. In some embodiments, the first portion of the lens housing and the second portion of the lens housing comprise metal.

[0141] Continuing further with these exemplary embodiments, in some embodiments, where the first device further comprises at least one electrical insulator disposed between at least a portion of the first conductive path and the second conductive path, the electrical insulator may include a first component and a second component. The first component of the electrical insulator disposed between the first conductive path and the second conductive path comprises the first lens and the second lens. That is, again with reference to Fig. 11 for illustration

purposes only, the first portion of the insulation may refer to the separation provide by the first **1106** and second **1107** lenses. That is, in some embodiments, the lenses are not made of a conductive material (or comprise embedded conductive materials) such that current could flow from the first portion **1101** to the second portion **1102** of the lens housing. In some embodiments, the second component of the electrical insulator disposed between the first conductive path and the second conductive path includes at least one of: an air gap and an electrically insulating material. That is, again with reference to Fig. 11, the second portion of the insulation may refer to the separation provided at the bridge **1103**. In some embodiments, the second component of the electrical insulator is disposed between the first lens and the second lens. In this manner, the second portion of the insulator may prevent current from flowing between the two components and thereby compromising the electrical isolation of the first and second portions of the lens housing.

[0142] In some embodiments, and as noted above, the electrically insulating material that electrically isolates the first portion of the lens housing from the second portion of the lens housing may comprise an injection moldable or similarly formed plastic material. This material may be preferred because of its ability to mold its shape to the particular area it is confined to. Moreover, because it is injection moldable, it may be easier to apply this material to portions of the frame, such as embedding within the lens housing or the bridge area. In some embodiments, the electrically insulating material comprises nylon.

[0143] In some embodiments, the first device as described above may comprise semi-rimless eyeglass frames. As defined above, in some embodiments, semi-rimless eyeglass frames typically have partial eye-wires around some of the first and second lenses to provide support. It may be preferred that the first and second conductive paths are provided in this portion of the semi-rimless eyeglass frames because, for instance, the eye-wire is typically the thicker portion of the lens housing (*i.e.* this portion may be better able to hide the electrical components, and may also better protect the electrical connections from damage) in comparison to the nylon monofilament or other material that may be used on the remaining sections of the lenses to hold them in place. In this regard, in some embodiments, the first conductive path and the second conductive path are each disposed within the lens housing of the semi-rimless spectacles. For semi-rimless frame design embodiments, both of the electrical conductors that comprise the first and second conductive paths, respectively, may be disposed over the top of the lens (or the

bottom, depending on the style of frames and/or where the portion of eye-wire (or the thicker portion of the lens housing) may be located). The first and second conductive paths may be separated by an electrically insulating material. That is, for instance, the lens housing in a semi-rimless design may comprise eye-wire (or any other suitable lens housing components) over the top portion of the first and second lens. This portion of the lens housing may comprise both the first and the second conductive paths, as well as an insulating material (such as nylon) disposed between the conductive paths such that the first and second conductive paths may be both electrically coupled to the first and second lens, and remain electrically isolated from the other.

[0144] In some embodiments, in the first device as described, the lens housing comprises full rimmed spectacle frames. Exemplary embodiments are shown again in Figs. 11 and 12, but embodiments art not so limited. For example and as described above, full rimmed design embodiments may also comprise the first conductive path and the second conductive path provided by materials embedded within the lens housing. That is, embodiments are not limited to using only lens housing that comprise conductive materials. The full rim embodiments may include lens housings that comprise metal or plastic (or some combination thereof). In general, full rimmed designs may be preferred from a functional standpoint as the eye-wires that many such embodiments comprise may provide a ready means, as described in examples above, of providing a first and second conductive path from the temple to the lens housings, and/or from the lens housings to the lenses.

[0145] Although embodiments may provide one or more conductive paths from a temple to the lens housing which may, in some embodiments, provide one or more advantages related to reducing the number of components used for the electro-active frames, embodiments are not so limited. Indeed, the concepts discussed and described above may be equally applicable to embodiments that comprise multiple electronics modules and/or other components located on both the first and the second temple. In general, these embodiments may present advantages over single module embodiments such as, for instance, greater flexibility in controlling the individual components (such as electro-active lenses) by having individual controls located on each temple for each (or both) components. Provided below are additional exemplary embodiments:

[0146] A first device is further provided that comprises a frame. The frame further comprises a lens housing adapted to support a first lens and a second lens, a first temple coupled to the lens

housing, and a second temple coupled to the lens housing. The first device further includes a first conductive path provided by one or more frame elements from the first temple to the lens housing, a second conductive path provided by one or more frame elements from the first temple to the lens housing, a third conductive path provided by one or more frame elements from the second temple to the lens housing, and a fourth conductive path provided by one or more frame elements from the second temple to the lens housing. As noted above, the use of frame elements provides many advantages over systems that may utilize exposed wires or other methods for establishing a conductive path between a temple of the frame and the lens housing. In the first device, each of the first, second, third, and fourth conductive paths are electrically isolated from each other. As noted above, it is generally beneficial to provide multiple electrically isolated conductive paths so as to control multiple electronic components and/or provide additional functionality, such as by providing power and signal paths to the components.

[0147] The first device as described above in some embodiments may provide the advantage that multiple electronics modules and/or electronic components may be disposed on either or both of the temples of the electro-active frame. This may, for instance, allow for more functionality than single module embodiments, based on, for instance providing for additional electronics to be included on the first device. Moreover, by providing electronics modules on both temples, embodiments may provide the advantage of not having to utilize a conductive path across the bridge of the frames to power/control electronic components on both sides of the lens housing. This may, in some embodiments, reduce the complexity of manufacturing that portion of the electro-active lens frame. In addition, in some embodiments, the conductive path across the bridge may be the location in which the electrical isolation between the various conductive paths is more likely to be compromised. Some embodiments may also provide for a more robust electro-active frame (and/or lens system), with potential backup systems and redundancy provided for the electronic components on each temple.

[0148] In some embodiments, in the first device as provided above, the first conductive path is electrically isolated from the second conductive path by an electric insulator and the third conductive path is electrically isolated from the fourth conductive path by an electric insulator. The insulator may comprise any suitable material and may be located in any suitable location, such as at least in the temple, hinge, or lens housing, as described above. In some embodiments, the first device further includes a first electronics module that may be disposed on the first

temple and a second electronics module disposed on the second temple. Such embodiment, as noted above, may provide the advantages of controlling multiple elements (such as electro-active lenses) individually, or providing a redundancy system so that the electro-active lenses may function after a failure in one of the electronics modules.

[0149] In some embodiments, the first device further includes a first lens having a first electrical contact and a second electrical contact and a second lens having a first electrical contact and a second electrical contact. In some embodiments, the first conductive path may electrically connect to the first electrical contact of the first lens, the second conductive path may electrically connect to the second electrical contact of the first lens, the third conductive path may electrically connect to the first electrical contact of the second lens, and the fourth conductive path may electrically connect to the second electrical contact of the second lens. In some embodiments, the first and second conductive paths electrically connect to the first electronics module and the third and fourth conductive paths electrically connect to the second electronics module.

[0150] That is, it may be the case that in some embodiments, the conductive paths that are provided from the first temple to the lens housing are segregated in both position and function from the conductive paths that are provided from the second temple to the lens housing (however, embodiments are not so limited). For instance, in some embodiments comprising electro-active lenses, the first and second conductive paths may be electrically connected to the first lens and the third and fourth conductive paths may be electrically connected to the second lens. In some embodiments, neither the first nor second conductive path is coupled to the second lens. Similarly, in some embodiments, neither the third nor the fourth conductive path may be electrically coupled to the first lens. In this regard, the first and second electrical paths may be electrically isolated from the third and fourth conductive paths based largely on the fact that there is no overlap in function or coverage. That is, for instance, the first and second conductive paths may be on a first side having a first lens, and the third and fourth conductive paths may be on a second side of the lens housing having the second lens. This, as noted above, in some embodiments, there may be no need to have a conductive path across the bridge. However, embodiments are not so limited, and any or all of the conductive paths may cross the bridge of the electro-active frames.

[0151] With reference to Figs. 11-13, exemplary embodiments of the first device comprising a plurality of electrically isolated conductive paths disposed on an electro-active spectacles frame are provided. With reference to Fig. 11, an exemplary embodiment of a device comprising electro-active lenses housed within an electro-active frame is provided. As described above, one or more electronic modules that can activate and deactivate one or both of the electro-active lenses **1106** and **1107** can be positioned within either or both temples of the electro-active spectacle frame.

[0152] As shown in Fig. 11, a full rimmed electro-active spectacle frame is provided. Moreover, as shown, Fig. 11 is an example of an exemplary embodiment in which the lens housing may comprise conductive material. As was described above, embodiments are not so limited.

[0153] The exemplary device in Fig. 11 comprises an upper rim portion **1101** (*i.e.* a first portion of the lens housing) that may comprise a portion of a first conductive path. The upper rim portion **1101** can be made of metal in some embodiments, but is not so limited. The first conductive path can provide a first link (*i.e.* an electrical connection) between an electronics module and a first electronic contact or terminal (not shown) of one or both electro-active lenses or any other electronics components that may be located on the lens housing.

[0154] Continuing with the description of the exemplary embodiment shown in Fig. 11, the exemplary electro-active spectacle frame comprises a lower rim portion **1102** (*i.e.* a second portion of the lens housing) that may comprise a portion of a second conductive path. The lower rim portion **1102** may also be made of metal, but is not so limited and any conductive material may suffice. The second conductive path may provide a second link (*i.e.* electrical connection) between the electronics module and a second electronic contact or terminal (not shown) of one or both electro-active lenses or any other electronics components that may be located on the lens housing.

[0155] By providing the upper **1101** and lower **1102** rim portions, embodiments may provide separate conductive routes to both electro-active lenses **1106** and **1107**. Thus, in some embodiments and as described above, the electro-active lenses (or any other components located on the lens housing) can be controlled/powered by a single electronics module positioned on either the right or left temple portion of the electro-active frame. However, embodiments are not

so limited and may provide for multiple electronics modules located on either or both of the temples.

[0156] As shown in Fig.11, the upper **1101** and lower **1102** rim portions, which may comprise a portion of the first and second conductive paths, respectively, may together form a bridge **1103** of the electro-active spectacle frames. The bridge **1103** of the electro-active spectacle frames can be formed without having the upper **1101** and lower **1102** rim portions touching (*i.e.* in physical or electrical contact), so as to ensure separate conductive paths (*i.e.* maintain the first and second conductive paths as electrically isolated from one another). In addition, the upper **1101** and lower **1102** rim portions are physically and electrically separated at the ends **1104** and **1105**, so as to maintain electrical isolation from the other. The upper **1101** and lower **1102** rim portions may be coupled to a hinge, temple, or other frame component at the ends **1104** and **1105**, but at different locations so as to remain electrically isolated from each other. The rim portions may also be electrically connected to the other portions of the first and second conductive paths at the ends **1104** and **1105**.

[0157] With reference to Fig. 12, an exemplary illustration of an aesthetic component is provided (*e.g.* a design mask). The design mask comprises an upper snap-on element **1201** and a lower snap-on element **1202**. The upper **1201** and lower **1202** snap-on elements can be positioned on top of the upper rim portion **1101** and the lower rim portion **1102**, respectively. The upper **1201** and lower **1202** snap-on elements may comprise a non-conductive material, such as plastic, but are not so limited. The upper **1201** and lower **1202** snap-on elements can be used to alter the style or design of the electro-active spectacles.

[0158] With reference to Fig. 13, an exemplary temple **1301** is shown that may comprise a part of an electro-active spectacles frame. One or more electronic components, such as an electronics module, may be coupled to the temple **1301**.

[0159] Embodiments Comprising A Compliant Conductive Element

[0160] Previously, the inventors developed novel electro-active spectacle lenses that may be manufactured as semi-finished lens blanks capable of being surfaced and edged using methods known to those skilled in the art into finished spectacle lenses that, for instance, correct a patient's vision (or provide other beneficial functionality, such as tinting, polarizing, filtering, etc.) and fit within a spectacle frame. The inventors have also developed novel electro-active

spectacle frames of various designs capable of operating and/or functioning with electro-active spectacle lenses and/or other electronic components, including, for example, the exemplary embodiments disclosed above.

[0161] As described therein with reference to exemplary lens design and manufacture, in some embodiments, the finished lenses may be processed from semi-finished lens blank using methods and equipment that may be known to those skilled in the art. In this regard, a means for making electrical connections between the frames and the lenses that is consistent with some or all of those methods and equipment may also be beneficial. In other instances (or in congruence), it may be beneficial to provide electrical connections between various components disposed on, or within, electro-active frames that may also provide flexibly, adaptability, durability, and/or more reliable electrical contacts.

[0162] As detailed below, a means for making such electrical connections (*e.g.* in a manner that may be consistent with currently used lens processing methods and/or frame designs) is provided. The means for providing the electrical connections between components of an electro-active fame (such as the connections from the lens to the frame), as described herein, may comprise a compliant conductive element. In this manner, embodiments may allow for a robust and forgiving connection consistent with the requirements related to the regular stress experienced by eyeglasses (such as when taken on and off one's face, being dropped, worn when sleeping, struck with objects, bent by small children, etc.). In addition, embodiments comprising a compliant conductive element that provides electrical connections as described herein may be utilized for any and all uses whereby the eyeglass frames houses some, most, or all of the electronics and the lens comprises a component or components that must be activated and or deactivated by an electrical current.

[0163] As used herein, a "compliant conductive element" may refer to a physically compliant and compressible material that is electrically conductive. That is, for instance, the material typically has the properties that it is physically malleable (*e.g.* capable of being deformed, at least along a surface) but is still electrically conductive such that is may comprise a portion of a conductive part. The conductive compliant element may comprise, by way of example only, conductive rubber. Conductive rubber may include, but is not limited to, an elastic hydrocarbon polymer. A particular not limiting example of material that may comprise a compliant conductive element includes a metal loaded silicone elastomer. The compliant conductive

element may be preferably extruded or otherwise molded into a shape that may conform to portions of either (or both) of the lens housing and lens so as to form an electrical connection (*e.g.* an electrically conductive bridge) between the lens and lens housing. The compliant conductive element may also be used to form electrical connections between other portions of the frame and/or other electrical components.

[0164] With some or all of the above in mind, a first device may be provided. The first device may include a lens comprising at least a first electrical contact. That is, for instance, the first lens may comprise an electro-active lens such that the lens may provide a particular functionality, feature, or property when current or voltage is supplied that it may not provide when no current or voltage is supplied (or the functionality may vary based on the amount of current or voltage supplied, etc.). Examples of such lenses were provided above. The electrical contact of the first lens may be utilized to electrically couple the lens (or a portion thereof) to other electronic components (such as, for instance, a controller or power supply) that may provide such voltage or current (*e.g.*, in the form of a control signal or power supply).

[0165] The first device may also comprise a lens housing holding the lens. The lens housing may include at least a second electrical contact. That is, for instance, the lens housing (such as was defined above) or a component therein may comprise a part of a conductive path, and the second electrical contact may be used to electrically connect the conductive path to another conductive element (which may also be embedded in the lens housing, coupled the lens housing, or comprise any other part of the first device or component thereto, such as the lens).

[0166] The first device may further comprise a compliant conductive element disposed between the first and the second electrical contact that electrically connects the first and second electrical contacts. That is, the compliant conductive element may be disposed such as to provide current between the first electrical contact and the second electrical contact (in this exemplary case, between the lens and the lens housing). In this manner, embodiments may supply current (*e.g.* power or a control signal) from a component coupled to another portion of the first device (*e.g.* on a first temple of an electro-active frame) to the lens via the lens housing.

[0167] As noted above, the use of a compliant conductive element may, in some embodiments, provide some advantages over previously used conductors and other means of connecting components in an electro-active frame, particularly when forming connections to an electro-active lens. For instance, the use of a compliant conductive element (as described above) may

form better electrical connections to the surface of an electrical contact (particularly shaped surfaces, such as beveled edges) because the compliant conductive element may conform substantially to some or all of those surfaces. In this manner, the interface between the electrical contacts (*i.e.* the area of the connection) may be larger, providing increased electrical conductivity between the two.

[0168] In addition, the use of a compliant conductive element may, in some embodiments, provide for a more robust electrical connection that may withstand external forces more effectively than previously used conductors. That is, in part because the electrical connections between a compliant conductive element and the electrical contacts may comprise a larger area, if a force applied to the device or a portion thereof causes a part of the electrical connection between the compliant conductive element and one of the electrical contacts to be separated (*i.e.* no longer directly electrically connected), there may still be sufficient contacts in other portions of the interface that may permit sufficient current to transfer between the components so as to result in little or no disruption in functionality of the device.

[0169] In addition, a compliant conductive element may, in some embodiments, conform and/or adapt to changes in the disposition of a first electrical contact in relation to a second electrical contact that it is disposed between (*e.g.* in the exemplary device described above, a compliant conductive element may adapt to changes in the disposition of the lens housing relative to the lens). For instance, if the separation between the lens and the lens housing increases at a location where an electrical contact is formed between the two components using a compliant conductive element, then in some embodiments, the compliant conductive element may expand in that location so as to maintain the electrical contact. Similarly, in some embodiments, if there is an increase in the force applied between the lens housing and the lens (for instance, an external force is applied to the lens housing causing it to be misshaped or displaced in the direction of the lens), the compliant conductive element may compress in the location between the components where the force is applied (this may include a temporary displacement, such as when the conductive compliant component absorbs some or all of the force applied by compressing and then expanding). By so doing, the compliant conductive element may, in some embodiments, absorb stress applied to the first device, and maintain the electrical connection between components.

[0170] Moreover, by absorbing some or all of the forces applied thereto, a compliant conductive element may, in some embodiments, prevent or limit damage to either of the components that comprise the first and second electrical contacts. For instance, if a force were applied to a typical device above that which causes the lens and the lens housing to directly contact, the lens may become chipped at the interface, which could threaten the integrity of the lens, the ability of the lens housing to hold the lens, and/or affect the electrical contacts between the two components. The use of conductive compliant material disposed between portions of these components may reduce or prevent this direct contact, and may serve to absorb such forces and limit damage.

[0171] The use of a compliant conductive element in a first device may, in some embodiments, provide advantages during the manufacture process as well. For instance, as noted above, many lenses are shaped and edged prior to being coupled to a lens housing of an electro-active frame. This may result in slight differences between each lens that is then coupled or housed within a lens housing. In embodiments where an electrical contact is formed between these components, the use of a compliant conductive element that may adapt or conform to features provided on either of the surfaces of the electrical contacts, as well as the relative disposition between the two components, may reduce manufacturing costs and defects, and provide for more reliable and suitable devices.

[0172] It should be noted that these advantages are provided as examples of the advantages that some embodiments may provide, and therefore embodiments disclosed herein need not have some or all of the advantages described above.

[0173] In some embodiments, in the first device as described above that includes a lens having a first contact, a lens housing having a second contact, and a compliant conductive element disposed between, and electrically connecting, the first and second contacts, the compliant conductive element comprises conductive rubber. That is, conductive rubber is an example of a material that may comprise the compliant conductive element. Conductive rubber may have some of the characteristics, such as physical malleability while also having sufficient conductivity, to provide some or all of the advantages noted above in some embodiments.

[0174] In some embodiments, in the first device as described above that includes a lens having a first contact, a lens housing having a second contact, and a compliant conductive element disposed between, and electrically connecting, the first and second contacts, the compliant

conductive element may be disposed substantially between the lens housing and the lens. That is, as noted above, in some embodiments, the compliant conductive element may be disposed between some or all of the portions of the lens and lens housing. In some embodiments, where the compliant conductive element is disposed between substantially all of the portions of the lens and lens housing, embodiments may comprise the compliant conductive element being disposed over the entire outer surface of the lens that is directly opposite to a surface of the lens housing (or only the portions of the outer surface of the lens that have a lens housing surface directly opposing the lens outer surface). In some embodiments, the compliant conductive element may be disposed between portions of the lens and lens housing where an electrical connection is not made (*e.g.* portions of the lens and lens housing not comprising an electrical contact). This may provide some of the benefits detailed above, including reducing damage caused by physical contact between the relatively rigid surfaces of the lens and lens housing, even in areas where no electrical connection is made. In some embodiments, the compliant conductive element is only disposed between portions of the lens and lens housing that comprises electrical contacts. The reduction in the amount of the compliant conductive element may thereby reduce manufacturing costs. An exemplary embodiment is shown in Fig. 25. In addition, in such embodiments, the lens housing may be manufactured so as to comprise different portions corresponding to sections that have the compliant conductive element disposed there between, and those that do not. In so doing, the first device may utilize a more efficient lens housing design to accommodate whether there is or is not compliant conductive material disposed between sections of the lens housing and the lens. Exemplary embodiments are disclosed in Figs. 21-25.

[0175] In some embodiments, in the first device as described above, the compliant conductive element has a shape that comprises any one of, or some combination of: a triangle, a square, a "figure 8," an oval, a circle, or a rectangle. As used herein, the "shape" of the compliant conductive element may refer to the cross section of the compliant conductive element taken on a plane perpendicular to the longest dimension of the compliant conductive element. For example, in some embodiments where the compliant conductive element is extruded, the shape generally corresponds to the aperture through which the compliant conductive element was extruded. Examples of shapes of the compliant conductive element are shown in Figs. 20(a)-(c).

[0176] In some embodiments, it may be preferred that the shape of the compliant conductive element comprises a "figure 8" because, for instance, the compliant conductive element may

provide structural support and assist in coupling the lens and the lens housing. A "figure 8" may refer to a compliant conductive element that has a shape that comprises two end pieces and a center piece disposed between the two end pieces. The two end pieces are thicker than the center piece. The two end pieces need not have the same thickness or the same length.

[0177] In some embodiments, it may be preferred that the compliant conductive element comprise a square or rectangle shape as opposed to a triangle shape (particularly when the lens has a beveled edge), because the square or rectangle shape may provide a greater area of electrical connectivity by conforming to more of the surface of the lens. This is due, in some embodiments, to the "triangle" shape resulting in the edge of the lens compressing the compliant conductive material against an opposing surface of the lens housing without permitting the compliant conductive element to cover the lower portions of the lens surface.

[0178] It should be noted that, in some embodiments, the shape of the compliant conductive element may not conform precisely to a corresponding shape (*e.g.* rectangle, square, etc.) at the surface of the compliant conductive element. That is, at the surface of at least a portion of the conductive compliant element, the shape of the compliant conductive element may be slightly altered as it conforms to an opposite surface of the lens or lens housing that it is physically contacted with. Thus, the "shape" of the compliant conductive element may refer to either the shape of the compliant conductive element when disposed between the first and the second electrical contacts, or the uncompressed shape of the compliant conductive element (*i.e.* the shape of the compliant conductive element either before it is between the first and second electrical contacts, or before it have a force applied to its surface). In addition, it should be understood that in some embodiments, the compliant conductive element may not comprise any shape, or it may comprise other shapes than those expressly mentioned, including irregular shapes and shapes that vary along the length of the compliant conductive element (*i.e.* the compliant conductive element may not have a single shape, but the shape may depend on the location of that particular portion of compliant conductive element.

[0179] In some embodiments, in the first device as described above, the compliant conductive element includes a first end having a first thickness, a second end having a second thickness, and a center portion having a third thickness that is disposed between, and coupled to, the first end and the second end. The first thickness of the first end and the second thickness of the second end are each greater than the third thickness of the center portion. An exemplary embodiment of

this shape is shown in Fig. 20(a). That is, embodiments so described may refer to the conductive element having a shape that corresponds to a "figure 8," which may have some or all of the advantages noted above.

[0180] In some embodiments, in the first device as described above, the compliant conductive element may comprise an extrusion. As used herein, an "extrusion" may refer to an object made by squeezing, or otherwise disposing, material through an aperture that shapes the material. It may be generally beneficial, in some embodiments, to use an extrusion for some or all of the compliant conductive element because, for instance, the use of an extrusion may be an efficient manner of disposing the compliant conductive element between the lens and the lens housing (or between any other two components). The space between the lens and the lens housing may be relatively small (on the order of a millimeter), and therefore an extrusion that may be injected into the cavity (particularly when the material may conform to the shape of the cavity) may be less complex than shaping a conductor into the correct size and shape and inserting it into the cavity. Moreover, it may be less complex to apply the compliant conductive element to portions of the lens housing that may be difficult to access based, for instance, on the design features of the first device. In addition, embodiments that utilize an extrusions may provide the advantage that compliant conductive element may be disposed between a plurality of different designs of lenses and lens housing, without having to design a specific a component or components for each combination.

[0181] In some embodiments, in the first device as described above, the lens comprises a first surface and the lens housing comprises a first surface. The compliant conductive element substantially conforms to at least a portion of the first surface of the lens and at least a portion of the first surface of the lens housing. As was described above, the compliant conductive element may have physical properties that permit it to adapt and conform to the interfaces of the components it is disposed between based on a force applied to its surface. Thus, in some embodiments, when the conductive compliant element is disposed in the lens housing or cavity thereto (or on a surface of the lens), and when the lens and lens housing are then coupled, a force may be applied to the compliant conductive element disposed between the opposing surfaces of the lens and the lens housing such that the conformation may occur. Embodiments may thereby provide some of the benefits that were described above, including the ability to provide better

electrical contacts between electrical contacts, and maintaining those contacts despite changes in the relative positions of the surfaces.

[0182] In some embodiments, the first device as described further comprises a first temple coupled to the lens housing and an electronics module coupled to the first temple. The compliant conductive element is electrically connected to the electronics module. As defined above, electrically coupled does not require that the two components be in direct physical contact. Thus, embodiments may provide that the first device comprises a conductive path from the electronics module to the compliant conductive material. The conductive path could include, for example, a conductor coupled to the electronics module, a portion of the temple itself (or a conductor embedded therein), a portion of the lens housing itself (or a conductor embedded therein), and the second electrical contact. As described above, it may be beneficial both structurally and aesthetically to locate electronic components in the temple of an electro-active frame because, for instance, the additional space provided (as compared to the lens and lens housing) as well as the ability to hide or mask those electronic components relatively out of sight of an observer (or at least not as pronounced a location as the lens housing or frame).

[0183] In some embodiments, in the first device as described above that comprises a first temple coupled to the lens housing and an electronics module coupled to the first temple, the first device further includes a conductor that is substantially embedded within the temple and/or the lens housing. The conductor may electrically connect the electronic module to the compliant conductive element. The conductor may comprise any suitable material, including metal. Although the conductor in some embodiments may be embedded substantially within the lens housing and/or the first temple, the conductor may have portions exposed so as to make electrical contacts with other components. As was described above, a conductive path may comprise a number of electrically connected components, and therefore using a conductor embedded in either the temple and/or the housing may be a means for efficiently establishing a conductive path from the electronics module to the compliant conductive element. The compliant conductive element may then be electrically coupled to another electronic component (such as an electro-active lens). In this manner, embodiments may provide a conductive path to conduct current (*e.g.* control signals and/or power) from the temple to the compliant conductive material (and then, for instance, to the electro-active lens). As noted above, in some embodiments, a first portion of the conductor may be exposed and electrically connects the electronic module to the

compliant conductive element. That is, as used herein, the first portion of the conductor may be "exposed" if it is not surrounded by a the lens housing along at least a portion of the conductor such that an electrical connection may be made to the compliant conductive element.

[0184] In some embodiments, in the first device as described above that comprises a first temple coupled to the lens housing, an electronics module coupled to the first temple, and a conductor that is substantially embedded within the temple and/or the lens housing, the lens housing comprises acetate. As noted above, acetate is a common material used in the manufacture of eyeglass frames, and is generally non-conductive. Thus, in some embodiments, so as to provide a conductive path from the electronics module coupled to the first temple, a conductor may be embedded in the lens housing comprising a non-conductive material. It may be generally preferred that a conductor is embedded within a frame element such that the frame element (or a portion thereof) may isolate a conductive path (or a portion thereof) from external forces, such as potential shorts and/or excess voltages. In contrast, in some embodiments where the lens housing comprises a conductive material, the lens housing itself (or a portion thereof) may comprise a portion of a conductive path that electrically connects the electronic module to the compliant conductive element.

[0185] In some embodiments, the first device as described above comprises semi-rimless, rimless, or fully rimmed spectacle frames. Exemplary embodiments of some of these spectacle frames are described below with reference to the figures.

[0186] In some embodiments, in the first device as described above that includes a lens having a first contact, a lens housing having a second contact, and a compliant conductive element disposed between, and electrically connecting, the first and second contacts, the lens includes a first groove, the lens housing includes a first cavity, and the compliant conductive element comprises a first and a second portion. The first portion of the compliant conductive element may be disposed substantially within the first groove of the lens. This is shown, for example in Figs. 19 and 23-24. As used herein, "disposed within" may refer to a portion of the compliant conductive element being located such that the cavity of the lens housing or the groove of the lens surrounds approximately three sides of the portion of the compliant conductive element. The second portion of the compliant conductive element may be disposed substantially within the first cavity of the lens housing. In this manner, the compliant conductive element may support the coupling of the lens and the lens housing, while at the same time completing

electrical connections with electrical contacts on the surface of each of the lens and the lens housing.

[0187] In some embodiments, in the first device as described above, the first portion and the second portion of the compliant conductive element are connected by a bridge. A "bridge" in this context refers to the material that is located between the first and second portions of the compliant conductive material. With reference to Fig. 20 for example, first portions **2002** and **2003** are connected, respectively, to second portions **2005** and **2006** by a "bridge." The bridge in these exemplary embodiments happens to comprise the same material as the first and second portions. However, the bridge may comprise any shape and any suitable material.

[0188] In some embodiments, in the first device as described above where the first portion of the compliant conductive element is disposed substantially within the first groove of the lens, and the second portion of the compliant conductive element is disposed substantially within the first cavity of the lens housing, the first portion of the compliant conductive element has a first shape that comprises any one of: a triangle, a square, a circle, and a rectangle. In some embodiments, the second portion of the compliant conductive element has a second shape that comprises any one of: a triangle, a square, a circle, and a rectangle. In general, it is preferred to choose the shape and dimensions of the portions of the compliant conductive element so as to maximize the electrical contacts that the material can make on the surfaces of the lens and/or the lens housing. In this regard, it may be beneficial to choose shapes that maximize the surface area interface when the conductive compliant element is compressed (usually a shape that corresponds to the shape of either the lens housing cavity or the lens groove. However, embodiments are not so limited. Examples of shapes are provided in Figs 20(a) – (c). In some embodiments, the lens has a first surface that is located within the first groove and at least a part of the first portion of the compliant conductive element substantially conforms to the first surface of the first groove. The "first surface" may comprise as at least a portion of the outermost surface of the groove of the lens. Again, this is typically the surface forms part of the conductive path with the compliant conductive material. In this regard, In some embodiments, the first surface of the lens is coated with a conductive paint so as to not only contacts the compliant conductive material, but may also provide of an easier and better connection to the components of the electro-active lens.

[0189] In some embodiments, in the first device as described above where the first portion of the compliant conductive element is disposed substantially within the first groove of the lens, and the second portion of the compliant conductive element is disposed substantially within the first cavity of the lens housing, the first groove of the lens has width approximately within the range of 0.4 mm and 1.0 mm and a depth approximately within the range of 0.4 mm and 1.0 mm. In some embodiments, the groove of the first lens has width of approximately 0.7 mm and a depth of approximately 0.6 mm. As described below, the specific dimensions of the components may depend on the functionality of the lens and lens housing. However, generally it is desirable to have the relative dimensions between the width and of the height cavity, the groove, and of the compliant conductive element to be relatively similar. This may permit the compliant conductive element to ser both a structural role (in coupling the lens and the lens housing, as well as serving as a protective layer of sorts between at lest a portion of the lens and the lens component. The dimensions of these components is discussed with reference to Figs. 20 and 23

[0190] In some embodiments, in the first device as described above where the first portion of the compliant conductive element is disposed substantially within the first groove of the lens, and the second portion of the compliant conductive element is disposed substantially within the first cavity of the lens housing, the lens housing has a first surface that is located within the first cavity. The "first surface" may comprise at least a portion of the outermost surface of the cavity of the lens housing. A part of the second portion of the compliant conductive element may substantially conform to the first surface of the first cavity. Similar to the connections that the compliant conductive material forms with the surface of the lens, the compliant conductive element also forms contacts with portions of the lens housing. However, in some (but certainly not all) embodiments the contacts formed with the lens housing are to embedded conductors that have portions exposed and therefore, while beneficial, it may not be as necessary for the compliant conductive material to conform to as much of the surface of the lens housing as it is to conform with the surface of the lens.

[0191] In some embodiments, in the first device as described above where the first portion of the compliant conductive element is disposed substantially within the first groove of the lens, and the second portion of the compliant conductive element is disposed substantially within the first cavity of the lens housing, the compliant conductive element has an uncompressed height of at least the distance between the first surface of the first groove of the lens and the first surface of

the first cavity of the lens housing. The "uncompressed height" of the compliant conductive element is the height of the compliant conductive element when the material is not subject to an external stress. The "height" of the compliant conductive element may refer to the dimension of the element that is substantially perpendicular to the lens housing and the lens. An example illustrating the uncompressed height is shown in Fig. 23(d). In some embodiments, the uncompressed height of the compliant conductive element is at least .75 mm. In some embodiments, the uncompressed height of the compliant conductive element is at least 1.45 mm. However, as noted above, the dimensions of the element may vary based on the other dimensions of the device. Generally, the greater the uncompressed height, the more surface covered (and more electrical connections that can be made) by the compliant conductive element when it is disposed between the lens and the lens housing. In this regard, in some embodiments, the first surface of the lens housing and the first surface of the lens compress at least a portion of the compliant conductive element when the lens housing and the lens are coupled. In this manner, the compliant conductive element can form electrical connections, while also providing ancillary benefits to the device, such as protecting the rigid components from damage from directly contacting one another.

[0192] In some embodiments, in the first device as described above, the lens comprises a first surface, the lens housing comprises a first cavity, and the compliant conductive element comprises a first surface. The compliant conductive element is disposed substantially within the first cavity of the lens housing, and the first surface of the compliant conductive element substantially conforms to the first surface of the lens. In some embodiments, the first surface of the lens comprises a first and second beveled edge. A "beveled edge" may refer to an inclination that is cut into a lens that forms an angle, including an angle equal to 90 degrees. The lens usually comprises a beveled edge (rather than a groove) in embodiments comprising full rimed frames (rather than semi-rimless frames), where the lens may be coupled to the lens housing based on the portion of the lens being disposed inside a cavity of the lens housing. In some embodiments, the first cavity has a first width and the compliant conductive element has an uncompressed width that is greater than the first width of the cavity. The "uncompressed width" may refer to the width of the compliant conductive element when the rubber is not subject to external stress. This is illustrated in Fig. 23(e) and described below.

[0193] In some embodiments, in the first device as described above, where the compliant conductive element is disposed substantially within a first cavity of the lens housing, and where a first surface of the compliant conductive element substantially conforms to a first surface of the lens, the cavity of the lens housing has a top surface. A portion of the lens extends into the first cavity of the lens housing. The compliant conductive element has an uncompressed height that is approximately equal to or greater than a distance from the top surface of the cavity of the lens housing to the portion of the lens that extends into the first cavity. This concept is illustrated in Fig. 23(d). Generally, the compliant conductive element preferably has a height such that when the lens is disposed in the cavity of the lens housing, a portion of the lens contacts, and thereby compresses the compliant conductive element. As noted above, it is generally beneficial to have a height that is substantially greater than this minimum distance to provide more robust electrical connections. The "top surface" may refer to the surface of the lens housing that is opposite the lens.

[0194] In some embodiments, in the first device as described above, the compliant conductive element comprises metal loaded silicon elastomers. In some embodiments, the metal comprises silver and aluminum (AG-Al). However, any material that has the physical properties described above with reference to the compliant conductive material may be used.

[0195] In some embodiments, in the first device as described above, the compliant conductive element has a volume resistivity that is less than 10 Ω - cm. In some embodiments, in the first device as described above, the compliant conductive element has a volume resistivity that less than 1 Ω - cm. The "volume resistivity" may refer to the electrical resistivity, resistivity, or specific electrical resistance. Generally, it is preferable to have a low volume resistivity for a conductor because there will be less losses associated with the resistance. This may be particularly important in some embodiments, as the compliant conductive element may be compressed, which may thereby increase the density, and concurrently increase the resistivity of the element. Thus, it may be important in some embodiments to choose a material that has a low resistivity, even when uncompressed such that its volume is decreased.

[0196] In some embodiments, in the first device as described above, the compliant conductive element has a hardness on the shore durometer A scale that is greater than 50. In some embodiments, the compliant conductive element has a hardness on the shore durometer A scale that is greater than 65. The hardness of the element refers to its ability to conform to surfaces

under pressure, as well as a materials general malleability. As noted above, in some embodiments, to form optimal connections, the compliant conductive element conforms to the shape of the lens and/or lens housing surfaces. In some embodiments, the compliant conductive element has a hardness on the shore durometer A scale that approximate equal to 70 and a volume resistivity of approximately .0008 Ω - cm.

[0197] Although described above with relation to a lens and a lens housing, embodiments are not so limited and may provide for the use of compliant conductive element between any two electrical contacts that may be disposed on any component or components of a first device (*e.g.* an electro-active frame).

[0198] It should be understood that, after reading the disclosure provided herein, a person of ordinary skill in the art may understand that various combination of the devices described above may be made such that some or all of the features described with regards to one device may be combined with some or all of the features of another device.

[0199] Description of Figures Related to a Compliant Conductive Element and Exemplary Embodiments

[0200] Provided below is a more detailed description of some of the figures included herein that may relate to a compliant conductive element, as well as descriptions of the exemplary embodiments disclosed. As noted, these exemplary devices are for illustration purposes and are not intended to be limiting.

[0201] With reference, to Fig. 14, an exemplary electro-active frame **1400** for use with electro-active lenses and/or other electronic components is shown. The exemplary electro-active frame **1400** can comprise lens housing **1404** (such as eye-wire) comprising any material such as, but not limited to, a plastic (*e.g.*, acetate). In some embodiments, the electro-active frame **1400** can be made by a mold or other techniques, such as injection molding. Additionally, some embodiments may provide that the electro-active frame **1400** can be made from one or more separately formed or fabricated pieces that are brought together (*i.e.* coupled) to form a complete electro-active frame.

[0202] The compliant conductive element **1401** (such as, for example, a conductive rubber) may, in some embodiments, be used to conduct an electronic signal from one side of the electro-active frame **1400** or lens housing **1404** (or one component thereon) to another side of the electro-active frame **1400** or lens housing **1404** (or another component thereon, including a lens

1405). In some embodiments, the compliant conductive element **1401** may be encapsulated by (*e.g.* substantially surrounded by or embedded within) an insulator (such as the lens housing **1404** that comprises a plastic material). In some embodiments, the compliant conductive element **1401** may be positioned (*e.g.* disposed) inside the electro-active frame **1400** (or the lens housing **1404**) as the electro-active frame **1400** is being fabricated (such as, for instance, during a molding process or an injection molding process). In some embodiments, the compliant conductive element **1401** may also be positioned inside cavities of the lens housing **1404** after the lens housing **1404** has been fabricated. This will be described in more detail below with reference to Figs. 18-25. In some embodiments, the compliant conductive element **1401** may be positioned between two frame halves (or between a plurality of portions of the electro-active lens frame) that are subsequently brought together and sealed.

[0203] In some embodiments, the compliant conductive element **1401** may be positioned in or near the nose bridge **1403** to provide connectivity from a first side of the electro-active frame **1400** (and/or lens housing **1404**) to a second side of the electro-active frame **1400** (and/or lens housing **1404**). The use of such material in the bridge **1403** may permit the nose bridge in such embodiments to be relatively small, which could provide a more aesthetically pleasing frame appearance. These embodiments may also be combined, for instance, with a single electronics module located on one of the temples that provides electronic signals and/or current to both a first lens and a second lens **1405** (that is, the conductive compliant material **1401** may provide a conductive path from a first part of the lens housing **1404** comprising a first lens **1405** to a second part of the lens housing **1404** comprising a second lens **1405**). In some embodiments, the compliant conductive element **1401** may be positioned on the back side of the electro-active frame **1400** (and/or lens housing **1404**) (*e.g.* on the side facing the wearer's head) or buried within (*e.g.*, embedded within) the electro-active frame **1400** (and/or lens housing **1404**).

[0204] Continuing with reference to Fig. 14, at the hinges **1402** of the electro-active frame **1400**, the compliant conductive element **1401** may form one or more electrical contacts with a temple (and/or components disposed thereon) of the electro-active frame **1400**. That is, the compliant conductive material **1401** may form a portion of a conductive path by providing electrical connections at or near the hinge **1402** with conductors disposed on (or coupled to) the temple of the electro-active frame **1400**. In some embodiments, the hinge **1402** itself may comprise a conductive material and may electrically connect to the compliant conductive

element **1401** and a conductor coupled to the temple. In some embodiments, the hinge **1402** may comprise the same material as the compliant conductive element **1401**.

[0205] With reference to Fig. 15, an assembled exemplary electro-active frame **1400** comprising compliant conductive element **1401** disposed within the lens housing **1404** is shown. When positioned (*e.g.* disposed) within the electro-active frame **1400** (and as shown, in lens housing **1404**), the compliant conductive element **1401** need not be visible (*e.g.*, at least a portion of the compliant conductive element **1401** may be disposed or positioned in the lens housing **1404** (*e.g.* the eye wire) of a fully rimmed or semi-rimless frame). Indeed, it may be preferred in some embodiments that the compliant conductive element **1401** is not visible for aesthetic reasons. In addition, embodiments comprising the compliant conductive element **1401** partially or completely embedded within one or more of the frame components may both provide electrical connections and also result in better protection for the conductive path created thereby from exterior forces and stresses, (for instance, the components may be less susceptible to short circuits and/or external electrical voltages and currents).

[0206] Figs. 14 and 15 disclose an exemplary embodiment whereby the compliant conductive element **1401** comprises four separate conductive paths (*i.e.* two on the left side of the lens housing **1404** and two on the right side of the lens housing **1404**). This may provide two separate conductive paths (and two electrical contacts) to each of the lenses **1405**. In this manner, embodiments may make available the necessary electrical connections to provide power and or control signals to electro-active lenses **1405** or other components disposed on the lens housing **1404**. In addition, in embodiments where the compliant conductive element **1401** (or other conductor) is also located in the bridge **1403**, the lens housing **1404** may comprise two conductive paths – a first that electrically connects to a first electrical contact on each of the lenses **1405**, and a second conductive path that is electrically isolated from the first conductive path and that electrically connects to a second electrical contact of each of the lenses **1405**. Similar embodiments were discussed with reference to Single Electronics Module embodiments disclosed above.

[0207] Figs. 16 and 17 illustrate the assembly of a portion of an electro-active frame. In some embodiments, the frame may comprise core **1601** that may comprise, for example, a steel wire. The exemplary components as shown are similar to those discussed with reference to Figs. 3-10. Specifically, the components as shown for the exemplary electro-active frame include: A core

element **1601**, which may in some embodiments comprise a conductive material and may be coupled to or disposed within the temple **1602** so as to provide a portion of a conductive path from one component to another. As shown, the core element **1601** may, for instance, provide a conductive path from the temple end (which may comprise, *e.g.*, a power source) to the electronics module **1605**. A housing module **1603** is shown, which may house the electronics module **1605** and be coupled to the temple **1602**. In some embodiments, the housing module **1603** may comprise a portion of the temple **1602**. A switch **1604** (such as a capacitance or "cap" switch) is shown, which may be coupled to the electronics module **1605** and/or the housing module **1603** to provide a switch or control for the electronics module **1605**. For instance, and as shown in Fig. 16, the housing module **1603** may have an opening that may allow a wearer to interact with switch **1604** so as to turn a function on or off, or to otherwise vary the functions provided by an electro-active spectacle. The electronics module **1605**, the switch **1604**, and the housing module **1603** may be coupled using any suitable manner, including one or more screws (as shown in Fig. 16) and/or two sided adhesive tape. One or more conductors **1606** may also be included to provide one or more electrical contacts (*e.g.* conductive paths) from the electronics module **1605** to the lens housing. The conductors **1606** could, for instance, electrically connect to the one or more conductive paths provided by compliant conductive element **1401** shown in Figs. 14 and 15. A hinge **1607** is also shown, which may be coupled to the temple **1602** or a component thereof (such as the housing module **1603**) and also to the lens housing. The hinge **1607** may provide the capability for each of these components to move relative to the other while remaining coupled. In some embodiments, the hinge **1607** may comprise one or more conductors, or may itself comprise conductive material so as to form a conductive path or portion thereof.

[0208] Fig. 17 illustrates the components shown in Fig. 16 coupled together in an exemplary embodiment. As can be seen, the core element **1601** is no longer visible as it is embedded within the temple **1602**. Similarly, the electronics module **1605** is housed within the housing module **1603** and covered (and likely coupled to) on one side by the switch **1604**. The hinge **1607** is coupled to the housing module **1603**. The conductors **1606** may be embedded substantially within portions of the hinge **1607** and/or housing module **1603** so as to form a portion of a conductive path between the electronics module **1604** and the lens housing.

[0209] With reference to Figs. 18 and 19, exemplary embodiments of semi-rimless spectacle frame designs will be described. It should be noted that although many of these concepts will be described therefore in the context of semi-rimless frames, many of the features and principles may also be used with (or applicable to) other frames, such as full rimmed and rimless. Moreover, these embodiments are for illustration purposes, and are thereby not intended to be limiting.

[0210] Figs. 18 (a) and (b) illustrate a typical exemplary semi-rimless frame **1800**. Fig. 18(a) shows a frontal view of the semi-rimless lenses, and Fig. 18(b) shows the cross-section from the points **X** to **X'** of the electro-active frames **1800**. As shown, the lenses **1803** are supported along their upper edge by a rigid portion of the frame **1802** (*e.g.* eye-wire, which may comprise a material such as metal) and supported along their lower edge by a section of clear plastic monofilament **1804** (typically nylon) that is connected to the rigid upper portion **1802** of the lens housing. The monofilament **1804** is shown as being disposed within a groove **1807** in the edge of the lens **1803**. The length of the monofilament **1804** may be such that it is under tension when the lens **1803** is mounted in the frame and may thereby hold the lens in place.

[0211] With reference to Fig. 18(b), a close-up of the cross section **X - X'** of Fig. 18(a) is shown so as to better illustrate an exemplary means by which the lens may be secured in a semi-rimless frame. As shown in this exemplary embodiment, the eye-wire **1802** may contain a cavity **1805** that secures a portion of an extrusion of a semi-rigid plastic **1801** (typically nylon) with a "figure-8" cross section. The remaining portion of the extrusion **1801** is disposed in the groove of the lens **1806** and keeps the lens **1803** from moving back and forth. In those portions of the outer surface of the lens **1803** that do not come into contact with the "figure-8" extrusion **1801** (*e.g.* along groove **1807**), the nylon monofilament **1804** may essentially take the place of the extrusion **1801** as shown in this exemplary embodiment. As the monofilament **1804** may be colorless and may be disposed completely (or substantially) within the lens groove **1807**, it may be nearly invisible except under close inspection.

[0212] It should be noted that construction of an electro-active capable semi-rimless frame design has been disclosed by the inventors in U.S. Pat. Pub. No. 2010/0177277 Al. Embodiments of frames disclosed therein may be similar in appearance to the exemplary embodiment of a frame shown in Fig. 18(b). Some of the differences that may enable the electro-active functionality of the frames disclosed therein may be related to the particular details

of how the frame is constructed and the use of other novel conductive structures, which are described in detail in U.S. Pat. Pub. No. 2010/0177277 Al, which is hereby incorporated by reference in its entirety.

[0213] Figs. 19(a) and (b) illustrate a comparison between an exemplary semi-rimless frame that is not electro-active, and an exemplary embodiment of an electro-active frame comprising electro-active lenses **1913**. That is, Fig. 19(a) shows a cross-section of a conventional semi-rimless frame, while Fig. 19(b) illustrates a cross section of a frame that is essentially the electro-active counterpart of the frame shown in Fig. 19(a). In both Figs 19(a) and 19(b), a monofilament **1904** is used along the lower portion of the lens (**1903** or **1913**) disposed within groove **1907** so as to keep the lens (**1903** or **1913**) secure within the frame. In some embodiments of the electro-active frame shown in Fig. 19(b), the eye-wire **1902** may be made of an electrically conductive material. However, this need not be the case, as a conductive path may be established within the eye-wire **1902** (and/or other components of the lens housing) using any suitable method, such as by, for instance, embedding a conductor within a non-conductive material. During the manufacturing process, in embodiments where the eye-wire **1902** comprises a conductive material, care may be taken to ensure that no coatings or finishes are applied to the inside of the eye-wire **1902** such that an electrically conductive surface is maintained (*e.g.* within the cavity **1905**).

[0214] With reference to Fig. 19(b), in some embodiments (and for the purposes of illustration only), an electro-active lens may comprise an interface **1908** between two substrates that contains internal electrodes for activating the lens **1913**. This has been previously described by the inventors, such as in U.S. Pat. Pub. No. 2010/0177277 Al., which is hereby incorporated by reference. However, as noted above, embodiments are not so limited and the methods, devices, and means disclosed herein may have applicability to any electro-active frame and/or components therein (*e.g.* any type of electro-active lens). During an exemplary manufacturing process comprising edging the exemplary electro-active lens **1913**, the groove **1906** may be placed such that it straddles this interface **1908** (which may, for example, comprise a liquid crystal layer between two electrodes).

[0215] Continuing with the exemplary manufacturing process, the lens **1913** may be edged and grooved, and one or more electrically conductive inks or paints **1909** may be applied to the locations where the electrodes are exposed within the groove **1906**. The inks and paints may be

used so as to provide a conductive path to the electrodes of the lens **1913** without substantially impairing the visual properties of the lens **1913**, or being visible by an observer. In some embodiments, the groove **1906** may be between 0.4 mm and 1.0 mm wide (*i.e.* the horizontal distance shown in Fig. 19(b)) and between 0.4 mm and 1.0 mm deep (*i.e.* the vertical distance in Fig. 19(b)). The inventors have found that, in some embodiments, it may be preferred that the groove **1906** may be approximately 0.7 mm wide and 0.6 mm deep. Generally, the groove should be such that the extrusion or other material **1911** (or a portion thereof) may be disposed within the groove and assist in coupling the lens to the lens housing. However, it is generally not preferred that the groove be too large, as it may become visible and affect the aesthetics of the device.

[0216] In some embodiments comprising an electro-active lens, to provide a lens **1913** that functions properly, a conductive pathway is made between the inner surface of the eye-wire **1902** and the conductive paint **1909** applied to the groove **1906** of the lens **1913** (*i.e.* the surface of the lens **1913** that comprises the groove **1906**). This may be accomplished with the use of a compliant conductive element **1911**. The compliant conductive element may be a physically compliant yet electrically conductive material that may, in some embodiments, be extruded in a shape that fits substantially within the eye-wire **1902** and the groove **1906** of the lens **1913**. Such a design may provide some or all of the advantages that were detailed above, including providing a conductive path between the lens housing and the lens, providing structural support for the device, preventing or minimizing damage to the rigid surfaces of the lens **1913** and lens housing **1902**, etc.

[0217] As was described above, the compliant conductive element may take any shape and have any suitable dimensions. In this regard, Fig. 20 (a) shows a cross section of an exemplary conventional extrusion (*i.e.* non-conductive) **2000** and its exemplary dimensions (in mm), while Figs. (b) and (c) show a cross section and dimensions (in mm) of two exemplary compliant conductive elements **2010** that may be used, for instance, in semi-rimless electro-active frames. Fig. 20(a) discloses a typical "figure 8" shape of a non-conducive element **2000**, while Figs. 20(b) and (c) disclose shapes that vary slightly from the non-conductive component. The upper portions (*i.e.* first portions) **2001**, **2002**, and **2003** of each of these elements are similar, as they may each, for example, be designed to fit within the same lens frame component (*e.g.* an eye-wire). As depicted, each of the compliant conductive elements **2010** have a different shaped

lower portion (*i.e.* second portion) **2005** and **2006** from that of the non-conductive extrusion lower portion **2004**. This may be due to the fact that the compliant conductive elements **2010** may be designed to come into contact with the conductive painted regions within the lens groove, and form electrical connections thereto.

[0218] As can also be seen in Figs. 20 (a), (b), and (c), as depicted, the overall vertical dimensions of the conductive compliant elements **2010** are larger than the traditional non-conductive "figure 8" extrusion **2000**. This may be done in some embodiments to ensure that when the lens is mounted in the frame (*i.e.* within the cavity of the frame) the bottom of the lens groove comes into contact with the bottom (*i.e.* second portion) **2005** and **2006** of the compliant conductive elements, such that the lens may compress it slightly. With the compliant conductive element **2010** under compression, it will likely maintain the physical (and hence electrical) connection between the lens, the compliant conductive element **2010**, and eye-wire at substantially all times, particularly as the frame flexes during donning and doffing the eye wear.

[0219] One of the important dimensions to ensure compression of the conductive compliant element is the "height," of the second portion of the conductive compliant element, which is shown as 0.75 mm for one of the compliant conductive elements **2010** by way of example only. The total height of this exemplary compliant conductive element is shown as 1.45 mm (.75mm + .7mm). As noted, the compliant conductive element **2010** could be made available in different heights to, for example, accommodate variations in lens processing (lens size and groove depth). While the design of the compliant conductive elements **2010** in Figs. 20(c) will likely function to form an electrical contact with portions of the surface of the lens (based on the height as shown), the width (horizontal dimension) is shown as not being optimized for the exemplary width of the groove of the lens and therefore its performance in conducting electricity may not be ideal. That is, the width of the bottom portion **2006** shown in Fig. 20(c) is not as wide as the groove in the lens. In contrast, the compliant conductive element **2010** in Fig. 20(b) is depicted as having a width that has been optimized – *i.e.* the width is larger, making it more likely that this configuration will make more robust electrical contacts. It should be noted that compliant conductive element **2010** made to the exact (or similar) shape as the "figure 8" design used for the non-conductive extrusion **2000** are, in some embodiments, the least preferred design as there may be no means to guarantee that the conductive compliant element **2010** will be compressed against the edge of the lens and hence provide a robust electrical connection.

[0220] It should be understood that the dimensions provided on Figs. 20(a)-(c) are provided for illustration only, and are by no means limiting. Indeed, the dimensions of these components may vary based on the dimensions of the lens (and the lens groove) and the lens housing (and any cavity provided therein).

[0221] In general, from the standpoint of aesthetics, the electro-active semi-rimless frame design is may be particularly useful. For instance, through the use of appliques, facades and various lens shapes the basic semi-rimless frame shown, for example, in U.S. Pat. Pub. No. 2010/0177277 Al can take on the look of many different styles while retaining its electro-active functionality.

[0222] Exemplary Embodiments Related to Full Rim Spectacle Frame Deigns

[0223] A typical full rim plastic frame (also referred to as zyl or acetate) known to those skilled in the art is shown in Fig. 21, where the lenses **2101** are supported along their entire circumference by a rigid plastic frame **2102**. While an electro-active capable plastic frame was discussed with reference to Figs. 14-17, additional embodiments are shown with reference to Fig. 22. As shown in Fig. 22, a physically continuous conductive pathway (*e.g.* an embedded conductor, such as a wire) is used to apply the driving voltage (*e.g.* the waveform) to the lenses and route synchronization signals from the master **2207** to the slave module **2208**. That is, for instance as shown in Fig. 22, the embedded conductor **2201** may provide a conductive path across the lens housing from the master electronics module **2207** to the slave electronics module **2208**. As noted above, embodiments that utilize a single electronics may also be used. Furthermore, Fig. 22 also shows openings in the metal casings **2206** that may hold modules or other components that allow the electronics modules **2207** and **2208** to be charged inductively. This may be beneficial in that such embodiments may provide power without the use of batteries (or may supplement the use of batteries to provide longer lifetime).

[0224] Continuing with reference to the embodiments shown in Fig. 22, a top conductor **2201** is shown embedded within the lens housing (that may comprise, *e.g.* acetate) and may carry a driving electronic signal from the right lens to the left lens. In addition, in some embodiments, the embedded conductor **2201** may also carry the power signal between the two lenses so as to synchronize the functionality between both lenses. Embedded conductor **2202** may carry the reference electronic signal to the lenses (*e.g.* ground). Fig. 22 also designates locations **2203** where special square (or any other appropriate shape) beveling into the lens housing (*e.g.* into the

acetate frame front) may occur so as to (1) expose portions of the embedded conductors **2201** and **2202**; (2) embed compliant conductive material; and/or (3) allow for an electrical connection between the exposed portions of the embedded conductors **2201** and **2202** to the compliant conductive element. That is, in the exemplary embodiment, the portions designated by **2203** may be the locations in which the conductive compliant material may be disposed within the lens housing, and where the conductive path from the lens housing to the lens may be created. Fig. 22 also indicates where the use of conductors **2204** (such as pogo pins) may be located so as to provide a conductive path from the temple to the lens housing (*e.g.* to the embedded conductors **2201** and **2202**). Fig. 22 also shows an exemplary location of a hinge **2205** to couple the temple to the lens housing.

[0225] With initial reference to Fig. 21, Fig. 23 shows a cross section view of the sections **X - X'** and **Y - Y'** for a conventional full rim design (Fig. 23(a)) and of an exemplary electro-active full rim design comprising a compliant conductive element (Figs. 23(b)-(e)).

[0226] As noted, Fig. 23(a) shows the cross-section **X – X'** of a conventional full rim (*i.e.* non-conductive) plastic frame with a lens **2302** possessing a beveled edge that sits (*i.e.* is disposed) within a similarly beveled region of an eye wire **2301**. That is, the lens **2302** is designed to have a top surface that substantially matches a bottom surface of the lens housing *(i.e.* the eye rim). This is one way in which traditional lens design coupled the lens to the lens housing.

[0227] Fig. 23(b) shows the section **X - X'** of an electro-active capable plastic frame in a region where no electrical contact is required. The basic construction is similar to that of the conventional frame design except that there is an embedded conductive pathway **2304** (*e.g.* metal wire or similar). As the conductive pathway **2304** is completely encased within the insulating material of the eye wire **2301** at this location**,** there is no electrical contact between the lens **2302** and lens housing **2301** (or a conductive path **2304** embedded therein).

[0228] Fig. 23(c) shows the section **Y - Y'** of an electro-active capable plastic frame in a region where electrical contact between lens housing **2301** and lens **2302** is required. In this region a square cavity **2305** is machined into the eye-wire **2301** that exposes the embedded conductive pathway **2304** (*e.g.* metal wire or similar). The cavity **2305** may also accept a compliant conductive element **2307** that may, in some embodiments, be extruded or otherwise configured into a rectangular shape. As also shown in Fig. 23(c), the top surface of the lens **2302** may be configured to be disposed within a portion of the cavity **2305** as well.

[0229] Fig. 23(d) shows the cavity **2305** and the compliant conductive element **2307** in detail. As with the semi-rimless electro-active frame, it may be desirable to have the edge of the lens **2302** that is coated with the conductive paint **2306** come into physical contact with the compliant conductive element **2307** and compress it (as shown by compression region **2308**) before the remainder of the circumference (*i.e.* the top surface) of the lens **2302** comes into contact with the conventionally beveled sections of the eye-wire **2301** (*e.g.* in the section defined by **X - X'** in Fig. 21, where no electrical contacts are made). As described above, with the compliant conductive element **2307** under compression (*i.e.* based on the force applied by the surface in the cavity **2305** of the lens housing **2301** and the top surface of the lens **2302**), it will maintain the physical (and hence electrical) connection between the lens **2302**, complaint conductive element **2307**, and conductive pathway **2304**, even as the frame flexes during donning and doffing the eye wear.

[0230] The dimensions of the compliant conductive element **2307** are generally determined by the dimensions of the cavity **2305** and the position of the cavity **2305** relative to the conventional lens bevel. The minimum height (H_{min}) of compliant conductive element **2307** may be the distance between the apex of the conventional lens bevel **2306** and the bottom of the cavity **2305** as shown in Fig. 23(d). Generally, as values of the uncompressed height ($H_{uncompressed}$) increase above H_{min}, the more robust the electrical connection between the compliant conductive element **2307**, the lens **2302**, and the lens housing **2301** (and/or the embedded conductive pathway **2304**). Maximum values of the height H may be determined empirically based on how compressible the compliant conductive element material is such that lens **2302** (or a portion thereof) can still be mounted into the lens housing **2301** using methods known in the art. That is, the maximum height may be the height at which the compliant conductive element **2307** will still compress sufficiently that the lens **2302** is adequately disposed within the cavity **2305** and thereby coupled to the lens housing **2301**.

[0231] With reference to Fig. 23(e), the width of the conductive compliant element **2307** is preferably a small amount (δ) larger than the width of the groove W such that the compliant conductive element **2307**, once inserted into the cavity **2305**, remains in place without the need for adhesives while the lens **2302** is mounted. The inventors have found that a δ value within the range of approximately 1 mm to 0.5 mm was preferred and functioned well for this purpose. In an exemplary embodiment, a rectangular compliant conductive element approximately 2.1 mm

wide (for a 2.0 mm wide cavity) and 1.2 mm tall enabled a robust electrical connection between lens **2302** and a lens housing with a δ value of approximately 0.1 mm (100 μm).

[0232] Exemplary Embodiments Comprising Full Rim Metal Spectacle Frame Designs

[0233] As noted above, the specific embodiments discussed herein are exemplary only, and other embodiments may exist that utilize the same or similar principles. For instance, in some embodiments, it may be desirable to have an electro-active capable frame with a full metal rim manufactured from a conductive material. A cross section for such a frame is shown in Fig. 24. In this exemplary embodiment, the eye-wire **2401** contains a square cavity **2402** to which preferably no coatings or finishes have been applied such that the conductive surface of the eye-wire **2402** material is easily contacted. Into the cavity **2402** another conductive compliant material **2403** may be mounted (*e.g.* disposed within) that may make the electrical connection between the lens **2404** and frame (*e.g.* the lens housing **2401**). In areas where the electrical connection need not be made, then the compliant conductive element **2403** may be omitted and the edges of the square cavity **2402** in the eye-wire **2401** support the bevel of the electro-active lens **2404**. In other embodiments the conductive compliant element **2403** may be mounted (*i.e.* disposed within) in all parts of the eye-wire cavity **2402** and only those areas of the lens **2404** to which conductive paint is applied make electrical contact. The shape of the conductive compliant element may be any shape, including rectangular (similar to the exemplary embodiments described above with respect to the exemplary full-rim plastic rim) or embodiments may have a slight bevel. The conductive compliant element **2405** shown with the slight bevel in Fig. 24 may also be suitable for full rim plastic frames in other embodiments.

[0234] As with the previously described frame designs, it is preferred to have the edge of the lens that is coated with the conductive paint come into physical contact with the compliant conductive material and compress it before the remainder of the circumference of the lens comes into contact with the remainder of the eye-wire. As described above, with the compliant conductive element under compression, it will maintain the physical and hence electrical connection between lens, compliant conductive element, and lens housing (*e.g.* conductive pathway), particularly as the frame flexes during donning and doffing the eye wear.

[0235] Fig. 25 illustrates an exemplary embodiment comprising a conductive compliant element **2501** providing a conductive path from the lens housing **2500** to an electro-active lens **2507**. The illustration on the left of Fig. 25 shows a close up of an exemplary electro-active

frame. The frame comprises a lens housing **2500** that could, for instance comprise a non-conductive material such as a plastic (*e.g.* acetate). Embedded within the lens housing **2500** is a conductor **2503**. As shown in this exemplary embodiment, conductor **2503** is electrically connected to the temple at **2506**, which could for instance comprise another conductor, such as a pogo pin. Conductor **2503** is also connected to compliant conductive element **2501** in cavity **2502** (for instance, the conductor **2503** may be exposed at some portions along the cavity **2502**. As shown, conductive compliant material **2501** is located within a portion of cavity **2502**. A second conductive path is also shown, comprising a second embedded conductor **2504**, which also connects to a compliant conductive element **2501** disposed within a cavity **2502** in the lens housing **2500**. The second embedded conductors 2504 electrically connects to a temple at a point **2506**. Thus, as shown, Fig. 25 illustrates an electro-active frame that comprises two separate conductive paths from a temple to the lens **2507** via compliant conductive elements **2501**. In portions of the lens housing **2500** where the conductive compliant element **2501** is not located, the lens housing **2500** comprises a cavity **2508** that may be of a traditional shape (*e.g.* not square) in which a portion of the lens **2507** (*e.g.* a beveled edge) may be disposed within. A hinge **2505** that couples a temple to the lens housing 2500 is shown as well.

[0236] On the right of Fig. 25 are shown closes up of the cross sections shown as **A-A** and **B-B** on the illustration on the left of Fig. 25. As shown, in section **A-A**, an electrical connection is formed between conductor **2503**, compliant conductive element **2501**, and lens **2507**. The cavity **2502** is shown as comprising a rectangular shape, and the compliant conductive element **2501**is shown as having dimensions such that it is substantially disposed within the cavity **2501** (dimensions in mm). At location **B-B**, there is no electrical contact made as the electro-active frame does not comprise a compliant conductive element **2501** in this location. The cavity **2508** is shown in this section, and the lens housing **2500** is shown as encapsulating the conductor **2503** such that no contact is made with the lens at this location. The last illustration is a cross section showing an overlap of the sections **A-A** and **B-B**, where the different between cavity **2508** and **2502** (comprising conductive element **2501**) can be seen.

[0237] Material Composition of the Conductive Complaint Element and Inks

[0238] As discussed above, the conductive compliant element, regardless of the frame design, may, for example, comprise a physically compliant yet electrically conductive material that is extruded or otherwise molded into a shape that conforms to both the frame and lens for the

purpose of forming an electrically conductive path (*i.e.* bridge) between lens and frame. While many different classes of material are suitable, good results have been obtained by the inventors when metal loaded silicone elastomers are used with volume resistivities of less than 10 Ω-cm and preferred results are obtained with volume resistivities of less than 1 Ω -cm. It has also been found that a material having values greater than 50 on the shore durometer A scale are suitable, but that values greater than 65 are preferred. The inventors have achieved good results with extruded silver and aluminum (Ag-AI) loaded silicone elastomer with a volume resistivity of 0.008 Ω -cm and a Shore A hardness of 70. However, embodiments are not so limited.

[0239] While such materials are typically manufactured to final shape prior to assembly into the electro-active frames, in certain embodiments, it may also be possible to apply uncured material in liquid or gel form immediately prior to assembling the eye wear such that upon cure the material conforms to both the lens and frame (*e.g.* the lens housing) simultaneously and thus forms an electrically conductive path (*e.g.* bridge) in that manner. This may be preferred in some embodiments, as the compliant conductive material may thereby contact the greatest amount of the surface of both the lens and the lens housing, and may thereby maximize the electrical connections thereon.

[0240] In some emobdiments comprising an electro-active lens, the conductive paint(s) or ink(s) applied to the edge of the lens to establish an electrical connection may be dependent upon the conductive materials used to make the internal electrodes of the lens itself. As these electrodes will typically be in the line of sight to both the wearer and viewer of the lenses, it is preferred to have a transparent conductive material such as ITO ink mixture X-806CN27S which is commercially available from Sumitomo Metal Mining of Japan, by way of example only. For lenses manufactured with this ink formulation, once edged and grooved, an additional amount of the X-806CN27S may be applied to the edge of the lens and cured. To establish a more robust electrical connection, a second conductive ink or paint may be applied over the cured X-806CN27S. While many conductive metal inks (silver and/or nickel based) are available, conductive carbon based inks are preferred for cosmetic reasons. Carbon based conductive inks are preferred as they do not oxidize (*i.e.* change color) with age and are not as bright in appearance as metal based inks. By way of example only, a conductive carbon ink such as mixture 122-49, commercially available from Creative Materials Incorporated may be preferred.

[0241] Electronic Frames Comprising a Housing Module

[0242] When designing and fabricating spectacles that comprise one or more electronic components, the manner in which these components are incorporated with the spectacle frames may also be considered. In some instances, the electronic components may be inserted or coupled to the frames of the electronic spectacles (for instance in a cavity of the temple or the lens housing). The electronic component or components may be inserted during fabrication or included thereafter. For example, in some embodiments in which the frame comprises a plastic material (such as acetate), the frame may be molded around the electronics during fabrication (such as during molding or injection molding of the plastic). However, this may limit access to the electronics, and may prevent repair or replacement. Moreover, the plastic material may expand and contract during the fabrication process, which may result in the frame components also changing size and/or shape. Molding the frames around the electronic components (such as around an electronics module) may result in spectacle frames that are not uniform, that have defects around the electronic components, are not structurally sound, do not provide access to the components therein, etc.

[0243] In some embodiments, a cavity may be formed in one of the components of the frame (such as one of the temples) during the fabrication process in which the electronics may be disposed either during fabrication or thereafter. Examples of such embodiments are illustrated in Figs. 3-10, where the electronics module **307** is shown as being inserted into (or placed within) the cavity **308** and coupled thereto with a fastener (such as a screw, adhesive, etc.)**.** Further examples are shown in Figs. 16-17, where the electronic frames comprise a housing module **1603** that is attached to one of the temples and houses an electronics module **1605** (*i.e.* the electronics module is disposed therein). Figs. 16 and 17 are described in more detail below. In some instances, when the frame (or a component thereof) comprises a plastic material (such as acetate) then, as noted above, the plastic material may expand and contract with heat, creating pressure on the electronics within the cavity and/or causing portions of the frame to deform around the components. Therefore, in some embodiments, it may be desirable to utilize a component (*e.g.* a housing module) that may be used to support the electronics and/or electronics module within (or coupled to) a structural element of the frame (such as the temple of the frame or the lens housing). In this regard, in some embodiments, such housing modules may be used to both couple (*e.g.* attach) the electronics to the electronic frame, as well as to maintain the shape and structural integrity (and thereby the aesthetics) of the electronic frames or a component thereof.

[0244] In some embodiments, electronic spectacle frames provided herein may include a housing module that may be coupled to (*e.g.* attached to and/or disposed within) a structural member of the electronic frames. As used herein, a "housing module" may refer to a component that may house (*e.g.* contain, substantially contain, surround, surround a portion of, encircle, etc.) of the electronics (and/or an electronics module) of the electronic spectacles. It should be noted that the housing module need not fully encapsulate the electronics or electronics module in some embodiments. That is, there could be area in which the housing module does not cover the electronics module. Such openings or apertures may allow for interaction with the electronics module, such as by allowing the wearer to turn electro-active lenses (or other electronic components disposed on the spectacle frames) "on" and "off" (*e.g.* through a capacitive or membrane switch). In some embodiments, an opening in the housing module may allow for the electronics module to be selectively placed into (and/or removed from) the housing module. For instance, in some embodiments an electronics module may be pressure fitted so as to be inserted into an opening (*e.g.* "slid in" or otherwise disposed into) and coupled to the housing module. The shape, size, and material of the housing module may vary based on the specific purpose of the component, as well as based on other factors such as the size, shape, and material of other components of the frame and/or the electronics module. For instance, the housing module may comprise a conductive material (*e.g.* a metal) or non-conductive material (*e.g.* plastic, carbon fiber, or nylon), and may be shaped to fit particular styles of frames. In general, it may be preferred that the material and size of the housing module may be chosen such that during typical use, the electronics module may not be inadvertently removed or decoupled from the housing module.

[0245] The inventors have found that an inadvertent voltage or current that may be applied to the electronic components disposed within an electronics module may create unpredictable and/or unwanted behavior by those electronic components, or any electronic components that may be electrically coupled to those electronic components (such as components that are supplied with power and/or control signals from the electronic components disposed within the electronics module). In this regard, the use of conductive materials coupled to the electronics (or an electronics module that comprises the electronic components) may create such electrical conductivity issues including shorting of the components and/or capacitance issues (*e.g.* electrical charge storage and dissipation). This may, for instance, cause the electronic components to activate when they are not intended to, or it may cause electrical damage to the

electronic components (for example, if excess current is inadvertently supplied). Therefore, it may be preferred in some embodiments that the electronic components disposed within (or substantially within) the electronics module may be electrically insulated from the electronic frames and/or the outside environment. That is, for instance, in some embodiments, an insulating material may be disposed between (or substantially between) the electronic components disposed with an electronics module and the frame of the electronic eyeglasses and/or the outside environment. However, there may still be one or more conductive paths between the electronic components disposed within the electronic module and one or more electronic components disposed on the frame and/or within one or more electro-active lenses such that the electronic component may provide power and/or control signals to these components.

[0246] For example, in some embodiments, a housing module may comprise a conductive component such as a metal. Such materials may be preferred in some embodiments because they may have structural properties that prevent or inhibit deformation of the frames and thereby serve to house and protect the electronic components (and the electronics module), while maintaining the aesthetic shape and appearance of the frames. However, the conductivity of the housing module may cause the electronic components to be inadvertently grounded, or may produce or supply additional charge to one or more of the electrical components when such charge is not required or desired. Therefore, in this example, it may be desirable in some embodiments to include an insulating material located between the housing module and the electronic components so as to prevent or reduce the risk of such shorting issues and/or stray electrical charges from an external source. In some embodiments, the insulating material may comprise a portion of the electronics module (such as a layer of material disposed on the outer surface of the electronics module, or the electronics module itself may comprise an insulating material), such that the electronics module may substantially electrically insulate the electronic components disposed therein from the conductive housing module (and/or other conductive components, such as a portion of the frame).

[0247] In general, the housing module may comprise any suitable material, including non-conductive materials (*e.g.* an insulating material). Thus, in some embodiments, the electronics module may comprise a conductive material, but may be electrically insulated (or substantially electrically insulated) from the frames and/or the outside environment by a housing module that

comprises a non-conductive material. Indeed, the inventors have found that in some embodiments, the use of non-conductive materials for the housing module may reduce inadvertent charge dissipation in the electronics module, and thereby may increase the performance of the electro-active lenses (and/or reduce failures or undesired behaviors) in some instances. Moreover, in some embodiments that may comprise a sensing mechanism (such as a capacitive touch switch), the use of an insulating material (*e.g.* layer) may prevent charge storage from an interaction with user, which may prevent or reduce the occurrence of a second electrical charge incorrectly indicating a second interaction with the user.

[0248] In some embodiments, an insulating material may be disposed within the housing module and may be located between the housing module and the electronics module (or a portion thereof). For instance, both the housing module and the electronics module could comprise a conductive material, but could be electrically insulated by a material disposed there between. However, as used herein, any insulating material or layer that does not comprise a portion of the electronics module (including a layer disposed on an outer surface), but that is disposed between the housing module and the electronics module (or a portion thereof) may be considered a part of the housing module.

[0249] In general, the insulating material may comprise any suitable electrical insulator, including plastics and/or rubber, or any other material or composition having suitably high resistivity. In some embodiments, it may be preferred that the insulator is chosen so as to effectively isolate the electronic components in a relatively short distance for voltages of at least approximately 5 volts (but it may be preferable in some embodiments to be at least approximately 20 volts), which may correspond to the typical amount of external (and internal) voltage applied to the frames. In some embodiments, the thickness of the insulator may be less than approximately 10 mm (and preferably in some embodiments of less than approximately 5 mm). In general, the thickness of the insulator may be preferred to be as small as possible, as the available space within the electronic frames may be limited, while still providing adequate electrical insulation. Therefore, in some embodiments, it may be preferred that the thickness of the insulating material may be less than 1mm.

[0250] As noted above, the housing module may be located in any suitable location on (or coupled to) the electronic frames. For instance, the housing module may be located on (or within or attached to) the lens housing or on (or within or attached to) one or both of the temples. That

is, for instance, in some embodiments the housing module may be inserted into a component of the lens frame (such as into a cavity within the component) and provide support to maintain the shape and aesthetics of the frame, while also providing a means of coupling one or more electronic components to the electronic spectacle frame. In some embodiments, the housing module may comprise a separate section of the frame. That is, for instance, in some embodiments, the housing module may be disposed between a temple of the frame and the lens housing, such that the housing module is coupled to both the lens housing and the temple. An example of this is shown in Figs. 16 and 17 and described in detail below. In such embodiments, the lens housing may be coupled to the temple using any suitable means, such as an adhesive, one or more fasteners (such as a screw), and/or the two components could be designed such that a portion of the housing module may be inserted into (or otherwise structurally fitted into or coupled to) the temple and/or the lens housing (or vice versa). In some embodiments, the lens housing and the temple may share a similar structural component (such as a similar core, such as the core **1601** shown in Figs. 16 and 17). The lens housing or temple and the electronics module may, in some embodiments, be connected by using one or more hinges.

[0251] Embodiments may thereby provide a housing module that contains, surrounds, encapsulates, is coupled to, or otherwise houses one or more electronic components (or portions thereof) and/or an electronics module that comprises one or more electronic components of an electronic spectacle frame. As noted above, in some embodiments, the housing module may provide structural support to the frame (or a component thereof) that prevents or reduces deformation of the frame during the fabrication process or during subsequent use of the frames, or may itself provide a portion of the frame consistent with the aesthetic style of the frames.

[0252] In some embodiments, it may be desirable to provide the ability to selectively couple (*e.g.* attach) or decouple (*e.g.* remove) the housing module and/or the electronics (or an electronics module) from the electronic spectacle frames. For instance, it may be desirable that the housing module be selectively coupled to the frames so that the housing module may be manufactured in a separate process from the other portions of the electronic frames. That is, for example, in some embodiments the electronic frames may be fabricated with a cavity to which the electronic housing module may be inserted into after the electronic spectacle frame, or a portion thereof, is fabricated. The housing module may then be disposed into the cavity, and an electronics module may thereafter be coupled to the housing module. In some embodiments, the

electronics module may be coupled to the housing module in advance of inserting the housing module into such a cavity. In some exemplary embodiments, the housing module may serve to provide support to the frame (or a component thereof) and prevent or reduce deformation of the frame (*e.g.* if the frame comprises a plastic material such as acetate or nylon). Similarly, it may also be desirable that the electronics (*e.g.* an electronics module) be selectively coupled to and/or decoupled to (*e.g.* removable) from the housing module. This may permit replacement of defective, obsolete, or exhausted components (such as an old or frequently used power source). Moreover, the ability to selectively insert and remove electronic components or an electronic module may provide the ability to customize the use of the electronic spectacle frames. For instance, the same electronic spectacle frames (or components thereof) may be used for different purposes, but may be manufactured in the same manner (thereby allowing for less expensive fabrication). The customization may be provided by coupling (and thereby utilizing) different electronic components (that may be comprised for instance in separate electronic modules) with the same or similar standard frames.

[0253] Although the housing module may be secured to the frame in any suitable manner (such as by using an adhesive, screws, etc.) as noted above, it may be preferred in some embodiments to provide a manner in which the housing module and/or the electronics may be readily coupled (and/or decoupled) to the frames. The inventors have found that an example of a relatively efficient manner may be to shape the housing module (or the electronics module) so as to be pressure fitted. That is, for instance, the housing module may be coupled to the frame by "snapping" the housing module into place. In this regard, the shape and/or size of the components may be such that if a force is applied in a particular direction of the housing module (or the electronics module), the component may contract in that direction. When a force is not applied in that direction, the component may expand. If the receiving component (*e.g.* the electronic frame or a cavity therein) is designed so as to accept the expansion of the housing module, the housing module could be inserted into place and be readily coupled thereto (or alternatively, with the application of a similar force, decoupled and removed). Similarly, an electronics module may be designed to be pressure fitted into the housing module. In this manner, either the housing module or an electronics module may be readily coupled (or decoupled) to the electronic frame (*e.g.* without the need for tools -such as screw driver) in a manner in which they may be inserted or removed without damaging the structure of the frames.

[0254] As noted above, the inventors have found that in some embodiments it may be preferred to have a housing module or an electronics module that may be pressure fitted. In some embodiments, the electronic spectacle frames may comprise a temple that has an opening in one end that allows for either the housing module or the electronics module (or both) to be inserted into the opening and thereby be disposed within the temple (*e.g.* within a cavity). An example of such a design is shown in Fig. 27 and described in detail below. In this way, in some embodiments, the housing module and/or the electronics module may be coupled/decoupled to the frames in a relatively efficient manner by applying pressure in a perpendicular direction (typically to deform the component to decrease a cross-sectional area) and inserting/removing the housing module or electronics module from the receiving component. In some embodiments, the housing module may comprise a component of the frame (*i.e.* as described above with reference to Fig. 16, the housing module may be coupled to the temple and/or the lens housing, but not necessarily be disposed within either) and an electronics module may be inserted into an opening in the end of the housing module and pressure fitted thereto. Some embodiments that comprise a pressure fitted component may provide several advantages, including, in some instances, providing an increase in the ease with which components may be coupled and decoupled.

[0255] For example, when an electronic component or components is chosen for use in an electronic frame, the electronics may be disposed in an electronics module that may be inserted into the opening in an end of the housing module or a frame component (*e.g.* by compressing an electronic module in one dimension). In some embodiments, the electronics module may be "slid" into place (*e.g.* inserted into the opening and thereby disposed in the housing module). The housing module (and/or the temple of the frames) may be configured so as to have an area, cavity, or opening that allows the electronics module to expand into and thereby the module may be coupled therein. An example of this is illustrated in Fig. 27. In addition, in some embodiments, the inventors have found that it may be more effective to compress the dimension of the electronics module that is perpendicular to the direction that it is inserted into the housing module (*i.e.* to decrease the dimension of the electronics module in a direction that is perpendicular to the axis of the temple (*e.g.* the axis on which the temple typically has its largest dimension)) because this may not, in some instances, effect the conductive path or the electronic components. This may be preferred in some embodiments to compressing the electronics module in a direction that is parallel to the axis that the temple extends along because such

embodiments may cause the electronic components and/or the conductive path to be compressed – which may require additional components to maintain such conductive paths and/or specific materials (such as conductive rubber) to comprise some of the components, and may also increase the risk of potential failures in electrical contacts in some embodiments. For instance, the electronics module may in some embodiments comprise electronic components (such as a power source) that are not easily compressible. In addition, in some embodiments, locating an opening in the end of the temple (or the housing module) may provide advantages over utilizing an opening in another location (such as along the body of the temple) such as increasing the durability of the electronic spectacles when in use (which is generally when the most force may be applied to the frames) because the opening may be blocked and/or protected by the other components of the electronic spectacles (*e.g.* a hinge or the lens housing). This may prevent the electronics module (and/or the housing module) from inadvertently being removed from the device. Again, an exemplary illustration of such embodiments is shown in Fig. 27 and described below.

[0256] As noted above, some embodiments may provide advantages over electronic spectacles that do not comprise a housing module in which electronics and/or an electronics module may be located within. For instance, some embodiments comprising a housing module may provide additional structural support to a frame or component thereof (*e.g.* to a plastic frame, which may otherwise deform around components contained in a cavity therein). The housing module may provide for removable access to an electronics module because the frame components may not be molded or formed directly around the electronic components. Some embodiments may also provide benefits in the manufacturing process. For instance, the housing module and/or electronics module may be manufactured in a separate fabrication process (and may comprise a different material) and be later assembled with other components of the frames. In some embodiments, providing an electronic module and/or housing module that may be selectively coupled and/or decoupled to the frame components and/or to each other, may increase the flexibility and utility of the electronic spectacle frames by allowing a single base frame to serve multiple purposes (*e.g.* by using multiple and/or different electronics that may be coupled and/decoupled as required) and may further provide a more robust design (because, for instance, defective or used components may be more readily replaced). Moreover, the use of pressure fitted components in some embodiments may permit quick coupling and uncoupling of the components, without the need for tools and or risk of damaging the components of the device.

[0257] Exemplary Embodiments of Electronic Spectacle Frames Comprising a Housing Module

[0258] Provided below are further exemplary embodiments of electronic frames. These examples are provided for illustration purposes only. In addition, a person of ordinary skill in the art after reading this disclosure may understand that various combinations of components discussed above or below may be made. In this regard, embodiments may provide electronic frames that comprise a housing module for electronics (and/or an electronics module) in electronic spectacles. Some embodiments, may comprise of the components and features described above in combination with a housing module. For example, some embodiments may also comprise a spring hinge and an electrical path from a temple to a lens. Some embodiments may also comprise a conductive compliant material that provides part of an electrical path between two or more components. Some embodiments may also comprise a single electronic module, or multiple electronics module. Some embodiments may also comprise a facade.

[0259] In some embodiments, a first device may be provided. The first device may include a frame having a first temple and a second temple. The frame may also comprise a housing module attached to a structural member. A "structural member" may refer to any portion of the frame including, by way of example, the lens housing, either of the temples, a cavity within a temple, the lenses themselves, etc. The housing module may be attached (or coupled) to the structural member in any suitable manner, including using one or more fastening devices (such as a screw), an adhesive, a common frame component (such as a core element), etc.. In some embodiments, the structural member and the housing module may be structurally configured so that they couple without the use of another component or device. For example, the housing module may be configured to be "pressure fitted" to a cavity within a structural member of the frame, or there may be one or more connectors or common components that may be used to couple (*e.g.* attach) the components.

[0260] In general, it may be preferred in some embodiments that the housing module is coupled to and/or configured so as to not detract from the aesthetic features of the structural member and/or the frame of the electronic spectacles. For example, the housing module may be designed so as to appear as part of the frame, or may be designed such that it adds to the stylistic design and appearance. In some embodiments, the housing module may be designed or configured to provide support to the structural member and also contain one or more electronic

components (or an electronics module that comprises one or more electronic components) of the device. It may be preferred, in some embodiments, that the support provided by the housing module prevents or reduces the deformity of a structural member, particularly where the structural member comprises a plastic (such as acetate), nylon, or any other material which may have their shape altered by the application of force, such as heat or physical force applied during fabrication and/or during typical use. The structural components may thereby be more susceptible to physical damage if not structurally reinforced (*e.g.* if electronics or an electronic module are to be located in a cavity). Thus, in some embodiments where the structural component of the electronic frames may comprise a material that may have its shape changed and deformed in a manner that affects the performance of the device and/or the structural aesthetics of the frames, it may be preferred to include a housing module that provides support. However, embodiments are not so limited, and the housing module may be attached or coupled to structural components (such as temples) that comprise any suitable material, including conductive materials such as metals, which may not require additional support to prevent deformation during use or subsequent to fabrication. In addition, as described below, the housing module may itself comprise a separate component such that it may not be disposed within the structural member (and thereby does not provide support for the structural member) or it may be coupled to a structural member or members. An example of such an embodiment is shown in Fig. 16.

[0261] In some embodiments, the first device as described above may include a first lens and a second lens coupled to the frame, and an electronics module. The electronics module may be located (*e.g.* disposed) within the housing module. That is, for instance, the electronics module may be disposed such that some or all of its components are contained within the periphery of the housing module. However, as noted above, in some embodiments, portions of the electronics module may not be covered (*e.g.* encapsulated or surrounded) by the housing module. Moreover, in some embodiments, portions of the electronics module may protrude through, or be disposed outside of, the housing module. One such example provided for illustration purposes may be a touch sensitive switch, such as a capacitive switch or a membrane switch, that has at least a portion that is exposed such that it may interact with a user (such as a user's finger). The electronics module may further include at least any two of: a power source; a controller; and a sensing mechanism (*i.e.* the electronics module may comprise more than one electronic component). For instance, the electronics module may comprise a power source and a controller;

a power source and a sensing mechanism; a controller and a sensing mechanism; or only one of these components.

[0262] In some embodiments, the first device may be self sufficient – that is, it may comprise a power source and one or more electronic components that are driven by the power source. It should be understood that the first device (*e.g.* an electronic spectacle frame) may comprise other electronic components disposed on (or within) different parts of the device (*e.g.* coupled to different parts of the frame such as the temples, the lens housing, or the lenses). Each of the electronic components may be electrically connected together (via one or more conductive paths) or each may be electrically isolated from one or more of the other electrical components and/or modules.

[0263] In some embodiments, in the first device as described above, an insulating layer may be disposed between one or more electronic components (that may themselves be disposed within the electronics module) and the frame of the first device. The term "disposed between" may refer to when an insulating material (*e.g.* an insulating layer) may be located so as to electrically isolate one or more of the electronic components from at least a portion of the frame. The insulating layer may also isolate some or all of the electronic components from the external environment. In general, the insulating layer may be designed or configured to electrically isolate the electronic components that may be disposed within the electronics module from external sources of current or voltage. As explained above, the less electrical contact the electronic components have to external sources of current and/or voltage, the less likely it is that an occurrence of a short current or external electrical charge or voltage may affect the performance of the electronic frames or components thereof. For example, in some embodiments, the insulating layer may be utilized so that inadvertent or unwanted voltages or currents are not applied to the electronic components disposed within the electronics module. For instance, in some embodiments where the electronics module may include a sensing mechanism, the sensing mechanism may not function properly if unwanted voltage or current is applied thereto (such as through a conductive housing module), or if a charge that was generated based on a user's "touch" is not effectively dissipated because of the conductive material. However, it should be noted that a conductive path may still be established to the components within the housing module (*e.g.* through the use of a conductor inserted into an opening of the electronics module). For instance, in some embodiments a sensing module that may be disposed

on the outside of the electronics module may have a conductive path to, for instance, a controller located inside the electronics module. In addition, a power source or controller may be electrically coupled to other components on the electronic frame. In some embodiments, these conductive paths may also be electrically isolated from the frames or a housing module that may comprise a conductive material.

[0264] In some embodiments, where an insulating layer may be disposed between one or more electronic components (which may be disposed within the electronics module) and the frame, the housing module may comprise the insulating layer. That is, for example, the housing module (or a portion thereof) may comprise an insulating material. The housing module may in some embodiments substantially surround and/or be coupled to the electronics module and thereby if the housing module comprises an insulating material, then a substantial portion of the electronics module (and thereby the electronic components disposed within the module) may be electrically isolated from the frame and/or the external environment. Indeed, in some instances, the electronics module may comprise a conductive material, and may thereby be electrically isolated (or portions thereof may be electrically isolated) by the housing module. This may permit some embodiments to include an electronics module that could comprise a conductive material (such as a metal). This material may offer advantages over other types of materials, such as with regard to increased manufacturing efficiencies, and/or may also comprise a material that is better able to protect the electronic components disposed therein such as, for instance, during manufacture, assembly, transportation, and/or during use of the first device.

[0265] In some embodiments, in the first device as described, where an insulating layer may be disposed between one or more electronic components that may be disposed within the electronics module and the frame of electronic spectacles, the housing module may comprise a conductive material and the insulating layer may be disposed between at least a portion of the housing module and the electronics module. By "at least a portion" it is generally meant that at least 25% of the electronics module may be isolated from the housing module by the insulating layer. For example, in some embodiments the housing module may not be adjacent to (or electrically coupled to) the entire surface of the electronics module, and thereby the insulating layer may need not electrically isolate the entire electronics module from a conductive housing module. For instance, the housing module may have one or more openings that may provide access to the electronics module (or components therein, such as a sensing mechanism). In some

embodiments, the insulating layer may isolate more of the electronics module (such as, for instance at least 50% or, preferably, at least 95%), which may depend on the design and functionality provided by the electronic spectacles.

[0266] In some embodiments, in the first device as described, where an insulating layer may be disposed between one or more electronic components that may be disposed within the electronics module and the frame of electronic spectacles, the insulating material may comprise a portion of the electronics module. That is, for instance, in some embodiments, the electronics module may have an insulating material disposed (*e.g.* attached or deposited) on its outer surface (or the outer surface or casing of the electronics module may comprise an insulating material) and thereby the electronics module may serve to electrically isolate some or all of the electronic components from the frame, the housing module, and/or external environment. Thus, as used herein, in some embodiments where an electronics module comprises an exterior wall (*e.g.* an outer wall, container, shell, etc.) that is made of, or includes, an insulating material, the exterior wall may be considered as the insulating layer disposed between the electronic components (that are disposed within the electronics module) and the frame. For example, in some embodiments, the outer wall (or the container) of the electronics module (or an insulating layer disposed thereon) may also serve to electrically isolate the electronic components that may be disposed within the electronics module from a housing module that comprises a conductive material (or any other component of the electronic spectacles, such as the frames). As noted above, the inventors have found that, in some embodiments such as when the housing module includes a conductive material, it may be preferred to electrically isolate the electronic components disposed therein from the housing module because, for instance, electrical charge may be stored or applied to the housing module (particularly where a sensing mechanism may be exposed between a portion of the housing module) that may thereby affect the performance of the electronics.

[0267] The insulating material that may be used in some embodiments may be of any suitable material, such as a plastic, nylon, rubber, carbon fiber, etc. In general, given the relatively small area typically available within a spectacle frame, it may be preferred to minimize the size of components and layers (including the insulating layer). That is, for instance, in some embodiments it may not be considered aesthetically pleasing if the portion of the electronic spectacle frame that comprises the electronics is readily perceivable (such as if the components extend out of the frame). In some embodiments, the insulating layer may be less than 5 mm

thick, and may preferably be less than 2 mm thick. In some embodiments, as was described in detail above, the insulating layer may comprise a part of the electronics module. That is, for instance, in some embodiments the insulating layer may comprise the exterior wall of the electronics module, or some other internal component that isolates the electronics disposed within from current or voltage that may be applied to (or retained on) the housing module. In some embodiments, the insulating layer may be disposed only between the portions of the housing module and the electronics module that may be coupled or physically connected (or electrically coupled to in the absence of the insulating material disposed between). This may reduce the size of the insulating layer while still electrically insulating the electronic components from any undesired external electrical charge.

[0268] In some embodiments, in the first device as described above, the housing module may be removably coupled to the first temple. That is, the structural member may comprise one of the temples of the frame. As used herein, "removably coupled" may refer to when the housing module (or another component) is not permanently coupled to the temple such that its removal would require altering the structure of the frame. For example, if the frame was molded around the housing module, then in some embodiments, the only way to remove the housing module may be to damage or permanently alter the structural component. As noted above, the housing module may be attached or coupled to the structural member in any suitable manner; however, it may be preferred that the housing module is removably coupled so as to provide greater flexibility in the fabrication process as well as adaptability in the field (*i.e.* in everyday use). In addition to the benefits noted above regarding the potential for increased efficiency in the fabrication process provided by manufacturing the housing module and the structural member (*e.g.* a temple) in a separate process (each of which may comprise a different material), embodiments may also provide the ability to exchange defective or obsolete electronics for new electronics (or electronics that provide a different functionality). For example, in some embodiments, the electronics module may be coupled to the housing module so that one need only coupled the housing module to the electronic frames to provide the electronic functionality (*i.e.* to couple the electronics to the frames). Similarly, the electronics may be removed by decoupling (*i.e.* removing) the housing module from the frames).

[0269] In this regard, in some embodiments, in the first device as described above, the housing module may be removably coupled to the first temple such that it is adapted to be removed and

recoupled to the first temple. For instance, in some embodiments, it may be desirable to be able to remove the housing module, replace or adjust the electronic module that may be disposed therein, and then recouple the housing module to the structural member. By allowing for the housing module to be removed, this may provide a user with easier access to the electronics module, without the risk of damaging other portions of the electronic frames (such as the lenses) when removing (or adjusting) the electronics module from the housing module. In some embodiments, as noted above, the housing module may be removed and replaced with another housing module (which may or may not comprise a new electronics module).

[0270] In some embodiments, in the first device as described above, the electronics module may be removably coupled to the housing module. That is, similar to embodiments wherein the housing module is removably coupled to the structural member, the electronics module may be removably coupled to the housing module such that it may be removed without permanently altering the structure of the housing module and/or the structural member (*e.g.* a temple of the frames). This may allow for a replacement electronic module to be used (such as if one or more electronic components fail or otherwise does not function as desired) without requiring the purchase of a new device. In addition, embodiments may provide for a single device (*e.g.* a single model electronic spectacles or frames) to be used for multiple purposes, such as those described in detail below with regard to the various electronic components that such devices may comprise. That is, for example, in one instance the electronics module may comprise the components to function as a Fall Down Monitor. The electronics module may be removed and a new module may be coupled to the housing module such that in another instance the same electronic spectacles may function as a Step Counter and Timer (or may provide any other suitable function). Indeed, any electronic component (which may be contained within an electronics module) may be coupled or removed in this manner.

[0271] In this regard, in some embodiments, the electronics module may be adapted to be removed and recoupled to the housing module. In this manner, for instance, the components that are disposed within the electronics module may be replaced (for instance, the power source may be replaced, *e.g.* if the power source comprises used batteries, etc.), without purchasing an entire new electronics module (or otherwise replacing the other electronic components that may still function properly). A user may simply remove the electronics module, replace an electronic

component (*e.g.* the power source such as one or more batteries) and recouple the electronics module to the housing module (that may, for instance, be still coupled to the electronic frames).

[0272] In some embodiments, in the first device as described above, the housing module may have a first end, a second end, and a body disposed between the first end and the second end. The first end may comprise an opening. The electronics module may be configured to be inserted into the opening. In some embodiments, the electronics module may have dimensions such that it is smaller than the opening, and therefore once inserted, it may be coupled to the housing module using a fastener such as an adhesive, a screw, or any other suitable means. In some embodiments the electronics module may be configured to be compressible in at least one direction (typically in the direction perpendicular to the direction the module may be inserted into the housing module). In this regard, the electronics module (or a portion thereof) may comprise a flexible material that may be deformed by the application of a force but may return to an original shape.

[0273] In some embodiments, the electronics module may be pressure fitted to the housing module. That is, for instance, the electronics module (or a component thereof) may expand into a section or portion of the housing module such that it locks into place (and may thereby be coupled to the housing module). In this regard, the housing module may comprise an opening for receiving the expanding portion of the electronics module. The electronics module may be removed by application of a similar force in the same direction on the expanding portion of the electronics module. An example of such an embodiment is illustrated and described with reference to Figs. 26 and 27 herein. However, embodiments are not so limited and in some instances, the electronics module may be inserted into the opening in the end of the housing module with or without compression of a dimension (*e.g.* the electronics module may be inserted into the opening and coupled to the housing module using a fastener).

[0274] In some embodiments, the electronics module may be located within the body of the housing module. That is, for instance, the electronics module may be inserted through an opening of the housing module and then be disposed inside the housing module and may thereby be coupled to the frame. The housing module may serve to both couple the electronics module to the frame and to provide protection/electrical isolation of the electronics module (and/or components therein) from external forces. In this regard, in some embodiments, the housing module may comprise a non-conductive material such as nylon or carbon fiber. As noted above,

this may prevent or inhibit an external electrical charge from affecting the operation of the electronics. In addition, the use of carbon fiber, plastics, etc. may be lighter than some other materials (such as some metals) – which may be another factor that may be considered given that the electronic spectacle frames may be worn by a user for extensive periods of time. However, embodiments are not so limited and the housing module may comprise a conductive material such as metal – which may provide in some instances greater protection from a physical force, additional support for other structural components, and/or may be less susceptible to deformation or damage.

[0275] In some embodiments, in the first device as described above, the structural member may comprise a cavity in the first temple and the housing module may be configured to be selectively placed within the cavity. As used herein "selectively placed" may refer to when the housing module is provided as a separate component (and thereby the electronics module may also be provided separately and disposed within the housing module) that may be later added to the temple, such as by "snapping" the housing module into the temple. In some embodiments, this may provide the advantage that the housing module may be designed and/or manufactured separately, and may be later placed within the temples of different style frames. However, "selective placement" may also involve a process by which the housing module may not be removably coupled (*i.e.* the housing module may be coupled to the structural member such that it may not be removed without damaging or permanently altering).

[0276] However, embodiments are not so limited, and the housing module may be selectively placed within a cavity so as to be removed there from. For instance, in some embodiments, the housing module may be coupled to the first temple using at least one of a fastening device (such as a screw) or an adhesive (such as a two face adhesive tape. In some embodiments, the housing module may be selectively removed. However, any suitable manner of coupling the housing module to the cavity in the temple may be used. In some embodiments, the housing module is pressure fitted to the cavity in the first temple. As used herein, "pressure fitted" may refer to, for example, when the housing module is snapped into the cavity. That is, the housing module may comprise a portion that may be reduced in size upon insertion, but may expand into a portion of the cavity of the temple such that it cannot be removed with a similar reduction in size. In this manner, the housing module may be removably coupled such that it may then be snapped in and out (*i.e.* coupled and uncoupled) by applying a similar force.

[0277] In addition, some embodiments in which the housing module is disposed within a cavity of the temple may provide some advantages. For instance, in some embodiments, the temple may comprise a plastic or nylon material. If the electronics module is directly inserted into the cavity, then material that comprises the temple may deform so as to conform to the shape of the electronics module. By utilizing a housing module, embodiments may provide additional support to the cavity so as to prevent the cavity from deforming. In some embodiments, where the temple comprises a conductive material such as a metal, the housing module may be inserted into the cavity so as to electrically isolate some, or all, of the electronics module from the temple. That is, for instance, the housing module may comprise an insulating material so as to limit the amount of current that may flow from the temple to the electronics module, which could affect the performance of such components and/or damage the components.

[0278] In some embodiments, in the first device as described above, the first lens may be electrically connected to the electronics module. That is, for instance, the first device may comprise a conductive path from the electronics module to the lens that is coupled to the lens housing. As noted above, the housing module (and thereby the electronics module that is housed therein) may be attached to any structural member of the device (*e.g.* a temple, the lens housing, etc,). In embodiments where the lens housing is attached to one of the temples, the conductive path may comprise an embedded conductor (such as conductive compliant material) and/or a conductive path through a hinge to the lens housing). The lens may comprise any additional electronic components needed to provide a given functionality (such as varying the focal length of the electro-active lens, changing the tint of the lens, etc.).

[0279] In some embodiments, in the first device as described above where the first lens is electrically connected to the electronics module, the electronics module may comprise a controller that is configured to generate a time varying signal to supply to the first lens from the power source. That is, for instance, in some embodiments it may be preferred to supply an AC signal to one or more of the electronic components. This may, for instance, create a large peak to peak voltage (*e.g.* 20 volts) which, when coupled to an electro-active lens, may in turn provide for increased clarity (while potentially increasing power consumption and cost). In some embodiments, the sensing mechanism may be configured to provide an input to the controller for determining when to supply the time varying signal to the first lens. That is, for instance, the sensing module may be configured to receive an input (*e.g.* from user, such as by tilting the head

or touching a switch), which then may be used to trigger the controller to supply the signal (such as an "on" - "off" switch) or to adjust the signal (*e.g.* adjusting the voltage, etc). In some embodiments, the power source comprises a battery. Generally, it may be preferred to use a simple power source given the relatively small area that may be available within the structural member (such as within the temple) and/or the housing module. However, it should be understood that any power source may be used. In some embodiments, the controller may include firmware. While firmware may be preferred in some embodiments because it may reduce the space required by the controller, embodiments are not so limited and the controller may comprise any combination of software and firmware to provide a desired functionality. In some embodiments, the controller may include a voltage multiplier. The voltage multiplier may be used in conjunction with a simpler (*e.g.* smaller) power source to provide a higher voltage while minimizing the space needed within the electronics module. However, embodiments need not utilize a voltage multiplier where the voltage (or the current) supplied by the power supply is sufficient. In some embodiments, the controller is configured to provide at least one of: a zero DC biased sine wave or a zero DC biased square wave to the first lens.

[0280] In some embodiments, in the first device as described above, the housing module may further include an aperture disposed on an outer side of the housing module. The "outer side" may refer to a side of the housing module that does not face toward a wearer's head (*e.g.* the side that faces away from the wearer's head). In this manner, and as noted above, the housing module need not fully encapsulate the entire electronic module. The aperture may provide an avenue in which a wearer may interact with the electronics module disposed therein. For instance, in some embodiments, the aperture may have an area that is approximately within the range of 1 cm^2 to 5 cm^2. While the size may vary based on the application and the use, this area is typically suitable to allow for a wearer to manually interact with the sensing mechanism. For instance, the sensing mechanism may comprise a touch sensitive switch exposed substantially through the aperture. As used herein, "touch sensitive" may including any switch that may be turned on or off by a wearer's touch. This may include, for example, a capacitance switch or a membrane switch. As used herein the touch switch may still be considered "exposed" even if a thin insulator layer is deposed over the touch sensitive component - it is still exposed to the extent that a wearer may interact with the touch sensitive switch. That is, the term "exposed" is used to refer to a configuration in which the touch sensitive switch is sufficiently not covered that it can respond to a user's touch. In this regard, in some embodiments, the use of a

capacitance switch generally requires that the electrical charge generated by the interaction with the wearer be dissipated. Otherwise such devices may create a short situation, or may activate the electro-active lenses incorrectly. Therefore, embodiments may require the use of an insulator, particularly when the housing module and/or the structural member of the frame comprise a conductive material.

[0281] In some embodiments, in the first device as described above, the structural member includes the first temple of an electronic spectacle frame. That is, for instance, the housing module may be coupled to (*e.g.* attached to) the first temple or a portion thereof. This may for instance comprise embodiments where the housing module may be disposed in a cavity of the first temple, embodiments where the housing module may be attached to a portion of the temple (*e.g.* as an extension of the temple or attached to one of the surfaces of the temple), embodiments where the housing module may be coupled to the temple and may also be coupled to the lens housing, etc. As noted above, however, it may be preferred in some embodiments that the housing module coincides with the style (*e.g.* the aesthetics) of the frame (*e.g.* or a portion thereof, such as the appearance of a temple).

[0282] In some embodiments, the first temple of an electronic spectacle frame may include a first portion and a second portion. The first portion may be located closer to the first lens than the second portion, and the housing module may be attached to the first portion of the first temple. This may be preferred in some embodiments, as it may utilize a shorter conductive path from the electronics module to any electronics (including electro-active lenses) that may be located on the lens housing. In some embodiments, the housing module may be the first portion of the first temple. That is, for instance and as noted above, the housing module may be disposed between the lens housing and a portion of the temple, but may not be disposed within the temple (or within a cavity in the temple). The lens housing may be coupled to the temple in any suitable manner including, for instance, the use of a fastener (such as a screw) or adhesive. In addition, in some embodiments, each of the lens housing and the temple may comprise a structural component or components such that the two components may be connected to one another. Some embodiments may provide advantages such as, for instance, allowing the manufacture of the electronics module separate from the temple and/or the lens housing (because the housing module may be subsequently coupled to these components). In addition, some embodiments may permit the fabrication of the temple without the creation of a cavity (or other

components for disposing the housing module and/or electronics module there within), which may result in more structural stability for the frame component.

[0283] In some embodiments, in the first device as described above, the housing module may comprise a conductive material such as, for instance, a metal or a compliant conductive material. As noted above, in some embodiments when the housing module comprises a conductive material, the first device may further include an insulating material disposed between the housing module and the electronics module. As noted above, "disposed between" may refer to a configuration in which the insulating layer electrically isolates the housing module from the electronics module (and/or the electronic components disposed within the electronics module). As noted above, in some embodiments, when the housing module comprises a conductive material, there may be an increased risk of shorting to the electronic components. In addition, in some embodiments that may use a sensing mechanism such as a touch switch (*e.g.* a capacitive switch), a charge may be generated by the user when activating the switch that may not dissipate if the housing module comprises a conductive material (*e.g.* the charge could be stored on the housing module). This could result in the sensing module (or other component) receiving signals that the wearer does not intend, which may alter the functionality of the electronic components of the device.

[0284] In some embodiments, in the first device as described above, the housing module may comprise a non-conductive material. For instance, the housing module may comprise a plastic (such as acetate) or nylon. This may be preferred in some embodiments because it may not require an additional insulator between the electronics module and the housing module. In some embodiments, the structural member may also comprise a non-conductive material. That is, for instance, both the housing module and the structural member may both comprise a non-conductive material. This may be preferred in some embodiments because it may be more readily achievable to electrically isolate one or more conductive paths from the electronics module to one or more other electronic components disposed on the frame of the electronic spectacles. In some embodiments, the structural member may comprise any one of, or some combination of: a plastic or nylon. In some embodiments, the structural member comprises acetate. Acetate may be preferred in some embodiments as it is a common material used in the manufacture of frames. However, as noted above, embedding electronics within an acetate frame without the additional support provided by a housing module may result in deformation of

the structural member. It should be understood that any suitable non-conductive material may be used for either the structural member and or the housing module.

[0285] In some embodiments, in the first device as described above where the housing module may comprise a non-conductive material, the structural member may comprise a conductive material. That is, the housing module may comprise a material such as plastic (*e.g.* acetate), nylon, etc., and the structural member that is coupled to the housing module may comprise a material such as a metal. The housing module may be configured or positioned so as to electrically isolate the electronics module (and/or the electronic components disposed within the electronics module) from the structural member (and the frame). That is, for instance, the housing module may be disposed within a cavity of the structural member, and the electronics module may be disposed within the housing module. The housing module may substantially house or encapsulate the electronics module (or at least the portions of the electronics module that could be electrically connected to the structural member or another portion of the frame) so as to electrically isolate the two components from one another. In some embodiments, the housing module and/or the structural member may have one or more apertures such that a wearer may interact with the electronics module (*e.g.* through a sensing mechanism such as a touch sensitive switch). In some embodiments, the housing module may not be disposed with the structural member, but may, for instance, be coupled thereto (*e.g.* to a portion thereof). The electronics module may be disposed with the housing module such that it is electrically isolated from the structural member by the housing module that comprises a non-conductive material. In this manner, embodiments may reduce the risk of shorting issues for the electronics module, and potentially increase the performance and responsiveness of the electronics module (including embodiments where, for instance, a touch sensitive switch that may produce a charge is to be dissipated).

[0286] In some embodiments, in the first device as described above where the housing module may comprise a non-conductive material, the electronics module may comprise a conductive material. As noted above, it may be beneficial in some embodiments to use a conductive material for the electronics module for manufacturing and/or durability purposes. However, embodiments are not so limited and in some instances, both the housing module and the electronics module may comprise a non-conductive material (such as an insulating material).

[0287] In some embodiments, in the first device as described above where the housing module comprises non-conductive material, the first device may further include a first lens having a first electrical contact and a conductive path in electrical contact with the first electrical contact of the first lens (*e.g.* electrically coupled). The electronics module may also have a first electrical contact. The conductive path may be electrically coupled to the first electrical contact of the electronics module. In this manner, embodiments may provide a conductive path between the electronics module and an electro-active lens. The electronics module may comprise electronic components for controlling some of the functionality of the lens (*e.g.* by varying the focal length, the tint, providing shutter effects, etc.) and may be controlled by the sensing module (such as by using the touch of a wearer or the tilt of his head, etc.). In some embodiments, the conductive path may include at least one pogo pin. A pogo pin may be used to maintain the electrical path, even if, for instance, the temple does not form a right angle with the housing, or if some other factor causes the conductive path between the lens housing and the electronics module to increase in size. In some embodiments, the conductive path may include a spring hinge. A spring hinge may be preferred in some embodiments because it may be used to hold electronic frames tight against a wearer's head. By utilizing a conductive path through the spring hinge, embodiments may provide for a conductive path despite the changing angle between the lens housing and the temple. In some embodiments, the conductive path may include a compliant conductive element. As noted above, the compliant conductive element may be used to form robust electrical connections with the electro-active lenses. Moreover, it may be readily applied within small areas and in prefabricated designs, as necessary.

[0288] In some embodiments, in the first device as described above, the housing module may have a thickness that is less than or equal to approximately 0.7 mm. As used herein, the "thickness" of the housing module may refer to the dimension of one of the sides of the housing module in a direction that is perpendicular to the electronics module. The inventors have found that generally, the performance of many sensing mechanisms (such as touch switches) begins to degrade at thicknesses of the housing module that are greater than 0.7 mm. For example, the thickness of the capacitance switch may be partly predicated on the thickness of the lens housing, as it may protrude out of the housing module so as to be available to a wearer to swipe. In addition, the smaller the thickness of the housing module, the greater the area potentially available for the electronics module. This may allow for more advanced electronics to be provided, and/or more electronic components (*e.g.* a bigger electronics housing module).

However, the decreased thickness may weaken the structural support of the housing module and/or decrease its insulation properties (when it does not comprise a conductive material). The inventors have found that, in some embodiments, the housing module may have a thickness that is less than or equal to approximately 0.5 mm. In some embodiments, the housing module may have a thickness that is less than or equal to approximately 0.3 mm.

[0289] In some embodiments, a first method of fabricating a device may also be provided. The method may include fabricating or manufacturing a frame having a first temple, a second temple, and a housing module that includes a first end, a second end, a body disposed between the first and second end, and a cavity disposed within the body. That is, for instance, the method may be applied to electronic spectacles that may comprise a housing module that has an area in which the electronics module may be located in (*e.g.* a cavity). An example of such embodiments is shown in Fig. 16. The first end may include an opening. The first method may further comprise inserting an electronics module (or electronic components) into the opening of the housing module such that the electronics module may be disposed in the cavity of the housing module. As noted above, utilizing such a method of fabricating a device by inserting the electronics module through an opening in the end of the housing module may be both an efficient manner of disposing the electronics module into the housing module (and thereby coupling the electronics to the frame), and may also serve to protect the electronics as, for example, less of the electronics module may be exposed to direct physical force – particularly when the frames are in use as the opening may be covered by other components (such as the lens housing).

[0290] In some embodiments, the first method as described above may further comprise removing the electronics module (*i.e.* a first electronics module) from the cavity through the opening of the housing module (and/or temple), and inserting an electronics module (*i.e.* a second electronics module) into the opening of the housing module such that the second housing module is disposed in the cavity of the housing module. In this manner, in some embodiments, the electronics module may be removed and replaced with a new electronics module that may comprise electronics that provide different functionality (thereby providing increased flexibility and functionality for the same electronic frames) or may be used to replace defective or depleted electronics (such as when a power source is drained). In this regard, in some embodiments, the first electronics module and the second electronics module may be different electronics modules. However, embodiments are not so limited, and in some instances, the first electronics module

and the second electronics module may be the same electronics module (*e.g.* they are the same module or they comprise the same components). As noted above, some embodiments may provide the advantage of being able to replace components within an electronics module, without replacing the entire module. Moreover, by using a method of removing and inserting the module thought the opening in the end of the housing module, embodiments may provide a fast and easier way of accessing and changing the electronic components as opposed to embodiments that may require applying an adhesive and/or fastener to the electronics module.

[0291] A second method may also be provided. The second method may comprise a method of manufacturing (*e.g.* fabricating) a device that includes a frame having a first temple and second temple. The first temple may include a first end; a second end, a body disposed between the first and second end; and a cavity disposed within the body. The first end may include an opening. The first method may further comprise the steps of inserting an electronics module into a housing module and inserting the housing module into the opening of the temple such that the housing module is disposed in the cavity of the first temple. As noted above, inserting the housing module into the cavity through an opening may be an efficient manner of coupling the housing module and/or the electronics module to the structural member (in this case the temple), particularly when the housing module may be pressure fitted so as to snap into place when it is inserted in one end of the temple. This provides the advantage of not necessarily requiring a fastener (such as a screw) or adhesive to couple the housing module to the temple (which may make removal of the housing module and/or recoupling more readily achievable). In addition, sliding the housing module into the temple through an end (rather than directly into the body) may be more efficient because it allows for the housing module and/or the electronics module to compress as necessary in the vertical direction (*i.e.* the direction perpendicular to the body of the temple). In addition, inserting the housing module into one end of the structural member may provide an efficient manner of replacing the housing module (and/or an electronics module that may be disposed within the housing module) in an electronic spectacle frame.

[0292] In some embodiments, the first method as described above may further comprise removing the housing module from the first cavity through the opening of the temple, and inserting a second housing module into the opening of the temple such that the housing module is disposed in the cavity of the first temple. Removing the housing module may provide ready access to the electronics module disposed therein. It may also provide for efficient replacement

of the components. In some embodiments, the housing module and the second housing module are the same housing module. That is, as noted above in some embodiments, this method may be used to simply replace some of the electronics components that may comprise the electronics module or may replace the electronics module itself. The housing module may thereby not need to be replaced, and may be reattached to the structural member (*e.g.* a temple or cavity therein) and include a new or revised electronics module located therein. Thus, in some embodiments, where the electronics module (or electronic components) is removed with the housing module, a second electronics module (or electronic components) may be inserted into the cavity in conjunction with the second housing module. However, embodiments are not so limited, and thereby in some embodiments, the housing module and the second housing module may be different housing modules. This exemplary method may be used in some situations where the housing module may be required to be replaced (*e.g.* if it was damaged or defective) or for instances when the electronics module and the housing module are coupled in such a way that they may not be readily coupled and recoupled, and the electronics module is to be replaced. In this regard, in some embodiments, the electronics module (or electronic components) may be removed with the housing module.

[0293] In some embodiments, the first method as described above may further include removing the housing module from the first cavity through the opening of the temple without removing the electronics module. That is, for instance, the electrics module may be disposed (*e.g.* located) within the housing module, but need not be coupled thereto. The housing module may provide structural support to the portions of the structural member located near or around the electronics module. The housing module may be removed and replaced if, for instance, it is damaged. In some instances, it may be removed and replaced for aesthetic regions (*e.g.* the wearer changes the style of the frames and/or other components of the frame).

[0294] In some embodiments, in the first method as described above, the step of inserting the electronics module into the housing module may include coupling the housing module to the electronics module. In some embodiments, in the first method as described above, the housing module may be inserted into the opening of the temple prior to the electronics module being inserted in the housing module. An electronics module may then be inserted into the housing module. In this manner, each component may be manufactured and assembled in different stages.

[0295] Although described above, Figs. 16 and 17 will now be described in more detail. Fig. 16 illustrates an exemplary embodiment of an electronic frame that comprises a housing module **1603**. A core element **1601** may be provided, which may in some embodiments comprise a conductive material (such as steel) and may be coupled to or disposed within the temple **1602** so as to provide a portion of a conductive path from one component to another and/or structural support for the temple. As shown, the core element **1601** may, for instance, provide a conductive path from the temple end (which may comprise, *e.g.*, a power source) to the electronics module **1605**. A housing module **1603** is shown, which may house (*e.g.* contain) the electronics module **1605** and be coupled to the temple **1602**. In some embodiments, the housing module **1603** may comprise a conductive material (*e.g.* metal). However, as noted above in some instances, the inventors have found that the use of a conductive material for the housing module **1603** may affect (or interfere with) the electronic components (*e.g.* in the electronics module **1605**) and/or the functioning of a sensing component or mechanism (such as a switch **1604,** which may comprise a capacitive switch). Therefore, in some embodiments, an insulating material may be disposed between the housing module **1603** and any electronic components of the electronic frames (*e.g.* the electronics module **1605**). In addition, in some embodiments, an insulating material may be disposed between the housing module **1603** and sensing component (*e.g.* a capacitive touch switch **1604**) so as to dissipate any electrical charge that may be generated and/or stored therein (or otherwise insulate the electronics from the charge). This may prevent an electrical charge from affecting the electronics, which could lead to unpredictable behavior (*e.g.* activation/deactivation of the electronics when not desired or signaled) or damage to the components.

[0296] In some embodiments, the housing module **1603** may comprise a portion of the temple **1602**. That is, for instance and as shown in Fig. 16, the housing module may be disposed between a portion of the temple **1602** and the lens housing. This may be preferred in some embodiments because it may allow for each component to be manufactured in separate processes and then assembled at a later point in time. The housing module **1603** and another portion of the temple (*e.g.* the end portion of the temple **1602)** and/or the lens housing may be attached in any suitable manner. As shown in the exemplary embodiment in Fig. 16, the core **1601** may be common to at least a part of the temple **1602** and the housing module **1603** so as to couple the components. In addition, in some embodiments,

[0297] A switch **1604** (such as a capacitance or "cap" switch) is shown, which may be coupled to the electronics module **1605** and/or the electronics module housing **1603** to provide a switch or control for the electronics module **1605**. For instance, and as shown in Fig. 16, the electronics module housing **1603** may have an opening that may allow a wearer to interact with switch **1604** so as to turn a function on or off, or to otherwise vary the functions provided by an electronic spectacle. The electronics module **1605**, the switch **1604**, and the electronics module housing **1603** may be coupled using any suitable manner, including one or more screws as shown in Fig. 16. As noted above, other methods may also be used, such as pressure fitting one or more components as described with reference to Figs. 26 and 27 below. One or more conductors **1606** may also be included to provide one or more electrical contacts (*e.g.* conductive paths) from the electronics module **1605** to the lens housing. The conductors **1606** could, for instance, electrically connect to the one or more conductive paths provided by compliant conductive element **1401** shown in Figs. 14 and 15. A hinge **1607** is also shown, which may be coupled to the temple **1602** or a component thereof (such as the housing module **1603**) and also to the lens housing. The hinge **1607** may provide the capability for each of these components to move relative to the other while remaining coupled. In some embodiments, the hinge **1607** may comprise one or more conductors, or may itself comprise conductive material so as to form a conductive path or portion thereof.

[0298] Fig. 17 illustrates the components shown in Fig. 16 coupled together in an exemplary embodiment. As can be seen, the conductive compliant element **1601** is no longer visible as it is embedded within the temple **1602**. Similarly, the electronics module **1605** is housed within the housing module **1603** and covered (and likely coupled to) on one side by the switch **1604**. In this regard, the housing module may be considered to comprise the switch, even though it may not be contained within the module itself. The hinge **1607** is coupled to the electronics module housing **1603**. The conductors **1606** may be embedded substantially within portions of the hinge **1607** and/or electronics module housing **1603** so as to form a portion of a conductive path between the electronics module **1604** and the lens housing.

[0299] With reference to Fig. 26 an exemplary embodiment of a touch switch **2600** is show in accordance with some embodiments. As shown, the touch switch **2600** may comprise one or more sections (**2601** and **2603**) that are raised or elevated (*i.e.* extend out from) the remaining structure of the touch switch **2602**. These portions **2601** and **2603** may extend out of one or

more apertures in the housing module so that a wearer may interact with the touch switch to send a control signal to the electronics therein. As noted above, in some embodiments the thickness of the housing module may be preferably less than 0.7 mm thick, so that the touch switch may protrude out of the aperture and still effectively react to signals provided by the swipe of a wearer's finger. In some embodiments, the touch switch may comprise the portions labeled as **2601** and **2603**, and the electronics module may comprise the portions **2602** (*i.e.* the touch switch may form one or more surfaces of the electronics module, or be directly coupled thereto). In addition, in some embodiments, the touch switch **2600** may form a portion of a pressure fitted electronics module that may be inserted into the housing module (*e.g.* through an opening in one of the ends) by being compressed in one more dimensions. When the electronics module is then inserted so as to be disposed within the housing module, the portions of the electronics module that were compressed may expand and "snap" into place (*i.e.* the portions be structurally coupled to the housing module). For instance, when the electronics module comprising the touch switch **2600** is inserted into a housing module, the portions **2601** and/or **2603** may extend into one or more apertures of the housing module. Once this occurs, the electronics module may be coupled to the housing module such that an inward force is applied to the portions **2601** and **2603** prior to removing the electronics module.

[0300] With reference to Fig. 27, an exemplary housing module **2701** is shown comprising an electronics module disposed therein. The exemplary housing module **2701** is shown as having an opening **2702** in one end in which the electronics module may be selectively inserted. That is, for instance, the electronics module may be inserted in the opening **2702** and slid into the housing module **2701** so as to be disposed with the body of the housing module **2701** (*e.g.* within a cavity). In some embodiments, the electronics module may be pressure fitted, such that when the electronics module is inserted into the opening **2702** and is sufficiently disposed in the housing module **2701**, the portions **2703** of the electronics module may extend into the apertures of the housing module **2701** and snap into place. The portions **2703** of the electronics module may in some embodiments comprise a touch sensitive switch (such as a capacitive or membrane switch), but embodiments are not so limited. For instance, portions **2703** may comprise any portion of the electronics module. In addition, an optional screw **2704** or other fastener may be used to couple the housing module **2701** to another structural member of the electronic spectacle frames (*e.g.* to a temple). In some embodiments, a fastener (such as screw **2704**) may be used to couple the electronics module to the housing module **2701** (that is, for instance, a portion of the

electronics module may extend into the housing module **2701** such that the screw **2704** could couple the two components together). In some embodiments, the use of a fastener may be in addition to a pressure fitted component (although it may be preferred to use a fastener when the electronics module is not pressure fitted so to prevent the electronics module form being removed from the housing module **2701** inadvertently. In addition, Fig. 27 shows an embodiment whereby a hinge **2705** is coupled to the housing module **2701** which may be used to couple the housing module **2701** to another structural member of the frame, such as the lens housing.

[0301] In some embodiments, a housing module as defined above may be used to cover or encapsulate portions of the electronics module. Some embodiments may serve several purposes, including for example, electrically isolating the electronics module from the electronic frames, from external components and forces, or both. In addition, in some embodiments, the housing module may secure the electronics module to the electronic spectacle frames. Embodiments may also provide the advantage of allowing the electronics module to be selectively placed into (*i.e.* attached or coupled to) and selectively removed from a structural member (such as the temple of the frames) of an electronic spectacle frame. In this manner, embodiments may provide the ability to change electronics modules quickly and efficiently.

[0302] Embodiments Comprising a Façade

[0303] As used herein, the term "façade" may refer to an element of an electronic frame that may be attached to any portion of the frame, but preferably is attached to the "front" of the frames (*e.g.* the lens housing) that faces in the direction of a wearer's gaze. That is, the façade may typically be located on the frames so to be the farthest component away from the wearer's face. The façade is generally designed to not serve any structural or functional purpose (*e.g.* it does not itself house the lenses), but is provided for aesthetic reasons. The façade may be decorative, and may mask or hide some of the functional components of the electronic spectacles, such as one or more conductive paths between electronic components. In general, it may be preferred that the lens housing may comprise a frame design that is less than or equal to the appearance provided by the façade. That is, for instance, in some embodiments, the façade may present the appearance of a full rimmed frame design on rimless or semi-rimless spectacles, or the façade may present a semi-rimless appearance for rimless spectacles. However, embodiments are not so limited and any style façade may be used on any type of lens housing.

[0304] Spectacle frames may provide both functional and aesthetic value to a wearer. As noted above, spectacle frames are often stylistic and it is generally desirable that they have an appearance that the wearer deems appropriate. In this regard, in some instances, the electronic components of electronic spectacles may generally be noticeable and/or may add additional structural components to a device. Thus, it may be preferred that these components be concealed or otherwise hidden from outside observers, while maintaining the aesthetics and functionality of the electronic spectacles. In some instances, this may be done by utilizing the structural components of the eyeglasses (*e.g.* by embedding components in a temple of the frame); however, this may not always be possible and/or may not be suitable for other portions of the frames, such as for components on the lens housing. Such approaches may also increase the cost and complexity of manufacturing the electronic frames, and may, in some instances, affect the structural integrity of the frames (*e.g.* the structural members may not be as robust and may not be capable of withstanding the same amount of force as regular frames without breaking). Moreover, embedding electronic components in the frame may make access and/or maintenance of the components more difficult. In some instances, it may be desirable that a single electronic frame is capable of use for multiple functions, and thereby electronic components may need to be changed or replaced with other components without needing extensive fabrication or damaging the electronic frames.

[0305] In some embodiments, a façade may be provided that may be used to both provide aesthetic value and/or to hide or conceal non-aesthetically pleasing components, such as those that are associated with electronic components. In addition, in some embodiments, the façade may be a separate component that can attach to a structural member (such as the lens housing or the temples) and may thereby be manufactured in a different process than the other components of the electronic frames. In some instances, a single style or type of façade may be used for multiple types of electronic frames, which may thereby reduce manufacturing costs. Furthermore, in some embodiments and described in more detail below, the façade may be detachable (and/or re-attachable) such that one façade may be replaced with another for an electronic frame. In this manner, for instance, a user may change the appearance of the electronic frames without changing (or damaging) the underlying frames or components therein. This may essentially provide the user with the ability to have different style frames (or the appearance of different style frames) by simply replacing the façade that is attached to the lens housing or other structural member.

[0306] Moreover, in some instances, the use of a façade may reduce the costs and complexity of manufacturing electronic spectacles frames, and in some embodiments, may reduce the complexity and fabrication of forming the electrical connections to electro- lenses (or other electronic components). For instance, in some embodiments, a conductive path from an electronic component (such as a power source, controller, and/or other components which may, for instance, be disposed in an electronics module) may be partially exposed after manufacturing. A façade may be used to both conceal this part of the conductive path, and also to protect and insulate the path from external forces. In this manner, in some embodiments, the conductive path (or a portion thereof) need not be embedded or manufactured directly into the electronic spectacle frames. Furthermore, it may be less complex to form such connections, particularly on rimless or semi-rimless frame designs, but for stylistic purposes, a wearer may desire a semi-rimless or full rimmed design, respectively. A façade may be used in such instances to provide the appearance of a different style frame, while allowing for spectacle frames that provide the functional and/or structural benefits of a different style frame.

[0307] Exemplary Embodiments of Electronic Spectacle Frames Comprising a Façade

[0308] Provided below are further exemplary embodiments of electronic frames. These examples are provided for illustration purposes only. In addition, a person of ordinary skill in the art after reading this disclosure may understand that various combinations of components discussed above or below may be made. In this regard, embodiments may provide electronic frames that comprise a façade.

[0309] A first device may be provided that comprises eyeglasses, where the eyeglasses may further include a lens housing and a first and a second temple coupled to the lens housing. The lens housing may support a first and a second lens (or other optics). The first and second lens may be electro-active lenses; however, embodiments are not so limited. The first device may further include a façade that covers the lens housing. The term "covers" as used herein may refer to when the façade provides aesthetic value while obscuring at least a part of the lens housing from view. However, the façade need not encapsulate the lens housing or surround the entire lens housing to "cover" it, but rather the façade obscures the lens housing (or portions thereof) from a viewer (typically from a frontal view). That is, and as described above, the façade may be provided for cosmetic reasons and may cover, for instance, the front of the lens housing (*i.e.* the portion of the lens housing that faces away from the wearer); however, embodiments are not

so limited as the façade may be located on any part of the frame. Examples of embodiments comprising a façade are shown in Figs. 28 and 29 and described in detail below.

[0310] The first device may further include an electronic component, and at least one conductive path may be provided from the electronic component to the first lens having a portion that runs through the lens housing. As used in this context, the term "runs through" may refer to when a conductor (such as a wire or conductive rubber) may be disposed within (or coupled to) the lens housing, or that the lens housing (or a component thereof) may itself be conductive. As noted above, an electronic component may comprise any electrical device or component thereof, which may in some embodiments include an electronics module (as described above). For instance, an electronic component may comprise a power source such that the first conductive path may drive current or voltage from the electronic component (*e.g.* a battery) to the first lens or any other component. The electronic component may also comprise any other component of an electronics module, such as a controller and/or sensor mechanism. The electronic component or components may provide some of the functionality of the electronic spectacle frames, while the façade may provide or enhance the aesthetic value and appearance of those same frames.

[0311] Some embodiments may thereby provide the advantages of the functionality of electronic spectacle frames with a desired aesthetic appearance. For instance, by utilizing a façade, embodiments may provide rimless or semi-rimless electronic spectacle frames that appear as semi-rimless or full rimmed frames. In this manner, some embodiments may provide the advantages associated with a semi-rimless or rimless design (*e.g.* in some instances, more accessibility to electronic components or electrical paths provided therein, less materials required to fabricate a lens housing, etc.) with the aesthetics of other frame designs (*e.g.* the façade could give the appearance of a metal or plastic (such as zyle style) front while the frames comprise a semi-rimless or rimless design behind the façade). In some instances, the use of a façade may provide the wearer with the ability to use different façades (and thereby give the appearance of different frame designs) while utilizing the same base electronic frames. That is, for instance, a wearer may be provided with the ability to change the appearance of frame style and design without having to purchase multiple (and potentially expensive) electronic frames. In some instances, the façade may hide or conceal portions of the conductive path. In this manner, it may be possible to use less desirable materials (*e.g.* materials with distinct and conspicuous colors) that may be less expensive and/or easier to use to fabricate the electronic frames without

sacrificing the aesthetic value of the lens. By concealing such undesirable components, the façade may thereby provide additional choices for components, as well as the location of the components. For instance, rather than requiring that the conductive path be completely or substantially embedded within the lens housing (or another structural member), embodiments that utilize a façade may locate these components in locations that might otherwise be visible but-for the façade concealing those portions. In this regard, in some embodiments, the use of a façade may permit fabrication of portions of the electronic frame (such as the lens housing) using components that may be less expensive than other, more desirable components (or may allow for the use of a smaller amount of those components), while still giving the appearance that the frames comprise the more desirable material. It should be understood that these advantages are purely exemplary and are not meant to be limiting.

[0312] In general, the electronic component (or components) in the first device as described above that comprises a façade may be located in any suitable location on the electronic frames. For instance, the electronic component (which may be included within an electronics module) may be coupled to the first temple. Locating the electronic component on the temple may be advantageous in some embodiments as it may provide a relatively large amount of space to dispose such components in a location that may not be readily apparent to an observer. In comparison, for instance, locating electronic components on the lens housing may be more apparent to an observer. However, embodiments are not so limited and in some embodiments, the electronic component (or components) may be coupled to the lens housing. This may provide, in some instances, an advantage in that a conductive path may not need to be provided from the temple to the lens housing (or to an electro-active lens). In addition, in some instances, the façade may be disposed so as to cover or conceal the electronic component from an observer, whether the component is located on the lens housing or on the temple.

[0313] In some embodiments, in the first device as described above that comprises a facade, at least one conductive path may be provided from the electronic component to the second lens having a portion that runs through the lens housing. That is, for instance, in some embodiments, an electronic component (or components) may be electrically connected to both the first lens and the second lens (and the first and second lens may be electro-active lenses). In this manner, a single electronic component (such as a power source, controller, etc.) may provide functionality to both lenses, and thereby reduce the number of electronic components that may need to be

located on the electronic frame. The conductive path may be provided by the lens housing, through the lens housing (*e.g.* by an embedded conductive element), and/or by a conductive element coupled to the lens housing. The façade may cover some, or all, of the conductive path provided to the second lens.

[0314] As noted above, in some embodiments, in the first device as described above, the façade may cover a portion of the lens housing. That is, the façade need not necessarily cover the entire lens housing of the electronic frames. In some embodiments, the façade is coupled electronic frames so as to cover only the front of the lens housing, which is often the portion of the lens housing that is most conspicuous to an observer. The façade may be coupled to the front of the housing using any suitable means, including by way of example only, an adhesive (*e.g.* double sided tape), a fastener (such as a screw), or the lens housing may be structurally configured so as to receive and couple to the façade. For instance, the lens housing may comprise a slot or recess, and the façade may comprise a corresponding structural component that may be inserted into the slot or recess and thereby couple the two components (or vice versa). However, any suitable means of coupling the components may be used. For instance, in some embodiments, the façade (or a component thereof) may be pressure fitted so as to be inserted into an opening of the lens housing, and expand (*i.e.* "snap" into place) so as to couple the two devices together.

[0315] Moreover, in some embodiments, the façade may only cover the top portion of the lens housing (such as if one or more electronic components are located on the top portion of the lens housing, and it is desirable to conceal or cover just those components). In some embodiments (for instance, in semi-rimless frame embodiments), the façade may only cover the portion of the lens housing that does not comprise eye-wire, and may thereby give the appearance of a full rimmed spectacle frame. The use of the term "appearance" in this context may generally refer to the perception of the components that an observer may have when viewing the first device or a portion thereof. Similarly, in some embodiments, such as when the electronic frame comprises a rimless design, the façade may provide the appearance of semi-rimless spectacle frames, and may thereby only be required to cover a corresponding portion of the rimless frames. Indeed, in general and as noted above, it may not be necessary in some embodiments for the façade to cover the portions of the lens housing that may be less conspicuous to an observer (such as the back of the lens housing). However, embodiments are not so limited, and in some instances, in the first

device as described above, the façade covers the entire lens housing. This may be advantageous in that the façade may provide a desired stylistic appearance no matter the angle that an observer is viewing the device from. However, providing a façade that covers all or substantially all of the lens housing may increase the cost and complexity of the façade, including in some instances, making it difficult to couple and decouple the façade to the electronic frames.

[0316] In some embodiments, in the first device as described above that comprises a façade, the lens housing may comprise rimless or semi-rimless spectacle frames. In this regard, the lens housing may include in some embodiments at least one of: one or more screws (*e.g.* rimless frame designs) or rim wire (*e.g.* semi-rimless or full rimmed designs). As was described above, the façade may provide the appearance that rimless frames (*e.g.* rims that do not comprise eye-wire and/or have a lens housing that comprises one or more screws that couple the lenses to the temples) are semi-rimless or full rimmed spectacle frames. Similarly, in some embodiments, the façade may provide the appearance that semi-rimless frames (*e.g.* rims that comprise eye-wire around some but not all of the outer edge of the lenses) are full rimmed spectacle frames. This may, for instance, provide an appearance that is desired for the wearer, while requiring less materials to manufacture the electronic frames, and may permit the use of materials that may be more functional but less suitable for a style or aesthetics (because the façade may cover the components), etc. In some embodiments, the façade may even be used to cover portions of a full rimmed electronic frame. This may be the case, for instance, if the full rim design uses components that are not aesthetically pleasing (but may be suitable for use in electronic spectacles, such as if the components of the frame comprise conductive materials). The façade may be used to cover such non-appealing features, and also serve to cover electrical connections between components. In addition, the use of the façade may permit the style of the full rimmed spectacles to be changed, without necessarily requiring the purchase of new electronic frames or significant portions thereof.

[0317] Therefore, as noted above, although in general the façade may be utilized to provide the appearance of spectacles as having a design that utilizes more frame, embodiments are not so limited. For example, in some embodiments, the façade may provide the appearance of full-rimmed frames on spectacles where the lens housing also comprises a full-rimmed frame design. In some embodiments, the lens housing may comprise a semi-rimless design, and the façade may also provide the appearance of a semi-rimless design. In some embodiments, the lens housing

may comprise a rimless design, and the façade may provide the appearance of a rimless spectacle frame. Such embodiments may enable the use to customize and/or change the appearance of the lens housing, while still maintaining the frame design features. That is, for instance, the façade may comprise a different color, design, material, and/or otherwise provide a different appearance. Moreover, the façade may also be used to hide or cover one or more conductive paths (or electronic components) that may otherwise be visible (or exposed) in such embodiments.

[0318] In some embodiments, in the first device as described above that comprises a facade, the façade may mask a conductive path. The use of the term "masks" in this context may refer to when the façade conceals or otherwise makes it difficult to view the masked object (in this case, the conductive path or a portion thereof). "Masking" may comprise, for instance, covering all or substantially all of a component (*e.g.* part of the components that comprise a conductive path), or only those components that are exposed or capable be being seen by an observer. As was noted above, the conductive path may comprise any type of conductive material, including by way of example a conductive wire (or other conductive material, such as a conductive compliant material described above) coupled to or embedded within (or substantially within) the lens housing. The façade may be disposed so as to cover the portions of the conductive material that are exposed or would otherwise be visible. For instance, if the conductive path comprises a wire that is attached to the lens housing (*e.g.* on an external surface), the façade may be disposed so that the conductor is not perceivable by an outside observer of the electronic frame. In some embodiments, particularly in embodiments comprising rimless or semi-rimless frames, it may be preferred that the conductive path comprises a conductive compliant material (*e.g.* conductive rubber), as it may, for instance, be readily disposed within a groove of the lens and/or the lens housing. However, this material may comprise a conspicuous color, shape, and/or appearance. The use of the façade may, in some instances, provide the advantage that this conductive material need not be painted, colored, or otherwise changed to be less conspicuous, and still permit the material to be located on the lens housing in places where, without the use of a façade, it would be apparent to an observer.

[0319] In some embodiments, in the first device as described above comprising a façade, the conductive path may also comprise the lens housing itself (or portions thereof) – *i.e.* the lens housing could comprise a conductive material. The portions of the lens housing that comprise

the conductive path may be of a different material than other portions of the lens housing, and this difference in material could be noticeable without an additional concealment process. The façade could be used in such embodiments to mask or cover these non-uniformities, so that the electronic frame appears as a single uniform material and composition.

[0320] In some embodiments, in the first device as described above comprising a façade, and as was noted above, the façade may be coupled to the lens housing utilizing an adhesive material. In general, any adhesive material that may suitably couple the façade to the lens housing may be used, such as for instance double sided tape or a glue epoxy. In some embodiments, in the first device as described above, the facade may be coupled to the lens housing utilizing one or more fasteners such as one or more screws. This type of fastener may be preferred in some embodiments, because the device may be designed so that a wearer (or a person or machine as part of the fabrication process) may readily align the façade properly with the lens housing. That is, the location of the screws on both the lens housing and the façade may be such that, when the screws are inserted properly, the façade is disposed so as to cover a desired portion of the lens housing. This may reduce human error that may be present in the use of adhesives (*e.g.* alignment may not be as precise).

[0321] In some embodiments, in the first device as described above that comprises a façade, the façade may be removably coupled to the lens housing. The term "removably" may refer to embodiments where the façade is coupled to the lens housing so as to permit the facade to be attached and detached without affecting the structure and function of the lens housing or other components of the electronic frame. For instance, the façade may be coupled to the lens housing using one or more screws such that a wearer (or other entity) may decouple the façade from the lens housing by unscrewing (*e.g.* removing) the screw, and may then recouple the same façade or a different façade by reinserting the screw or screws. However, any suitable means may be utilized. For instance, in some embodiments, the façade and lens housing may be configured such that the façade has a structural portion that connects (*e.g.* may be inserted into a groove or cavity) to the lens housing such that the two components are coupled. The components may be decoupled by applying an appropriate force in a particular direction. For example, the lens housing and the façade may be configured such that façade is pressure fitted to the lens housing.

[0322] Embodiments that comprise a façade that is removably coupled may provide some advantages. For instance, some embodiments may permit different façades to be used for the

same base electronic frame. This may permit an electronic frame to provide different styles without requiring the purchase of multiple electronic frames (which could be increase expenses). In addition, the ability to couple and decouple the façade to the lens housing (or other portion of the frame) may permit access to one or more components that are typically covered by the façade. For instance, if the façade covers an electronic component, and that component needs to be removed, replaced, or otherwise interacted with, a removably coupled façade may be removed from the electronic frame to provide such access. In contrast, a device that comprises a façade that is not removably coupled may not provide ready access to such devices, and may cause damage to the electronic frames if the façade is removed.

[0323] In some embodiments, where the façade may be removably coupled to the lens housing, the lens housing may be configured to be coupled to a plurality of facades and each of the plurality of facades may be different. As noted above, this may permit different façades to be matched with different electronic frames, and readily allow for changes in the appearance and style of the device. In addition, in some embodiments, "different facades" may comprise façades that are made of the same materials and have the same appearance, but are separate components. That, is for instance, one façade may be replaced by an identical façade (which may be used, for instance, if the façade breaks or is otherwise damaged).

[0324] In general, the façade and/or the lens housing may comprise any suitable material. For instance, in some embodiments, in the first device as described above, the façade may comprise a metal and the lens housing may comprise a plastic material, such as for instance acetate. Such embodiments may for instance, permit the majority of the frame to be fabricated using an inexpensive material (either in the cost of the material itself or in the cost of fabricating a frame using the material) such as plastic, while giving the appearance of a more expensive or stylish frame (such as one that is made of a metal). However, embodiments are not so limited and in some embodiments, the façade may comprise a plastic material and the lens housing may comprise a metal. Similarly, in some embodiments, both the lens housing and the façade may comprise a metal material, or both the lens housing and the façade may comprise a plastic material.

[0325] The façade may also have any suitable shape or size. In some embodiments, it may be preferred, that the thickness of the façade is less than approximately 5 mm. In general, it may be desirable that the façade is not readily identifiable as a separate component from the frame. By

fabricating the thickness of the façade so as to be relatively thin, this may assist in giving the appearance of a uniform frame, even from various viewing angles. However, it may also be desirable that the façade by structurally strong enough to withstand the typical forces experienced by the lens housing of spectacle frames.

[0326] With reference to Fig. 28, a top view and a front view of an exemplary electronic spectacle **2800** that comprises a façade **2804** is provided. The exemplary electronic spectacle **2800** comprises two temples **2801** that are coupled to the lens housing **2803** by hinges **2806**. The lens housing **2803** is shown as a semi-rimless design (*e.g.* in this example, having eye wire on the top portion of the lens, but comprising nylon along the bottom portion of the lens to hold it in place. The electronic spectacles are also shown as comprising an electronics module **2802** located in one of the temples **2801**. The façade **2804** is shown in this exemplary embodiments as providing the appearance of a full rimmed spectacle frame (that is, eye wire on the around the entirety of the lenses). Indeed, as shown, the façade **2804** covers the front portion of the lens housing **2803** such that there are no portions of the lens housing visible to an observer located in front of the electronic spectacles **2800**. For instance, the façade extends so as to cover both hinges **2806** and lens housing **2803**. The façade also comprises a bridge **2805** portion that extends between the two lenses.

[0327] With reference to Fig. 29, the same exemplary embodiment of electronic spectacles **2800** is shown from a rear view**.** As shown, the lens housing **2803** (shown as the darker portions of electronic spectacle frames **2800**) is again shown as comprising a semi-rimless design. The façade **2804** is shown as covering the lens housing **2803** and also extending between and around the entirety of the lenses. However, as can be seen, the façade **2804** does not provide structural support to the lenses, as the lenses are held in place by the lens housing **2803** which connected to hinges **2806**. In this exemplary embodiment, the electronic spectacle frames **2800** will provide the appearance of a full rimmed spectacle frame (based on the appearance of the façade **2804**), while comprising a lens housing **2803** that is semi-rimless. As was described above, the façade **2804** may comprise any material and may be coupled to the lens housing **2803** using any suitable means, including those described in detail above.

[0328] It should be understood that, after reading the disclosure provided herein, a person of ordinary skill in the art may understand that various combinations of the devices described above

may be made such that some or all of the features described with regards to one device may be combined with some or all of the features of another device.

[0329] Spectacle Lens Frame Electronics

[0330] As noted above, electronic spectacles and frames may comprise any suitable electronic components. That is, for instance, exemplary spectacle frames such those describe above, or any other electronic spectacles such as, for instance, those described in U.S. Pat. Appl. No. 12/684,490, filed January 8, 2010 and entitled "ELECTRO-ACTIVE SPECTACLES AND ASSOCIATED ELECTRONICS" (incorporated by reference herein in its entirety) can comprise electronic components to provide a variety of functions, such as, for example, control of electro-active lenses. Additional exemplary functions (and components to accomplish the functions) are described below.

[0331] These components, whether alone or in some combination, can be built into or otherwise coupled to the spectacle lens frame or lenses and/or be located remotely and be in communication with components on the electronic spectacle frame or lens. Some of the components may be controlled by the wearer. Moreover, each of the components described below may be located on electronic frames that comprise some or all of the features described above. Furthermore, the components (including the electrical components referenced) and descriptions provided herein are exemplary, and many variations and combinations of these features may be included.

[0332] Fall Detector Module:

[0333] A fall detector module may be used by seniors or other individuals to determine if a fall has occurred. These modules may utilize, by way of example, an accelerometer, a gyroscope, or other motion sensor coupled to the electronic spectacles worn by a user. If a fall is detected, the module can trigger an alarm system in a house, an alarm could be sent to preset phone numbers (*e.g.*, 9-1-1), and/or a message may be sent to one or more e-mail addresses. In some embodiments, electrical components located on the electronic spectacles may also enable a manual signal (such as a call to a preset phone number or e-mail address) with, for example, a finger touch to the temple or the press of a button located somewhere on the electronic spectacles (such as a touch twitch). These manual operations could also thereby serve as an indication that a wearer has suffered a fall or other emergency situation.

[0334] In some embodiments a Fall Detector Module may comprise a small electronic module coupled to, or disposed within, the frame or the lenses of electronic spectacles. The module may be disposed in any suitable location on the electronic frames, and may be coupled thereto in any suitable manner. For instance, the Fall Detector Module may be disposed on the electronic spectacles in the manners described above with regard to the electronics module. Moreover, the components disposed within the fall detector module may be electrically or operationally coupled to one or more components that are disposed outside of the module (such as a power source or transmitter).

[0335] In some embodiments, the Fall Detector Module may include various electrical components. For instance, as noted above the module may comprise a fall sensor to detect that a fall has occurred (*e.g.,* a micro-accelerometer or a micro-gyroscope). The module may also comprise a power source, a controller, and/or a small transmitter. The controller may include a microprocessor that may receive signals from the fall sensor and determine whether a fall has occurred. The controller may also comprise preprogrammed instructions (*e.g.* stored in a memory device) to execute one or more functions so as to provide an alarm or notification service (*e.g.* the controller may be configured to send a signal via a transmitter indicating that a fall has occurred, such as dialing or connection to a phone number such as 9-1-1; sending an email; etc). In some embodiments, a modified cell phone or a number of signal relay devices present in the house (or in any suitable location) can detect the alarm signal from the module, and send a series of emergency information (*e.g.* test message, e-mail, phone call, etc) via an existing network (*e.g.* internet, cell phone, or custom network) to individuals or health care institutes. In some embodiments, the device may utilize an ITO patterned layer (or other transparent or translucent materials) of electro-active lenses as a transmitter (*e.g.* an antenna); however, embodiments are not so limited. For instance, a conductive material may be disposed in the frames (*e.g.* within a portion of the temple) or within the module that may be used to transmit a signal.

[0336] Step Counter and Timer Module:

[0337] In some embodiments, a Step Counter and Timer Module may be include that, for instance, may count the number of steps taken by a wearer (*e.g.* for walker or jogger) over a given period of time. This may be used to determine the distance traveled by a wearer for a set period of time, the wearer's pace (*e.g.* miles-per-hour or average time to complete a mile), and/or

any other relevant information. In some embodiments, this information may be displayed to a user via a heads-up display (HUD) in the lenses of the electronic spectacles in real time (e.g. while the wearer is exercising). The Step Counter and Timer Module may also comprise a button (*e.g.* touch switch) that may reset and/or display these results (*e.g.* pertaining to time and distance) on a small LCD housed on the frame or via a HUD.

[0338] In some embodiments, the components of the module may include a motion detection and/or distance detection system to determine the distance travelled by the wearer. This may include, for example, a power source, a sensor, and/or a controller (that may comprise hardware, software, and/or firmware) to count the number of steps taken. The controller may be a simple counter (*e.g.* it may simply count the number of steps taken based on signals received by the sensor) or it may include calibration techniques to adjust the distance measurements to the particular wearer for more accurate measures. The sensor may comprise, by way of example, micro-electromechanical (MEMS) inertial sensors and software that detect steps (in some embodiments, the software may form a part of the controller that receives the signals from the motion sensor). Examples of such sensors may include, for example, a micro-accelerometer and/or a gyroscope that detects either 1-, 2- or 3-axis of acceleration. The sensor may also comprise a vibration detector, which may utilize any suitable method of detecting when a step occurs, such as piezoelectric materials that generate a voltage or a simple mechanical sensor. This information may be sent from the sensor to the controller, which may then determine the number of steps taken.

[0339] In some embodiments, the module may also include a timing mechanism. The timing mechanism may function like a stop-watch, which may be activated by the user in any suitable way (such as via sudden movement of the head, or through the use of a button or switch on the electronic frames). The timer may comprise a portion of the function provided by the controller, or may be a separate component. As noted above, in some embodiments, the module may further include a display system, such an LCD screen or components of a HUD to convey the relevant information to a wearer.

[0340] Drowsiness Detector and Alarm Module:

[0341] In some embodiments, a Drowsiness Detector and Alarm Module may be included on the electronic spectacles. This module may, for instance, be utilized for long distance drivers or individuals that work late shifts to determine their level of alertness and their ability to operate a

motor vehicle or other heavy machinery safely. The module may, for example, detect sudden head motion (or any other motion associated with drowsy behavior) and trigger an alarm when the predefined motion is detected.

[0342] In some embodiments, the module may comprise components such as a motion sensor, a controller, an alarm or display, etc. The sensor may, for instance, detect a sudden movement (or other movement associated with drowsiness) and send this information via a signal the controller. The controller can process the data received from the sensor and trigger an audible or visible alarm if it is determined that such action is necessary. The motion sensor may comprise, by way of example, a micro-gyroscope, accelerometer, or any other suitable motion detector. The controller may comprise a micro-processor, hardware, software, and/or firmware to receive and process the information from the sensor and to activate an alarm if necessary. The alarm may, in some embodiments, be included in the electronic spectacle frames or lenses, or could be located remotely. For example, an external alarm may be located on the wearer's person and may vibrate, or an alarm could comprise the wearer's car stereo, etc. In such embodiments, the electronic frames may further include a transmitter to send a signal to the external alarm components to activate the device.

[0343] Timer as Taking Pill Reminder Module:

[0344] In some embodiments, the electronic spectacles may comprise a Timer as Taking Pill Reminder Module (or any other reminder module). The module may, for example, use an audio (for a wearer to hear) or visual (such as an LED or HUD for the wearer or a third-person to see) signal to indicate that it is time for the wearer to take his medication (or to perform any other tasks); however, embodiments are not so limited, and may comprise a timer and an alarm that may be set by a user for any purpose.

[0345] In some embodiments, the Time as Taking Pill Reminder Module may comprise electronic components such as, for example, an electronic timer, controller, a visible or audible alarm, and an input component. The electronic timer (such as an electronic clock) may comprise any suitable components to determine time, date, time lapsed, etc. The controller may comprise a micro-processor, hardware, software, and/or firmware to receive and process the information from the timer and to activate an alarm if necessary. The alarm may, in some embodiments, be included in the electronic spectacle frames or lenses, or could be located remotely. For example, an external alarm may be located on the wearer's person and may vibrate, or an alarm could

comprise sending a signal to another device (such as an email or text message to a cell phone). The input component may enable a wearer to enter time and date information to set a reminder, and may include, by way of example, a keyboard entry component, a voice recognition system – which would require a microphone, etc. The input component may also receive a signal from an external device such as a cell phone, personal computer, laptop, etc. that may be used to program the controller or timer with the information about a reminder. This may utilize any suitable method of transferring date, including a physical interface (such as a USB input), short range communication (*e.g.* Bluetooth®), radio frequency, or other network interface (Wi-Fi, Wi-Max, wireless network, etc). The module may also be capable of storing multiple dates and timers (*e.g.* multiple different medication reminders), and may provide different indications for each reminder.

[0346] UV Light Monitor Module:

[0347] In some embodiments, electronic spectacles may comprise an Ultra Violate (UV) Light Monitor module. This module may, for example, be utilized during outdoor activities to determine the risk to a wearer associated with harmful UV rays and alert the wearer to this risk. In some embodiments, the module may comprise a sensor (that may be disposed the frame or the lenses) that can detector the UV intensity of light. This may include, for example, a photodiode or photocathode. The module may also comprise a controller, which may comprise a micro-processor, hardware, software, and/or firmware to receive and process the information from the sensor and to determine the level of risk associated with exposure to the UV light. The module may further include a display to indicate to the wearer or a third party the current level of UV light and/or the associated risk to the wearer. The display may include an LED indicator or other display (such as an LCD) or a HUD in the lenses of the electronic spectacles to provide this information to a wearer. For example, when UV intensity detected by the sensor passes a certain predetermined limit, a visible or audio indicator (*e.g.*, an LED or audible beeper) may provide a warning signal to the wearer.

[0348] Emergency Wireless Call Module:

[0349] In some embodiments, electronic spectacles may comprise an Emergency Wireless Call Module that may, for example, be utilized by seniors or other individuals to alert authorities as to an emergency. The module may for example utilize a preset phone number, e-mail address, or other device and any communication medium to send out a signal related to an emergency. The

module may include a sensor or input component that may be used to activate the module. For example, the sensor may comprise a touch switch or other push button that may be activated using a finger touch to the temple of the electronic spectacles. The module may include or be combined with a GPS or other position locator to identify the location of the individual and/or the emergency. This location information may be sent along with the emergency message to enable a more rapid response to the emergency. Embodiments may also provide the ability to communication (*e.g.* verbally) through the module to an emergency responder or third party.

[0350] The Emergency Wireless Call Module may comprise any suitable electronic components such as a sensor, a controller, and/or a transmitter. The transmitter may comprise any suitable components to provide a signal processing path for connecting to an outside network, such as those described with reference to the fall detector module, or any other suitable components. These may comprise an antenna that may be disposed in the frame (*e.g.* a temple), in the lens, and/or within the module. The controller may comprise a microprocessor, software, hardware, and/or firmware that may receive a signal from the sensor, connect to a network, and send an emergency message (or otherwise facilitate the communication between the wearer and a third party).

[0351] Directional Hearing Aids Module:

[0352] In some embodiments, the electronic spectacles may include a Directional Hearing Aid Module that may be utilized to enhance the hearing of the wearer. The module may comprise, for instance, hearing aids or other auditory assistance devices coupled to the electronic frame. As used herein, a hearing aid may refer to any electro-acoustic device that typically fits in or behind the wearer's ear, and is designed to amplify and/or modulate sound for the wearer. Any suitable hearing aid that may be disposed within, or coupled to, the electronic spectacles may be used. The hearing aid may include an internal power source, or the hearing aid may be connected to a power source disposed on, or within, the electronic spectacles. In some embodiments, the electronic spectacles may comprise multiple hearings aids. Each hearing aid may be powered by a separate power source or by a single power source (*e.g.* using a conductive path across the lens housing).

[0353] Pulse and Partial Oxygen Concentration (PO2) Monitor Module:

[0354] In some embodiments, the electronic spectacles may comprise a Pulse and Partial Oxygen Concentration (PO2) Monitor Module that may, for example, comprise a small electro-optical sensor or acoustic sensor that can be placed at the area near the ear of the user, or other suitable location to detect hear rate and other vital signs. In some embodiments, the module may comprise a receiver that receives signals from a device that may be located on the wearer's body (such as a strap across the wearer's chest), where the device or component monitors the pulse rate and sends this information to a controller disposed within the module for recording and/or analysis. This information may then be displayed to a wearer (*e.g.* via a HUD or LCD display).

[0355] In some embodiments, the module may further comprise an electro-optical sensor (or other similar device) that may be capable of measuring the blood oxygen level of the wearer using, for instance, pulse oximetry. This may comprise an external component that may extend from the electronic spectacles to the wearer's ear that may be in communication with one or more components on the electronic spectacle frames (such as a controller). That is, for instance, a sensor may be disposed in a location such that light having certain wavelengths may be passed sequentially through the wearer (*e.g.* the wearer's ear) and received by a photo detector. The difference in the absorbance of light of different wavelengths may then be measured, enabling the determination of the absorbance due to the pulsing arterial blood alone (excluding other factors such as venous blood, skin, bone, muscle, fat, and etc). This information may be sent to a controller or similar device, which may then determine the amount of the oxygen in the blood.

[0356] The Pulse and Partial Oxygen Concentration (PO2) Monitor Module may also comprise components for displaying the results of the vital statistics that were measured, such an LCD display or a HUD in the lenses. The module may also comprise an alarm, and the controller may be configured to trigger the alarm if abnormal readings are found. In some embodiments, components (such as those described above with regard to the Fall Detector Module) for alerting emergency services or other individuals may also be utilized.

[0357] RFID Monitor Module:

[0358] In some embodiments, the electronic spectacles may include a radio frequency identification (RFID) Monitor (or other near field communication device such as Bluetooth®, contactless interfaces, etc.). This module may comprise, for example, an antenna that may be embedded in the lenses or elsewhere in the frame (*e.g.* in one of the temples). The module may be coupled to the frame, such disposed within a portion of the frame (which may contain other

electronics, including an electronics module). The RFID Monitor Module may be utilized to send and/or receive information from components or devices that may otherwise not be coupled to the electronics disposed on the electronic spectacles and thus may be utilized in combination with some of the embodiments described above.

[0359] In some embodiments, the "working mode" for the module can be passive or active. For example, in passive mode, the module may not require its own power source, but may utilize a magnetic or electric field generated by another device to activate and thereby send or receive information. The RFID Monitor Module may include a microprocessor and/or memory storage device coupled to the antenna. The module may be used for any suitable purpose, such as for security (*e.g.* it may comprise encrypted information that may be used to access a location or files on a computer), to make payments (*e.g.* the microprocessor and memory device may comprise payment account information that may be sent to a point-of-sale terminal to complete a financial transaction), to identify individuals, etc. The module may also be used by a locator (*e.g.* it may be scanned by a device that can identify the individual, thereby identifying the individual as being at the location where the scanner is located).

[0360] Flash Memory Card Module:

[0361] In some embodiments, the electronic spectacles may include a Flash Memory Module that may be utilized to store and transport information. For example, a personal computer or other communication device may read or write to the module contained in the electronics spectacles, such as within one of the temples. In some embodiments, the Flash Memory Module, and the memory device stored therein, may be coupled to an RFID Monitor Module or other communication device so as to send and receive data, or there could be a physical interface to the module. That is, for instance, in some embodiments, the information may be transferred to or from the memory device wirelessly or through a physical interface (such as a USB port). The Flash Memory Module may also comprise a power source and/or a controller.

[0362] Digital Watch and Alarm Module:

[0363] In some embodiments, the electronic spectacles may include a Digital Watch and Alarm Module that may maintain the current time and alert an individual when particular time occurs. This module may comprise similar components as those that were described above with reference to the Timer as Taking Pill Reminder Module, including an electronic clock, power

source, controller, input device (for setting times for an alarm), alarm system (or other visual or audio alerts), etc. The module may also comprise a display (such as an LCD display or a HUD) or even an audio indication that may provide the time to the wearer. For example, this module may comprise a press button or other touch switch that a wearer may interact with such that a signal is sent to a controller in the module to display the time.

[0364] Electronic Eyewear Repairing Kits:

[0365] In some embodiments, the electronic spectacles may comprise a module that may include tools that may be used for immediate eyeglass repair and maintenance. This module may, for instance, store components such as conductive rubber strips, a conductive glue dispenser, screws, screw driver, etc. The Electronic Eyewear Repairing Kits may be a physically separable module that may be inserted into a cavity or opening of the eyeglass frames, or could be a component that could be coupled to the outer surface of the electronic frames. In some embodiments, the module may be permanently coupled to the electronic spectacles, and the tools and components may be inserted and removed as needed.

[0366] Voice Recorder Module:

[0367] In some embodiments, an electronic spectacle frame may include a Voice Recorder Module. This may be used, for instance, to record audio messages from the wearer, to dictate correspondences and letters for the wearer, or to record audio noises that the wearer is hearing (such as recording a speech or a lecture). This may comprise, for instance, a sensor (such as a push button or touch switch) that may activate the voice recording function. The module may further include a microphone, power source, data storage device, speaker or audio output (for the wearer to hear the recorded audio data), and or a transmitter for sending the audio data to another device. In some embodiments, the voice recorder module (or the storage component therein) may be read by a wireless reader and played on a speaker, or any other suitable playback mode. That is, for example, the Voice Recorded Module may be coupled to a RFID Monitor Module, or comprise similar components (such as a physical interface) for transferring the information stored therein.

[0368] Battery Pack:

[0369] In some embodiments, electronic spectacles may include an extra battery pack. The extra power source may be stored, for instance, as a backup power for a lens driving module or

any other electronic component. The battery pack may be stored within the electronic frames (*e.g.* within a component or module of a temple or the lens housing) or may be coupled to an outer surface using any suitable means.

[0370] Spy video or still picture recorder:

[0371] In some embodiments, the electronic spectacles may comprise a recording device such as a miniature video camera (*e.g.*, a pin hole camera) or still picture recorder (*e.g.* a camera) and associated equipment. This module and components may be utilized, for instance, to record visual images without outside observers being aware of the recording device. The spy video or still picture recorder may be coupled to a power source (*e.g.* a battery), a controller, a sensor, and/or a data storage device. The controller may be coupled to the sensor, such that the wearer may activate or deactivate the recording device based on an interaction with the sensor (*e.g.* a touch switch or a device such as a micro-accelerometer that may detect a sudden movement of the wearer's head). The sensor may send a signal to the controller, which may then determine whether to activate the recording device. The data storage device may comprise any suitable component, such as RAM or Flash memory. This data stored in the storage device may be retrieved from the electronic spectacles using any of the suitable methods described herein. For example, in some embodiments there may be a physical interface to the storage device (which may, in some embodiments, comprise a part of the recording device) or the electronic spectacles could wireless transfer the data (including in real time) to a receiving device using an antenna, short range communications, or similar method.

[0372] Thermometer

[0373] In some embodiments, the electronic spectacles may comprise a digital thermometer that may measure and display the temperature of the surrounding environment (*e.g.* ambient temperature). That is, for instance, the electronic spectacles may comprise a variable resistor or other device that may have a variable voltage drop based on the temperature of the device (which can therefore be monitored to determine a corresponding temperature). However, embodiments are not so limited, and any suitable electronic thermometer may be used. The thermometer may be electrically coupled to a display and/or a sensor, such that the wearer may interact with the sensor and thereby request that the display show the current temperature. The display may, for example, comprise a LCD display or a HUD.

[0374] Remote Controller

[0375] In some embodiments, the electronic spectacles may include a controller for other devices (*e.g.* a garage door, a car, a TV, etc). For example, the electronic spectacles may comprise the components of a typical remote control device, such as a controller, a sensor, a storage device, and a transmitter (such as an antenna or infrared device). The storage device may contain information on the instructions, protocols, codes, and transmission/reception standards for activating or controlling a device that is not otherwise coupled to the electronic spectacles. The sensor (or other input components) may be configured to receive a command from a wearer, and signal to the controller to convey instructions or information to the remote device. For example, a sensor that may be disposed on the side of the temple of spectacles may be touched or pressed using certain predefined finger moves to indicate different desired functionality – which may very convenient for seniors. The controller may then utilize the predefined functions and corresponding instructions stored in a memory device to identify instructions to send to the remote device corresponding to a desired function requested by the wearer. The controller may then utilize the transmitter to send this information wirelessly to the remote device.

[0376] Data Collection Unit

[0377] In some embodiments, electronic spectacles may include a Data Collection Unit that may be used by a wearer to record information about the wearer, the wearer's surrounding, or an other suitable information. For example, in some embodiments, data that can be collected may include the on and off angles when the eyeglass are controlled manually, the time interval between two sequential battery charges, the wearer's behavior or physical state (such as daily calorie burning rate, real time pulse, skin moisture, daily UV exposure), etc. The Data Collection Unit may comprise one or more sensors, a controller, and/or a storage device for receiving and storing relevant data, or it may be operatively coupled to any of the components in described with respect to the modules above. The data that is collected may be wirelessly transferred to a device (*e.g.* using an antenna and connecting to a network such as a mobile device network) with high computation power in-real time, or stored in the memory residing in the module and transferred after data collection (*e.g.* using an RFID module or physical interface). The receiving device may for instance use artificial intelligence to analyze the data for specific applications, such as to train the software to reset the personalized control parameter, or provide recommendations for wearer's daily activity.

[0378] In some embodiments, the data collection unit may be a unit separate from the frame/lens electronics that can be used to capture data stored in the electronic frames. For example, data stored in RAM included in the lens electronics can be relayed to a remote unit for analysis. Data may be relayed via a wireless or wired link (including e.g. infrared or radio frequency). In some embodiments, data may be stored in local storage disposed within the frame electronics for long periods of time and then collected (or transferred) periodically or, as noted above, there may be instantaneous data collection in some instances.

[0379] Embodiments Comprising a Moisture Barrier

[0380] For some embodiments comprising electronic frames that may include one or more electrical connections between an electronic component (or components) that may be disposed on the electronic frames and one or more electro-active lenses that may be coupled to a lens housing, the inventors have found that one issue that may arise in some instances is that moisture may affect the conductive path between these components. That is, moisture may affect the electrical contacts between the electrical components disposed in the electro-active lens and the electrical components disposed outside of the lens. The moisture may create inconsistent performance of the electro-active lenses and/or result in one or more failed connections between the components (*i.e.* the electrical path may be severed such that current cannot flow between the components). The inventors have found this to be particularly prevalent for the electrical connections that are formed around the periphery of the electro-active lens.

[0381] The moisture may contact the conductive paths between the electronic components on the electronic frames and the electronic components disposed in the electro-active lenses based on, for example, openings that may exist from the manufacturing process (*e.g.* the connection may not be fully sealed to the outside environment) or even from degradation of the components during use (which may create gaps or otherwise expose the electrical connections between the components). Indeed, the inventors have found that salt (which may contact the lens from a wearer's skin or perspiration) may degrade the components of the electronic spectacles (such as the lenses) and thereby create openings and/or otherwise expose and degrade the conductive paths.

[0382] In some embodiments, a first device, may be provided. A first device may include a lens comprising at least a first electrical contact, a lens housing holding the lens, where the lens housing comprises at least a second electrical contact, and a conductive element disposed

between the first and the second electrical contact, wherein the conductive element electrically connects the first and second electrical contacts. The first device may further comprise a barrier layer that is disposed so as to cover at least a portion of the conductive material. The "barrier layer" may be disposed so as to cover the conductor (or a portion thereof) at or near the periphery of the lens such that it may not be exposed to the external environment. As noted above, the inventors have found that the location between the electro-active lenses and the lens housing typically tends to be where the conductors are exposed to the external environment. The barrier layer may be moisture resistant, such that it may prevent moisture from contacting the electrical connections. In some embodiments, the barrier layer of moisture resistant material may comprise a polymer substance.

[0383] In some embodiments, the barrier layer may be applied or disposed in areas of the electronic spectacles between two components (such as between the lens housing and the electro-active lenses). In some embodiments, these components of the electronic spectacles may be coupled in advance, and the barrier layer may be applied in a later process (*e.g.* as part of a finishing or sealing process after the electrical connections have been formed). This may be preferred because, for instance, the barrier layer may function to prevent the electrical connection at the interface between the components from being exposed to the external environment. Thus, in some embodiments, once the barrier layer is set, access to this interface may be limited. However, embodiments are not so limited, and the barrier layer may be applied at any suitable time.

[0384] The inventors have found that in some embodiments it may be preferred that the barrier layer may comprise a material that has a viscosity that is thin enough such that it may be applied or injected into the areas between the components of the electronic spectacles. As noted above, in some embodiments the barrier layer may be applied to prevent or limit contact with moisture (*e.g.* water) and, therefore, it may be preferred that the viscosity of the barrier layer material be comparable to water. In this manner, the barrier layer may be applied to (and thereby disposed in) the same areas that would otherwise be accessible to this moisture. In some embodiments, where the barrier layer may comprise a polymer material (such as a two component epoxy), after the barrier layer has been applied to the electronic spectacles, it may be cured to set the material in place. In general, the barrier layer may be cured using any suitable process, such as visible light curing, ultra-violet curing, and/or thermal curing. In some embodiments, where thermal

curing is used, the material of the barrier layer may be chosen such that it may be cured at a low enough temperature that the other components of the electronic spectacles (*e.g.* the lenses, lens housing, and/or electronics) are not affected by the increase in temperature.

[0385] The inventors have also found that, in some embodiments, it may be preferred that the material that comprises the barrier layer be flexible and/or soft enough such that it does not damage (or damage other components, such as the lens) when experiencing the typical forces of daily use. For instance, when the barrier layer is disposed in the area between the lens housing and the lens component, there may be forces applied to either one of, or both of these components in various directions. If the barrier layer is too rigid, this force may be applied to the lens, which could cause chipping or cracking. This may result, for example, in exposure of the electrical contacts, damage to the lens, and/or one or more components could be decoupled.

[0386] An exemplary embodiment that comprises a barrier layer applied to electronic spectacles so as to prevent or limit exposure of the electrical contacts between a lens and a lens housing to the outside environment (including to moisture) is shown in Fig. 30. The electronic spectacles comprise a lens housing **3001**, a conductor **3002** (in this case, shown as a compliant conductive material), conductive paint **3003** that forms a part of an electrical path to one or more electrical components of the lens **3004**, and a barrier layer **3005**. As shown in Fig. 30, in some instances a space or area may exist between the lens housing **3001** and the lens **3004** shown as air gap **3006**. As noted above, this may be created during the manufacturing process (*e.g.* the lens housing **3001** and a portion of the lens **3004** do not fit tightly so as to seal the components there between from exposure to the outside environment) and/or may develop through use of the spectacles. On the opposite side of the air gap **3006** shown in Fig. 30 is a barrier layer **3005** that has been disposed so as to insulate the conductor **3002** from the external environment. The barrier layer **3005** is shown as disposed within the area between the lens housing **3001** and the lens **3004**. As noted above, the barrier layer **3005** could have been injected into this region between these components, and may have been cured thereto so as to be coupled to the lens housing **3001** and/or the electro-active lens **3004**.

[0387] Combination of Elements

[0388] Although many embodiments were described above as comprising different features and/or combination of features, a person of ordinary skill in the art after reading this disclosure may understand that in some instances, one or more of these components could be combined

with any of the components or features described above. For instance, embodiments of electronic frames that comprise a spring hinge may also comprise any one of, or some combination of (1) a compliant conductive material; (2) a façade; (3) a housing module that is coupled to an electronics module; and/or (4) one or more electronics modules (and/or a conductive path form one electronics module to one or both electro-active lenses): Similarly, embodiments that comprise a compliant conductive material may also comprise any one of, or some combination of: (1) a façade; (2) a housing module that is coupled to an electronics module; and/or (3) one or more electronics modules (and/or a conductive path form one electronics module to one or both electro-active lenses). Similarly, embodiments that comprise a façade may also comprise any one of, or some combination of: (1) a housing module that is coupled to an electronics module; and/or (2) one or more electronics modules (and or/a conductive path form one electronics module to one or both electro-active lenses). Similarly, embodiments that comprise a housing module that is coupled to an electronics module may also comprise one or more electronics modules (and/or a conductive path form one electronics module to one or both electro-active lenses). Moreover, the exemplary features and aspects of any of the above embodiments may also be used in any suitable combination, as would be understood by one of ordinary skill in the art after reading this disclosure.

[0389] The above description is illustrative and is not restrictive. Many variations of the invention will become apparent to those skilled in the art upon review of the disclosure. The scope of the invention should, therefore, be determined not with reference to the above description, but instead should be determined with reference to the pending claims along with their full scope or equivalents.

[0390] A recitation of “a”, “an” or "the" is intended to mean “one or more” unless specifically indicated to the contrary

[0391] All publications mentioned herein are incorporated herein by reference to disclose and describe the methods and/or materials in connection with which the publications are cited. The publications discussed herein are provided solely for their disclosure prior to the filing date of the present application. Nothing herein is to be construed as an admission that the present invention is not entitled to antedate such publication by virtue of prior invention. Further, the dates of publication provided may be different from the actual publication dates, which may need to be independently confirmed.

WHAT IS CLAIMED IS:

1. A first device, comprising:

a frame comprising a first temple and a second temple, wherein the frame comprises a housing module coupled to a structural member;

a first lens and a second lens coupled to the frame; and

an electronics module, wherein the electronics module is located within the housing module; and wherein the electronics module comprises at least any two of:

a power source;

a controller; and

a sensing mechanism.

2. The first device of claim 1, wherein an insulating layer is disposed between one or more electronic components located within the electronics module and the frame of the first device.

3. The first device of claim 2, wherein the housing module comprises the insulating layer.

4. The first device of claim 3, wherein the electronics module comprises a conductive material.

5. The first device of claim 2,

wherein the housing module comprises a conductive material; and

wherein the insulating layer is disposed between at least a portion of the housing module and the electronics module.

6. The first device of claim 2, wherein the insulating layer comprises a portion of the electronics module.

7. The first device of claim 6, wherein the housing module comprises a conductive material.

8. The first device of claim 1, wherein the electronics module is removably coupled to the housing module.

9. The first device of claim 8, wherein the electronics module is adapted to be removed and recoupled to the housing module.

10. The first device of claim 1,

wherein the housing module comprises a first end, a second end, and a body disposed between the first end and the second end;

wherein the first end comprises an opening; and

wherein the electronics module is configured to be inserted into the opening.

11. The first device of claim 10, wherein the electronics module is pressure fitted to the housing module.

12. The first device of claim 10, wherein the electronics module is located within the body of the housing module.

13. The first device of claim 10, wherein the housing module comprises nylon or carbon fiber.

14. The first device of claim 1,

wherein the structural member comprises a cavity in the first temple; and

wherein the housing module is configured to be selectively placed within the cavity.

15. The first device of claim 14, wherein the housing module is coupled to the first temple using at least any one of: a screw or a two face adhesive tape.

16. The first device of claim 14, wherein the housing module may be selectively removed.

17. The first device of claim 14, wherein the housing module is pressure fitted to the cavity in the first temple.

18. The first device of claim 1,

wherein the first lens is electrically connected to the electronics module;

wherein the controller is configured to generate a time varying signal to supply to the first lens from the power source; and

wherein the sensing mechanism is configured to provide an input to the controller for determining when to supply the time varying signal to the first lens.

19. The first device of claim 1, wherein the power source comprises a battery.

20. The first device of claim 1, wherein the controller comprises firmware.

21. The first device of claim 1, wherein the controller comprises a voltage multiplier.

22. The first device of claim 1, wherein the controller is configured to provide at least one of: a zero DC biased sine wave or a zero DC biased square wave to the first lens.

23. The first device of claim 1, wherein the housing module further comprises an aperture disposed on an outer side of the housing module.

24. The first device of claim 23, wherein the aperture has an area that is approximately within the range of $1cm^2$ to $5cm^2$.

25. The first device of claim 23, wherein sensing mechanism comprises a touch sensitive switch exposed substantially through the aperture.

26. The first device of claim 25, wherein the touch sensitive switch is a capacitance switch.

27. The first device of claim 1, wherein the structural member comprises the first temple.

28. The first device of claim 27, wherein the first temple comprises a first portion and second portion, wherein the first portion is located closer to the first lens than the second portion, and wherein the housing module is coupled to the first portion of the first temple.

29. The first device of claim 27, wherein the first temple comprises a first portion and second portion, and wherein the housing module comprises the first portion of the first temple.

30. The first device of claim 1, wherein the housing module comprises a conductive material.

31. The first device of claim 1, wherein the housing module comprises non-conductive material.

32. The first device of claim 1, wherein the electronics module comprises non-conductive material.

33. The first device of claim 1, wherein the electronics module comprises a conductive material.

34. The first device of claim 31, wherein the structural member comprises any one of plastic or nylon.

35. The first device of claim 31, wherein the structural member comprises acetate.

36. The first device of claim 31, wherein the structural member comprises conductive material, and wherein the housing module electrically isolates the electronics module from the structural member.

37. The first device of claim 36, wherein the structural member comprises metal.

38. The first device of claim 31, further comprising:

a first lens comprising a first electrical contact;

a conductive path in electrical contact with the first electrical contract of the first lens;

wherein the electronics module has a first electrical contact; and

wherein the conductive path is in electrical contact with the first electrical contact of the electronics module.

39. The first device of claim 38, wherein the conductive path comprises pogo pins.

40. The first device of claim 39, wherein the conductive path comprises a compliant conductive element.

41. The first device of claim 1, wherein the housing module has a thickness that is less than or equal to approximately .7 mm.

42. A method of fabricating a device,

wherein the device comprises

a frame having a first temple and second temple; and

a housing module comprising:

a first end and a second end, wherein the first end comprises an opening; and

a body disposed between the first and second end, wherein the body comprises a cavity;

wherein the method comprises inserting an electronics module into the opening of the first end of the housing module such that the electronics module is disposed in the cavity of the body of the housing module.

43. The first device of claim 42, wherein the method further comprises removing a first electronics module from the cavity through the opening of the first end of housing module; and

inserting a second electronics module into the opening of the first end of the housing module such that the second housing module is disposed in the cavity of the housing module.

44. The first device of claim 43, wherein the first electronics module and the second electronics module are the same electronics module.

45. The first device of claim 43, wherein the first electronics module and the second electronics module are different electronics module.

46. A method of fabricating a device comprising a frame having a first temple and second temple, wherein the first temple comprises:

a first end;

a second end,

a body disposed between the first and second end; and

a cavity disposed within the body;

wherein the first end comprises an opening, and

wherein the method comprises:

inserting an electronics module into a housing module;

inserting the housing module into the opening of the temple such that the housing module is disposed in the cavity of the first temple.

47. A first device, comprising:

a lens comprising at least a first electrical contact;

a lens housing holding the lens, wherein the lens housing comprises at least a second electrical contact;

a conductive material disposed between the first and the second electrical contact, wherein the conductive material electrically connects the first and second electrical contacts; and

a barrier layer that is disposed so as to cover at least a portion of the conductive material.

ABSTRACT OF THE DISCLOSURE

Embodiments may provide a first device that includes a frame having a first temple and a second temple. The frame may also comprise a housing module coupled (*e.g.* attached) to a structural member. The first device may further include a first lens and a second lens coupled to the frame and an electronics module that may be located within the housing module. The electronics module may include at least any two of: a power source; a controller; and/or a sensing mechanism.

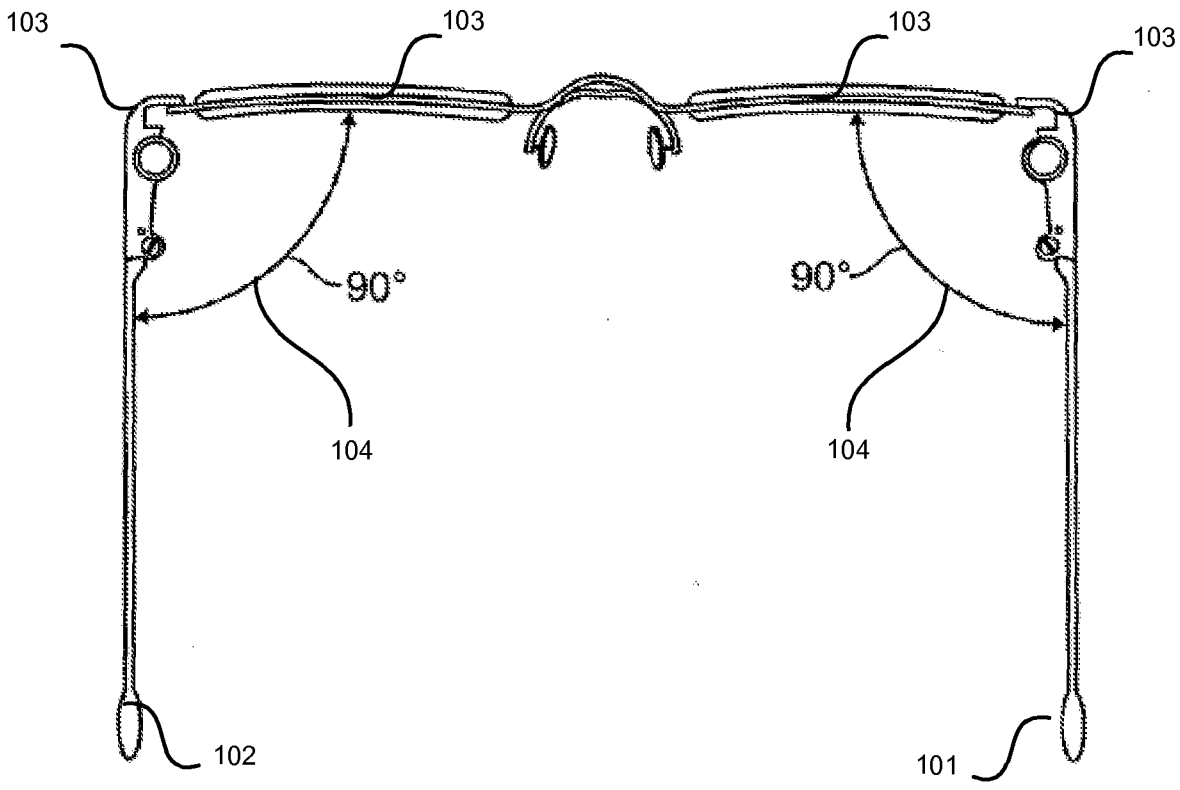


FIG. 1

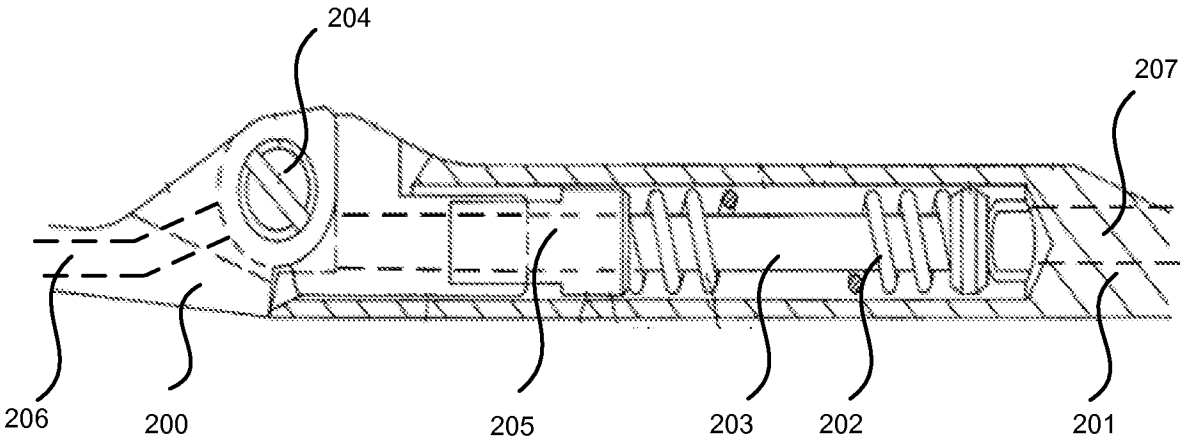


FIG. 2(a)

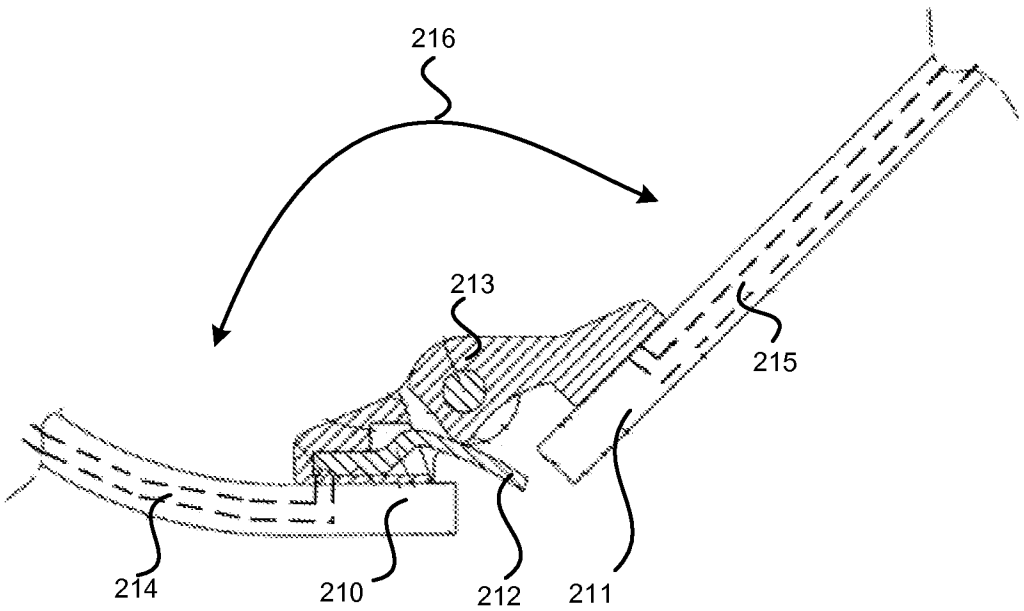


FIG. 2(b)

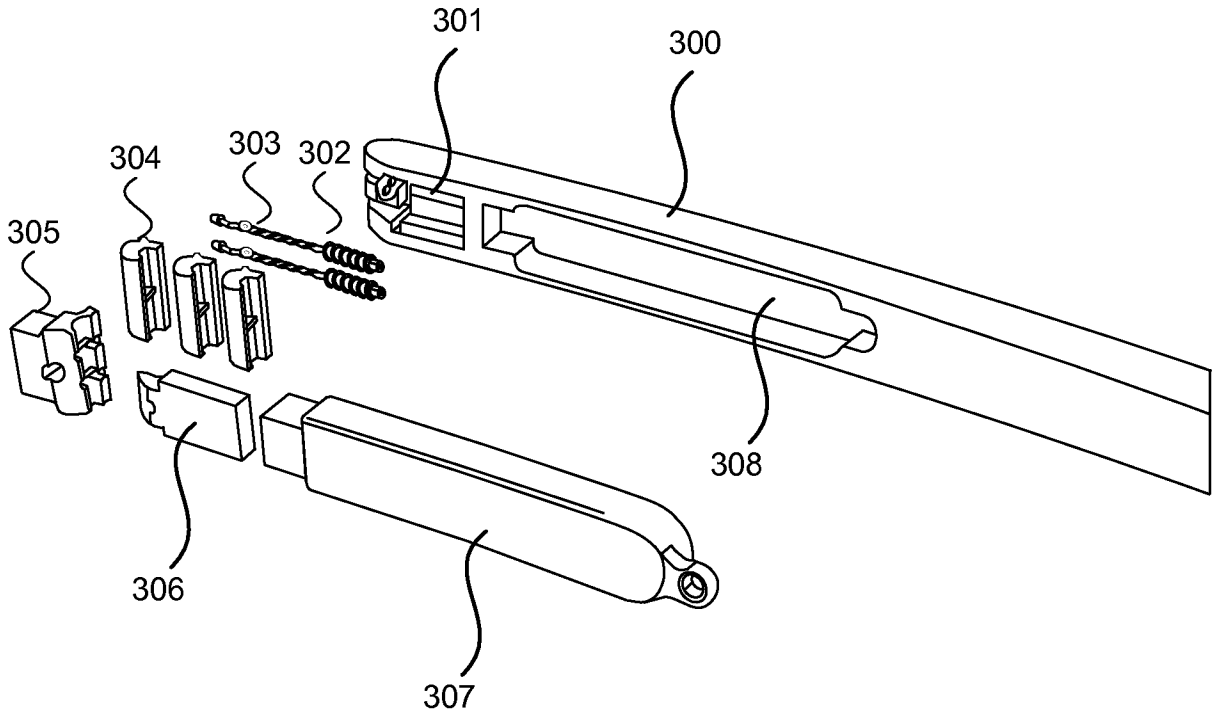


FIG. 3

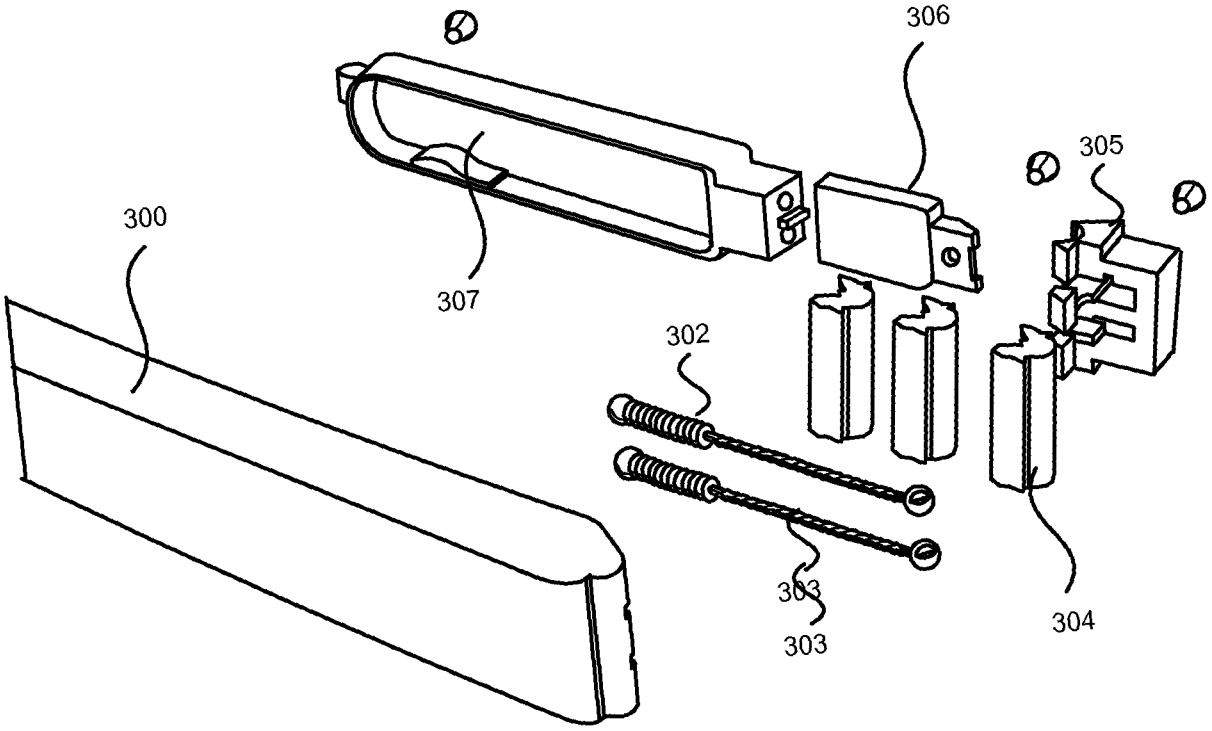


FIG. 4

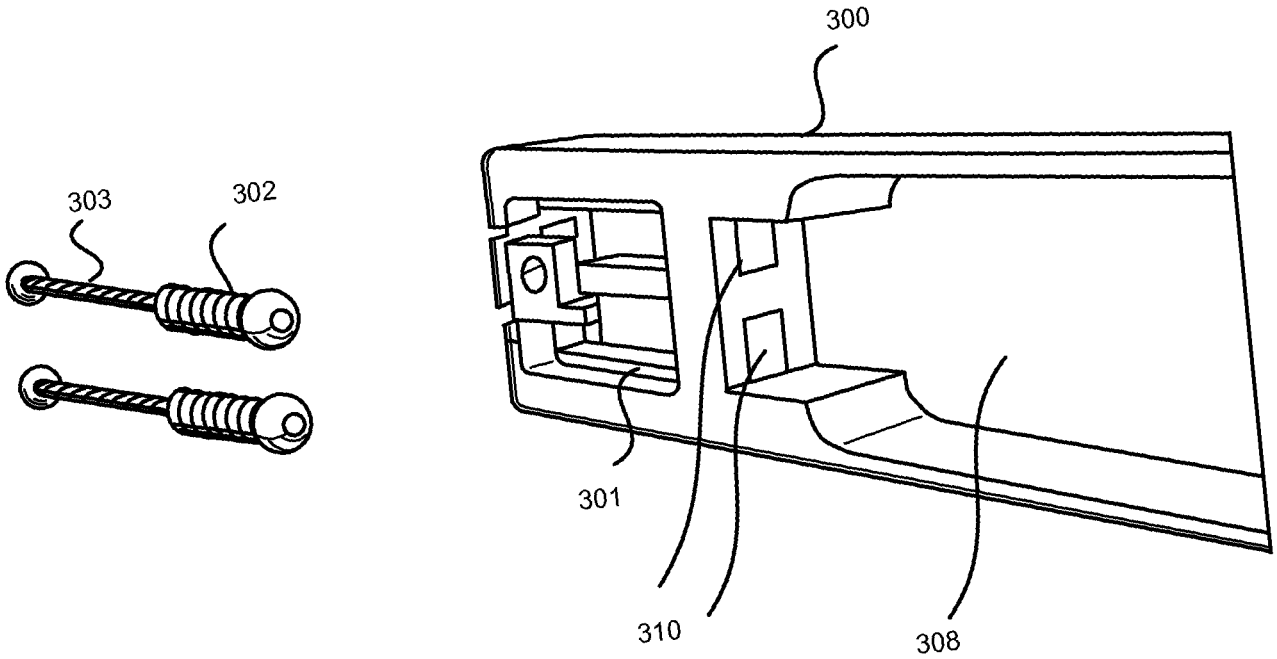


FIG. 5

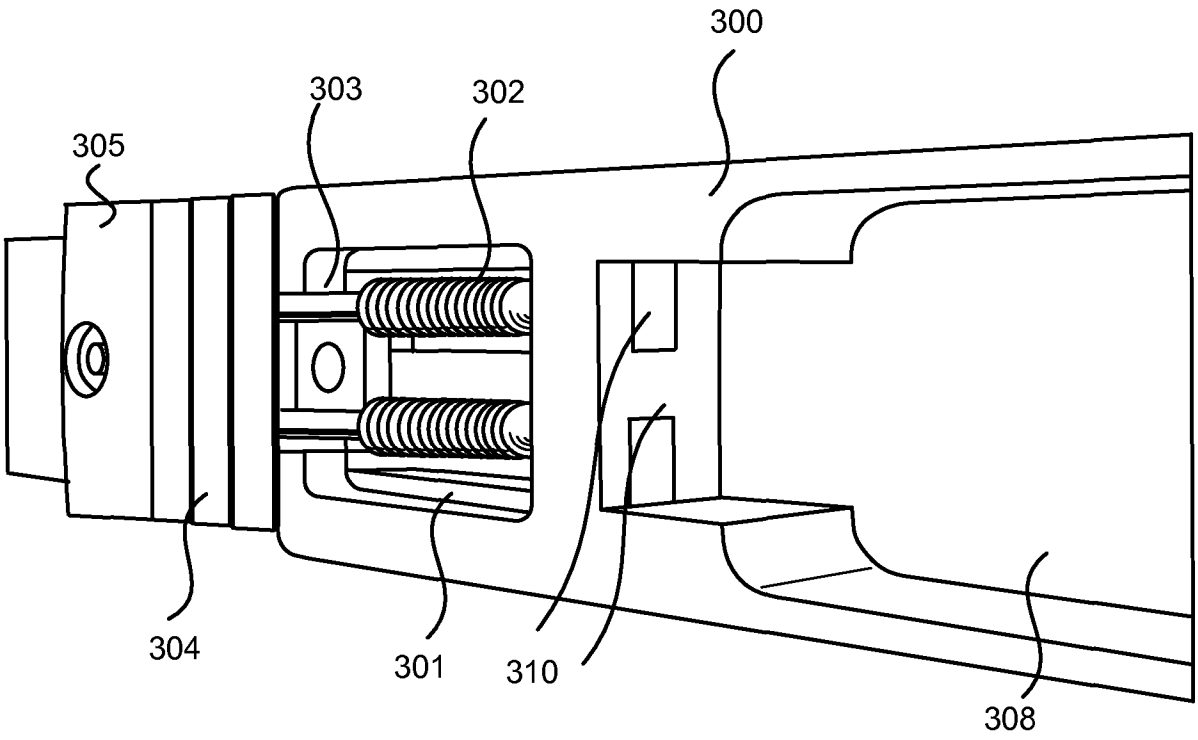


FIG. 6

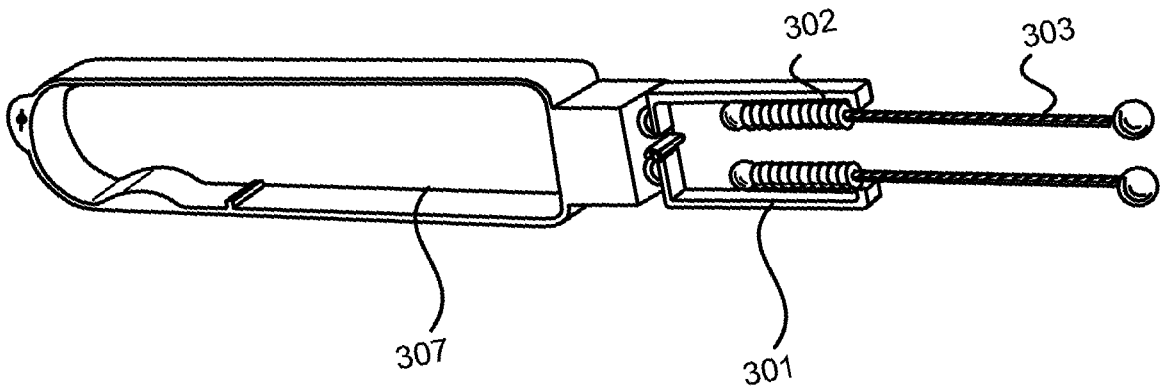


FIG. 7

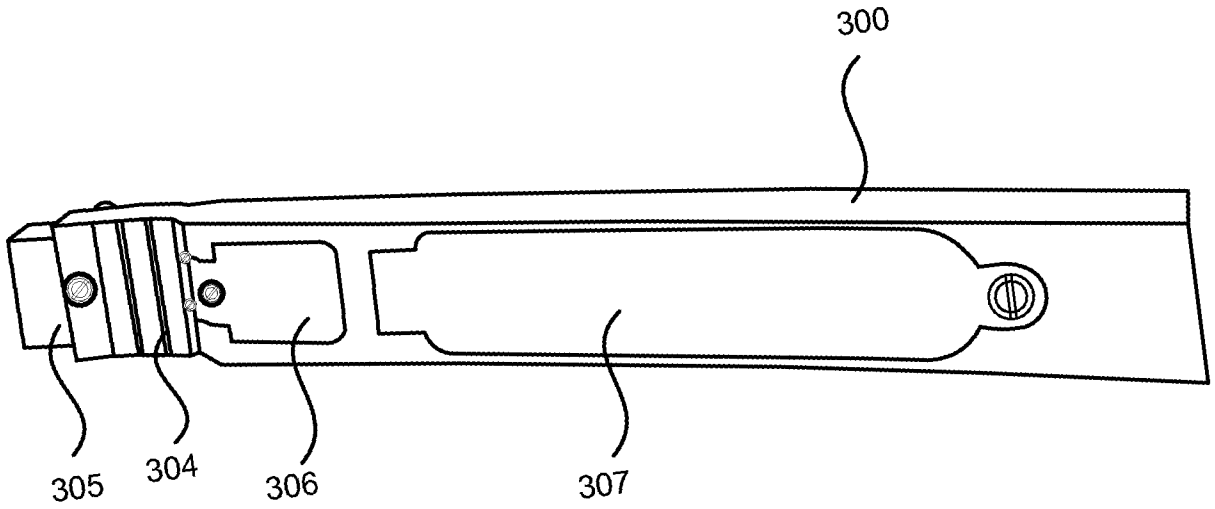


FIG. 8

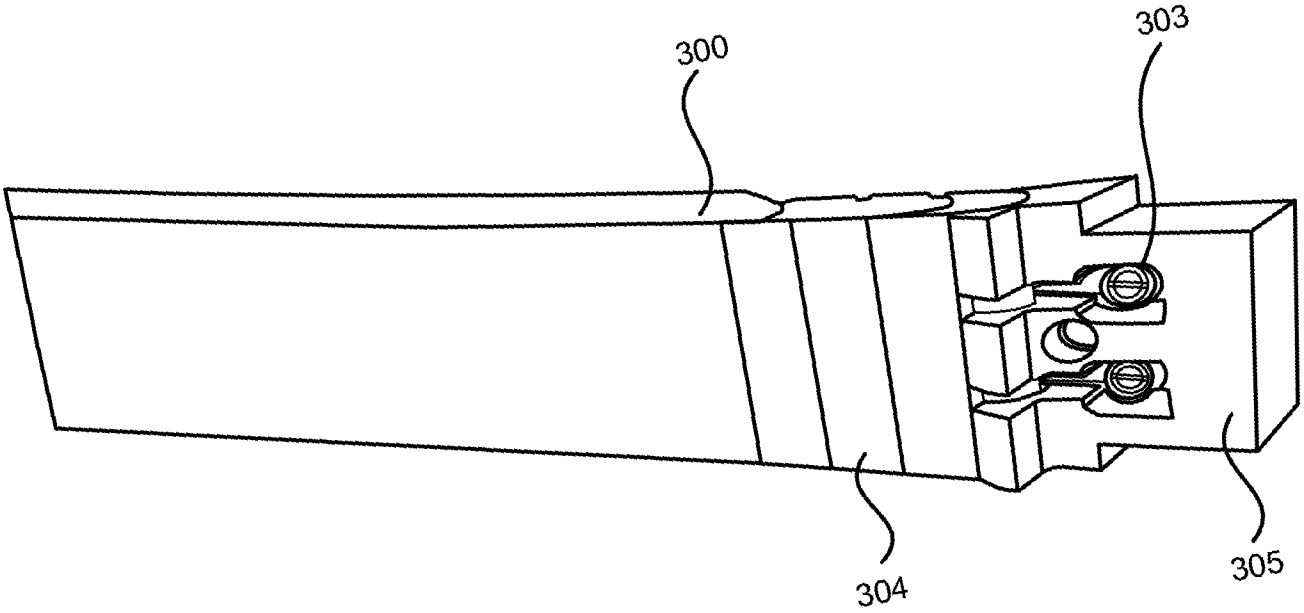


FIG. 9

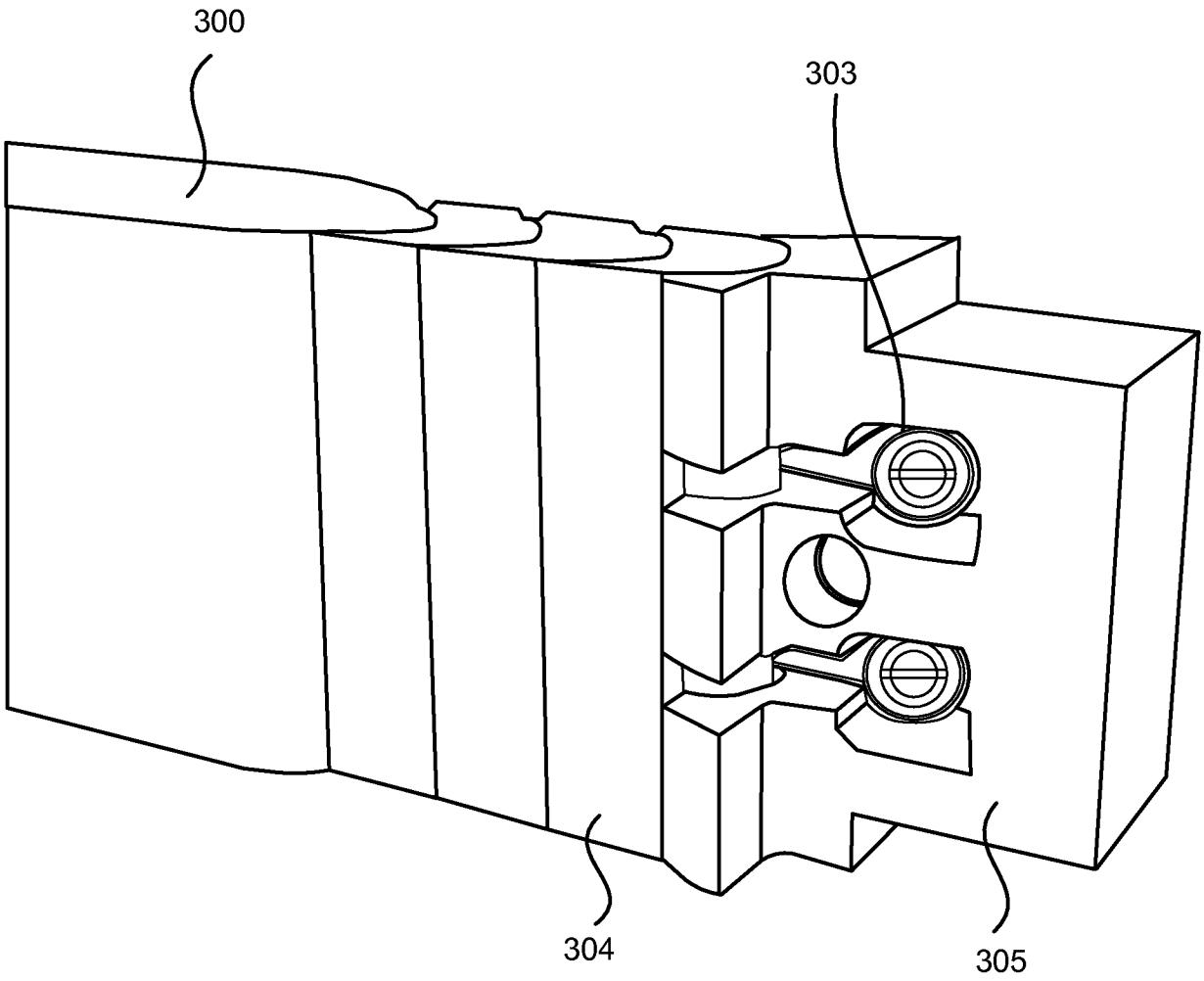


FIG. 10

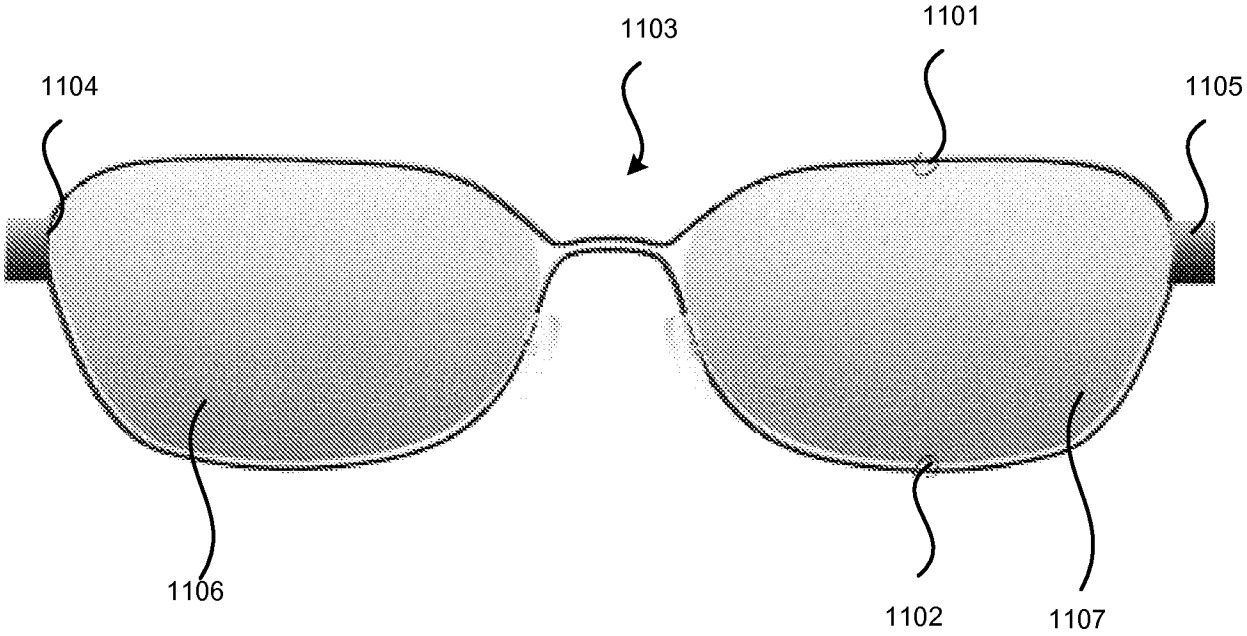


FIG. 11

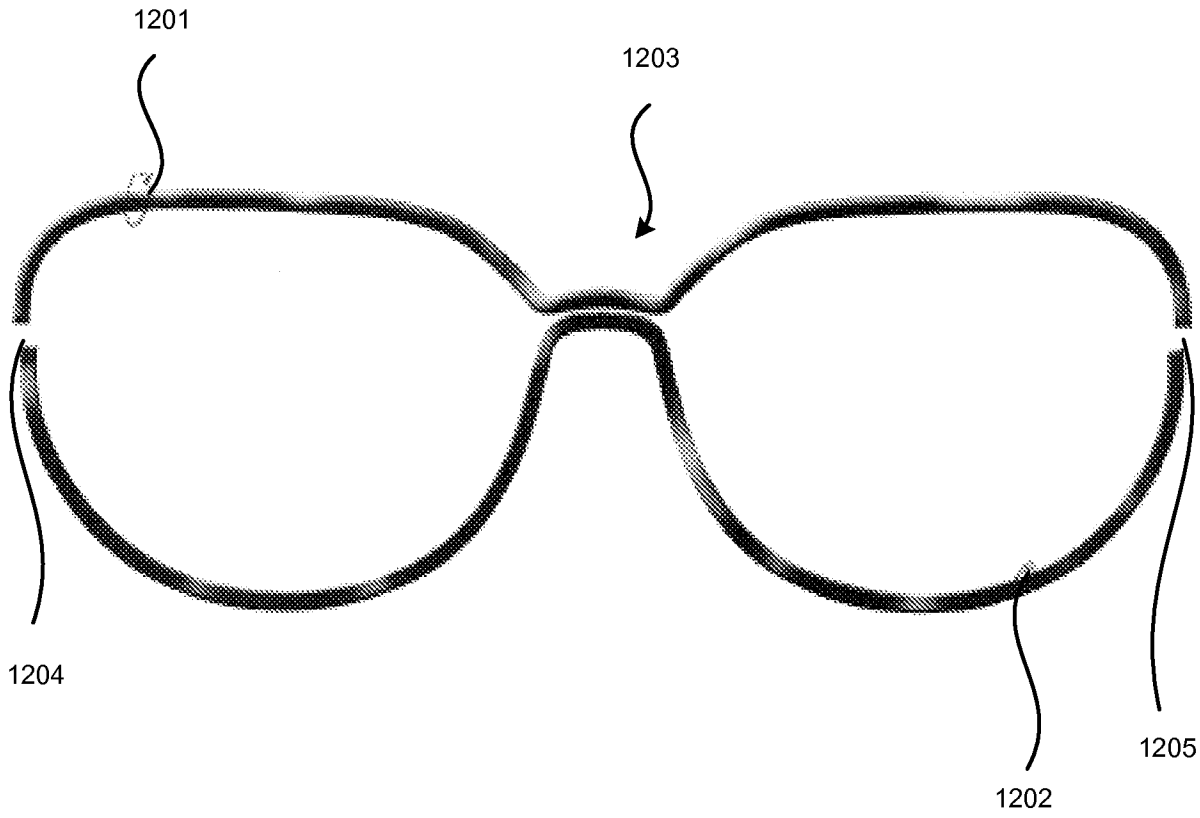


FIG. 12

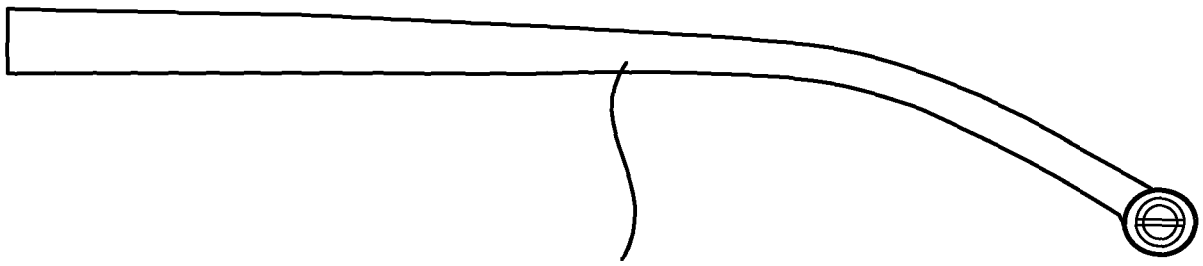


FIG. 13

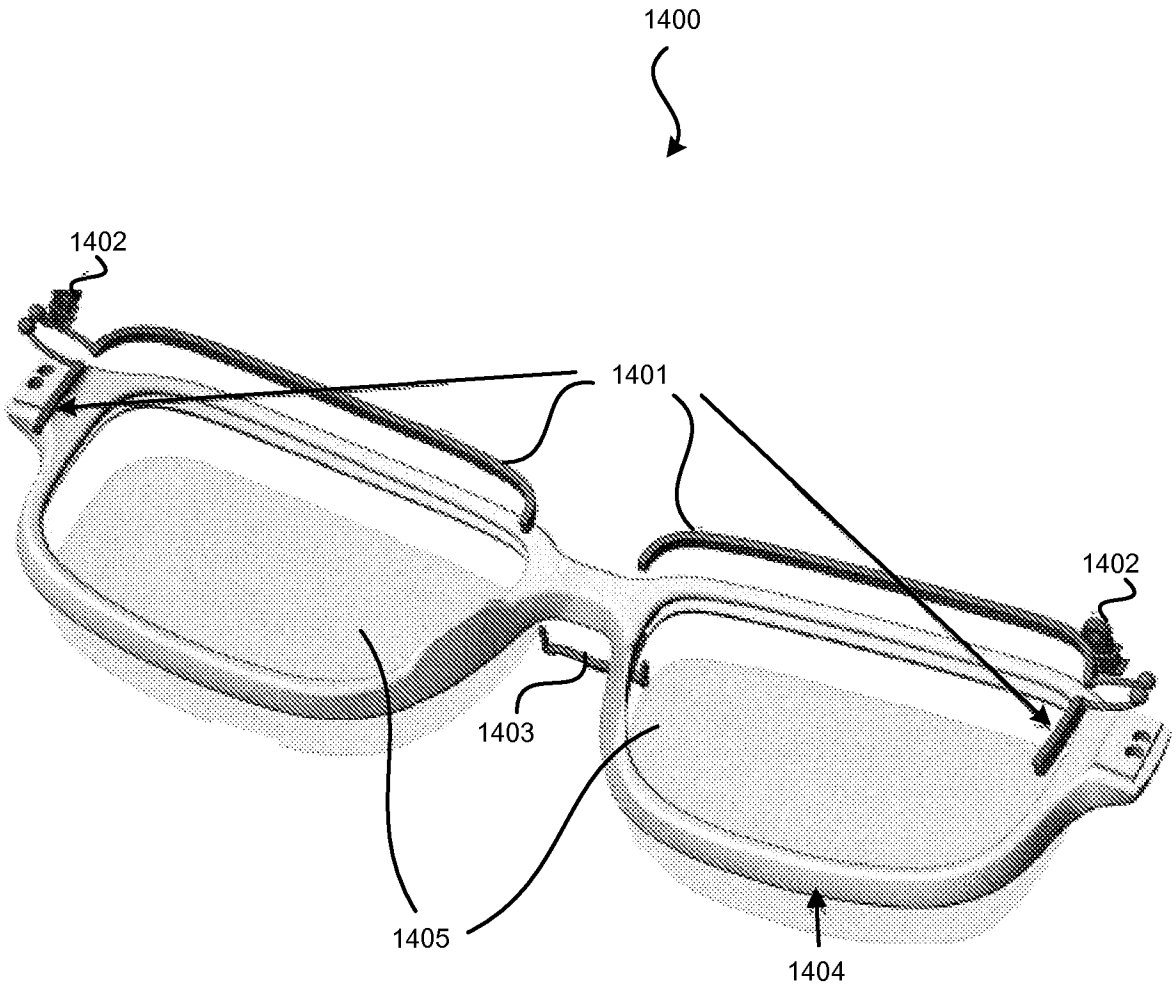


FIG. 14

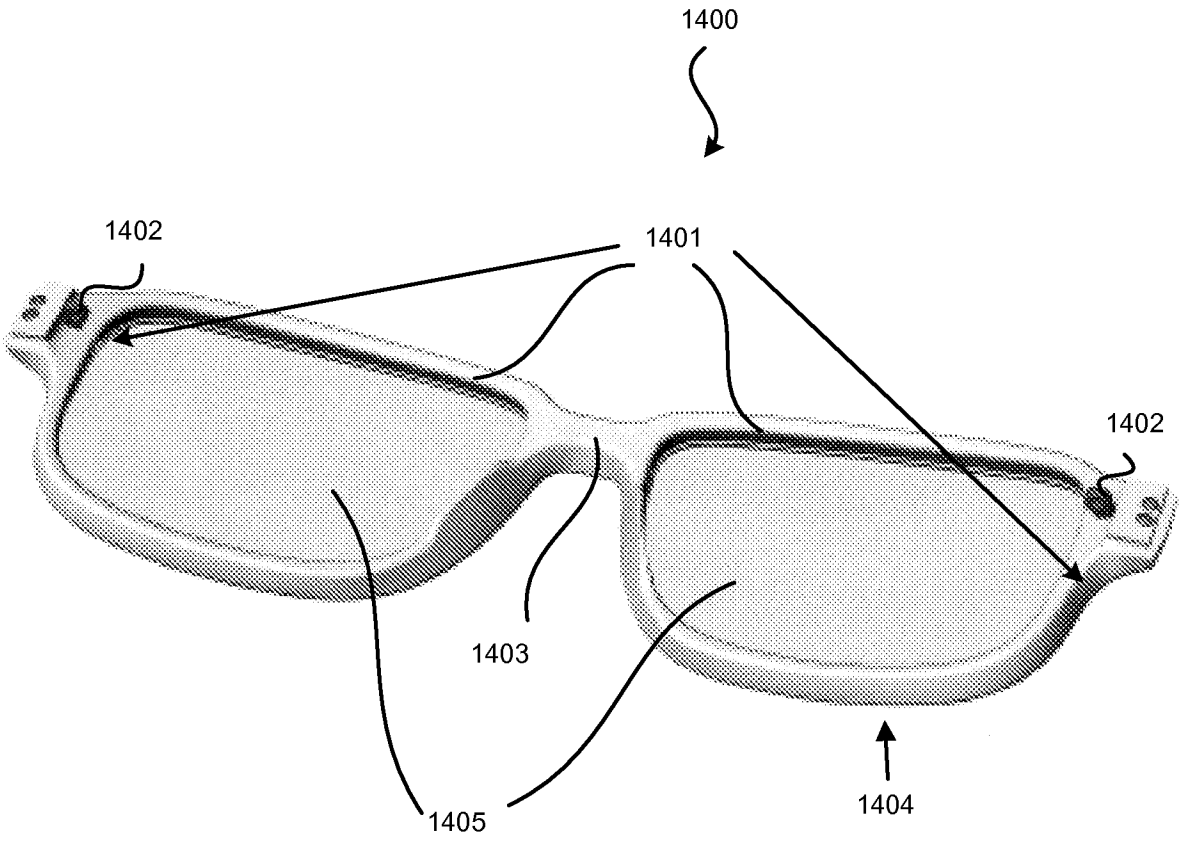


FIG. 15

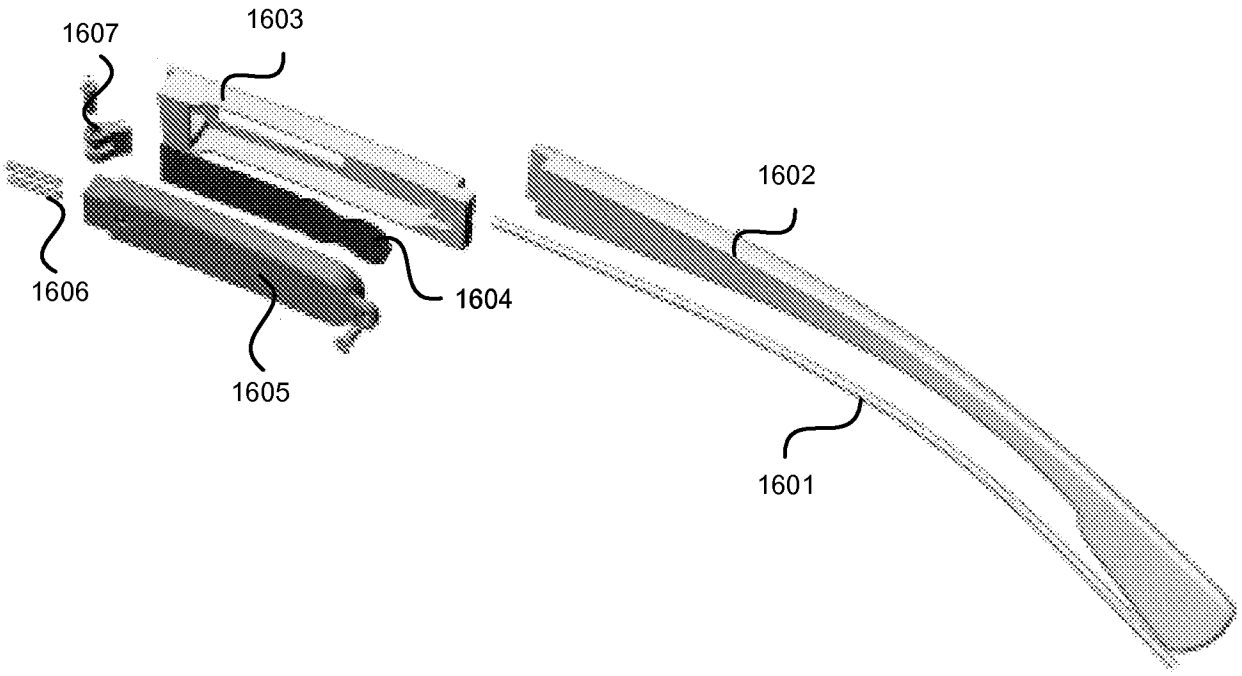


FIG. 16

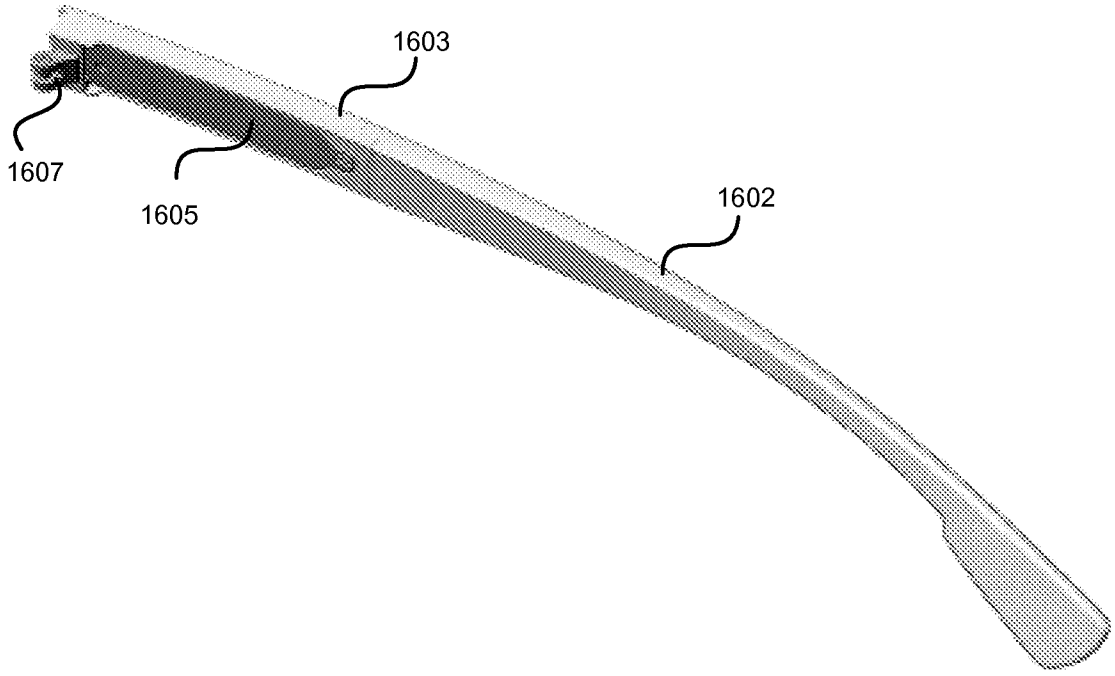


FIG. 17

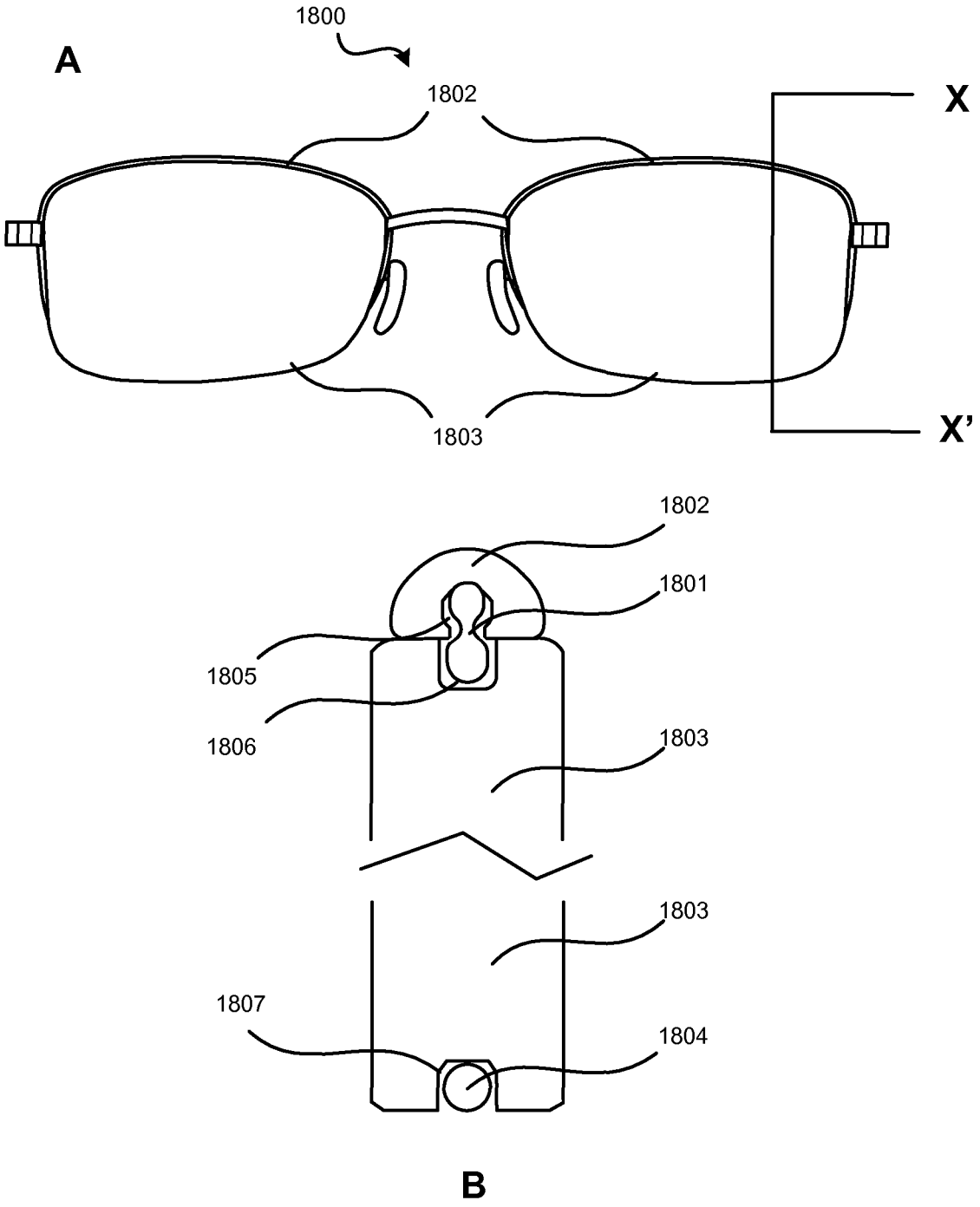


FIG. 18

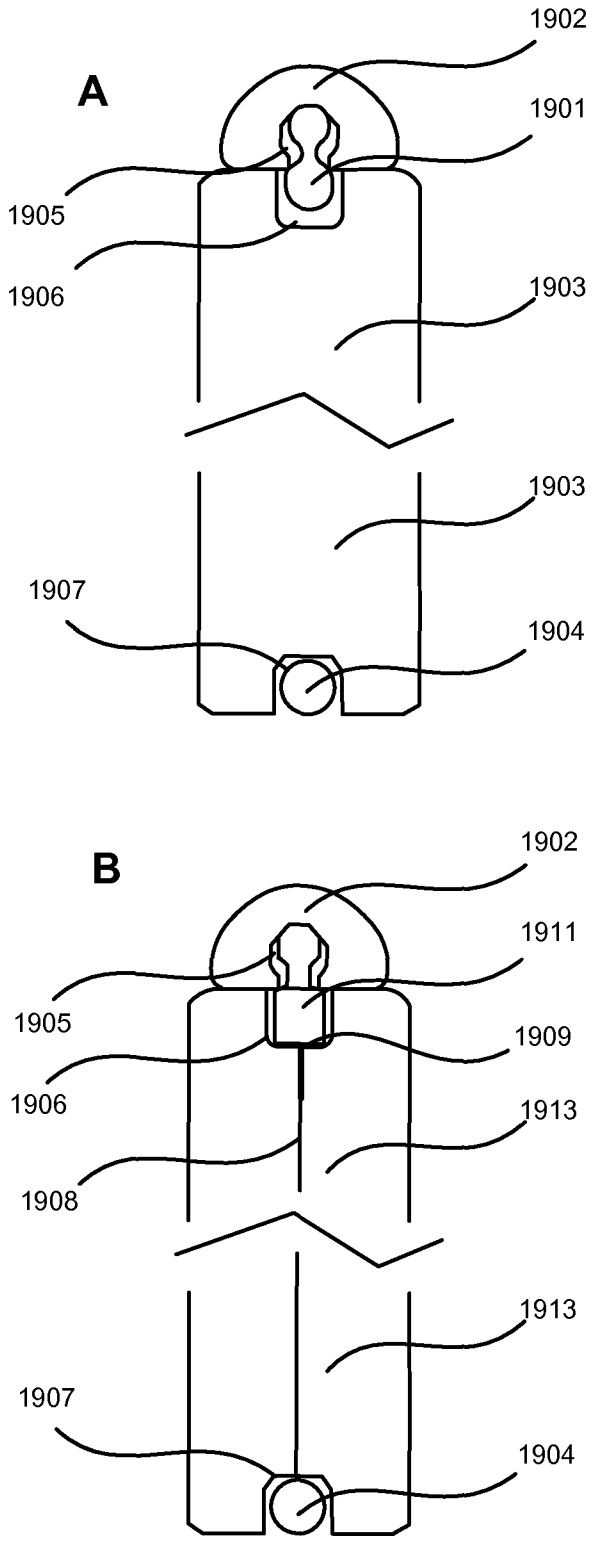

A
1902
1901
1905
1906
1903
1903
1907
1904
B
1902
1911
1905
1909
1906
1913
1908
1913
1907
1904

FIG. 19

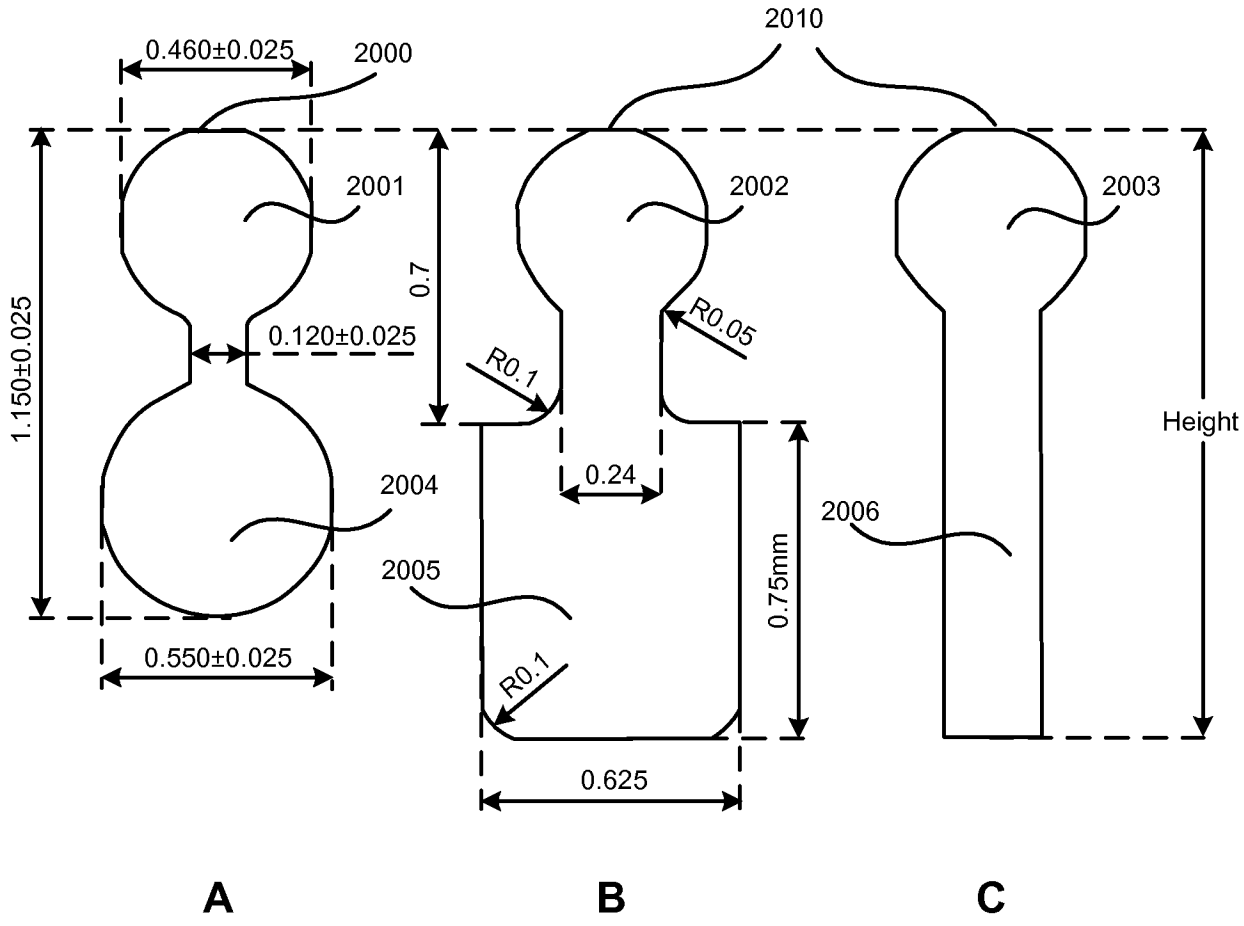

0.460±0.025
2000
2010
2001
2002
2003
0.7
1.150±0.025
0.120±0.025
R0.1
R0.05
Height
0.24
2004
2006
2005
0.75mm
0.550±0.025
R0.1
0.625
A
B
C

FIG. 20

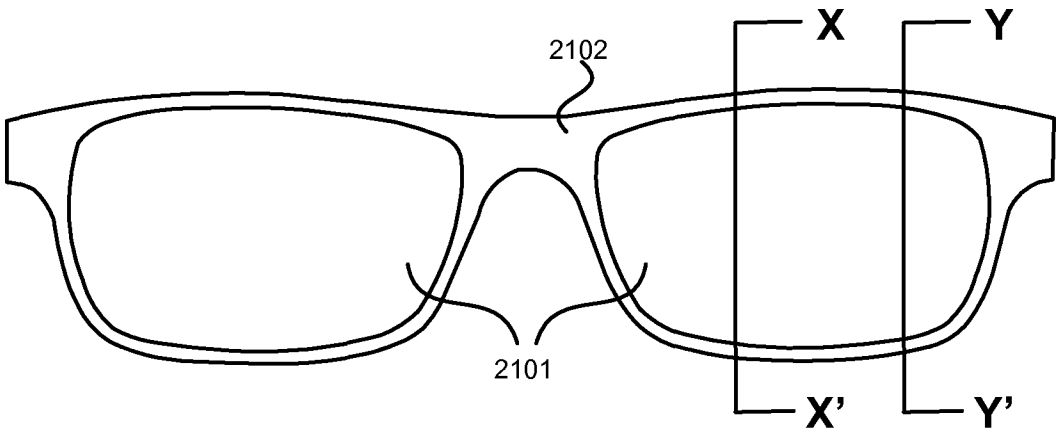


FIG. 21

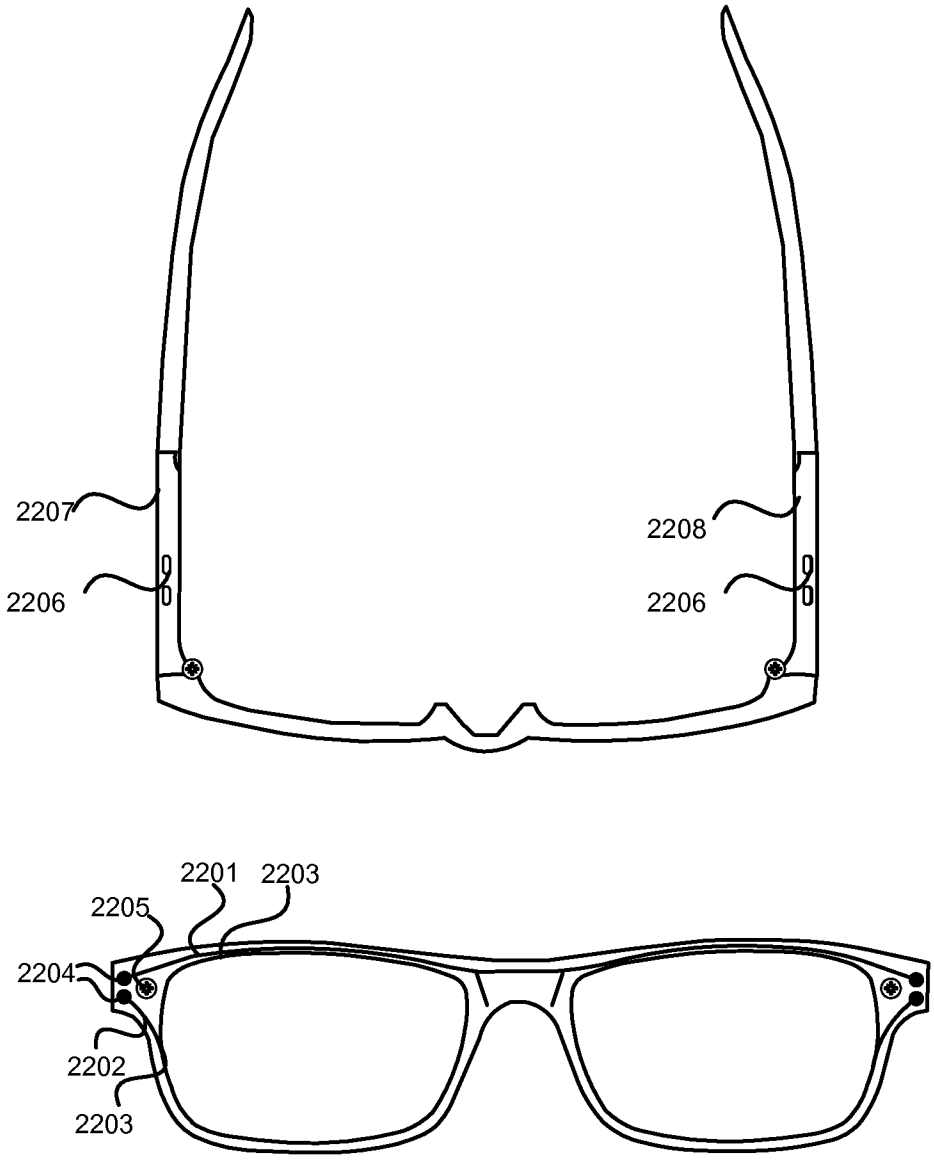


FIG. 22

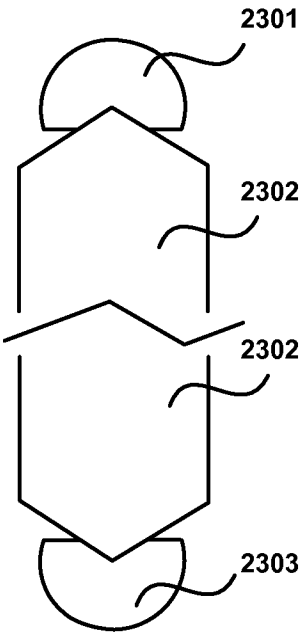


Fig. 23(a)

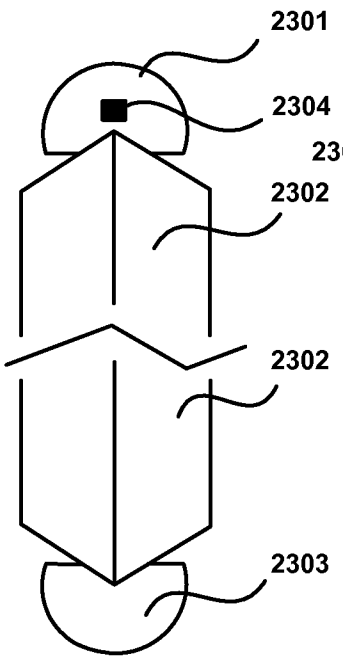


Fig. 23(b)

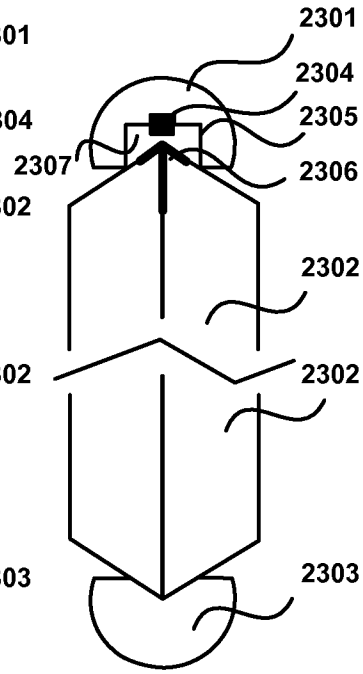


Fig. 23(c)

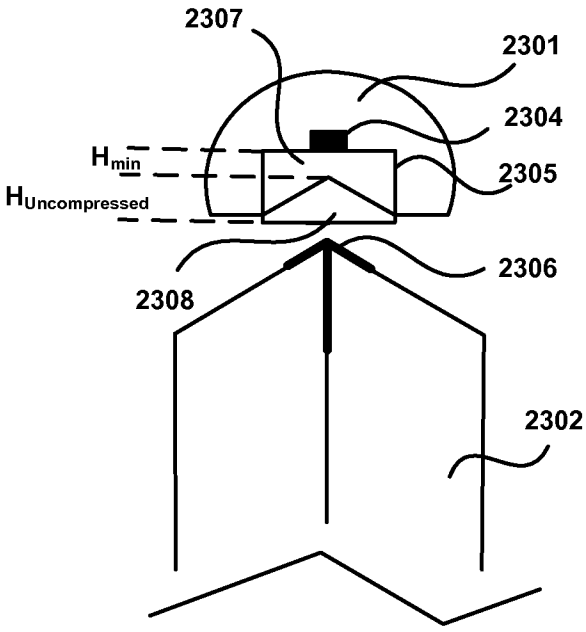


Fig. 23(d)

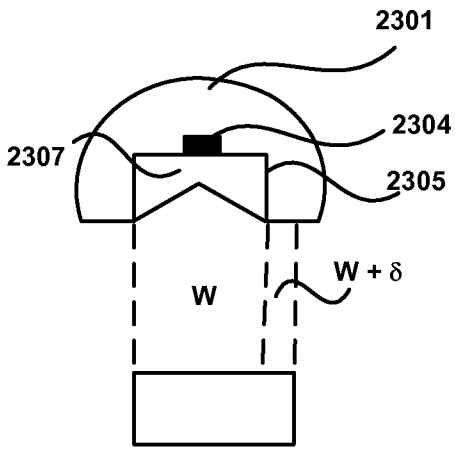


Fig. 23(e)

FIG. 23

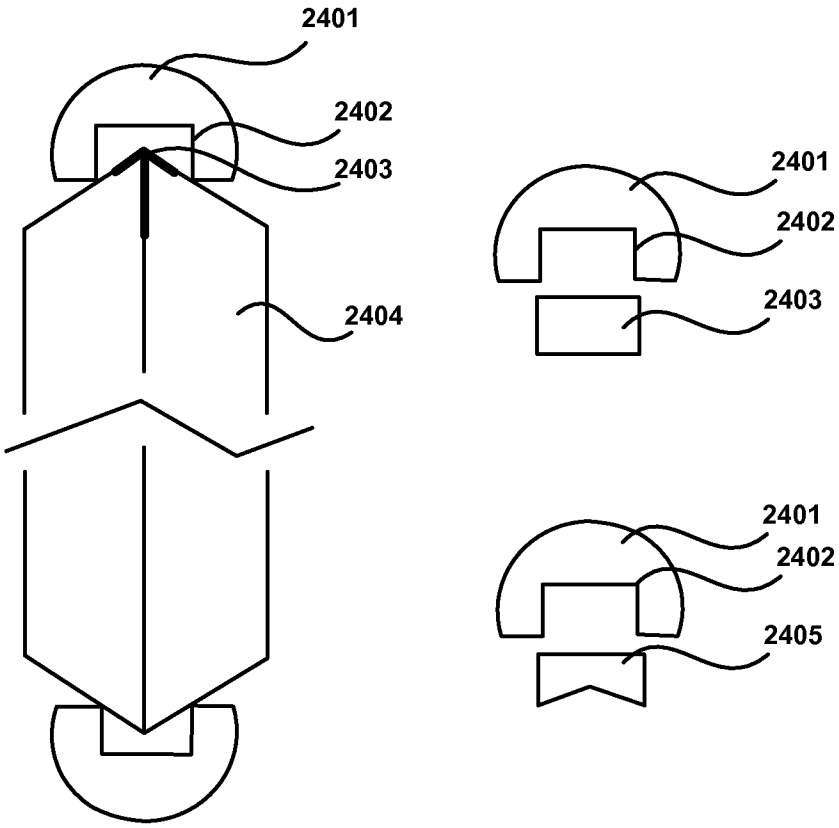


FIG. 24

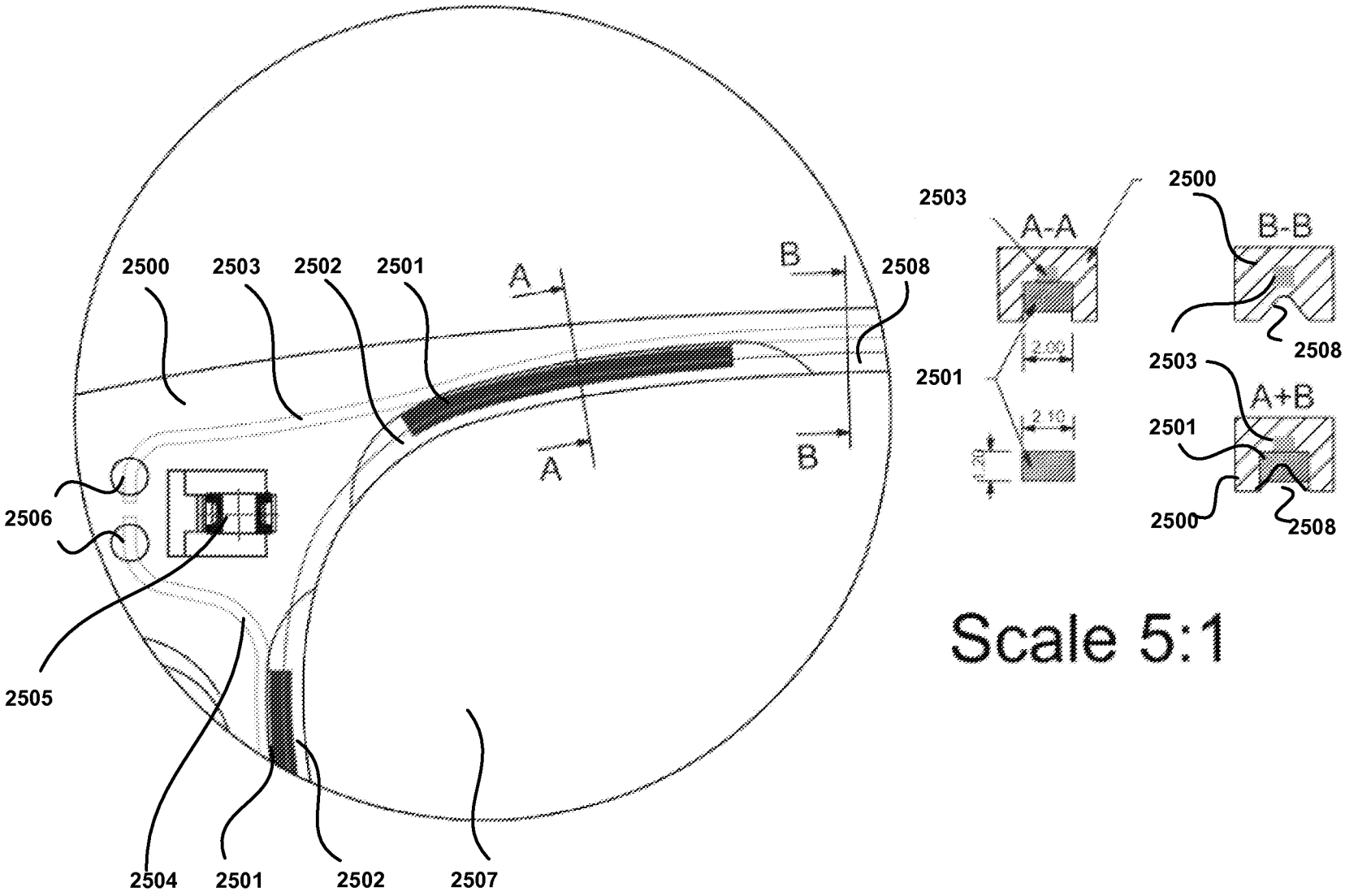

2500
2503
2502
2501
A
B
2508
2506
2505
2504
2501
2502
2507
2503
A-A
2501
2.00
2.10
0.2
B-B
2500
2508
2503
A+B
2501
2500
2508
Scale 5:1

FIG. 25

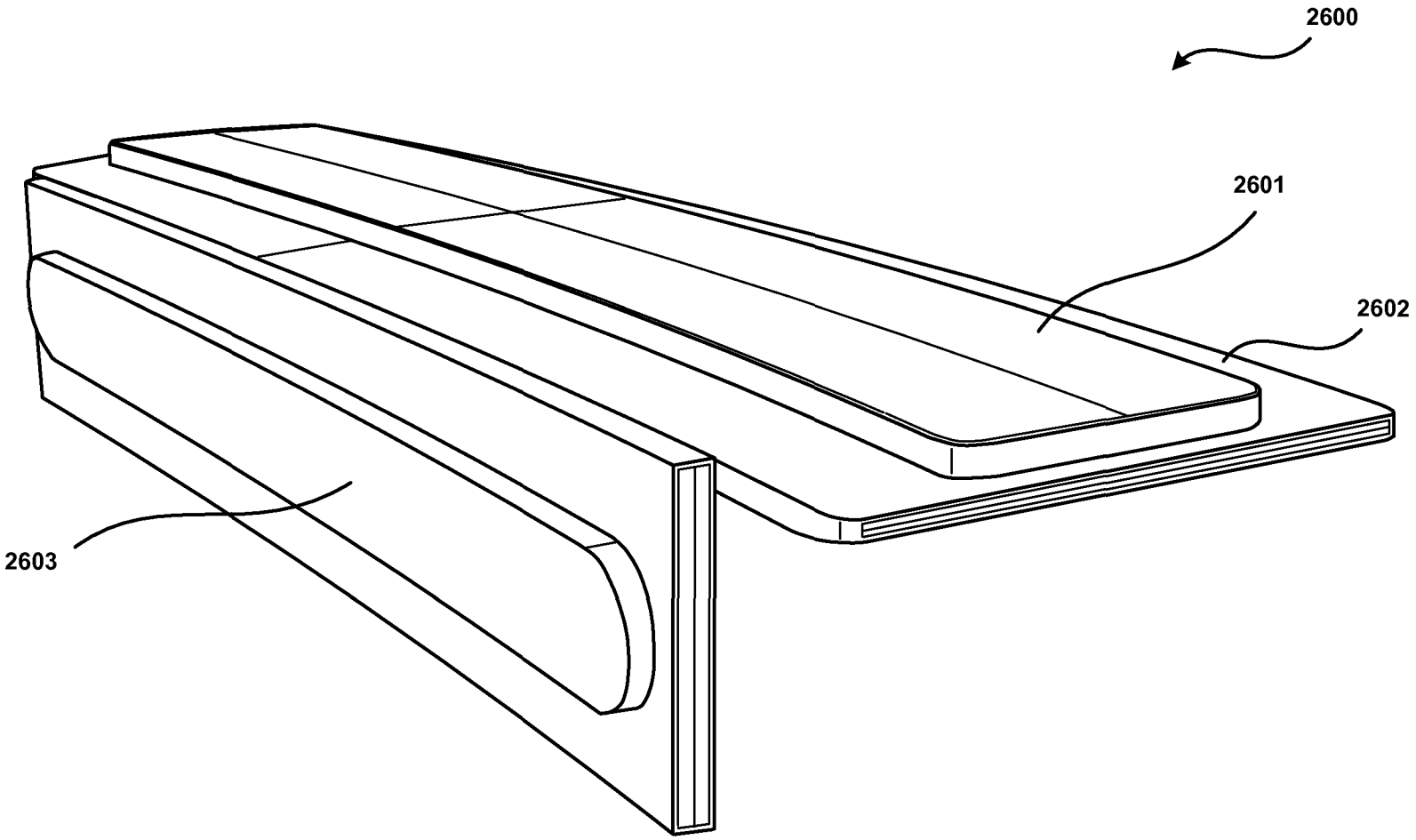


FIG. 26

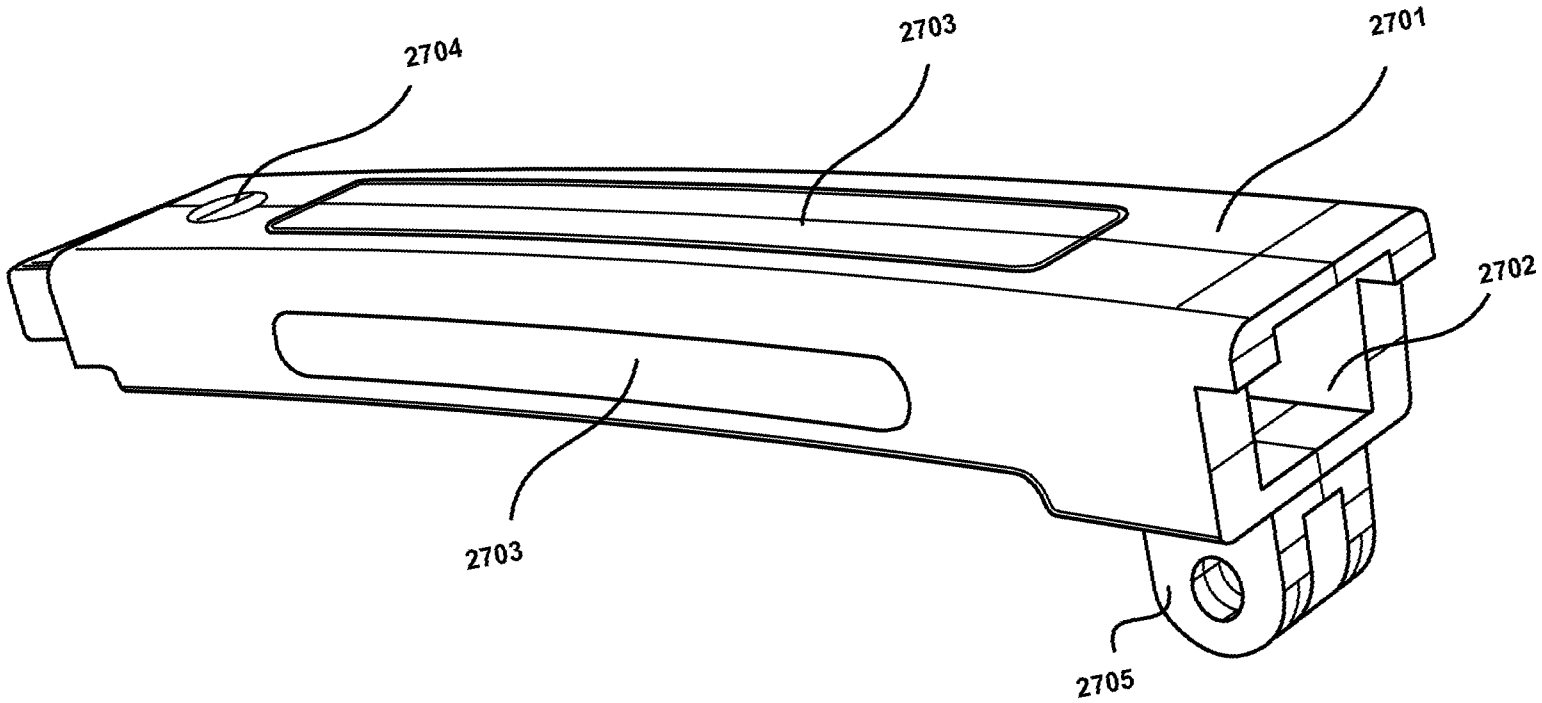


FIG. 27

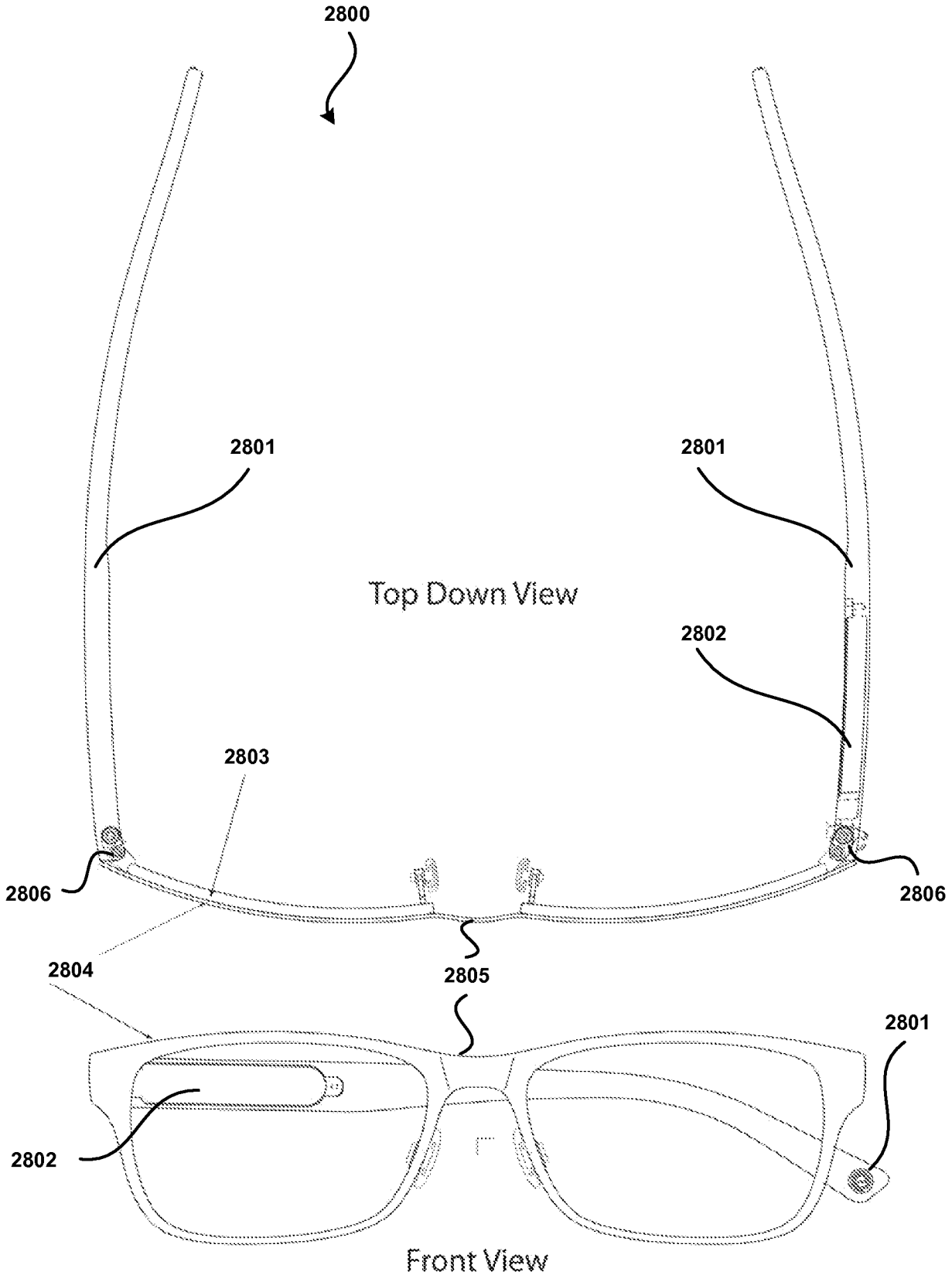

2800
2801
2801
Top Down View
2802
2803
2806
2806
2804
2805
2801
2802
Front View

FIG. 28

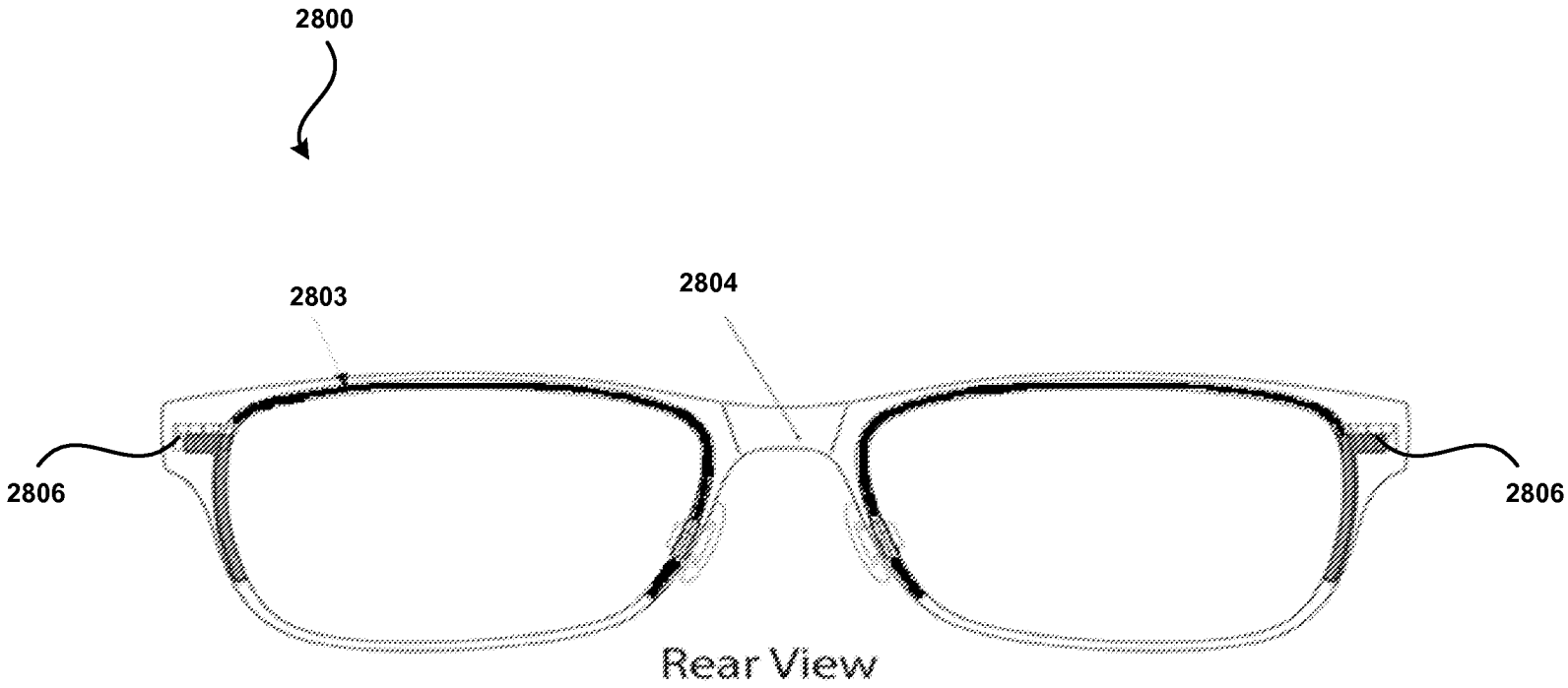


FIG. 29

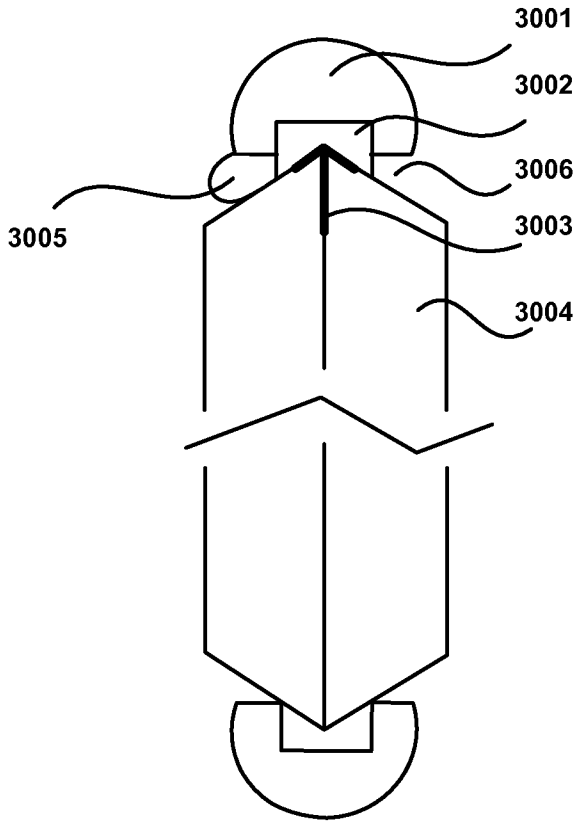


FIG. 30

Electronic Acknowledgement Receipt

EFS ID:	11432937
Application Number:	13298992
International Application Number:	
Confirmation Number:	1095
Title of Invention:	ELECTRONIC SPECTACLE FRAMES
First Named Inventor/Applicant Name:	Ronald D. Blum
Customer Number:	72162
Filer:	Patrick M. Lafferty/Joan Soll
Filer Authorized By:	Patrick M. Lafferty
Attorney Docket Number:	91904-817521
Receipt Date:	17-NOV-2011
Filing Date:	
Time Stamp:	16:59:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	2011_11_17_ADS_91904-817521.pdf	55308 083f1b11ba04cee670fdfd8b8c093596c9b69a7a	no	5

Warnings:	
Information:	

This is not an USPTO supplied ADS fillable form					
2		2011_11_17_NONPROV_91904-817521.pdf	430632 972e8dfb1bdd4968af6ad97a3fb5c250db0913ae	yes	132

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	125
	Claims	126	131
	Abstract	132	132

Warnings:					
Information:					
3	Drawings-only black and white line drawings	2011_11_17_DRWGS_91904-817521.pdf	496160 f730cfe6faf6e048237b12cc104bae93071ef550	no	30
Warnings:					
Information:					
		Total Files Size (in bytes):	982100		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

SCORE Placeholder Sheet for IFW Content

Application Number: 13298992 Document Date: 11/17/2011

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Form Revision Date: February 8, 2006