FIG. 31B illustrates the ideal surface relief diffractive structure 3001 in comparison to the smoothed surface relief diffractive structure 3102 to clearly illustrate the differences in each design approach. For the surface relief diffractive structures depicted in FIGs. 30 and 31, $d_1''$ $< d_1' < d_1$. As a result, the surface relief diffractive structure 3102 can lead to an even further decrease in switching and clearing time. Further, ' > for the surface relief diffractive structures depicted in FIGs. 30 and 31 (i.e., the width of the region of non-ideal phase profile is larger for the surface relief diffractive structure 3102 in comparison to the surface relief diffractive structure 3002). Overall, however, the decrease in diffraction efficiency experienced by the surface relief diffractive structure 3102 can be less than the decrease in diffraction efficiency experienced by the surface relief diffractive structure 3002

## Conclusion

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. It will be apparent to one skilled in the pertinent art(s) 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.

Overall, the present invention can be embodied as an unfinished lens blank, a semi-finished lens blank, a finished lens blank, an edged lens, a contact lens, an intra-ocular lens, a corneal inlay or a corneal onlay.

The invention is not limited to the operational descriptions provided by the included flowcharts. Rather, it will be apparent to persons skilled in the relevant art(s) from the teachings herein that other operational control flows are within the scope and spirit of the present invention. Control steps can be added or eliminated as will be understood by one skilled in the relevant art(s).

**WHAT IS CLAIMED IS:**

1. A method, comprising:
forming a first substrate;
forming a second substrate comprising a surface relief diffractive structure, an electro-active material seal structure and an adhesive seal structure;
positioning the first substrate and the second substrate to form an adhesive cavity and to contain electro-active material over the surface relief diffractive structure;
filling the adhesive cavity with an adhesive; and
curing the adhesive to adhere the first substrate to the second substrate to form a lens.

2. The method of claim 1, further comprising forming the first substrate to comprise a progressive addition optical power region.

3. The method of claim 1, further comprising dispensing electro-active material onto the surface relief diffractive structure prior to positioning the first substrate and the second substrate.

4. The method of claim 1, wherein positioning further comprises forming the adhesive cavity between the front substrate, the back substrate, the electro-active material seal structure and the adhesive seal structure.

5. The method of claim 1, wherein positioning further comprises containing the electro-active material between the surface relief diffractive structure, the front substrate and the electro-active material seal structure.

6. The method of claim 1, wherein forming the first substrate comprises forming the first substrate to have a radius of curvature that is at least 2 mm larger than a radius of curvature of the second substrate.

7. The method of claim 1, further comprising edging the lens to expose one or more electrical contacts on an edge of the lens and positioned between the first and second substrates.

8. A lens, comprising:

a first substrate;

a second substrate comprising a surface relief diffractive structure, an electro-active material seal structure around the surface relief diffractive structure, and an adhesive material seal structure around a periphery of the second substrate;

electro-active material contained by the surface relief diffractive structure, the first substrate and the electro-active material seal structure; and

adhesive material adhering the first substrate to the second substrate and contained by the first substrate, the second substrate, the electro-active material seal structure and the adhesive material seal structure.

9. The lens of claim 8, wherein the first substrate comprises a progressive addition optical power region.

10. The lens of claim 8, wherein the first substrate is in physical contact with the second substrate only at the electro-active material seal structure and the adhesive material seal structure.

11. The lens of claim 8, wherein one of the first and second substrates comprises one or more fill ports.

12. The lens of claim 8, wherein a radius of curvature of the first substrate is at least 2 mm larger than a radius of curvature of the second substrate.

13. The lens of claim 8, wherein the lens comprises one or more electrical contacts on an edge of the lens positioned between the first and second substrates.

14. An electro-active lens, comprising:

an electro-active element providing a first incremental add power; and

a progressive addition optical power region providing a second incremental add power region, wherein the electro-active element and the progressive addition optical region are in optical communication and wherein the electro-active element transitions from an on-state to an off-state in less than approximately 250 milliseconds (ms).

15. The electro-active lens of claim 14, wherein the off-state is substantially free of haze.

16. The electro-active lens of claim 14, wherein the electro-active element provides a first optical power in the off-state and a second optical power in the on-state.

17. The electro-active lens of claim 14, wherein the electro-active lens comprises:
electro-active material,
one or more transparent electrodes;
a substrate; and
one or more alignment layers.

18. The electro-active lens of claim 17, wherein the substrate comprises a surface relief diffractive structure, an electro-active seal structure and an adhesive seal structure.

19. The electro-active lens of claim 18, wherein a diffraction efficiency of the substrate in the off-state is approximately 0% and a diffraction efficiency of the substrate in the on-state is approximately 100%.

20. The electro-active lens of claim 17, wherein the electro-active material is a cholesteric liquid crystal.

21. The electro-active lens of claim 14, wherein the electro-active element transitions from the off-state to the off-state in less than approximately 100 milliseconds (ms)

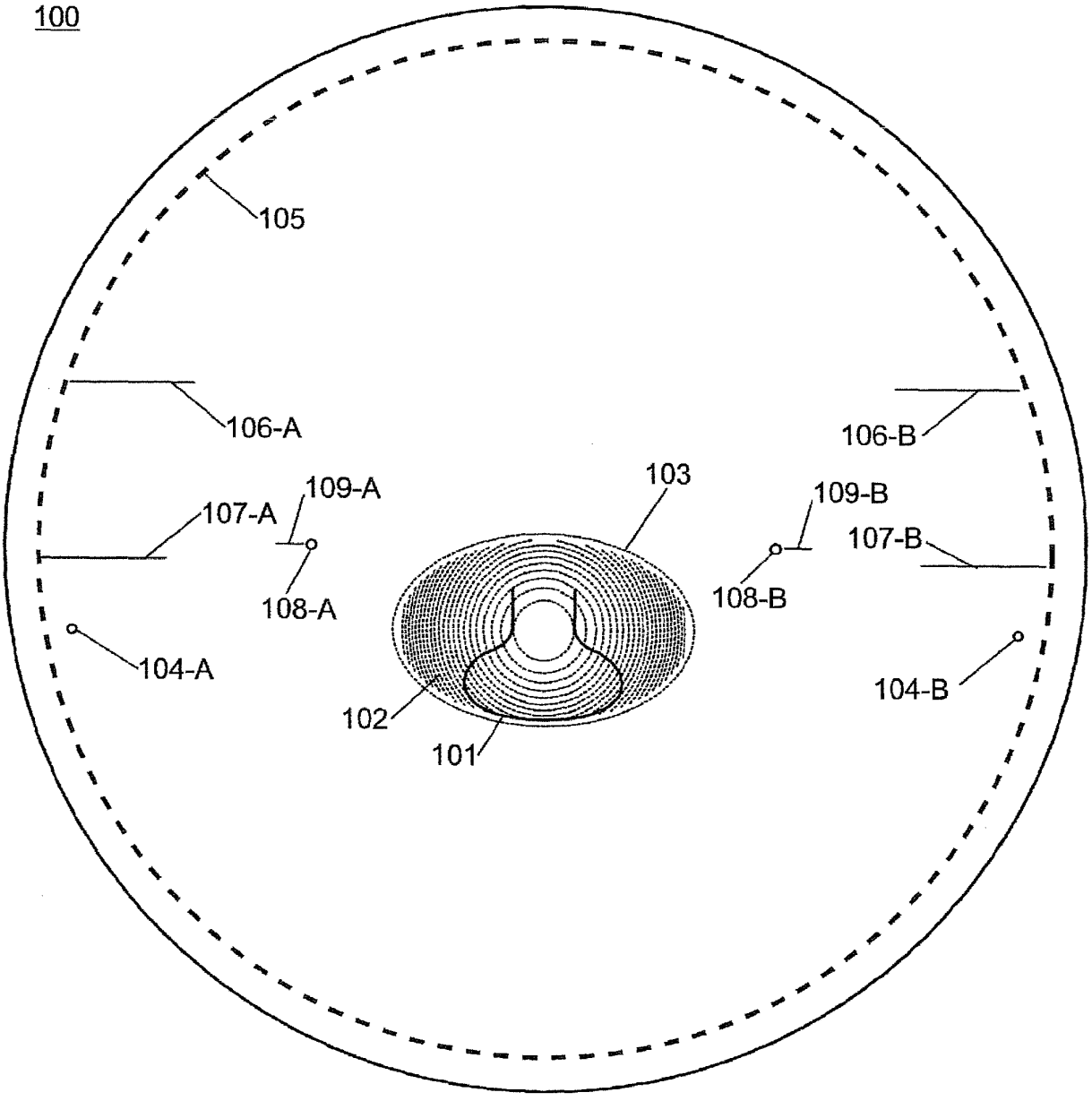

100
105
106-A
106-B
103
109-A
109-B
107-A
107-B
108-A
108-B
104-A
104-B
102
101

FIG. 1

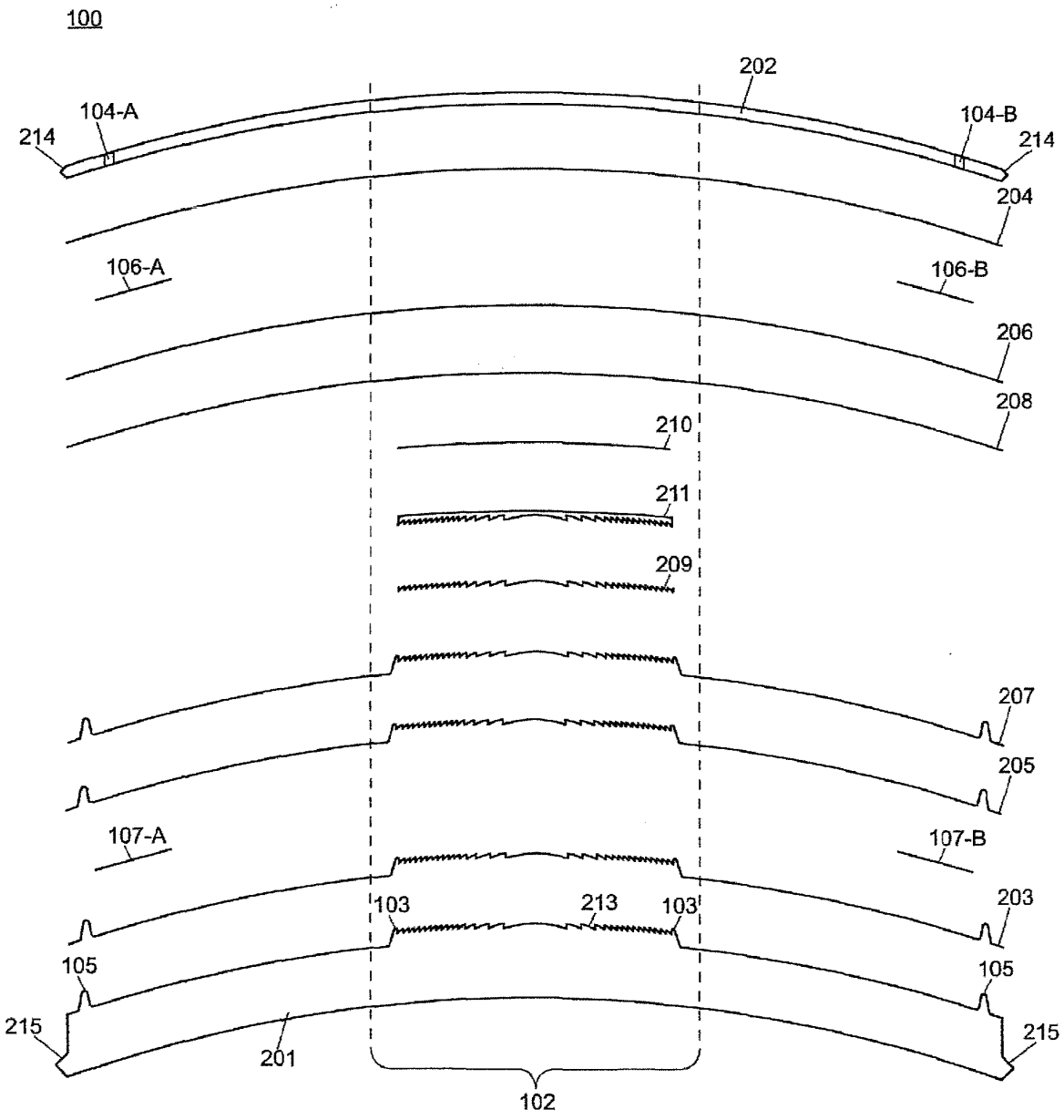

100
202
104-A
104-B
214
214
204
106-A
106-B
206
208
210
211
209
207
205
107-A
107-B
103
213
103
203
105
105
215
215
201
102

FIG. 2

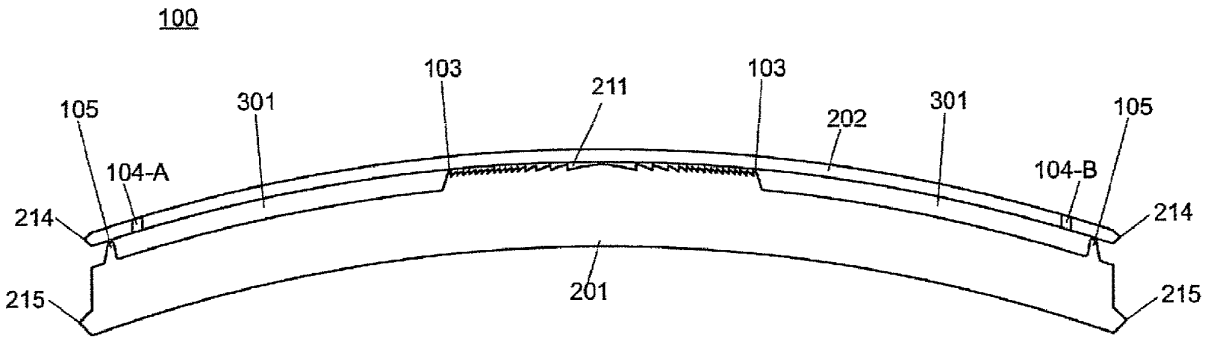

100
105
301
103
211
103
202
301
105
104-A
104-B
214
214
215
201
215

FIG. 3

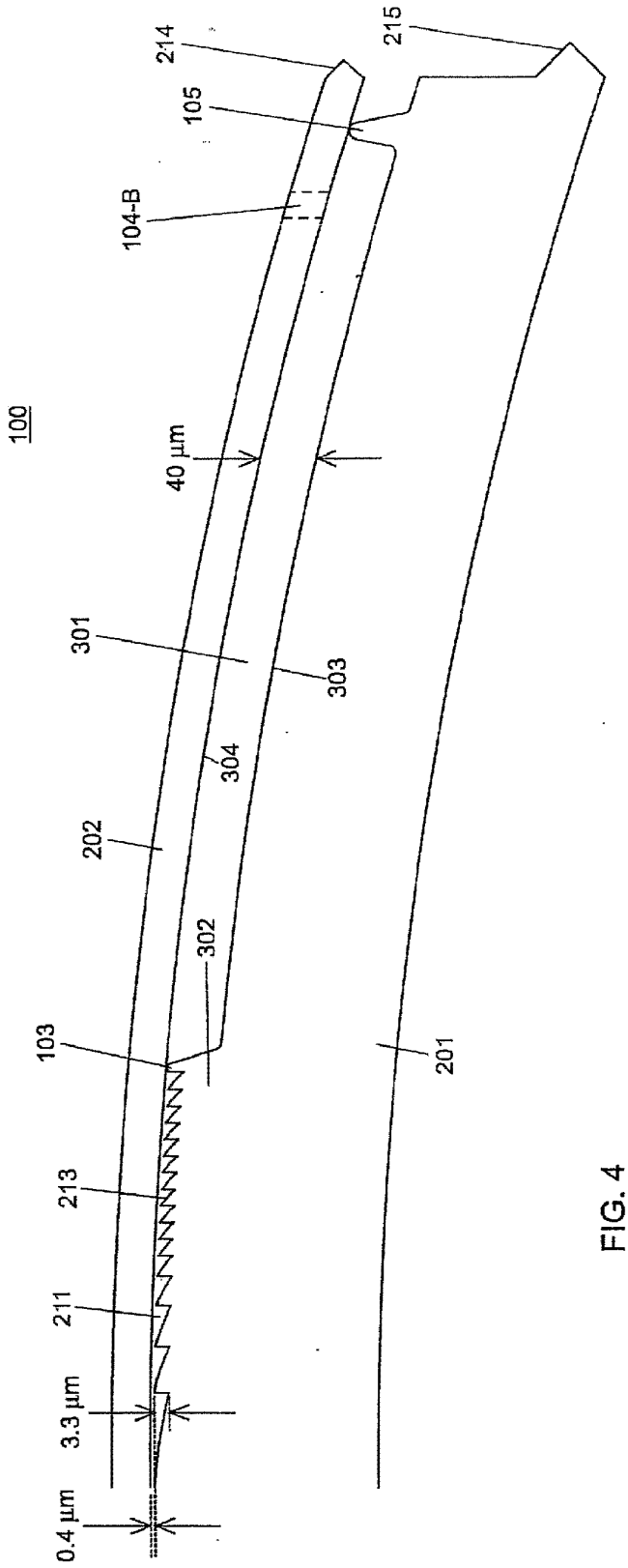

100
214
215
105
104-B
40 µm
301
303
304
202
302
103
201
213
211
3.3 µm
0.4 µm

FIG. 4

FIG. 5

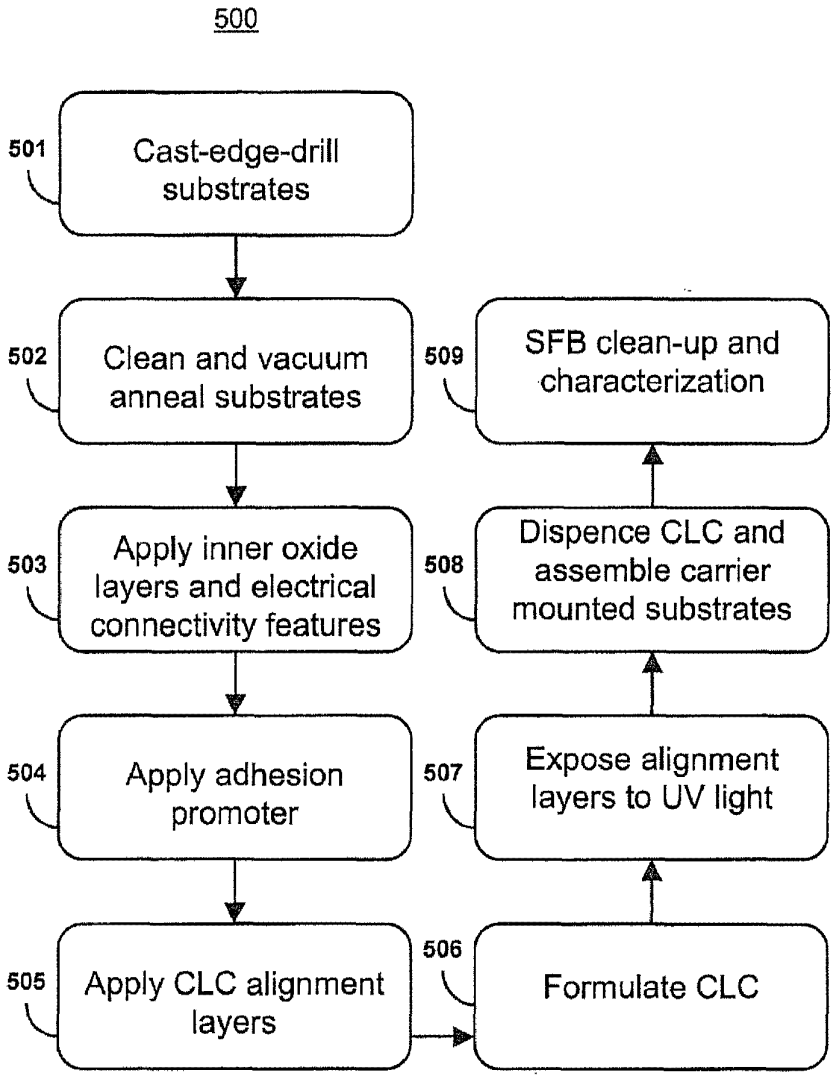

500
501
Cast-edge-drill substrates
502
Clean and vacuum anneal substrates
503
Apply inner oxide layers and electrical connectivity features
504
Apply adhesion promoter
505
Apply CLC alignment layers
506
Formulate CLC
507
Expose alignment layers to UV light
508
Dispence CLC and assemble carrier mounted substrates
509
SFB clean-up and characterization

FIG. 6

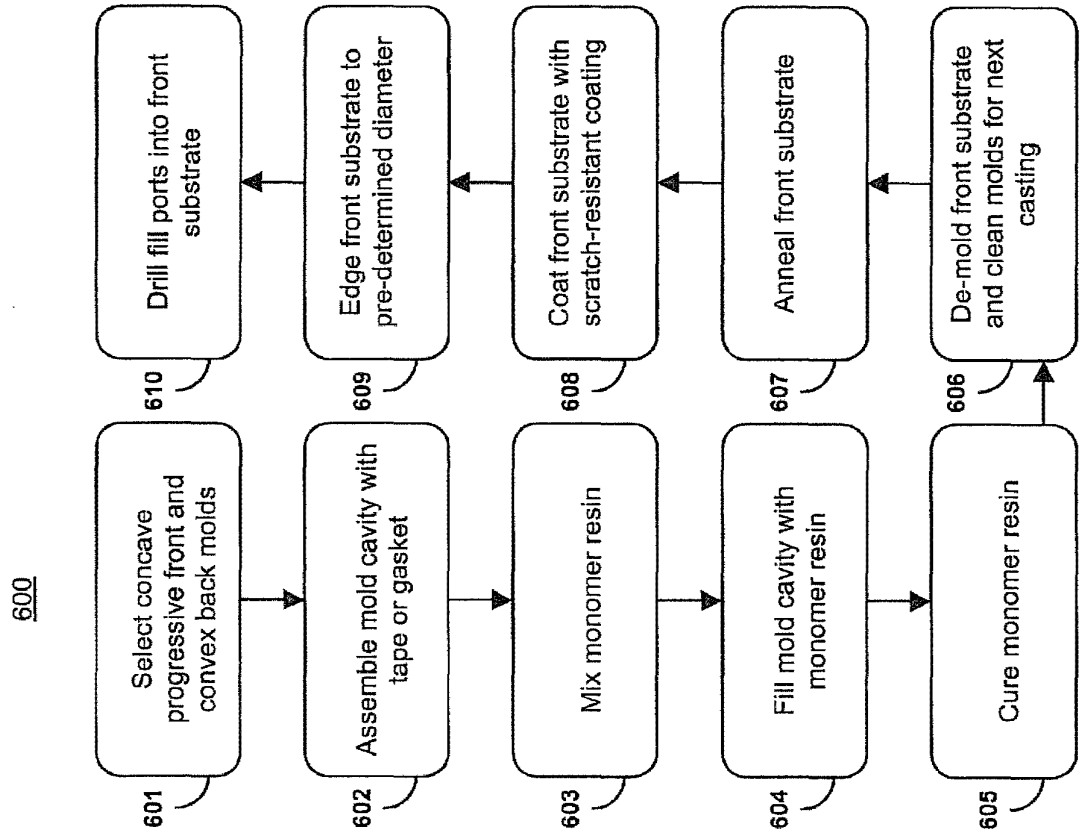

600
Select concave progressive front and convex back molds
601
Assemble mold cavity with tape or gasket
602
Mix monomer resin
603
Fill mold cavity with monomer resin
604
Cure monomer resin
605
De-mold front substrate and clean molds for next casting
606
Anneal front substrate
607
Coat front substrate with scratch-resistant coating
608
Edge front substrate to pre-determined diameter
609
Drill fill ports into front substrate
610

FIG. 7

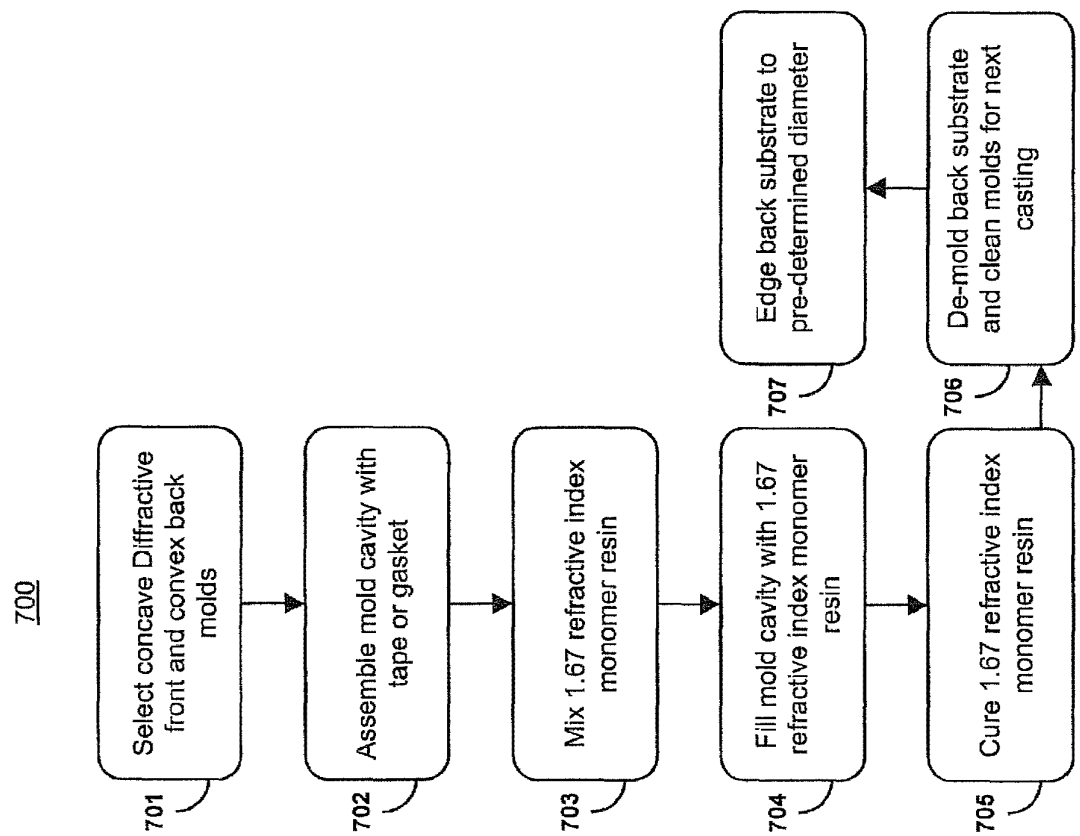

700
Select concave Diffractive front and convex back molds
701
Assemble mold cavity with tape or gasket
702
Mix 1.67 refractive index monomer resin
703
Fill mold cavity with 1.67 refractive index monomer resin
704
Cure 1.67 refractive index monomer resin
705
De-mold back substrate and clean molds for next casting
706
Edge back substrate to pre-determined diameter
707

FIG. 8

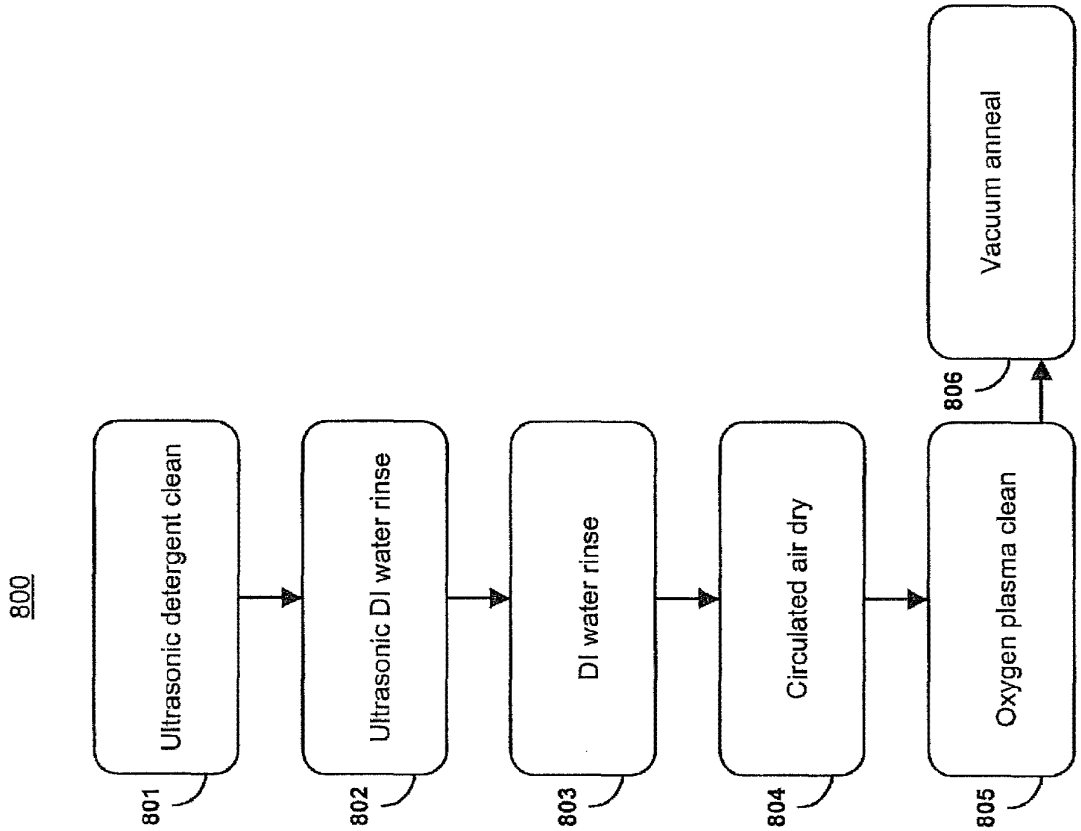
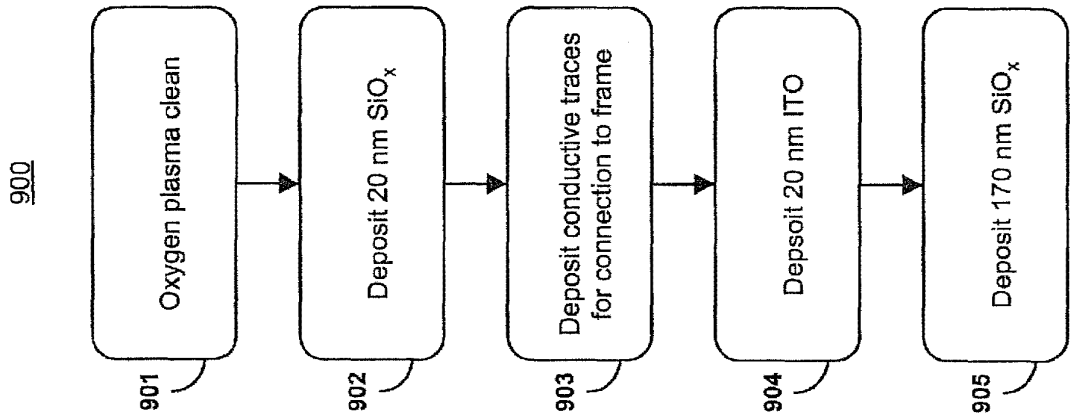

800
Ultrasonic detergent clean
801
Ultrasonic DI water rinse
802
DI water rinse
803
Circulated air dry
804
Oxygen plasma clean
805
806
Vacuum anneal

FIG. 9


900
Oxygen plasma clean
Deposit 20 nm $SiO_x$
Deposit conductive traces for connection to frame
Depsoit 20 nm ITO
Deposit 170 nm $SiO_x$
901
902
903
904
905

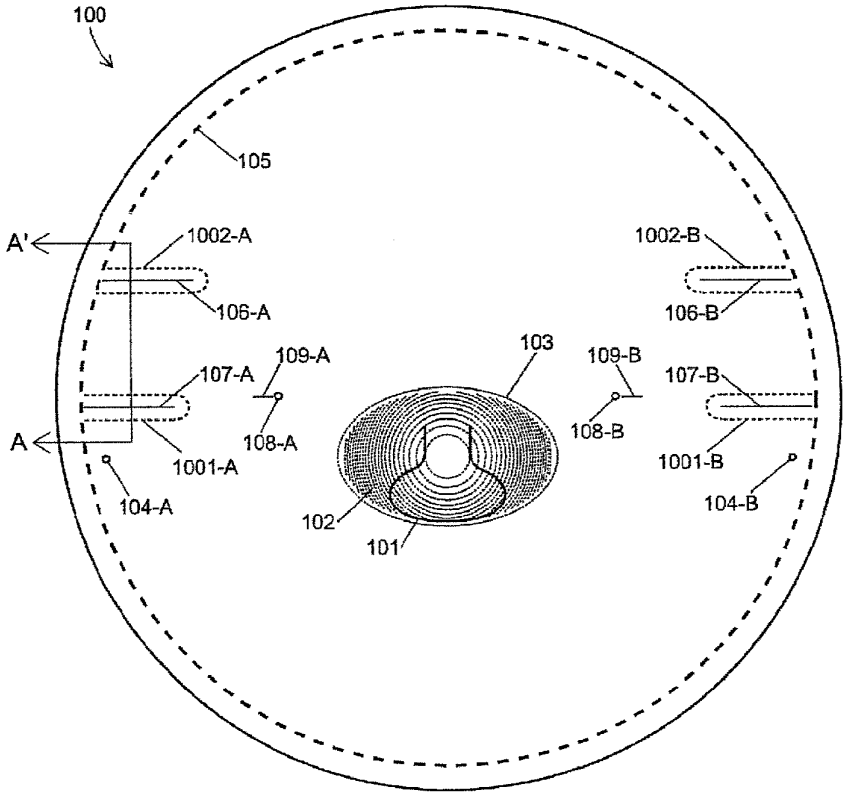



FIG. 10A

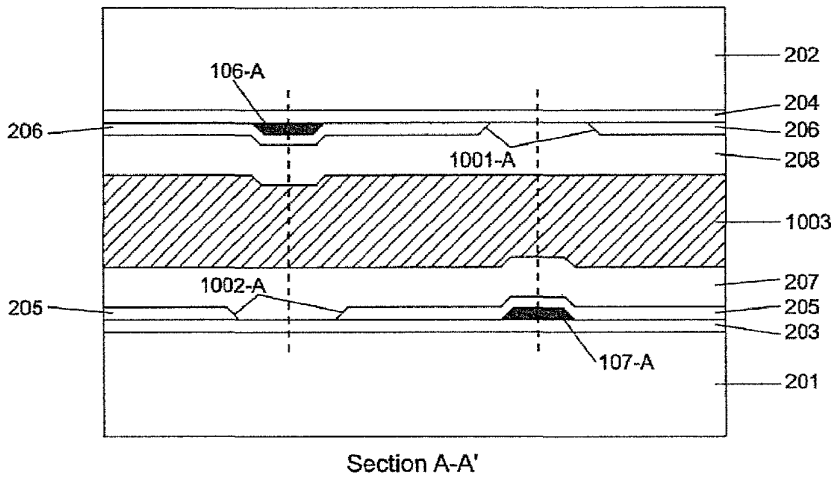



FIG. 10B

FIG. 11

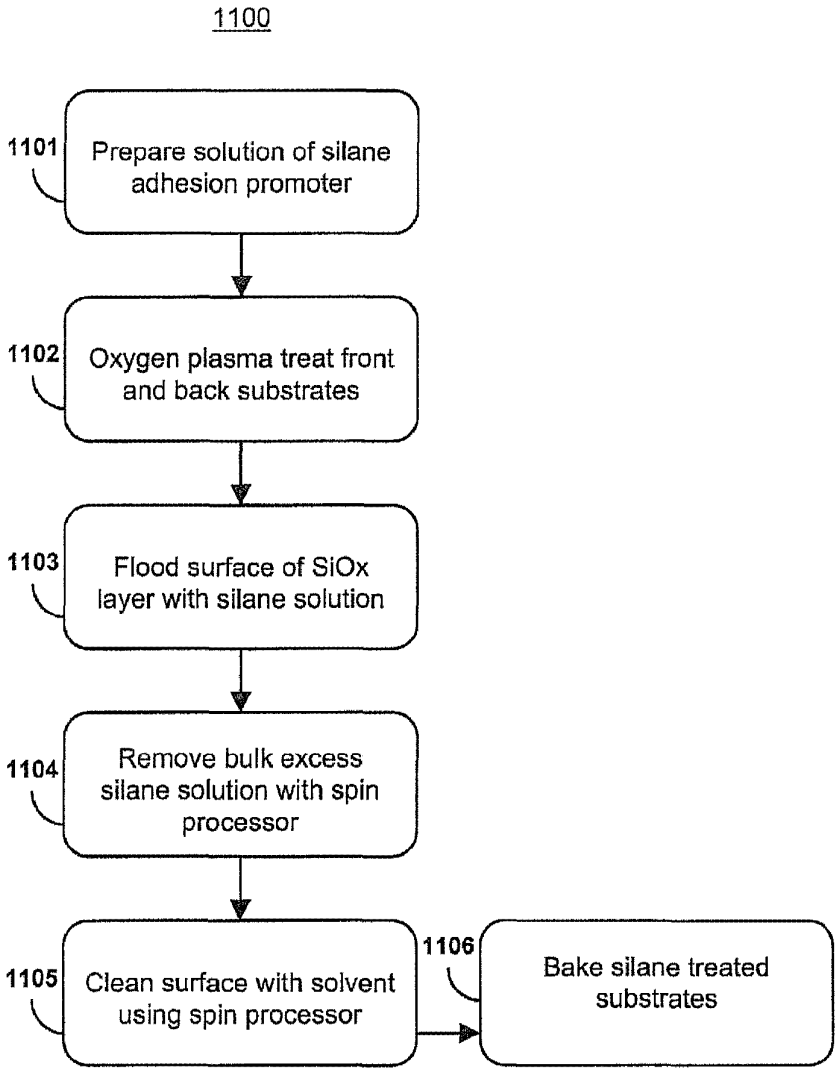

1100
1101
Prepare solution of silane adhesion promoter
1102
Oxygen plasma treat front and back substrates
1103
Flood surface of SiOx layer with silane solution
1104
Remove bulk excess silane solution with spin processor
1105
Clean surface with solvent using spin processor
1106
Bake silane treated substrates

FIG. 12

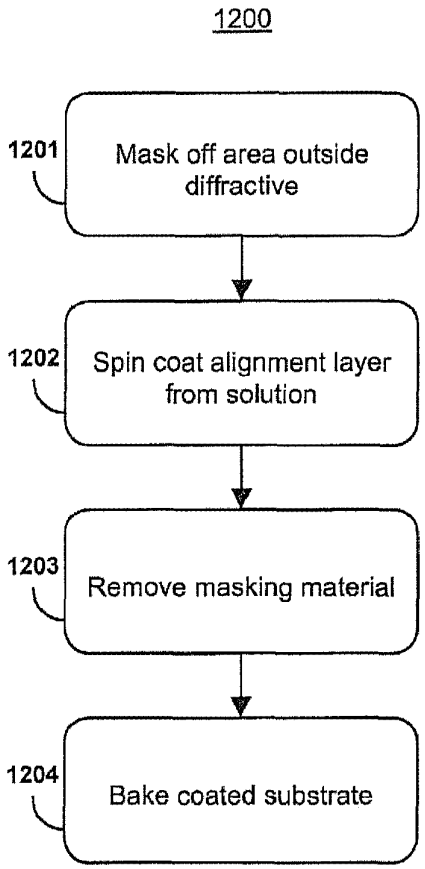
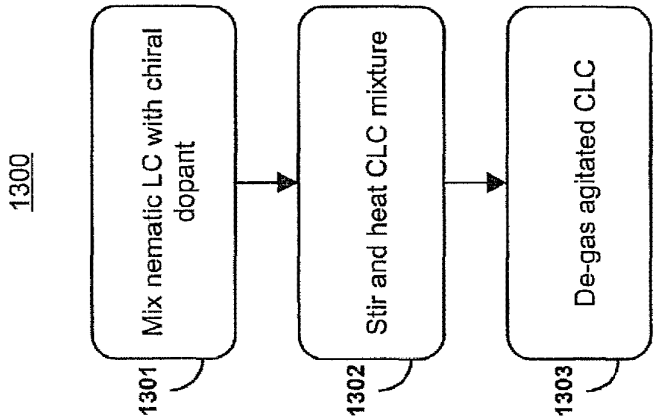

1200
1201
Mask off area outside diffractive
1202
Spin coat alignment layer from solution
1203
Remove masking material
1204
Bake coated substrate

FIG. 13


1300
Mix nematic LC with chiral dopant
1301
Stir and heat CLC mixture
1302
De-gas agitated CLC
1303

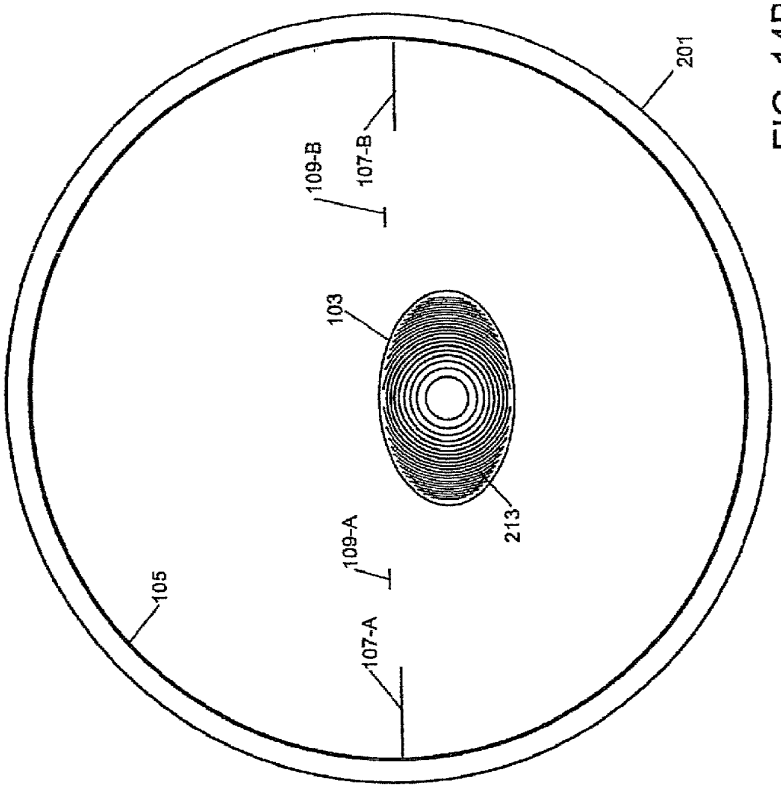



FIG. 14B

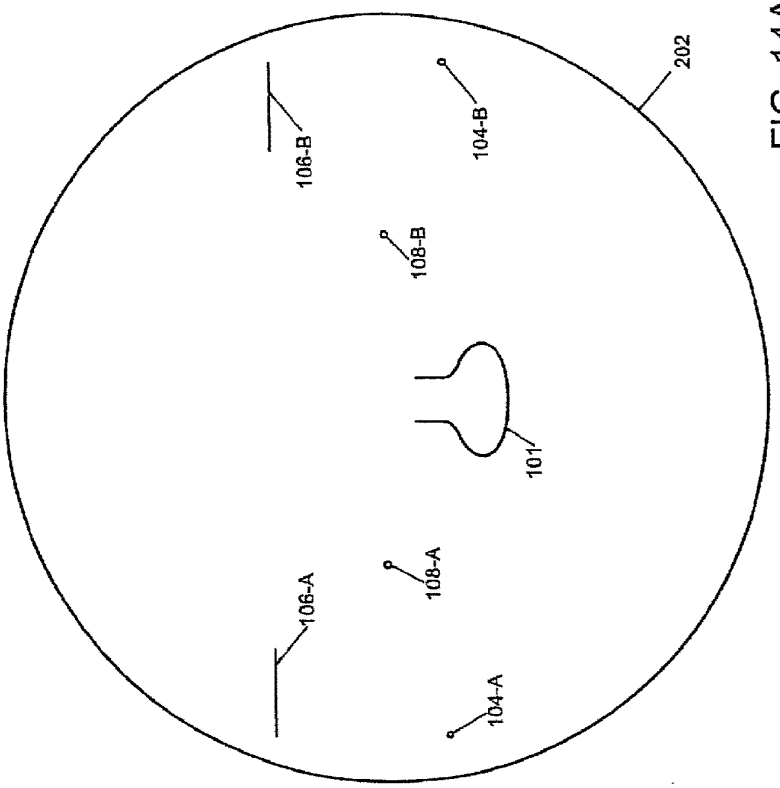



FIG. 14A

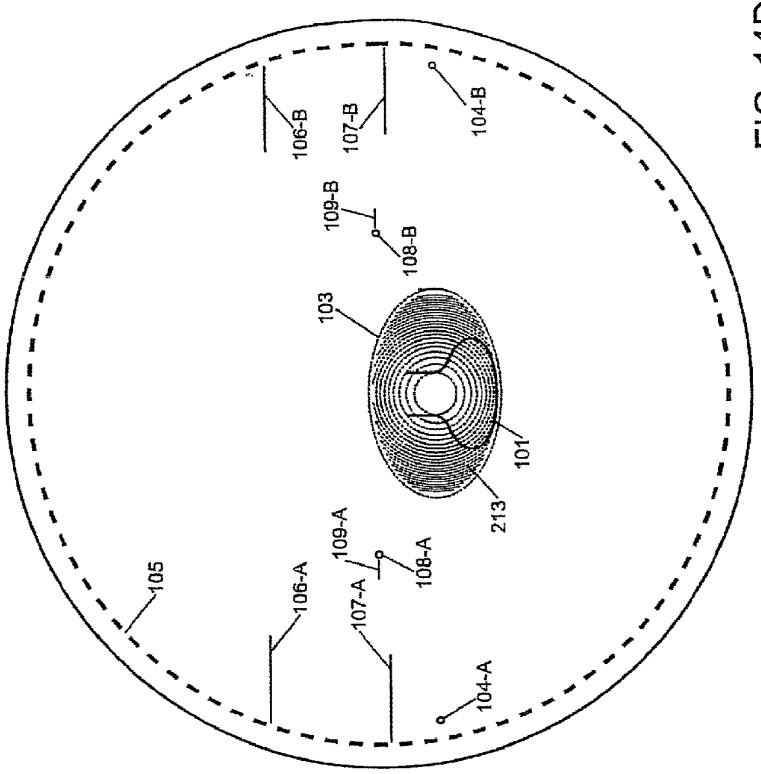



FIG. 14D

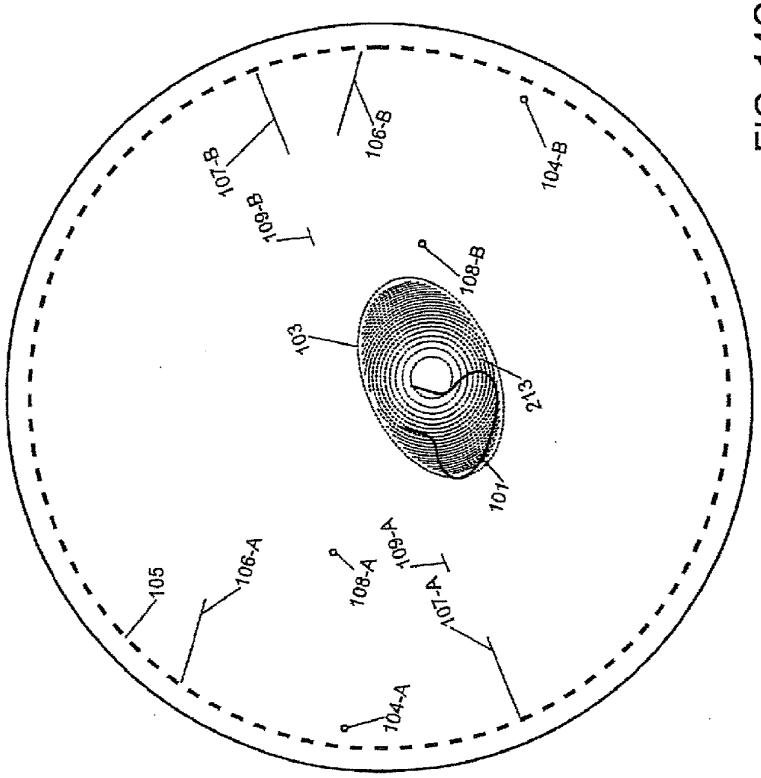



FIG. 14C

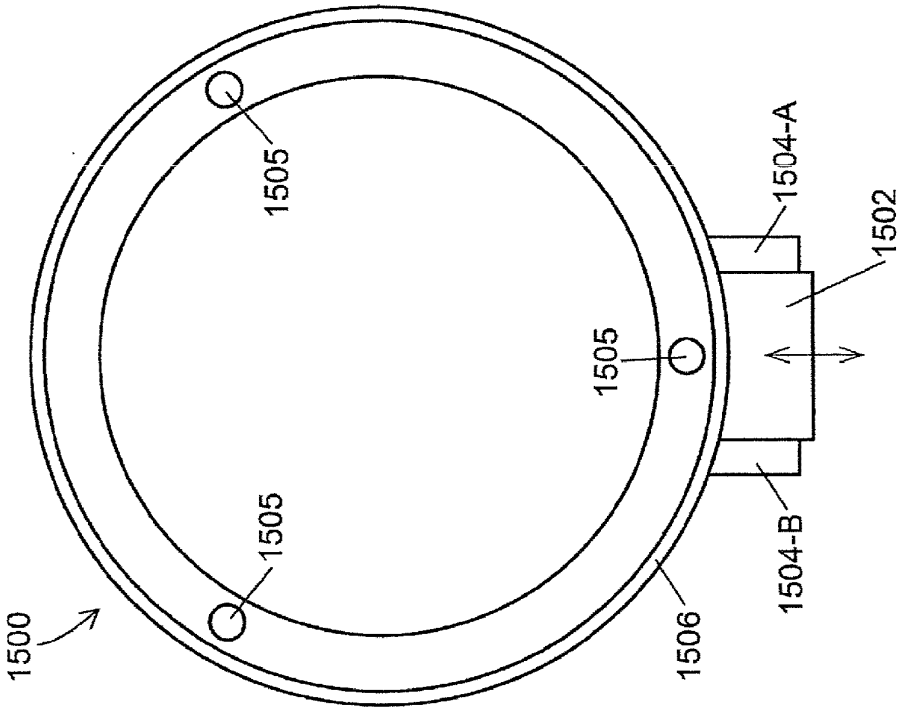



FIG. 15B

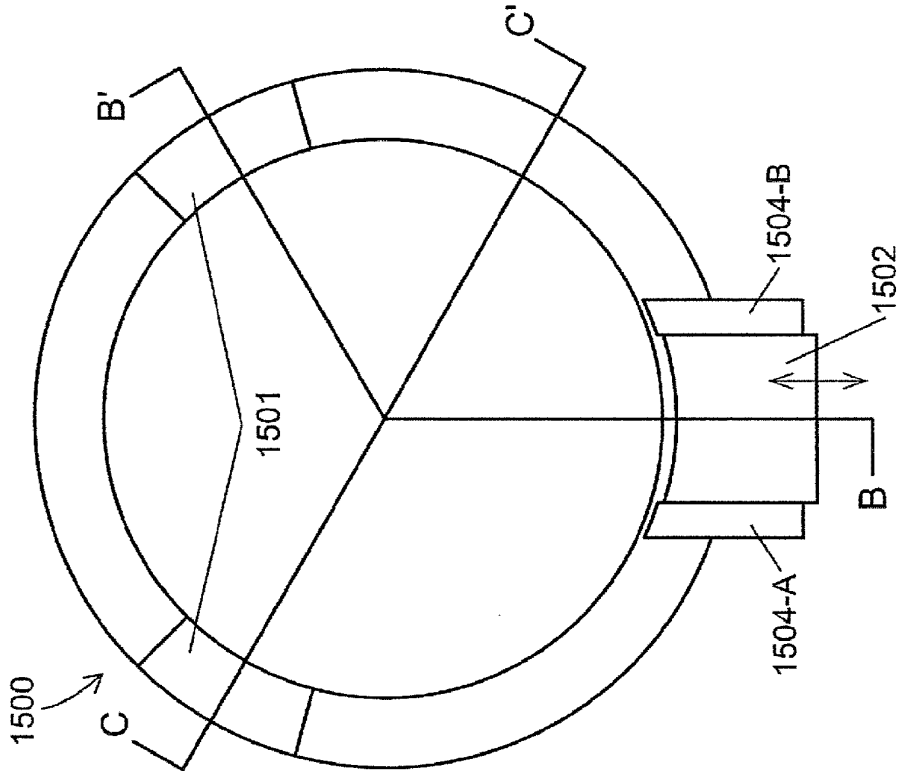



FIG. 15A

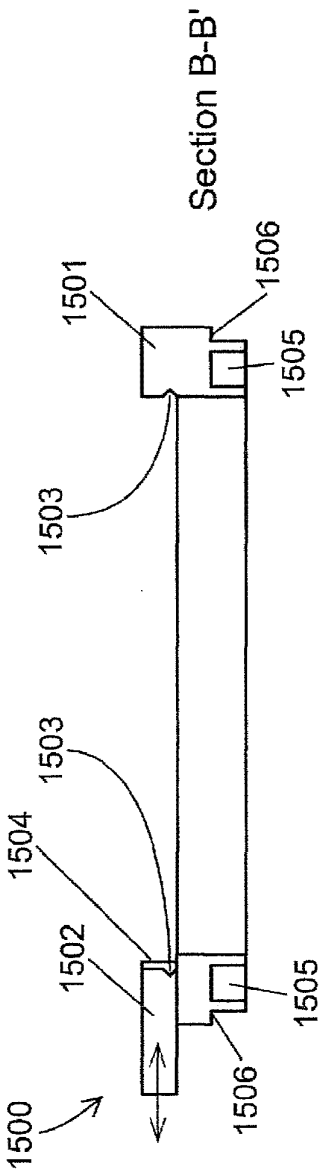



FIG. 15C

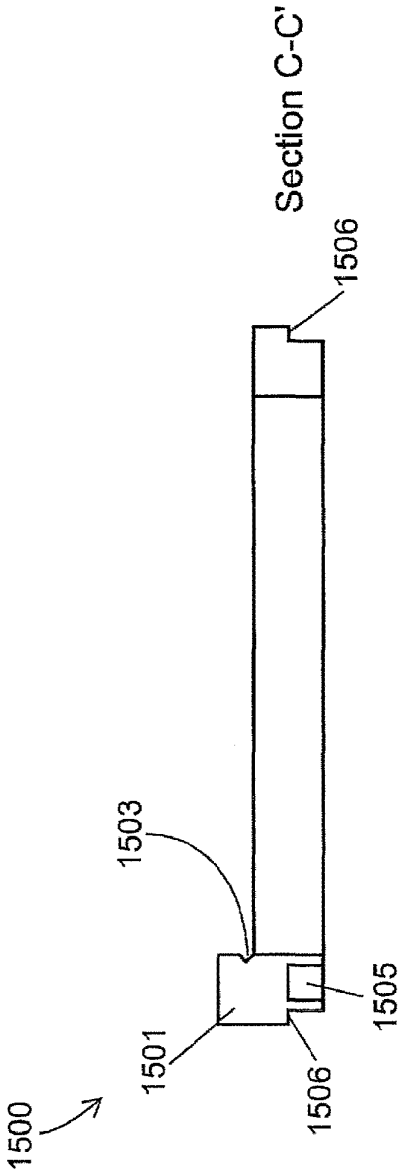



FIG. 15D

FIG. 16

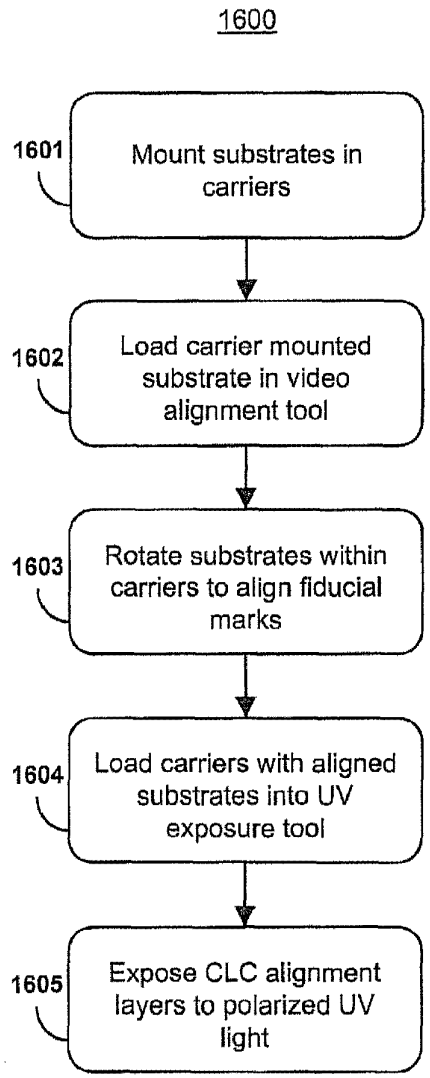
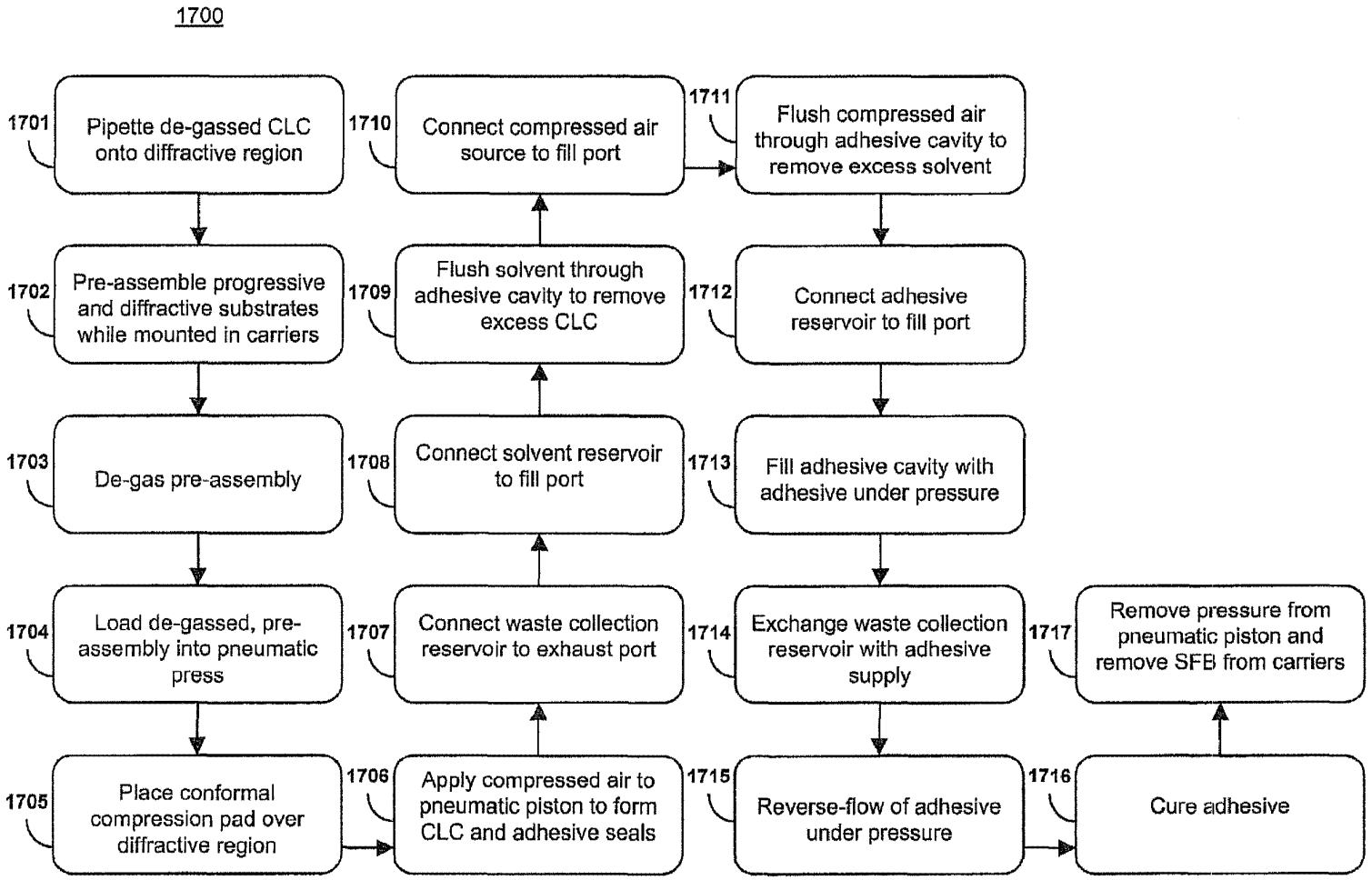

1600
1601
Mount substrates in carriers
1602
Load carrier mounted substrate in video alignment tool
1603
Rotate substrates within carriers to align fiducial marks
1604
Load carriers with aligned substrates into UV exposure tool
1605
Expose CLC alignment layers to polarized UV light

FIG. 17


1700
1701
Pipette de-gassed CLC onto diffractive region
1702
Pre-assemble progressive and diffractive substrates while mounted in carriers
1703
De-gas pre-assembly
1704
Load de-gassed, pre-assembly into pneumatic press
1705
Place conformal compression pad over diffractive region
1706
Apply compressed air to pneumatic piston to form CLC and adhesive seals
1707
Connect waste collection reservoir to exhaust port
1708
Connect solvent reservoir to fill port
1709
Flush solvent through adhesive cavity to remove excess CLC
1710
Connect compressed air source to fill port
1711
Flush compressed air through adhesive cavity to remove excess solvent
1712
Connect adhesive reservoir to fill port
1713
Fill adhesive cavity with adhesive under pressure
1714
Exchange waste collection reservoir with adhesive supply
1715
Reverse-flow of adhesive under pressure
1716
Cure adhesive
1717
Remove pressure from pneumatic piston and remove SFB from carriers

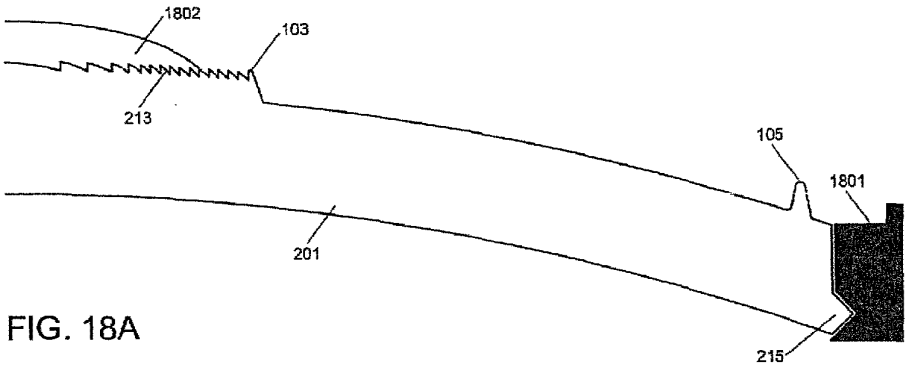



FIG. 18A

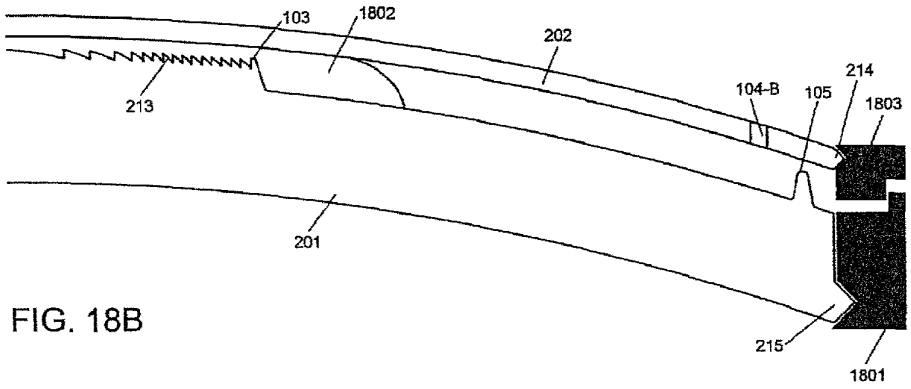



FIG. 18B

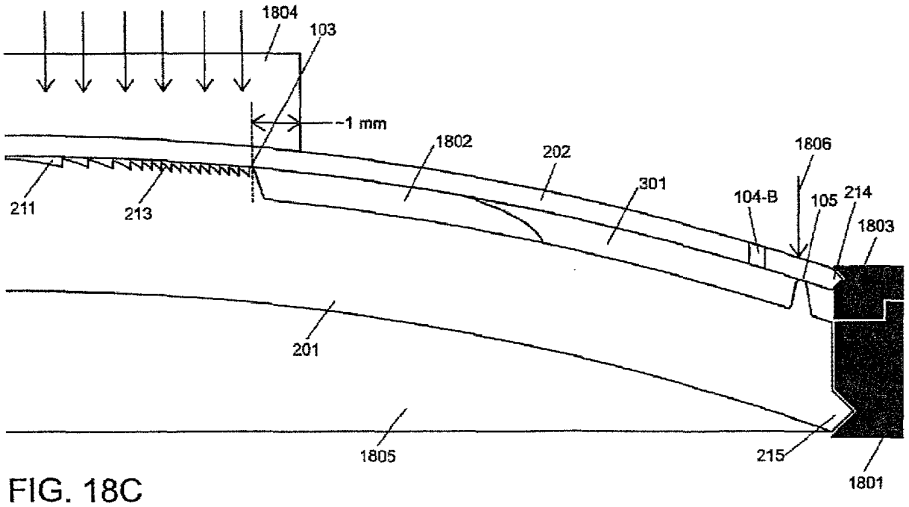



FIG. 18C

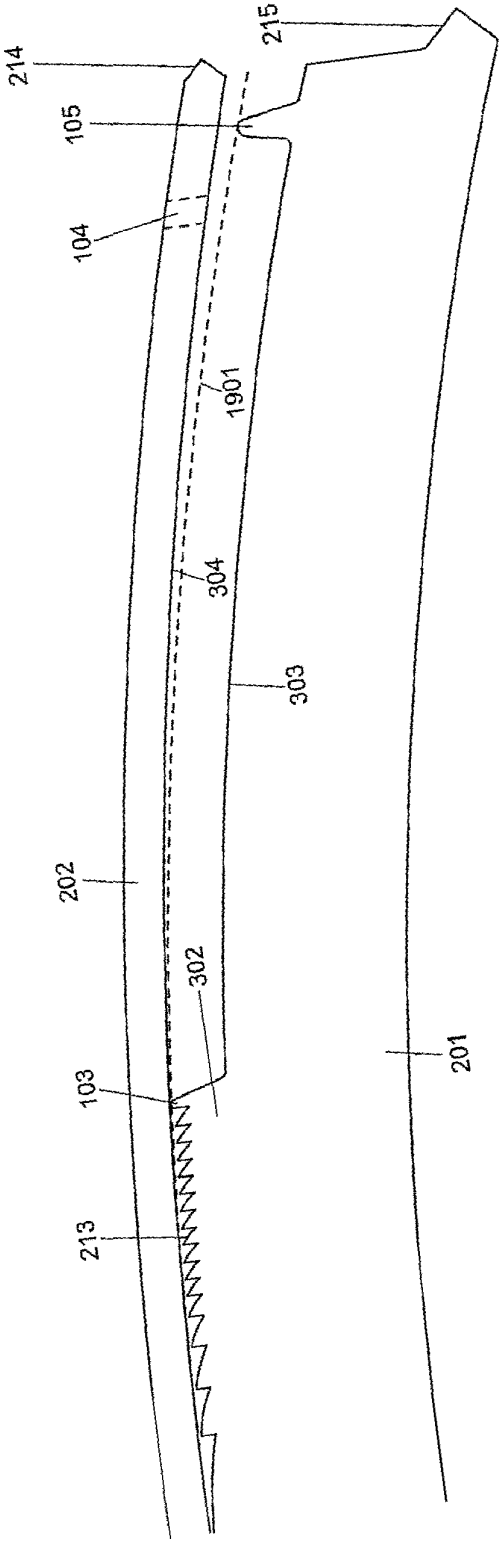



FIG. 19

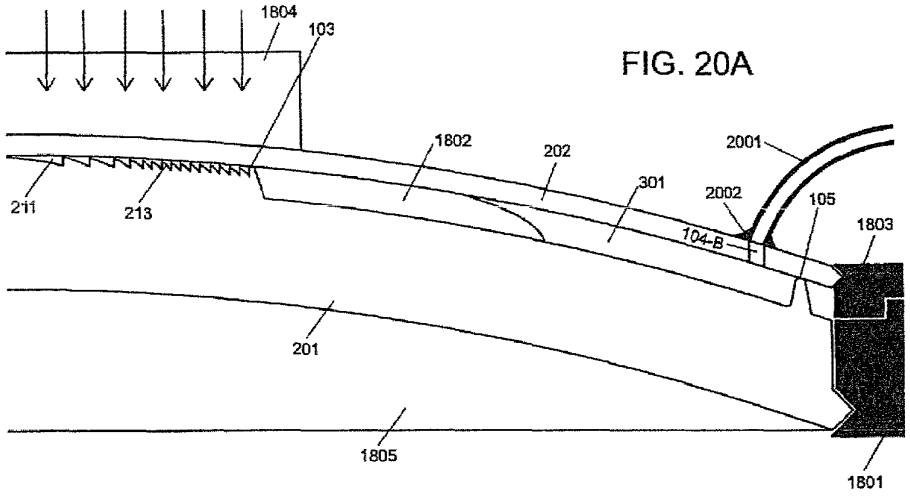



FIG. 20A

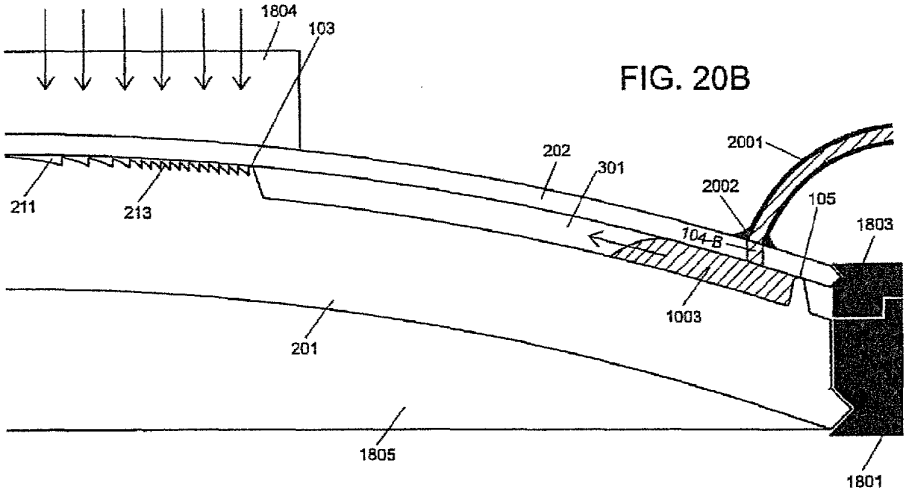



FIG. 20B

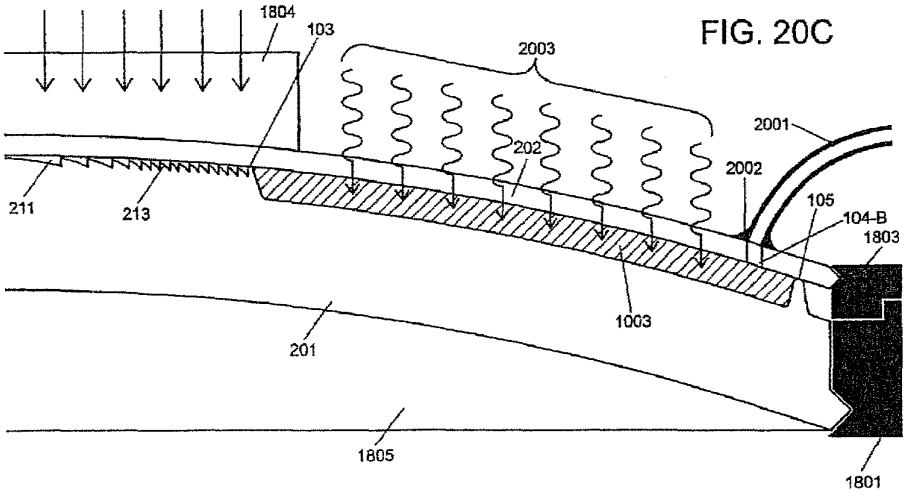



FIG. 20C

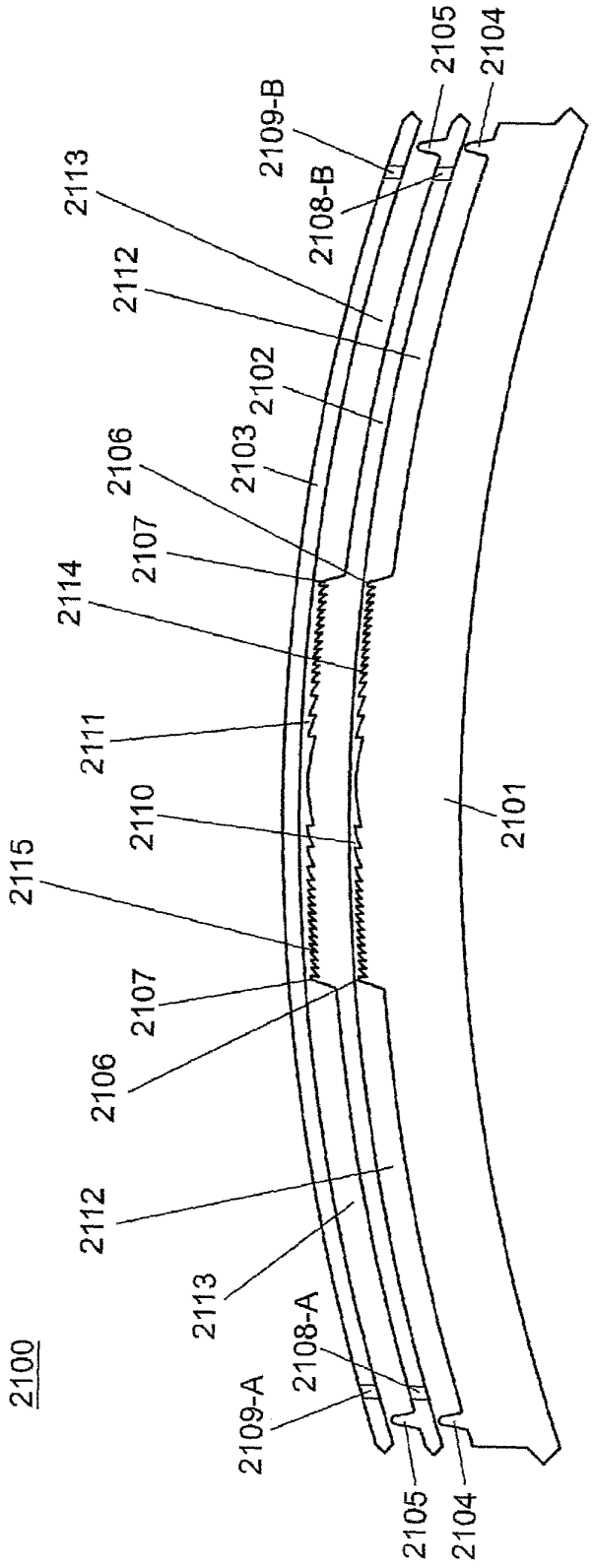

2100
2101
2102
2103
2104
2105
2106
2107
2108-A
2108-B
2109-A
2109-B
2110
2111
2112
2113
2114
2115

FIG. 21

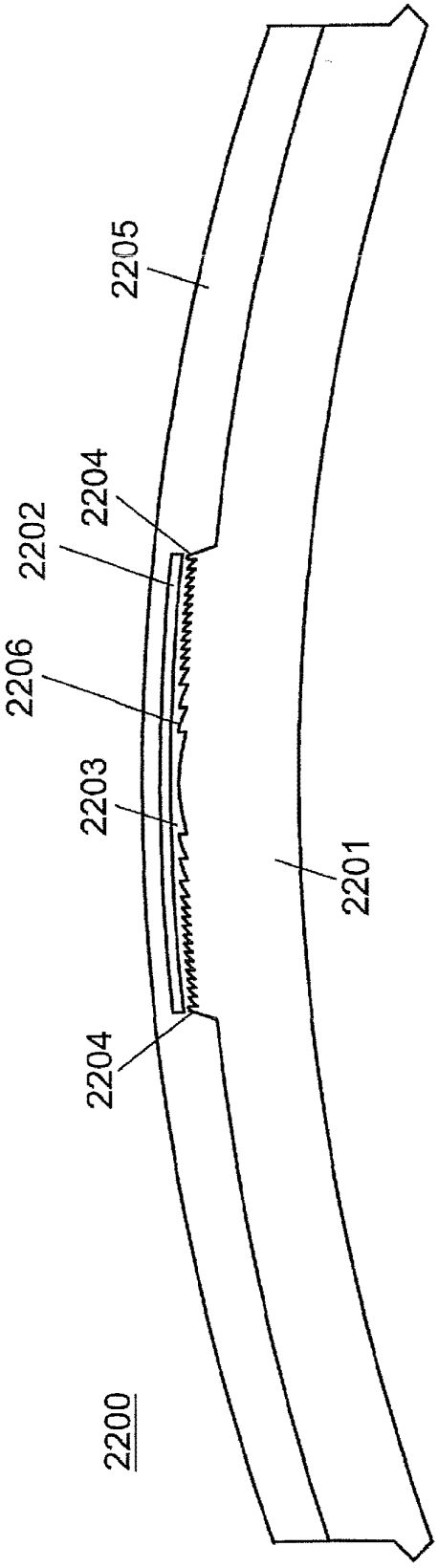



FIG. 22

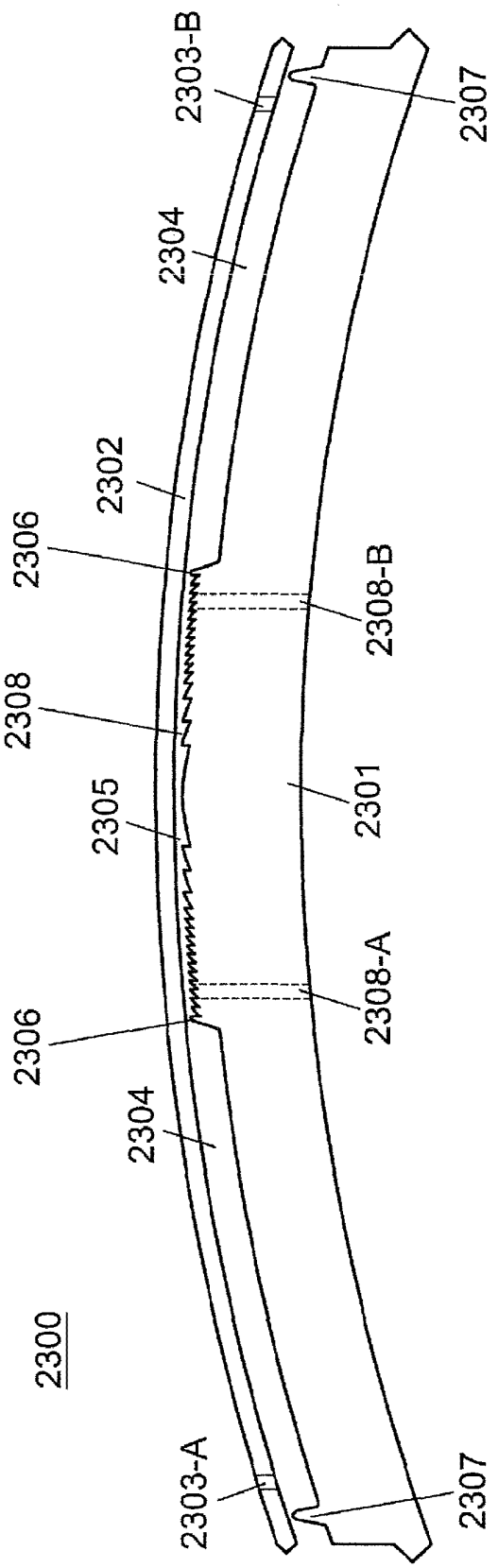
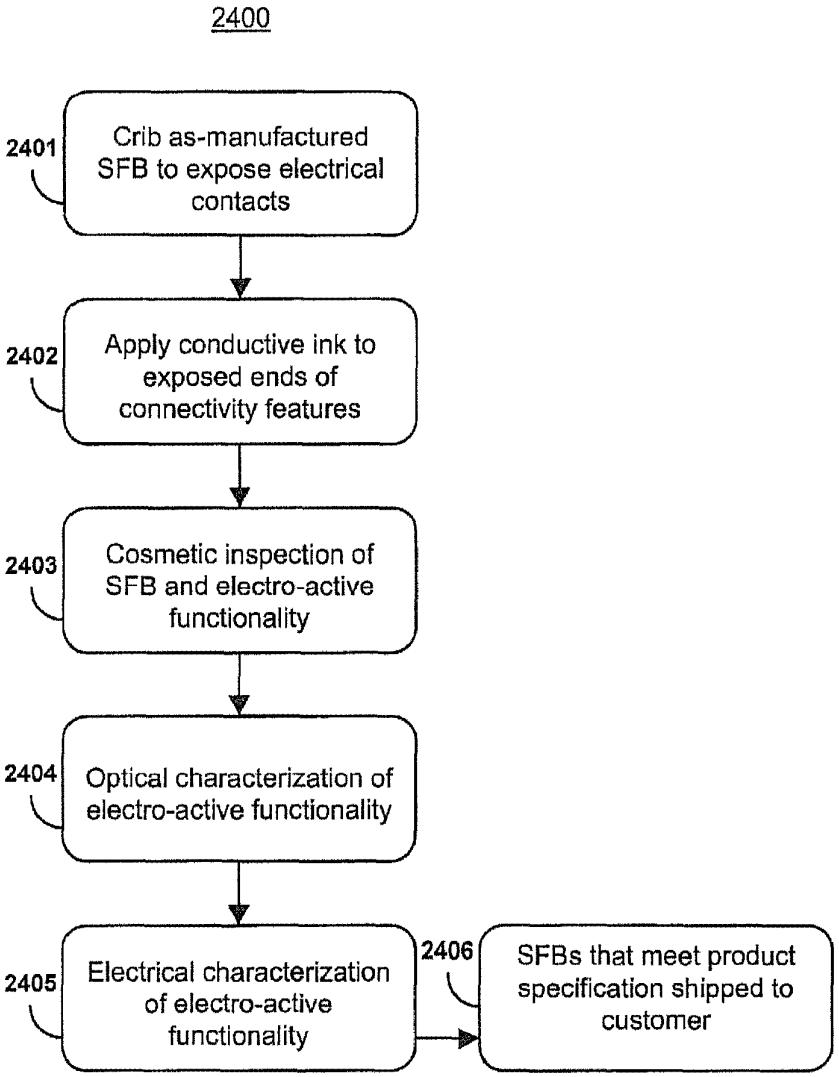

2303-B
2307
2304
2302
2306
2308-B
2308
2305
2301
2306
2308-A
2304
2300
2303-A
2307

FIG. 23

FIG. 24


2400
2401
Crib as-manufactured SFB to expose electrical contacts
2402
Apply conductive ink to exposed ends of connectivity features
2403
Cosmetic inspection of SFB and electro-active functionality
2404
Optical characterization of electro-active functionality
2405
Electrical characterization of electro-active functionality
2406
SFBs that meet product specification shipped to customer

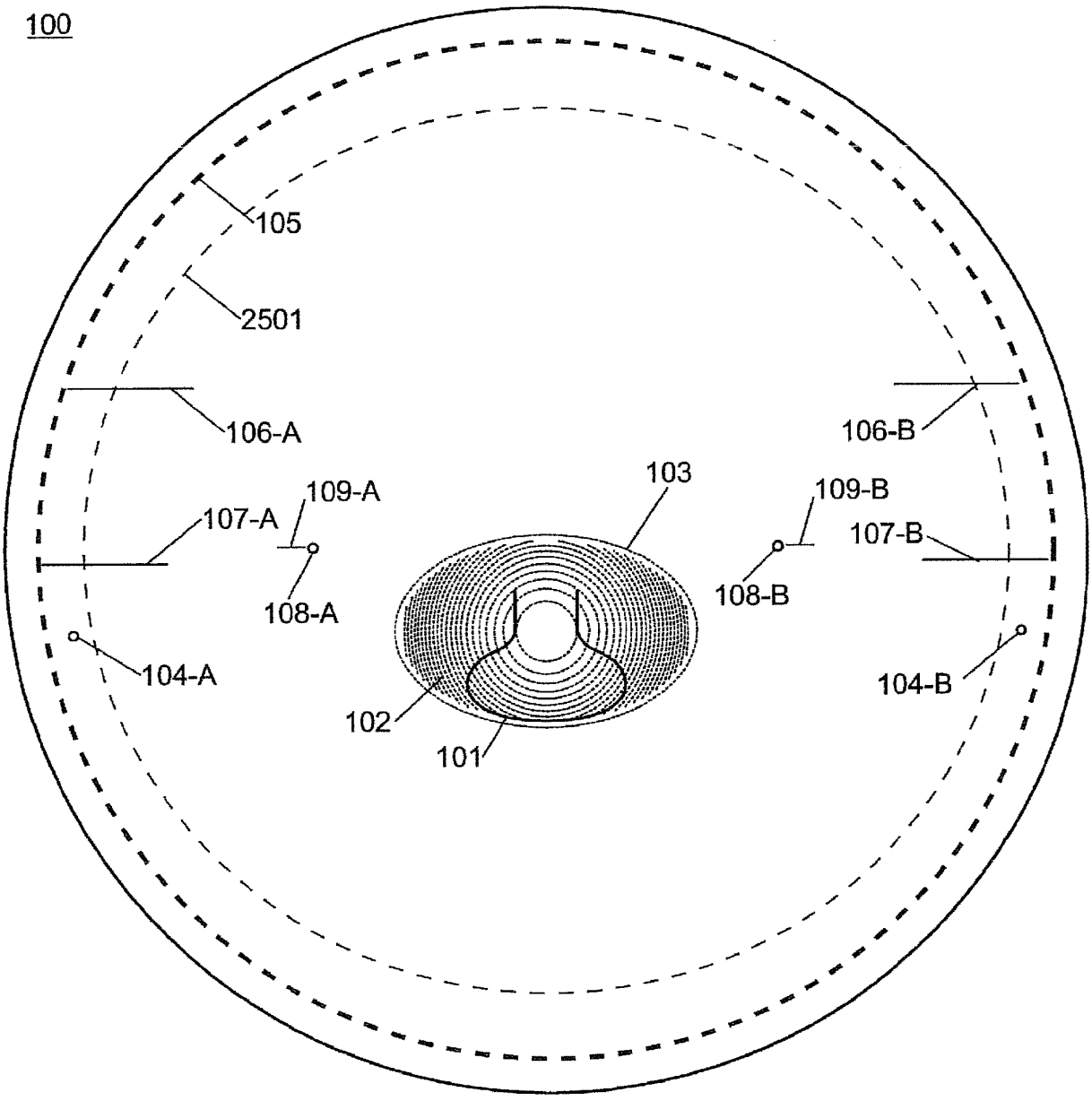

100
105
2501
106-A
106-B
103
109-A
109-B
107-A
107-B
108-A
108-B
104-A
104-B
102
101

FIG. 25

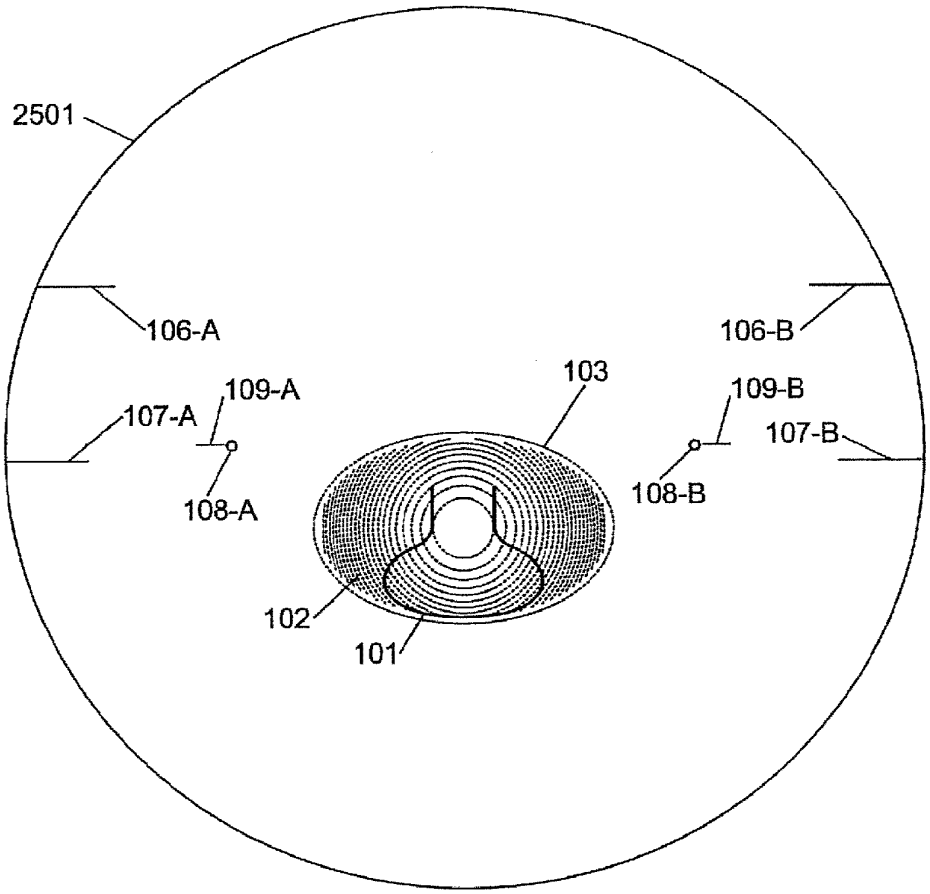



FIG. 26A

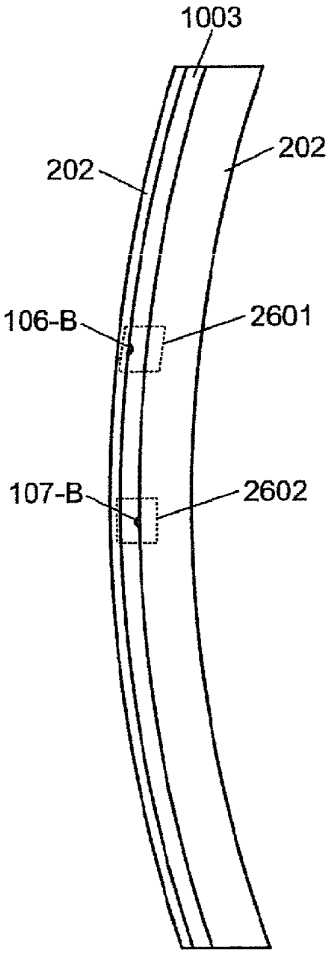



FIG. 26B

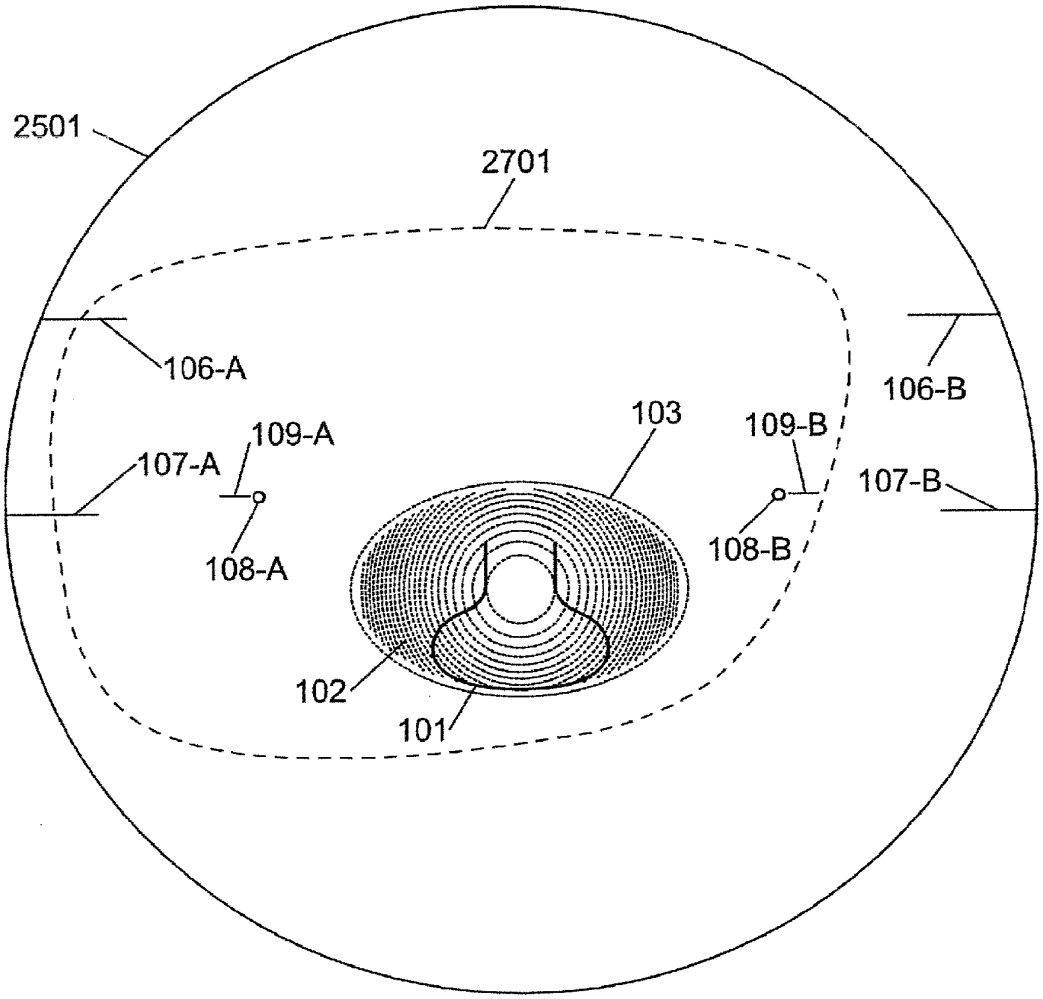



FIG. 27

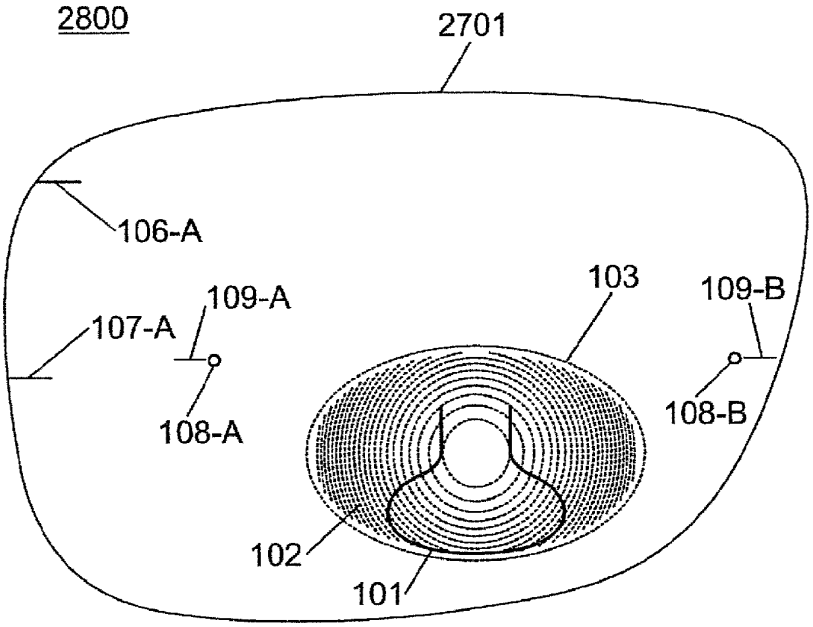



FIG. 28

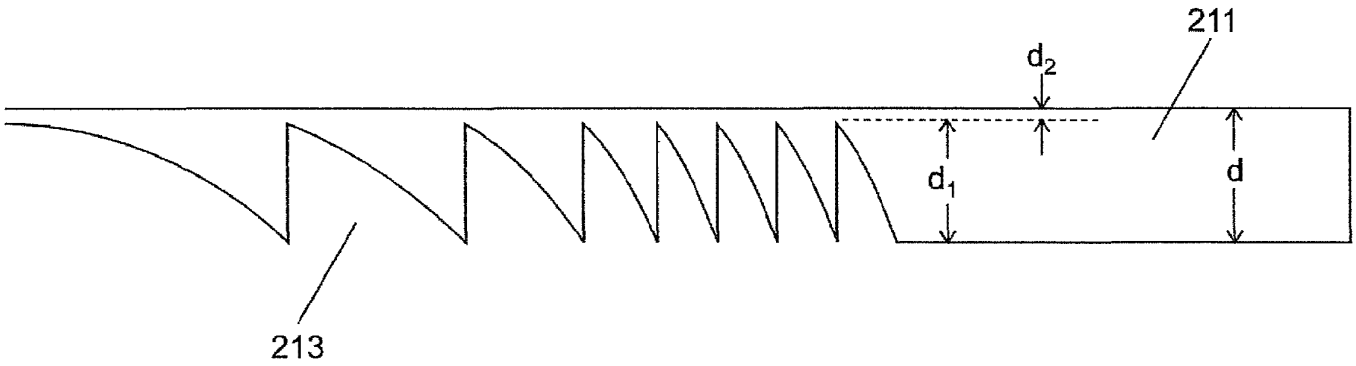



FIG. 29

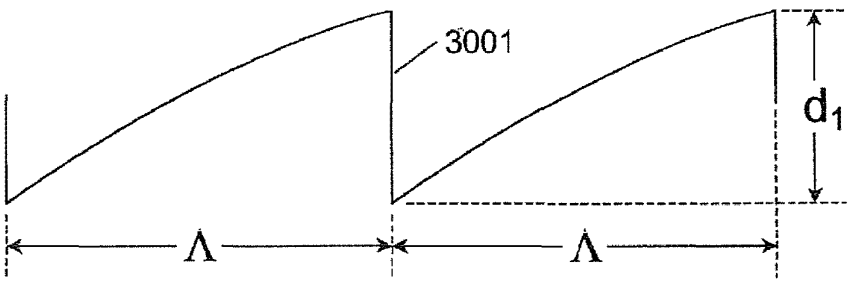



FIG. 30A

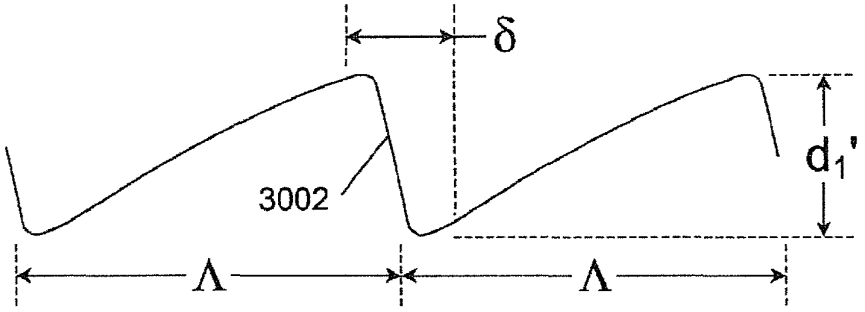



FIG. 30B

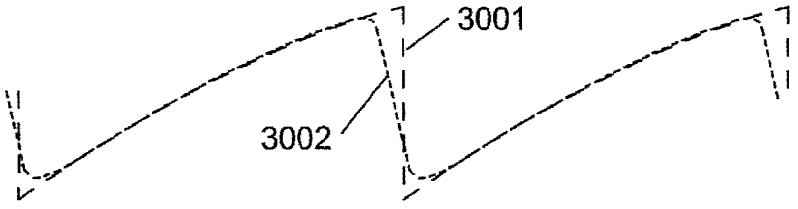



FIG. 30C

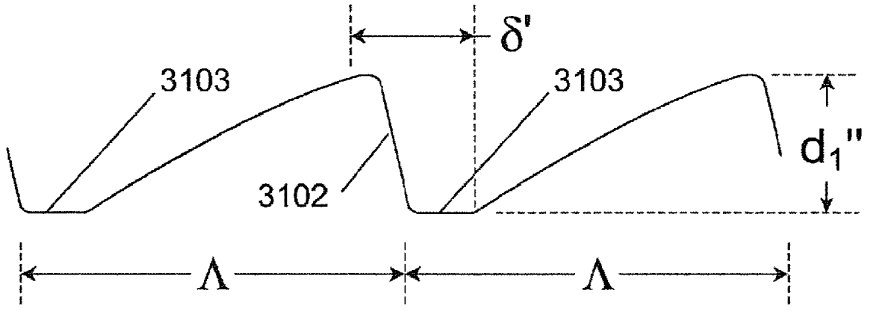



FIG. 31A

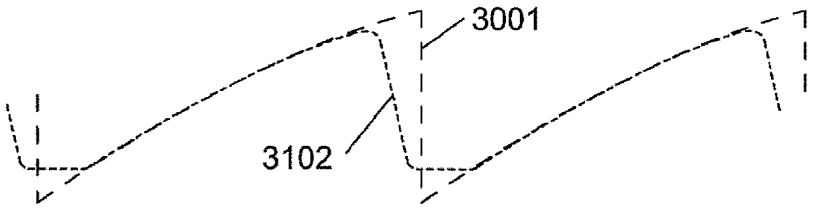



FIG. 31B

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 09/40300

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G02C 7/02 (2009.01)
USPC - 351/159
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)
IPC(8) - G02C 7/02 (2009.01)
USPC - 351/159

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 359/558; 351/168

*Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)*
PubWEST (PGPB,USPT,EPAB,JPAB), Google
Search Terms Used: lens, substrate, layer, strata, stratum, diffract, electroactive, electro-active, EAP, seal, close, enclose, shut, secure, adhesive, glue, adhere, cavity, chamber, recess, radius, radii, curve, sphere, electric, contact, electrode, focus, focal, optic, power, port,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2007/0216862 A1 (BLUM et al.) 20 September 2007 (20.09.2007) Fig. 11; Para [0092], [0105], [0108]-[0109], [0125]-[0128], [0154]-[0156], [0161]-[0164], [0167], [0173], [0176]-[0177], [0186]-[0187], [0191], [0217]-[0219], & [0221]-[0222] | 1-21 |
| A | US 2006/0126698 A1 (BLUM et al.) 15 June 2006 (15.06.2006) Fig. 3 & 7A-8C; Para [0037]-[0040], [0060], [0076]-[0077] & [0085] | 1-21 |
| A | US 2007/0242173 A1 (BLUM et al.) 18 October 2007 (18.10.2007) Abstract; Fig. 1-6; Para [0042]-[0049], [0054]-[0062] & [0067]-[0069], [0072]-[0081] & [0089]-[0100] | 1-21 |

☐ Further documents are listed in the continuation of Box C. ☐

* 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 |
|---|---|
| 22 May 2009 (22.05.2009) | 04 JUN 2009 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

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

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 061 002**
**A1**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 82101325.7

(51) Int. Cl.³: G 02 C 1/06

(22) Date of filing: 20.02.82

(30) Priority: 05.03.81 IT 3062881 U

(43) Date of publication of application:
29.09.82 Bulletin 82/39

(84) Designated Contracting States:
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(54) **Metal rim particularly useful in eyeglass frames.**

(57) The eyeglass rim (2) comprises, on the inside thereof and along the engagement line of the lens (3), a continuous half-closed groove (4) wherein a rib (8) of a plastics material mating gasket (7) is force fitted, this latter being further provided with two wings (9, 10) extending therefrom to a V-like configuration and being arranged to bear on the rim (2) to provide a lens-bearing seat (11).

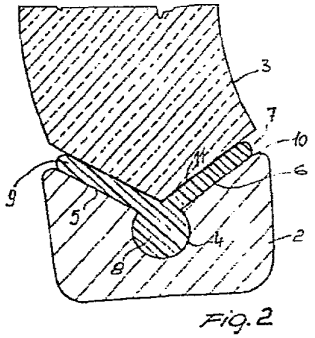


Fig. 2

EP 0 061 002 A1

This invention relates to a metal rim particularly useful in eyeglass frames.

Metal eyeglass frames conventionally include rims formed with a continuous groove along their inside center region, wherein the edges of the lenses are accommodated during the assembling thereof.

Such a structure is liable to lead to the lenses being splintered where they contact the metal rims under higher load conditions, or in the event of incidental shocks.

A primary object of this invention is to provide an eyeglass rim which can obviate the above problems.

Another object of the invention is to provide an eyeglass rim, wherein the lens no longer contacts the metal directly.

A further object is to provide a rim which can facilitate the insertion of the lens therein.

Yet another object of this invention is to provide an eyeglass rim of moderate cost.

These and other objects, such as will be apparent hereinafter, are achieved by a metal rim particularly for eyeglass frames, characterized in that it comprises, on the inside thereof and along the line or direction of lens engagement, a continuous half-closed groove, into said groove there being force fitted a rib of a plastics material mating gasket, said gasket being further provided with two wings or flanges

extending therefrom according to a concave configuration in cross-section and being arranged to bear onto said rim to constitute a lens-bearing seat.

Further features and advantages of the invention will be more apparent from the following detailed description of a preferred embodiment, given herein by way of example and not of limitation, and illustrated in the accompanying drawing, where:

Figure 1 is a general view of eyeglasses having a metal frame; and

Figure 2 is an enlarged scale sectional view taken along the line II-II of Figure 1.

With reference to the drawing figures, an eyeglass frame 1, as indicated, comprises two metal rims 2 which serve the function of holding the lenses 3.

The metal rim 2 is provided on its inside center portion with a half-open continuous groove 4 of slightly greater than semicircular cross-section, on either sides whereof are two V-like shoulders, 5 and 6, extending outwards from the opposite edges of the groove 4.

A plastics gasket 7 has a rib 8 of semicircular cross-section adapted for insertion into the groove 4 to a snug fitting, and two wings or flanges, 9 and 10, which extend V-like from said rib and bear onto the shoulders 5,6 to define a seat 11, wherein the V-shaped edge of the lens 3 can be fitted.

Instead of a V-shape of the lens edge and the seat 11, modified shapes may be adopted, such as to form generally a concavity.

The gasket 7 is formed by extrusion and then cut to length such that it can be inserted into the rim and span it in its entirety.

Instead of semicircular cross-section for the groove 4 and the rib modified cross-section contours may be used, such as an arrow-like one, provided that snug fitting or shape engagement relationship between the rib and the groove is obtained.

The lens is no longer held in contact with the frame metal, thus avoiding all risks of splintering or breakage and solving the problems encountered conventionally with such eyeglass frames.

The dimensions of the gaskets are so minimal as to be unobtrusive and not to affect the eyeglasses appearance.

The gasket is firmly seated in the rim, and cannot be incidentally dislodged in handling the eyeglass frames for storage, nor while being handled for the insertion of the lenses therein.

The gasket is preferably formed from nylon, but other non-rigid plastic materials may be alternatively utilized.

The dimensions may likewise be any selected ones to suit individual requirements.

CLAIMS

1. A metal rim particularly for eyeglass frames, characterized in that it comprises, on the inside thereof and along the line or direction of lens (3) engagement, a continuous half-closed groove (4), into said groove (4) there being force fitted a rib (8) of a plastics material mating gasket (7), said gasket (7) being further provided with two wings or flanges (9, 10) extending therefrom according to a concave configuration in cross-section and being arranged to bear onto said rim (2) to constitute a lens-bearing seat (11).

2. A rim according to Claim 1, characterized in that on either sides of said half-closed groove (4) said rim (2) is formed with two V-shaped shoulders (5, 6).

3. A rim according to one or more of the preceding claims, characterized in that said rib (8) on said gasket (7) is shaped to mate with said groove (4), and in that said wings or flanges (9, 10) of said gasket (7) are arranged to bear on said V-like shoulders (5, 6) of the rim (2).

4. A rim according to one or more of the preceding claims, characterized in that said gasket (7) constitutes the lens-bearing seat (11), thereby the lens (3) is no longer held in contact with the rim metal (2).

5. A rim according to one or more of the preceding claims, characterized in that said gasket (7) is formed from a non-rigid plastics material, preferably nylon.

6. A metal rim particularly for eyeglass frames, substantially as herein described and illustrated.

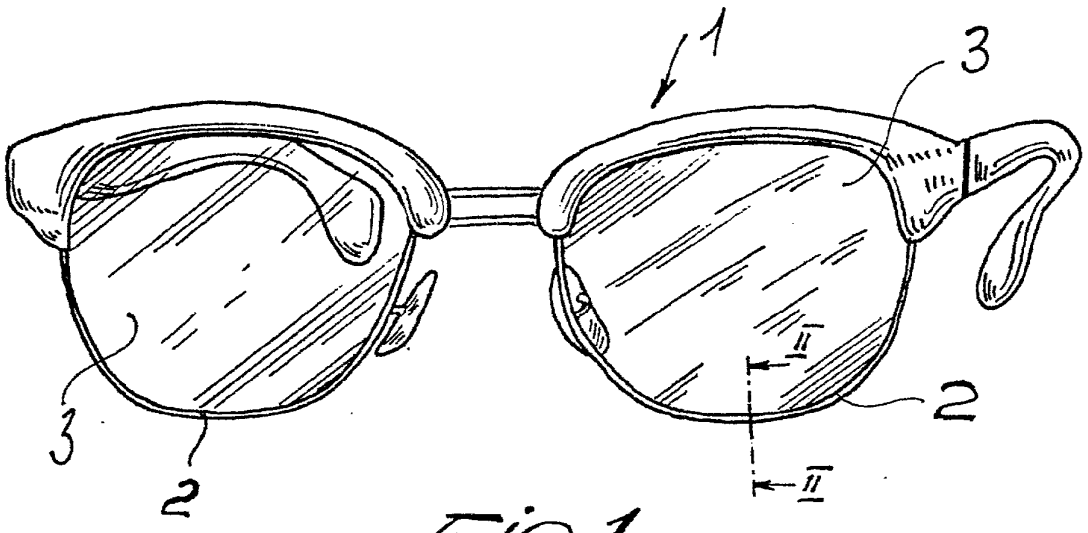



Fig. 1

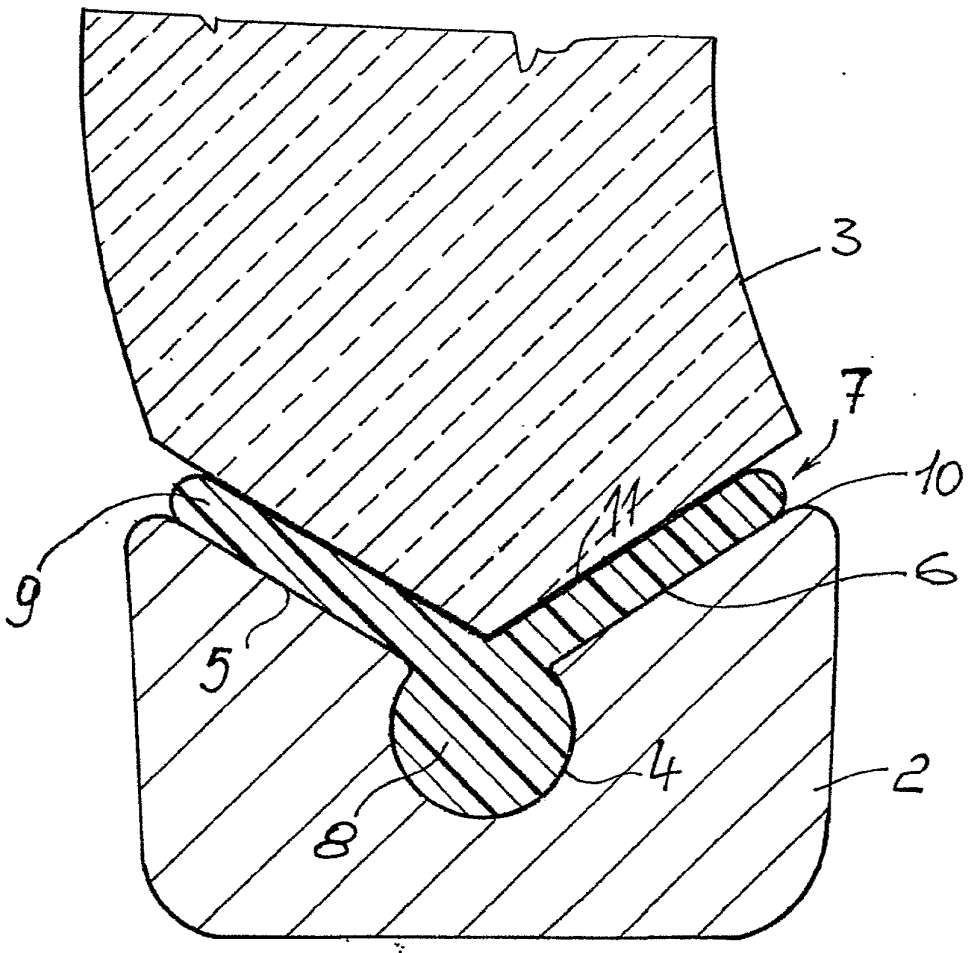



Fig. 2

European Patent Office

0061002

Application number

EP 82 10 1325

# EUROPEAN SEARCH REPORT

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. ³) |
|---|---|---|---|
| X | DE-A-2 039 085 (E.BECK) *Page 2, lines 6-17; claims 1,2; figure 6* | 1-6 | G 02 C 1/06 |
| A | DE-A-3 038 032 (MURAKAMI) *Page 7, lines 19-31; claims 1,5; figure 10* | 1-6 | |
| A | FR-A-1 551 484 (VEYRAT) *Page 2, column 2, lines 8-19; claims 7-9; figure 9* | 1-6 | |

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

G 02 C

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 21-06-1982 | SEIFERT H.U. |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503. 03.82

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2008-083299
(43)Date of publication of application : 10.04.2008

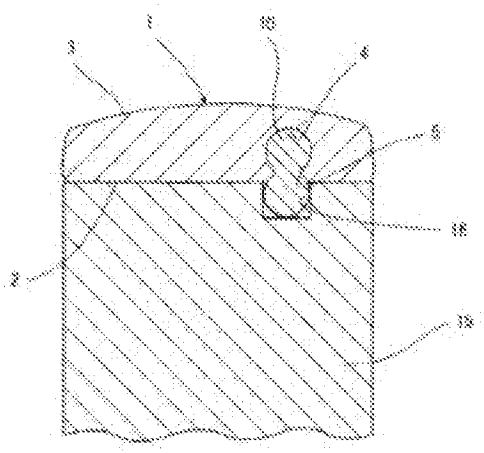
(51)Int.Cl. *G02C 1/04 (2006.01)*

(21)Application number : 2006-262089
(22)Date of filing : 27.09.2006

(71)Applicant : BIITO:KK
(72)Inventor : HAGIWARA TSUTOMU

## (54) STRUCTURE FOR LENS MOUNTING PART OF SPECTACLE FRAME, AND LENS MOUNTING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide the structure for lens mounts of spectacle frames which allow mounting of lenses for vision correction, by which the mounting of the lenses for vision correction of the intensity varying in thicknesses, depending on the distances from a center is made possible.
SOLUTION: In the structure of the lens mounts of the spectacle frames, having a pair of half rims 1 and used for mounting the lenses 15 varying in the thicknesses, depending on the distances from the center to each inner surface 2 side of a pair of half rims 1, the width of each of the half rims 1 is formed to approximately the same as the maximum thickness of the lenses 15; and fitting grooves 4 are disposed in the positions apart by the prescribed distances from the central part on the inner surface 2 side of each of the half rims 1, respectively. The structure is so constituted that a connecting member 10 is fitted between the fitting groove 4 and the upper half part of the fitting groove 16, disposed on the peripheral surface of the lens 15.



(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2008-83299
(P2008-83299A)
(43)公開日　平成20年4月10日(2008.4.10)

| (51)Int.Cl. | F I | テーマコード（参考） |
|---|---|---|
| G02C 1/04 (2006.01) | G02C 1/04 | |

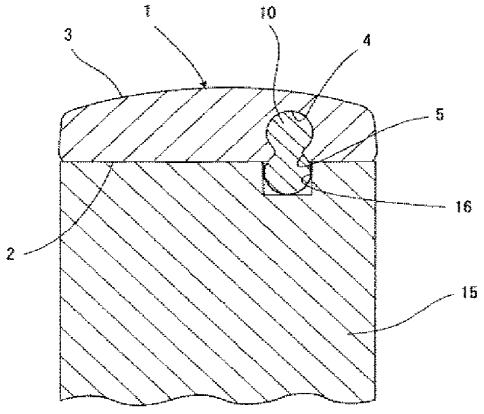
審査請求 未請求　請求項の数 4　OL　（全 7 頁）

(21)出願番号　特願2006-262089 (P2006-262089)
(22)出願日　平成18年9月27日 (2006.9.27)

(71)出願人　500166323
有限会社ビート
福井県福井市上江尻町３－４０９
(74)代理人　100088074
弁理士　中林　幹雄
(72)発明者　萩原　勉
福井県福井市上江尻町３号４０９番地　有限会社ビート内

(54)【発明の名称】メガネフレームのレンズ取付け部の構造及びレンズの取付け方法

(57)【要約】
【課題】　中心からの距離によって厚みの異なる強度の視力矯正用のレンズの取付けを可能にするメガネフレームのレンズ取付け部の構造を提供する。
【解決手段】　一対のハーフリム１を備え、該一対のハーフリム１の各々の内面２側に、中心からの距離によって厚みの異なるレンズ１５を取り付けるためのメガネフレームのレンズ取付け部の構造であって、前記各ハーフリム１の幅は、前記レンズ１５の最大厚みと略同一に形成されるとともに、該各ハーフリム１の内面２側の中央部から所定の距離離れた位置にそれぞれ嵌合溝４が設けられ、該嵌合溝４と前記レンズ１５の周面に設けられた嵌合溝１６の上半部との間に連結部材１０を嵌合させるように構成されている。
【選択図】　図２



【特許請求の範囲】
【請求項1】
一対のハーフリムを備え、該一対のハーフリムの各々の内面側に、中心からの距離によって厚みの異なるレンズを取り付けるためのメガネフレームのレンズ取付け部の構造であって、
前記各ハーフリムの幅は、前記レンズの最大厚みと略同一に形成されるとともに、該各ハーフリムの内面側の中央部から所定の距離離れた位置にそれぞれ嵌合溝が設けられ、
該嵌合溝と前記レンズの周面に設けられた嵌合溝の上半部との間に連結部材を嵌合させるように構成されていることを特徴とするメガネフレームのレンズ取付け部の構造。
【請求項2】
前記各ハーフリムの嵌合溝は、前記各ハーフリムの内面の中央部から各ハーフリムの前面方向に所定の距離離れた位置に設けられていることを特徴とする請求項１に記載のメガネフレームのレンズ取付け部の構造。
【請求項3】
前記レンズの嵌合溝の下半部には支持部材が嵌合されるとともに、該支持部材は張力を付加した状態で両端部が前記各ハーフリムの両端部に連結されていることを特徴とする請求項１又は２に記載のメガネフレームのレンズ取付け部の構造。
【請求項4】
一対のハーフリムを備えたメガネフレームの各ハーフリムの内面側に、中心からの距離によって厚みの異なるレンズを取り付けるためのレンズの取付け方法であって、
前記各ハーフリムの内面の幅を前記レンズの最大厚みと略同一に形成するとともに、該各ハーフリムの内面側の中央部から所定の距離離れた位置にそれぞれ嵌合溝を設け、該嵌合溝と前記レンズの周面に設けた嵌合溝の上半部との間に連結部材を嵌合させ、この状態で、レンズの嵌合溝の下半部に支持部材を嵌合させて、該支持部材に張力を付加した状態で該支持部材の両端部を前記各ハーフリムの両端部に連結することにより、各ハーフリムの内面側にレンズを取り付けることを特徴とするレンズの取付け方法。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、メガネフレームのレンズ取付け部の構造及びレンズの取付け方法に関し、特に、ハーフリムタイプ（「ナイロールタイプ」ともいう。）のメガネフレームに有効なメガネフレームのレンズ取付け部の構造及びレンズの取付け方法に関する。
【背景技術】
【0002】
メガネフレームには種々のタイプのものがあり、例えば、一対のハーフリムと、両ハーフリムの内縁部間を連結するブリッジと、各ハーフリムの外縁部に蝶番を介してそれぞれ回動自在に連結されるテンプルと、各ハーフリムの内縁部に連結されるノーズパッドとを備えたハーフリムタイプのメガネフレームが知られている。
【0003】
このような構成のハーフリムタイプのメガネフレームにあっては、各ハーフリムの内面側にレンズを位置して、各ハーフリムの内面側に設けられている嵌合溝とレンズの周面に設けられている嵌合溝の上半部との間に水糸等からなる連結部材を嵌合させ、レンズの嵌合溝の下半部に水糸等からなる支持部材を嵌合させ、支持部材に張力を付加した状態で支持部材の両端部を各ハーフリムの両端部に連結することで、各ハーフリムの内面側にレンズを取り付けている（例えば、特許文献１参照。）。
【特許文献1】特開平１０－１９７８２８
【発明の開示】
【発明が解決しようとする課題】
【0004】
ところで、上記のような構成のハーフリムタイプのメガネフレームにあっては、各ハー

フリムの内面の幅方向の中央部に嵌合溝が設けられ、このハーフリムの嵌合溝とレンズの周面に設けた嵌合溝との間に水糸等からなる連結部材を嵌合させているため、レンズの種類によっては取り付けることができない場合があり、消費者のデザインの選択の幅を狭くしている。

【0005】

つまり、例えば、視力矯正用のレンズを取り付ける場合、弱度の視力矯正用のレンズは、中心からの距離によって厚みが異なることはないが、強度の視力矯正用のレンズは、中心からの距離によって厚みが大きく異なる（例えば、上下が薄く、左右が厚い）。このため、弱度の視力矯正用のレンズを支持するハーフリムを用いた場合に、レンズを上側の部分ではレンズの厚みとハーフリムの幅とを一致させることができるものの、左右側ではレンズの厚みがハーフリムの幅よりも厚くなるため、レンズがハーフリムから食み出してしまい、レンズを支持し切れず、使用可能なレンズが弱度の視力矯正用に制限されていた。

【0006】

本発明は、上記のような従来の問題に鑑みなされたものであって、レンズの種類（厚みの異なる様々なレンズ）に関わらずに取り付けることが可能であって、消費者のデザインの選択の幅を広げることができるメガネフレームのレンズ取付け部の構造及びレンズの取付け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】

【0007】

上記のような課題を解決するために、本発明は、以下のような手段を採用している。

すなわち、請求項１に係る発明は、一対のハーフリムを備え、該一対のハーフリムの各々の内面側に、中心からの距離によって厚みの異なるレンズを取り付けるためのメガネフレームのレンズ取付け部の構造であって、前記各ハーフリムの幅は、前記レンズの最大厚みと略同一に形成されるとともに、該各ハーフリムの内面側の中央部から所定の距離離れた位置にそれぞれ嵌合溝が設けられ、該嵌合溝と前記レンズの周面に設けられた嵌合溝の上半部との間に連結部材を嵌合させるように構成されていることを特徴とする。

【0008】

本発明によるメガネフレームのレンズ取付け部の構造によれば、中心からの距離によって厚みの異なるレンズを各ハーフリムの内側に取り付ける場合に、各ハーフリムの幅をレンズの最大厚みと同一に形成し、各ハーフリムの内面側の中央部から所定の距離離れた位置に嵌合溝を設けているので、各ハーフリムの内面の嵌合溝とレンズの周面に設けた嵌合溝との間に連結部材を嵌合させることにより、各ハーフリムの内面側にレンズを安定して支持することができる。

【0009】

請求項２に係る発明は、請求項１に記載のメガネフレームのレンズ取付け部の構造であって、前記各ハーフリムの嵌合溝は、前記各ハーフリムの内面の中央部から各ハーフリムの前面方向に所定の距離離れた位置に設けられていることを特徴とする。

【0010】

本発明によるメガネフレームのレンズ取付け部の構造によれば、中心からの距離によって厚みの異なるレンズを各ハーフリムの内側に取り付ける場合に、レンズの前面側よりに嵌合溝を設けることにより、各ハーフリムの内面側の嵌合溝とレンズの周面の嵌合溝との間に連結部材を嵌合させることが可能となり、各ハーフリムの内面側に連結部材を介してレンズを安定して支持することができる。

【0011】

請求項３に係る発明は、請求項１又は２に記載のメガネフレームのレンズ取付け部の構造であって、前記レンズの嵌合溝の下半部には支持部材が嵌合されるとともに、該支持部材は張力を付加した状態で両端部が前記各ハーフリムの両端部に連結されていることを特徴とする。

【0012】

本発明によるメガネフレームのレンズ取付け部の構造によれば、各ハーフリムの内面側

の嵌合溝とレンズの周面の嵌合溝との間に連結部材を嵌合させ、レンズの周面の嵌合溝の下半部に支持部材を嵌合させ、この支持部材に張力を付加した状態で支持部材の両端部を各ハーフリムの両端部に連結することで、各ハーフリムの内面側にレンズを取り付けることができる。

【0013】

請求項４に係る発明は、一対のハーフリムを備えたメガネフレームの各ハーフリムの内面側に、中心からの距離によって厚みの異なるレンズを取り付けるためのレンズの取付け方法であって、前記各ハーフリムの内面の幅を前記レンズの最大厚みと略同一に形成するとともに、該各ハーフリムの内面側の中央部から所定の距離離れた位置にそれぞれ嵌合溝を設け、該嵌合溝と前記レンズの周面に設けた嵌合溝の上半部との間に連結部材を嵌合させ、この状態で、レンズの嵌合溝の下半部に支持部材を嵌合させて、該支持部材に張力を付加した状態で該支持部材の両端部を前記各ハーフリムの両端部に連結することにより、各ハーフリムの内面側にレンズを取り付けることを特徴とする。

【0014】

本発明によるレンズの取付け方法によれば、中心からの距離によって厚みの異なるレンズを各ハーフリムの内側に取り付ける場合に、各ハーフリムの幅をレンズの最大厚みと同一に形成し、各ハーフリムの内面側の中央部から所定の距離離れた位置に嵌合溝を設けているので、各ハーフリムの内面の嵌合溝とレンズの周面に設けた嵌合溝との間に連結部材を嵌合させ、この状態で、レンズの嵌合溝の下半部に支持部材を嵌合させて、支持部材に張力を付加した状態で、支持部材の両端部を各ハーフリムの両端部に連結することにより、各ハーフリムの内面側にレンズを取り付けることができる。

【発明の効果】

【0015】

以上、説明したように、本発明のメガネフレームのレンズの取付け部の構造及びレンズの取付け方法によれば、厚さの異なる様々な種類のレンズを取り付けることができるので、消費者のデザインの選択の幅を広げることができる。

【発明を実施するための最良の形態】

【0016】

以下、図面に示す本発明の実施の形態について説明する。

図１～図３には、本発明によるメガネフレームのレンズ取付け部の構造の一実施の形態が示されていて、このメガネフレームのレンズ取付け部の構造は、所謂ハーフリムタイプ（「ナイロールタイプ」ともいう。）のメガネフレームに適用したものであって、強度の視力矯正用のレンズの取り付けを可能に構成したものである。

【0017】

なお、以下の説明において、強度の視力矯正用レンズ（以下、「強度用レンズ」という。）とは、中心からの距離によって厚みの異なるレンズ、すなわち、メガネフレームの前方から見て、上下、左右の厚みが異なるレンズ（例えば、上下の厚みが薄く、左右の厚みが上下よりも厚いレンズ等）をいい、弱度の視力矯正用レンズ（以下、「弱度用レンズ」という。）とは、中心からの距離によって厚みの異ならないレンズ、すなわち、メガネフレームの前方から見て、上下、左右の厚みが略同一のレンズをいう。

【0018】

ハーフリムタイプのメガネフレームは、一対のハーフリムと、両ハーフリムの内縁部間に連結されるブリッジと、各ハーフリムの外縁部に溶接等により一体に連結される蝶番と、各蝶番に回動自在に連結されるテンプルと、両ハーフリムの内縁部に溶接等により一体に連結される一対のノーズパッドとを備え、各ハーフリムの内面側にそれぞれ強度用レンズが取り付けられる。

【0019】

各ハーフリム１は、図１～図３に示すように、下方が開口する略円弧状に形成されるとともに、内面２が外面３よりも幅広の断面略台形状に形成されている。この場合、各ハーフリム１の内面２の幅は、強度用レンズ１５の最大厚さ（左右の厚さ）と略同一に形成さ

れ、各ハーフリム１の内面に強度用レンズ１５を取り付けた際に、強度用レンズ１５の左右の前後面とハーフリム１の前後面とが面一になるように構成されている。

【0020】

各ハーフリム１の内面２には全周に亘る嵌合溝４が設けられ、この嵌合溝４内に後述する連結部材１０の上半部が嵌合される。この場合、嵌合溝４は、各ハーフリム１の幅方向の中央部よりもメガネフレームの前面方向に所定の距離離れた位置に設けられ、後述する連結部材１０の上半部の形状に合致する形状に形成されている。

【0021】

本実施の形態においては、嵌合溝４は、後述する連結部材１０の断面形状に合致する断面略円形状に形成されている。この場合、嵌合溝４の開口部５は内部よりも幅狭に形成され、この幅狭に形成された開口部５によって嵌合溝４内から連結部材１０が脱落するのが防止される。

なお、嵌合溝４は、断面略円形状に限らず、他の周知の形状に形成してもよい。要は、嵌合溝４内からの連結部材１０の脱落を防止できる形状に形成であればよい。

【0022】

連結部材１０は、合成樹脂、合成ゴム等から形成される断面略ダルマ形状をなす紐状体であって、例えば、市販の合成樹脂製、合成ゴム製の水糸等を使用することができる。連結部材１０は、ダルマ形状の上半部が各ハーフリム１の嵌合溝４内に嵌合され、下半部が後述する強度用レンズ１５の周面に設けられる嵌合溝１６の上半部内に嵌合される。

【0023】

強度用レンズ１５は、前述したように、上下、左右の厚みが異なるレンズであって、図１～図３に示すように、周面に全周に亘る断面矩形状の嵌合溝１６が設けられている。この場合、嵌合溝１６は、強度用レンズ１５の上下側の薄い部分では、図３に示すように、厚み方向の略中央部に配置され、左右側の厚い部分では、図２に示すように、厚み方向の中央部よりも前面側に配置されている。なお、図２及び図３において、図中右側を前面側として、左側を後面側としている。

【0024】

そして、上記のように構成したメガネフレームの各ハーフリム１の内側に強度用レンズ１５を取り付けるには、まず、強度用レンズ１５を各ハーフリム１の内側に位置し、各ハーフリム１の内面２の嵌合溝４と強度用レンズ１５の周面の嵌合溝１６の上半部との間に連結部材１０を嵌合させる。

【0025】

そして、強度用レンズ１５の周面の嵌合溝１６の下半部に支持部材（図示せず）を嵌合させ、この支持部材に張力を付加し、この状態で支持部材の両端部を各ハーフリム１の両端部にそれぞれ連結する。ここで、支持部材は、連結部材１０と同一素材から形成される断面略円形状の紐状体であって、連結部材１０と同様に、市販の合成樹脂製、合成ゴム製の水糸等を使用することができる。

【0026】

このようにして、各ハーフリム１の内側にそれぞれ強度用レンズ１５を取り付けることにより、所定の度数の強度用レンズ１５を備えたメガネを構成することができ、このメガネを顔の前面側に装着することにより、強度用レンズ１５を通した視界が得られ、使用者の視力を矯正することができるものである。

【0027】

上記のように構成した本実施の形態によるメガネフレームのレンズ取付け部の構造にあっては、中心からの距離によって厚みの異なる強度用レンズ１５であっても、弱度用レンズと同様に、各ハーフリム１の内面側に取り付けることができるので、消費者のデザインの選択の幅を広げることができる。

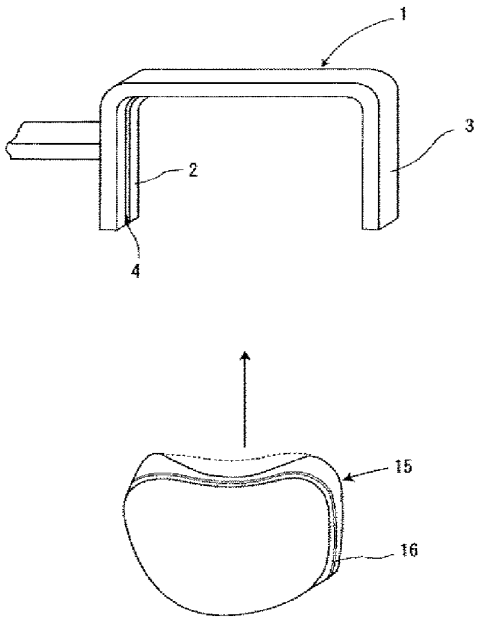
【図面の簡単な説明】

【0028】

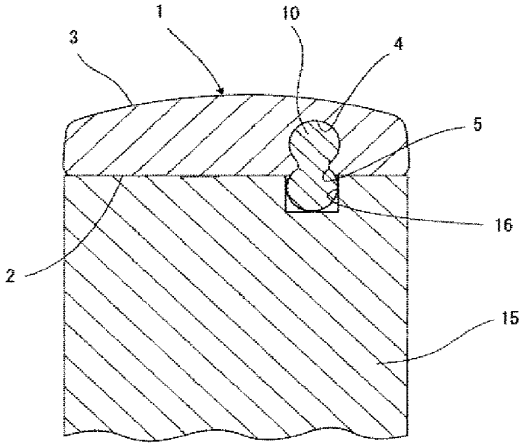
【図1】本発明によるメガネフレームのレンズ取付け部の構造の一実施の形態を示した概

略図であって、ハーフリムの全体を示した概略図である。
【図2】ハーフリムの内側に強度用レンズを取り付けた状態を示した断面図であって、強度用レンズの左右側の厚みの最大の部分とハーフリムとの関係を示した断面図である。
【図3】ハーフリムの内側に強度用レンズを取り付けた状態を示した断面図であって、強度用レンズの上側の厚みの最小の部分とハーフリムとの関係を示した断面図である。
【符号の説明】
【0029】
１　ハーフリム
２　内面
３　外面
４　嵌合溝
５　開口部
１０　連結部材
１５　強度用レンズ
１６　嵌合溝

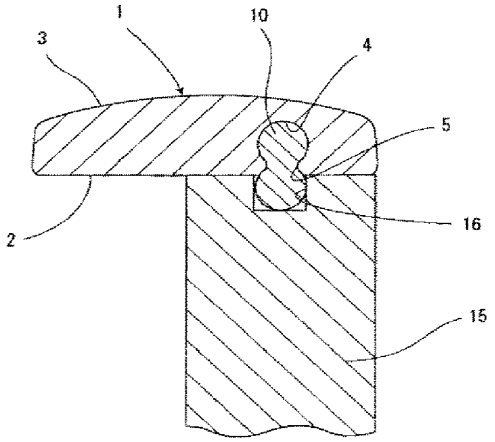
【図1】




【図2】



【図3】



**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)<br><br>figures 16,18,31<br>column 6, lines 9-36<br>column 11, lines 71-73<br>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)<br>figure 6 | 12 |
| A | WO 2009/081542 A1 (PANASONIC CORP [JP]; MATSUI MASATOMO) 2 July 2009 (2009-07-02)<br>figures 15, 18<br>& EP 2 233 964 A1 (PANASONIC CORP [JP])<br>29 September 2010 (2010-09-29)<br>figures 15, 18 | 18 |
| A | US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)<br>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

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"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

## 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 |
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| | | 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 |

# 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<br>91904-813919 | Date of mailing *(day/month/year)*<br>2 December 2011 (02-12-2011)<br>**PAYMENT DUE**<br>within **ONE MONTH** from the above date of mailing |
| International application No.<br>PCT/US2011/042882 | International filing date *(day/month/year)*<br>1 July 2011 (01-07-2011) |
| Applicant<br>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<br>NL-2280 HV Rijswijk<br>Tel. (+31-70) 340-2040<br>Fax: (+31-70) 340-3016 | SALAüN, Marion<br>Tel: +49 (0)89 2399-2126 |

Form PCT/ISA/206 (April 2005)
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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

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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<br>column 2, lines 33-38,47<br>column 2, line 55 - column 3, line 12<br>column 3, lines 24-3239-45 | 17,18 |
| X | US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)<br>figures 1A,4B,5B,14<br>paragraphs [0067], [0074], [0099]<br>claim 14 | 1,17,18, 29-33 |
| X | GB 1 563 929 A (AMERICAN CYANAMID CO)<br>2 April 1980 (1980-04-02)<br>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

## 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 |
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| 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 |

PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference P-70890-PC | FOR FURTHER ACTION | see Form PCT/ISA/220 as well as, where applicable, item 5 below. |
|---|---|---|
| International application No. PCT/US2008/058056 | International filing date *(day/month/year)* 24 March 2008 | (Earliest) Priority Date *(day/month/year)* 04 May 2007 |
| 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 2 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. ☐ 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. 1A

   ☐ 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) (April 2005)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/058056

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G02C 7/06 (2008.04)
USPC - 351/168
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)
IPC(8) - G02C 7/06, G02C 7/04 (2008.04)
USPC - 351/168, 351/124

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Google Patent Search, Minesoft PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y | US 2005/0237485 A1 (BLUM et al) 27 October 2005 (27.10.2005) entire document | 1-16, 18-24, 31<br>---<br>17, 25-30 |
| Y | US 6,115,177 A (VOSSLER) 05 September 2000 (05.09.2000) entire document | 25-27, 29 |
| Y | US 5,742,379 A (REIFER) 21 April 1998 (21.04.1998) entire document | 27-30 |
| Y | US 6,719,425 B2 (CONNER) 13 April 2004 (13.04.2004) entire document | 17 |
| A | US 4,418,990 (GERBER) 06 December 1983 (06.12.1983) entire document | 1-31 |
| A | US 2005/0225723 A1 (PILU) 13 October 2005 (13.10.2005) entire document | 1-31 |

☐ Further documents are listed in the continuation of Box C. ☐

* 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 |
|---|---|
| 07 July 2008 | 17 JUL 2008 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

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

# PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: ROBERT SCHAFFER
PEARL COHEN ZEDEK LATZER, LLP
1500 BROADWAY, 12TH FLOOR
NEW YORK, NY 10036

# PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)* 17 JUL 2008

Applicant's or agent's file reference
P-70890-PC

**FOR FURTHER ACTION**
See paragraph 2 below

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/US2008/058056 | 24 March 2008 | 04 May 2007 |

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G02C 7/06 (2008.04)
USPC - 351/168

Applicant
PIXELOPTICS, INC.

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

- [x] 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
- [x] 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
- [ ] 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 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 notified 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/US | Date of completion of this opinion | Authorized officer: |
|---|---|---|
| Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | 07 July 2008 | Blaine Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2008/058056

**Box No. I Basis of this 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 43*bis*.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. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ on paper

      ☐ in electronic form

   c. time of filing/furnishing

      ☐ contained in the international application as filed

      ☐ filed together with the international application in electronic form

      ☐ furnished 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 and/or table(s) relating thereto 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:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No. PCT/US2008/058056

**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) | Claims | 17, 25-30 | YES |
| | Claims | 1-16, 18-24, 31 | NO |
| Inventive step (IS) | Claims | None | YES |
| | Claims | 1-31 | NO |
| Industrial applicability (IA) | Claims | 1-31 | YES |
| | Claims | None | NO |

2. Citations and explanations:

Claims 1-16, 18-24, 31 lack novelty under PCT Article 33(2) as being anticipated by Blum et al.

Regarding Claim 1, Blum et al. disclose an eyeglass frame comprising an electronic module, wherein said module is located within a spatial void (Fig. 4 shows position of controller/battery 420 within void and anterior to hinge; also para. [0025]) of the eyeglass frame anterior to the hinge (Fig. 1, 'Controller/Battery' 120 and Paragraph [0014]).

Regarding Claim 2, Blum et al. disclose 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 (Fig. 1, Electro-Active Material 130 and Paragraph [0022]).

Regarding Claim 3, Blum et al. disclose an electronic module that contains electronics and a power source for driving an electroactive lens 130, 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 (within the lens, Paragraph [0025]).

Regarding Claim 4, Blum et al. disclose a method for controlling an electro-active lens 130 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 ('tilt switch' operation, Paragraph [0015-0016]).

Regarding Claim 5, Blum et al. disclose an electronic module attached to a rimless eyeglass frame (half-eyes, para. [0013]) located within a spatial void (fig. 4), wherein the frame has an electro-active lens to which the module is directly connected (Fig. 1, Controller/Battery 120 and Electro-Active Material 130).

Regarding Claim 6, Blum et al. disclose the method of Claim 4, wherein said module is moisture resistant (Fig. 4, and Paragraph [0025], "Controller/Battery 420 can be incorporated within the lens").

Regarding Claim 7, Blum et al. disclose the module of Claim 5, wherein said module is moisture resistant (Fig. 4, and Paragraph [0025], "Controller/Battery 420 can be incorporated within the lens").

Regarding Claim 8, Blum et al. disclose the method of Claim 4, wherein said module houses a power source (Fig. 1, 'Controller/Battery' 120 and Paragraph [0025]).

Regarding Claim 9, Blum et al. disclose the module of Claim 5, wherein said module houses a power source (Fig. 1, 'Controller/Battery' 120 and Paragraph [0025]).

Regarding Claim 10, Blum et al. disclose the method of Claim 4, wherein said module houses a switch ('tilt switch', Paragraph [0015]).

Regarding Claim 11, Blum et al. disclose the module of Claim 5, wherein said module houses a switch ('tilt switch', Paragraph [0015]).

Regarding Claim 12, Blum et al. disclose the frame of Claim 1, wherein said module is sealed from the outside environment Fig. 4, and Paragraph [0025], "Controller/Battery 420 can be incorporated within the lens").

Regarding Claim 13, Blum et al. disclose the frame of Claim 1, wherein said module is affixed to a temple ('on or in the temple', Paragraph [0025]).

Regarding Claim 14, Blum et al. disclose the module of Claim 3, wherein said module is affixed to one of the group comprising rimless, rimmed, and semi-rimless frames ('half-eyes', Paragraph [0026]).

Regarding Claim 15, Blum et al. disclose the module of Claim 14, wherein the frame comprises one of the group comprising zyle, metal, a combination of zyle and metal ('front eye wire of the frame', Paragraph [0025]).

See supplemental page.

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V: Citations and Explanations

Regarding Claim 16, Blum et al. disclose 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 rangefinder, a power source, a micro-processor, and a controller ('range finder', 'tilt switch', Paragraph [0015]).

Regarding Claim 18, Blum et al. disclose the method of Claim 10, wherein said switch is a tilt switch ('tilt switch', Paragraph [0015]).

Regarding Claim 19, Blum et al. disclose the module of Claim 11, wherein said switch is an automatic switch (Paragraphs [0019]-[0020]).

Regarding Claim 20, Blum et al. disclose the method of Claim 20, wherein said switch is a automatic switch (Paragraphs [0019]-[0020]).

Regarding Claim 21, Blum et al. disclose the module of Claim 11, wherein said switch is a manual switch (manual switch, Paragraph [0021]).

Regarding Claim 22, Blum et al. disclose the method of Claim 10, wherein said switch is a manual switch (manual switch, Paragraph [0021]).

Regarding Claim 23, Blum et al. disclose the module of Claim 19, wherein said switch is a tilt switch ('tilt switch', Paragraph [0015]).

Regarding Claim 24, Blum et al. disclose the method of Claim 20, wherein said switch is a tilt switch ('tilt switch', Paragraph [0015]).

Regarding Claim 31, Blum et al. disclose an eyeglass frame, comprising:
a) a hinged temple connected to the frame ('hinge screw', Paragraph [0025]); and
b) a universal eyeglass frame housing positioned anterior to the hinge, wherein said housing contains an electronic module (Fig. 1, Controller/Battery 120).

Claim 17 lack an inventive step under PCT Article 33(3) as being obvious over Blum in view of Conner.

Regarding Claim 17, Blum et al. disclose the module of Claim 3, but lacks the teaching said frame is a hinge-less frame.
Conner teaches an eyeglass frame which is hingeless (abstract) and further teaches the hinge-less frame is lighter and more comfortable for the wearer (col. 1, lines 5-8, 58-60).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the hinge-less frame of Conner as the eyeglass frame of Blum et al. in order to take advantage of its lighter weight and increased comfort for the wearer.

Claims 25-26 lack an inventive step under PCT Article 33(3) as being obvious over Blum in view of Vossler.

Regarding Claims 25-26, Blum et al. disclose the frame of Claim 16, further comprising a sensor, wherein the sensor may be a tilt switch (claim 26) and further wherein said controller provides for feedback from said sensor, wherein said controller turns off the electronic power if said sensor does not indicate movement (eye tracking sensor, tilt switch, or range finder, Paragraph [0015] and 'switching off',Paragraph [0020]), but lacks the teaching that the movement must be within a set period of time.
Vossler teaches an eyeglass frame 101 comprising a sensor 18 and a controller 17 (fig. 1) in which measurements of movements are taken within a set period of time (cycles of measurements over time, col. 6, lines 49-54). Vossler teaches the sensor may be a tilt switch (col. 5, lines 35-46; col. 6, lines 35-37).
It would have been obvious to one of ordinary skill in the art at the time of the invention to take measurements of the movements within a set period as taught by Vossler for the sensor of Blum et al. in order to allow the quickest possible reactions to a user movement (Vossler, col. 6, lines 54-57).

Claim 27 lack an inventive step under PCT Article 33(3) as being obvious over Blum in view of Vossler, further in view of Reifer.

Regarding Claim 27, Blum et al. disclose the frame of Claim 25, wherein said sensor is a range finder ('range finder', Paragraph [0015]), but lacks the teaching that the movement must be within a set period of time.
Reifer teaches a range finder (abstract) in which measurements are taken within a set period of time (col. 4, lines 36-47) in order to accurately determine a distance range (Reifer, col. 4, lines 57-60).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the set measurement period of Reifer to take the distance finder measurements of Blum et al. in order to accurately determine distance.

**Supplemental Box**

**In case the space in any of the preceding boxes is not sufficient.**
Continuation of:

Claims 28, 30 lack an inventive step under PCT Article 33(3) as being obvious over Blum in view of Reifer.

Regarding Claim 28, Blum et al. disclose the frame of Claim 16, further comprising a sensor,and further wherein said controller provides for feedback from said sensor, wherein said controller turns off the electronic power if said sensor does not indicate movement (eye tracking sensor, tilt switch, or range finder, Paragraph [0015] and 'switching off',Paragraph [0020]), and that the sensor may be a range finder (claim 30) (para. 0015), but lacks the teaching that the controller provides for a timing delay after receiving a signal from the sensor.
Reifer teaches a sensor (range finder, abstract) having a controller (CPU 10, col. 4, lines 28-30) and further teaches the controller provides for a timing delay after receiving a signal from the sensor as part of the measurements used to accurately determine the distance (col. 4, lines 57-61).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the delay of Reifer in the distance finder measurements of Blum et al. in order to accurately determine distance.

Claim 29 lacks an inventive step under PCT Article 33(3) as being obvious over Blum in view of Reifer, further in view of Vossler.

Regarding Claim 29, Blum et al. disclose the frame of Claim 28, wherein said sensor is a tilt switch ('tilt switch', Paragraph [0015]), but lacks the teaching that the controller provides for a timing delay after receiving a signal from the tilt switch sensor.
Vossler teaches an eyeglass frame 101 comprising a sensor 18 and a controller 17 (fig. 1) in which the sensor may be a tilt switch (col. 5, lines 35-46; col. 6, lines 35-37) and in which measurements of movements are taken within a set period of time (cycles of measurements over time, col. 6, lines 49-54) and that the controller provides for a timing delay after receiving a signal in order to give the controlling unit time to complete the realignment of the polarizing filters (col. 6, lines 46-49). It would have been obvious to one of ordinary skill in the art at the time of the invention to take measurements of the movements within a set period as taught by Vossler for the sensor of Blum et al. in order to allow time to realign the polarizing filters of the electroactive lens.

Claims 1-31 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

**COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH**

International application No. PCT/US2010/020498

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<br>Y | US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)<br>paragraph [0078] - paragraph [0098];<br>figures 9C,10,11 | 1-4,23<br>5-14 |
| Y | WO 2008/002388 A2 (PIXELOPTICS INC [US];<br>BLUM RONALD D [US]; HADDOCK JOSHUA N [US];<br>DUSTO) 3 January 2008 (2008-01-03)<br>paragraph [0027] - paragraph [0033] | 5-8,<br>12-14 |
| Y | US 4 991 951 A (MIZUNO MITSUYOSHI [JP] ET AL) 12 February 1991 (1991-02-12)<br>abstract | 9-11 |
| A | US 2007/258039 A1 (DUSTON DWIGHT P [US] ET AL) 8 November 2007 (2007-11-08)<br>paragraphs [0036], [0045] | 1-14,23 |

☐ 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

1

INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US2010/020498

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.

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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.

---

1. The first and the third groups of claims have in common the fact that they both relate to electro-active spectacles. However, electro-active spectacles are well known in the art and these features can therefore not be considered as forming a single general inventive concept. Furthermore, the second group of claims relates to a charger for electro-active spectacles having an inductive charging area. Electro-active spectacles having a rechargeable battery which can be charged inductively and the corresponding chargers are well known in the art, as disclosed for example in US2007/0258039 in paragraph [0045]: "an eyeglass case may be adapted to be an inductive charger suitable for recharging power source". Using inductive charing in electro-active spectacles and in the corresponding charger does therefore also not constitute a single general inventive concept within the sense of Rule 13.1 PCT.
2. The first group of claims deals with the problem of positioning the driving module within the frame of electro-active spectacles and contacting this module with the lenses. The second group of claims is dedicated to the mechanical construction of the charger for such electro-active lenses. In particular, it requires movable arms for supporting the temples of the spectacles. The third group of claims deals with the problem of switching the spectacles between different (active/inactive) states and the way how this switching is realised. Those features of the three groups of claims which may be considered to form special technical features are therefore no related.
3. The groups of claims listed above are therefore neither linked by a single general inventive concept, nor do they share common special technical features. The requirements of unity expressed in Rule 13.1 and 13.2 PCT are thus not fulfilled.

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2008273166 A1 | 06-11-2008 | AR 066226 A1 | 05-08-2009 |
| WO 2008002388 A2 | 03-01-2008 | AU 2007265652 A1 | 03-01-2008 |
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| | | JP 2817178 B2 | 27-10-1998 |
| US 2007258039 A1 | 08-11-2007 | NONE | |

# 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<br>91904-8512PC | Date of mailing *(day/month/year)*<br>29 February 2012 (29-02-2012)<br>**PAYMENT DUE**<br>within **ONE MONTH** from the above date of mailing |
| International application No.<br>PCT/US2011/061505 | International filing date *(day/month/year)*<br>18 November 2011 (18-11-2011) |
| Applicant<br>PIXELOPTICS, INC. | |

1. This International Searching Authority

(i) considers that there are 4 *(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 | 3 | = | EUR 5.355,00 |
|---|---|---|---|---|
| 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<br>NL-2280 HV Rijswijk<br>Tel. (+31-70) 340-2040<br>Fax: (+31-70) 340-3016 | LUUKKONEN, Kirsi<br>Tel: +49 (0)89 2399-7957 |

Form PCT/ISA/206 (April 2005)
Registered Mail

INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US2011/061505

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

1. claims: 1-17, 19, 23, 24, 27-37, 41-47

removable mechanical connections between electronics module, housing module and frame

---

2. claims: 18, 20-22

specificities of the controller,

---

3. claims: 25, 26

specificities of the switch.

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4. claims: 38-40

elastic hinge

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It is considered that there are 4 inventions covered by the claims indicated as follows:
- Group 1 (claims 1-17, 19, 23, 24, 27-37, 41-47): removable mechanical connections without additional locking component between electronics module, housing module and frame,
- Group 2 (claims 18, 20-22): specificities of the controller,
- Group 3 (claims 25, 26): specificities of the switch,
- Group 4 (claims 38-40): elastic hinge.

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 claims 1 and 42 is already known (see the grounds for this objection below).
- The special technical features of each group are:
- Group 1 : embedding of electrical components such that they are easily interchangeable,
- Group 2 : specific driving of the electro-active lens,
- Group 3: specific user input to the controller,
- Group 4: good pressure of the temples on the user's head.
- The problem solved by these special technical features can therefore be construed as:
- Group 1: how to remove easily electronic components from a spectacles,
- Group 2: how to save electrical power,
- Group 3: how to enable the user to communicate with the controller,
- Group 4: how to combine electrical and elastic hinge connectivity.

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 4 groups of claims.
In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 4 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.

D1 discloses a first device, comprising:
a frame (Fig 2) comprising a first temple (Fig 2, (102); [0050]) and a second temple (Fig 1), wherein the frame comprises a housing module (Fig 2, (202)) coupled to a structural member (Fig 2, (102));
a first lens and a second lens (Fig 2, (104); [0049]) coupled to the frame; and
an electronics module ([0048]; Fig 5, (202)), wherein the electronics module is located within the housing module ([0048]; Fig 5, (502)); and
wherein the electronics module comprises at least any two of:
a power source ([0048]);
a controller (or processor, see [0048]); and
a sensing mechanism ([0056]).
Thus, the device of D1 has all the features of claim 1, its subject matter being therefore not novel.
Furthermore, D2 (Claim 1; Fig 2, 8); D3 (Fig 3B, [0030 D2 ([Fig 1A-1C; [0073, 0074]), D3 (Fig 5; [0092]), D4 (Fig 5, 8) also each anticipates the subject matter of claim 1.
Similarly, each mounting method for the spectacles of D1-D4 anticipates the method according to claim 42, whereby an electronics module is inserted into a cavity within a housing module.

**Annex to Form PCT/ISA/206**
**COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH**

International Application No
PCT/US2011/061505

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 | WO 2010/080999 A1 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; WANG YONGPING [US]; BLUM) 15 July 2010 (2010-07-15)<br><br>figures 2,5,9,12<br>paragraphs [0048], [0050], [0056], [0069], [0082], [0089] - [0091], [0098], [0099] | 1-17,19, 23,24, 27-37, 41-47 |
| X | WO 2009/098719 A1 (COZZANI LAURA MARIA [IT]) 13 August 2009 (2009-08-13)<br><br>figures 2,5,8<br>claim 1 | 1-17,19, 23,24, 27-37, 41-47 |
| X | WO 2008/002388 A2 (PIXELOPTICS INC [US]; BLUM RONALD D [US]; HADDOCK JOSHUA N [US]; DUSTO) 3 January 2008 (2008-01-03)<br><br>figure 5<br>paragraph [0092] | 1-17,19, 23,24, 27-37, 41-47 |
| X | US 2008/273166 A1 (KOKONASKI WILLIAM [US] ET AL) 6 November 2008 (2008-11-06)<br><br>figures 5,8 | 1-17,19, 23,24, 27-37, 41-47 |

☐ 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/US2011/061505

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | US 2010271588 A1 | 28-10-2010 |

## Important Information

**General:**

- The **claims cannot be changed** at this point in the procedure, the transmitted report is **not** the international search report (see Art. 19 PCT).
- Any payment has to be made **directly** to this ISA, payments to other entities will not be accepted.
- In case of a **total of more than 2 inventions** found: when paying please **specify exactly** which claims should be searched (unless you pay for all inventions found)
- An **extension of** the set **time limit** cannot be granted.

**Payment by cheque** (not accepted as of 01/04/2008)**:**

- The **date to be considered as the date on which the payment is made** is the **date of receipt of the cheque at the EPO,** provided that the cheque is **met.**
- Copies of cheques sent by fax or by mail are not considered to be a valid payment.
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- For a list of accounts held by the EPO please see http://www.european-patent-office.org/epo/new/bank_euro.pdf

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**Payments by credit card are not possible.**

**Payments under protest** (one-step procedure under Rule 40 PCT as of 13/12/2007)**:**

- For general information on the protest procedure at ISA/EP, please refer to the Special Edition No. 3 of the OJ of the EPO 2007, pages 140-145, http://www.european-patent-office.org/epo/pubs/oj007/08_07/special_edition_3_epc_2000_decisions.pdf
- Any protest will **only be accepted if**, within the time limit set in the invitation, the additional fees for each invention to be searched **and** the protest fee are paid.
- The protest has to be **accompanied by a technical reasoning.**

**European Patent Organisation**

**Account details**

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| | | |
|---|---|---|
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| 61/152,140 | 12 February 2009 (12.02.2009) | US |
| 61/157,579 | 5 March 2009 (05.03.2009) | US |
| 61/157,580 | 5 March 2009 (05.03.2009) | US |
| 61/170,222 | 17 April 2009 (17.04.2009) | US |
| 61/242,406 | 15 September 2009 (15.09.2009) | US |
| 61/252,770 | 19 October 2009 (19.10.2009) | US |


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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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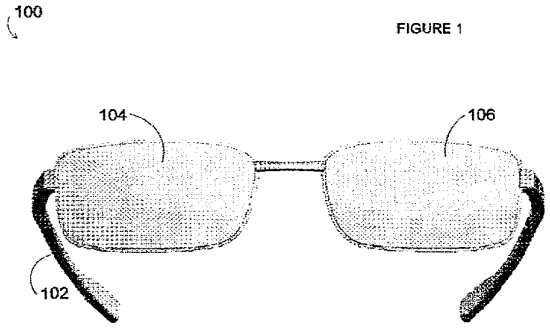
**Published:**

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: ELECTRO-ACTIVE SPECTACLES AND ASSOCIATED ELECTRONICS

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.

WO 2010/080999 A1

# ELECTRO-ACTIVE SPECTACLES AND ASSOCIATED ELECTRONICS

Inventors: William Kokonaski
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Mark Graham
Claudio Dalla Longa
Sambo He
Christian Krutzik

## 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.

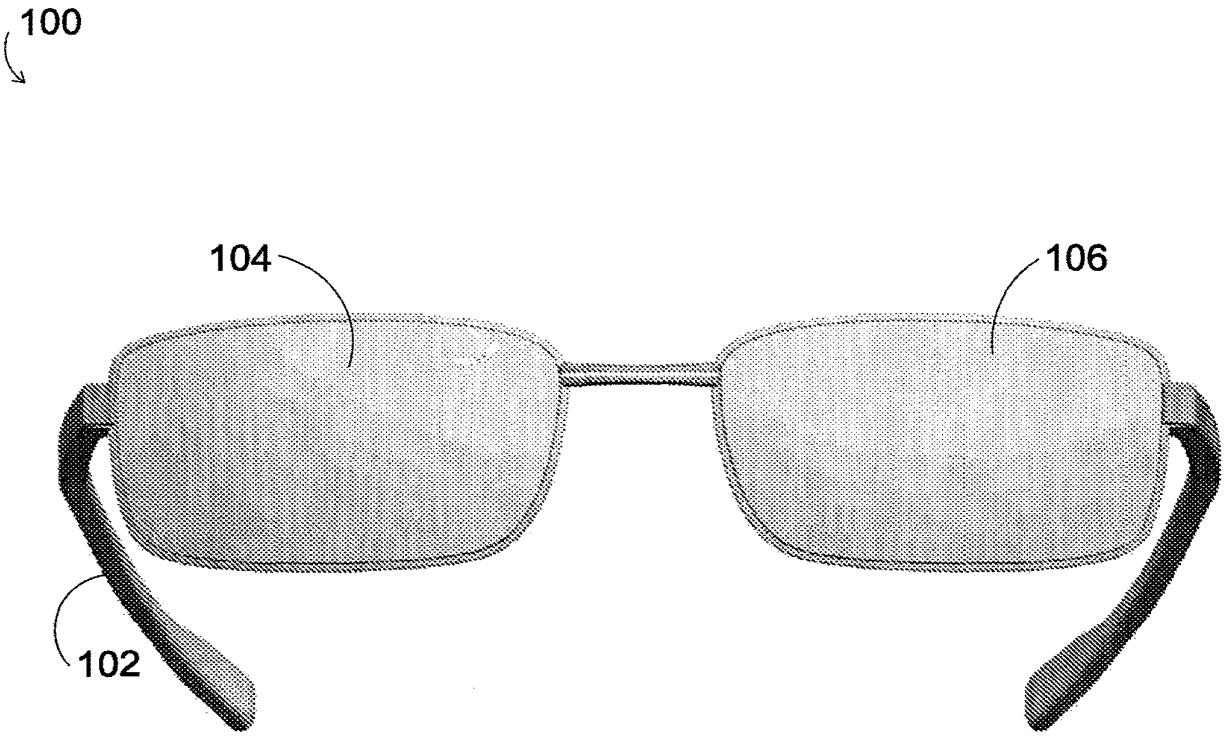


FIGURE 1

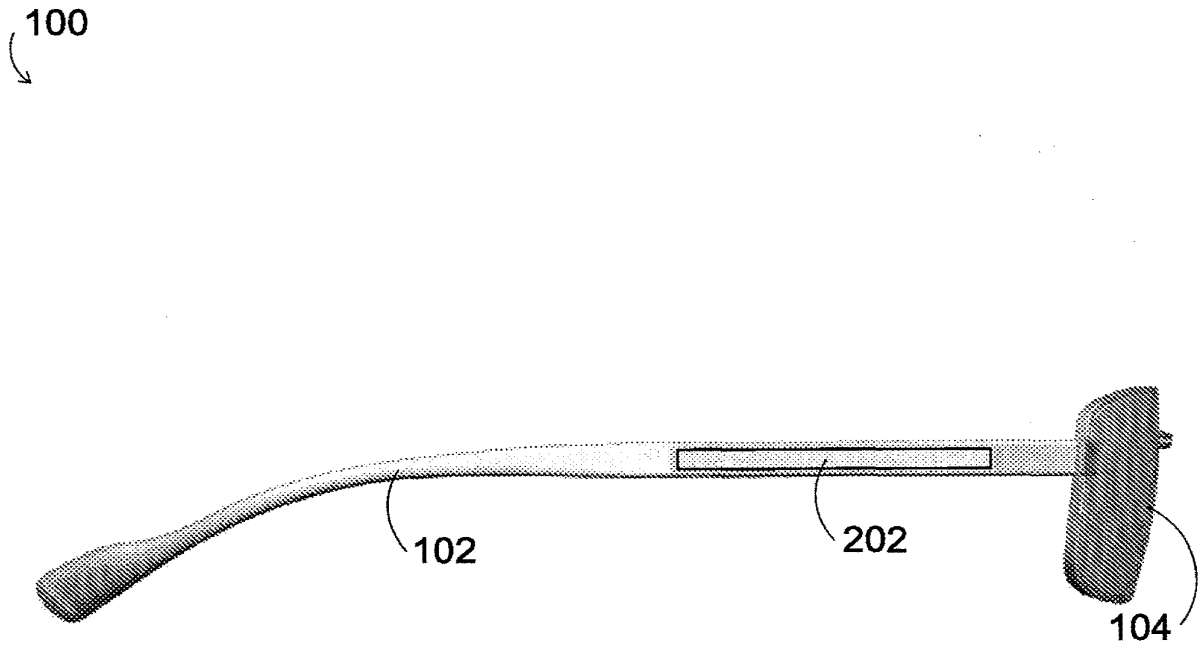


FIGURE 2

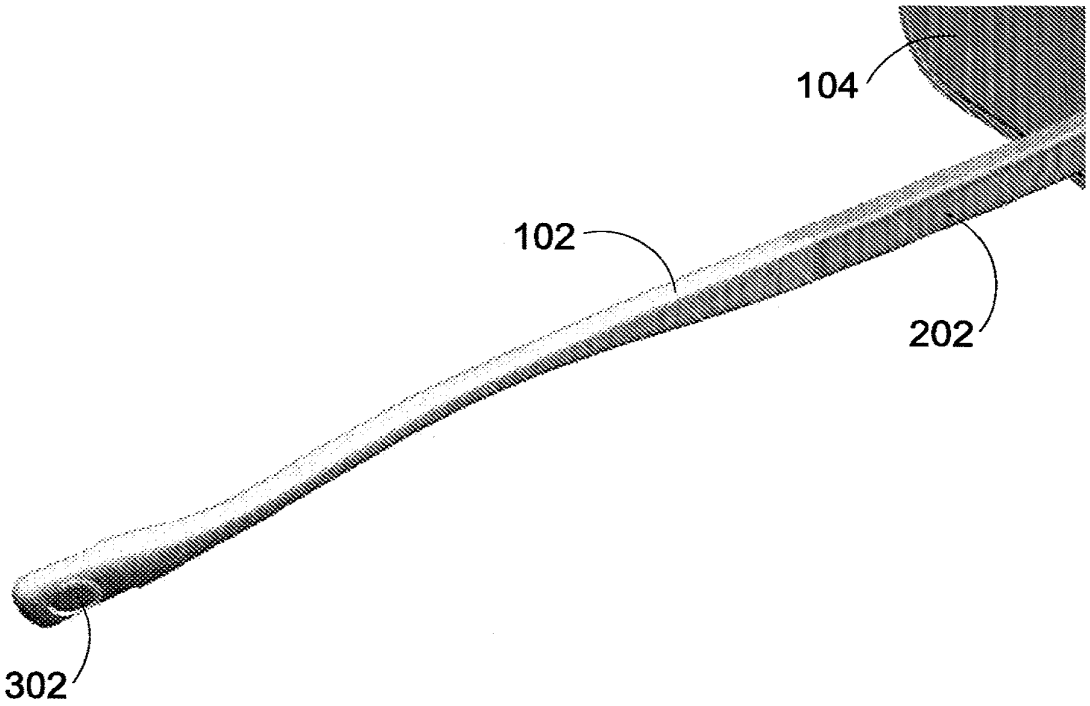


FIGURE 3

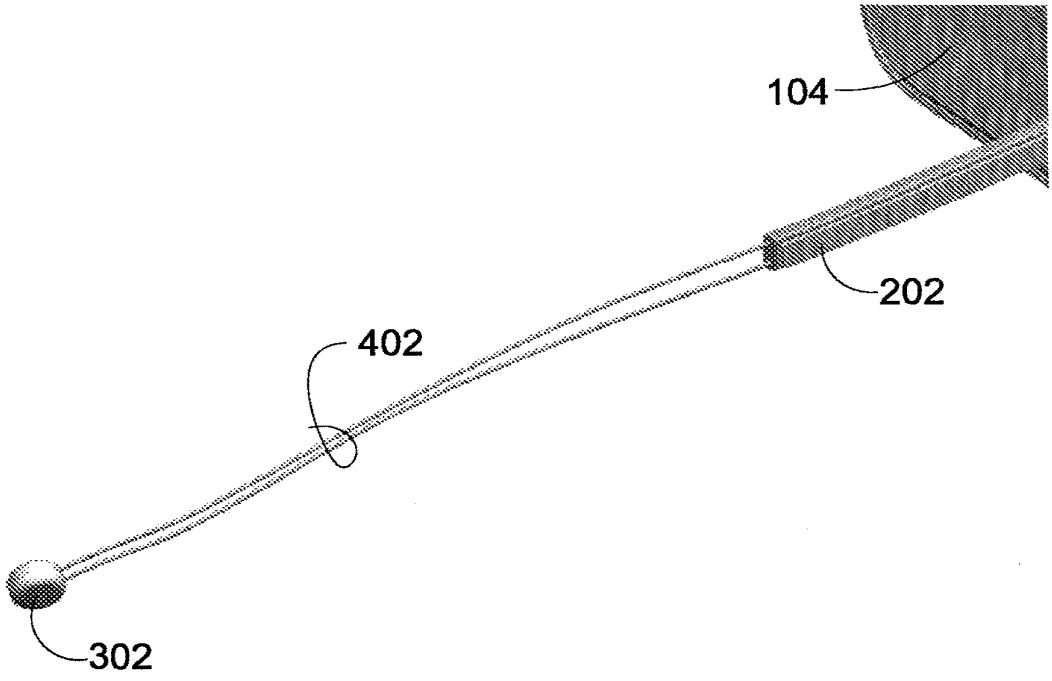


FIGURE 4

202



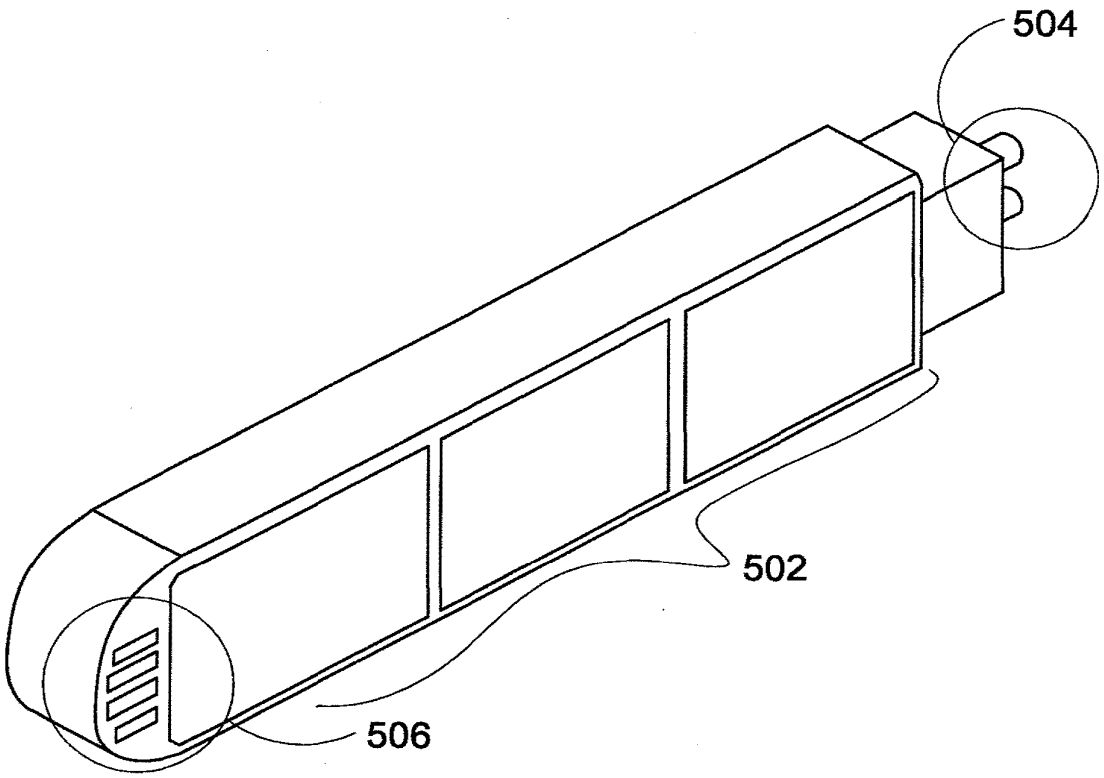


FIGURE 5

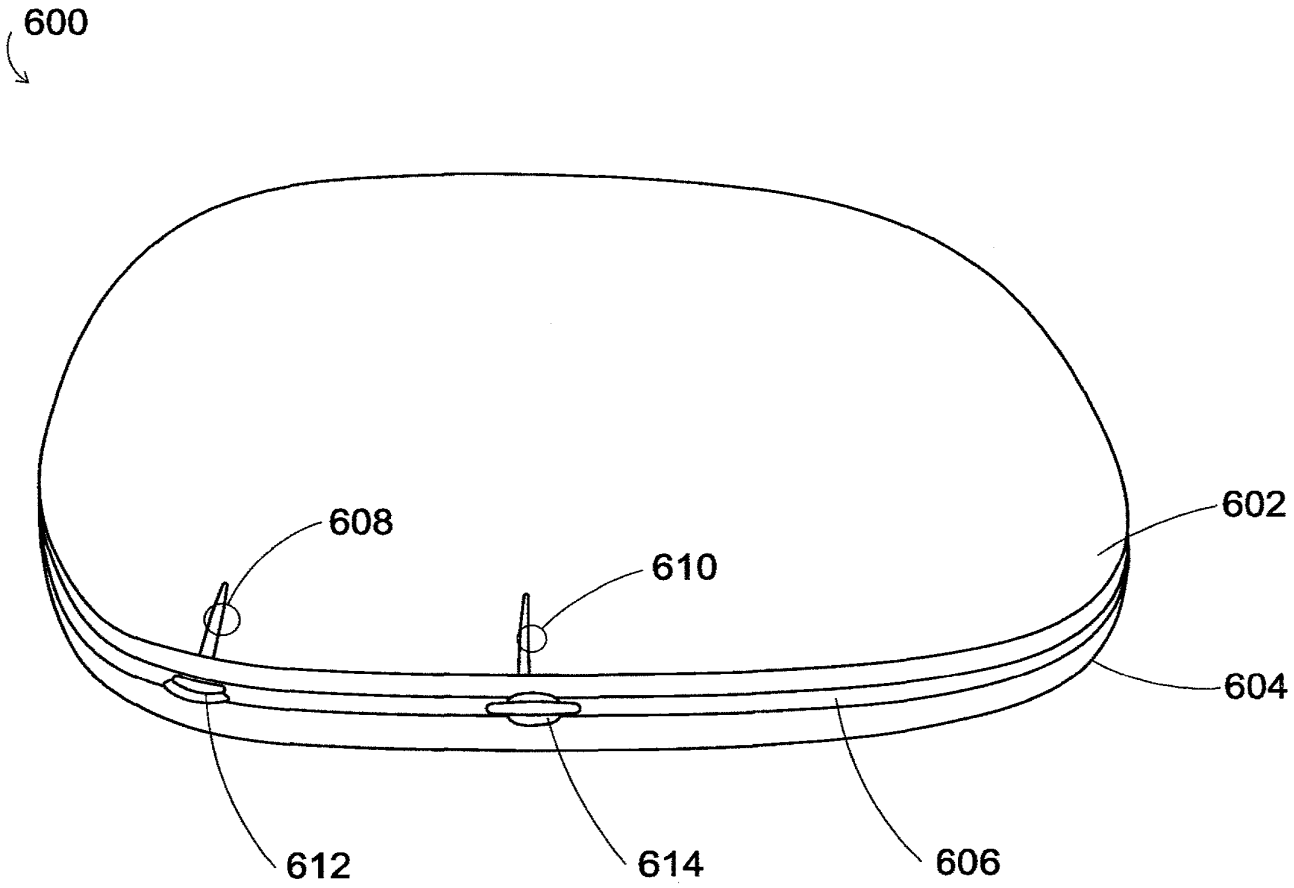


FIGURE 6

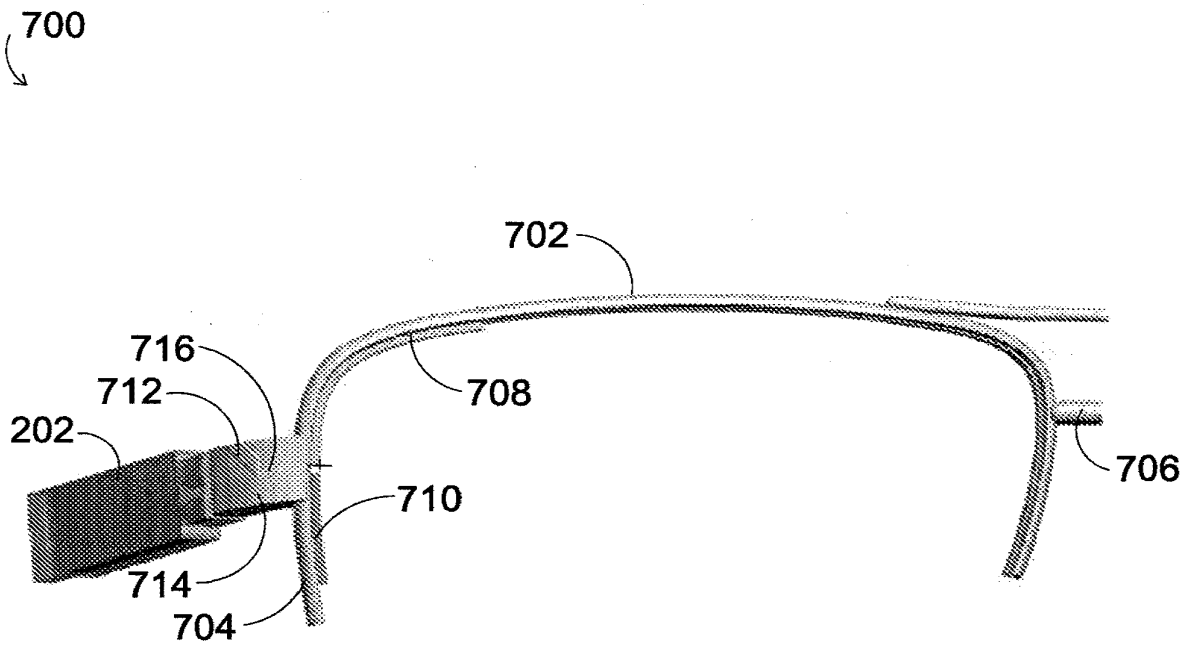


FIGURE 7

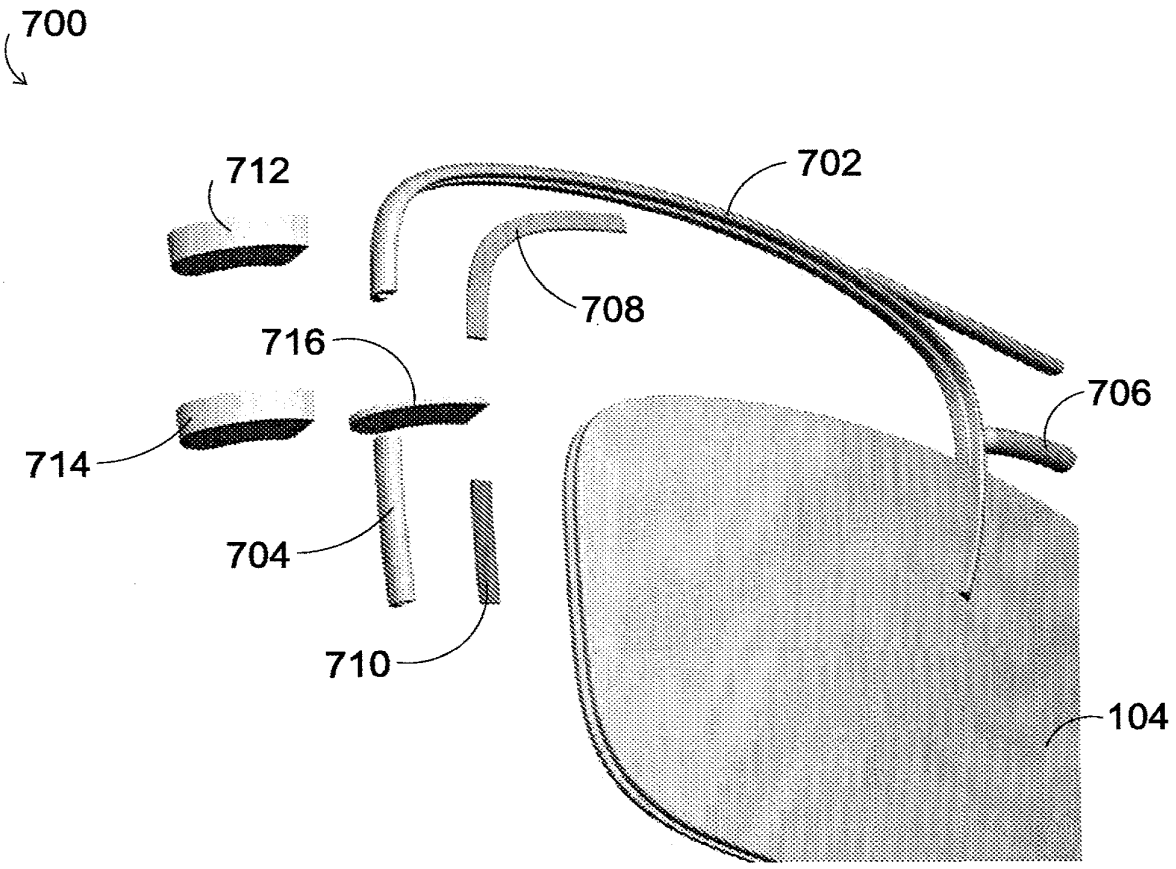


FIGURE 8

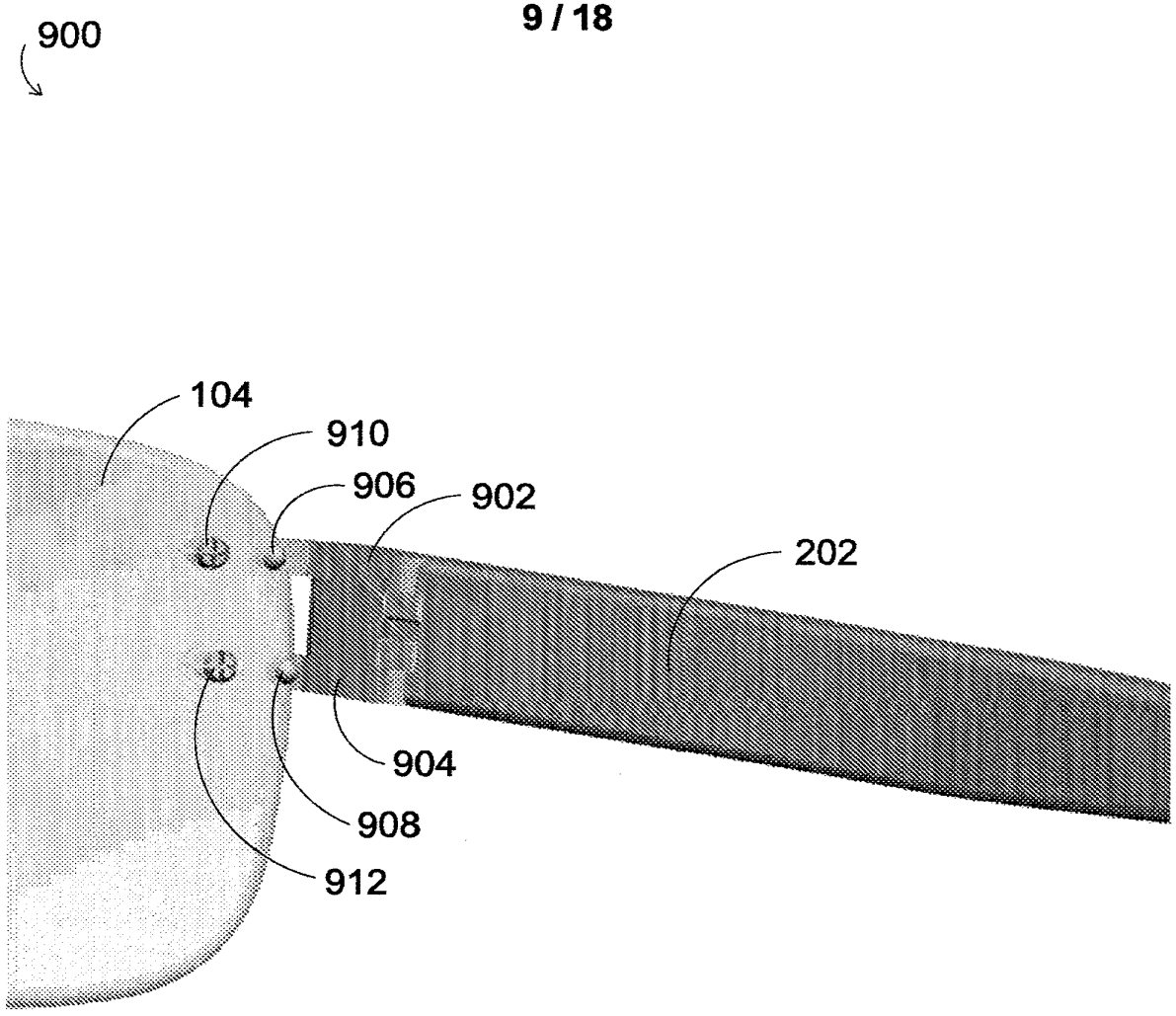


FIGURE 9

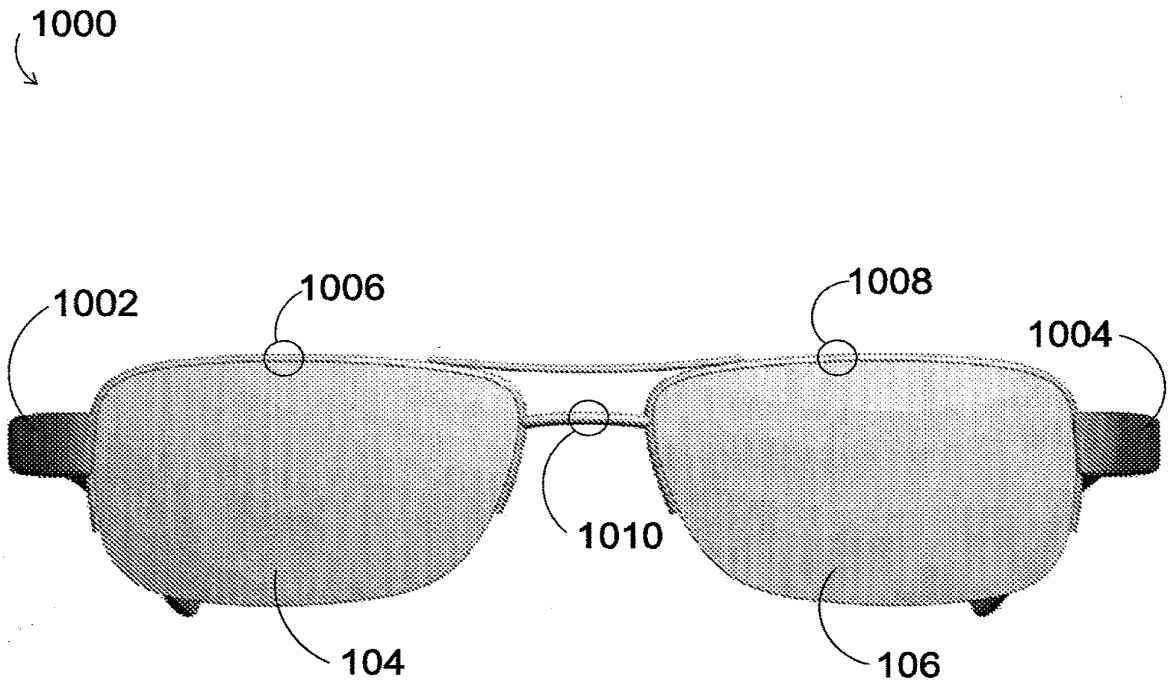


FIGURE 10

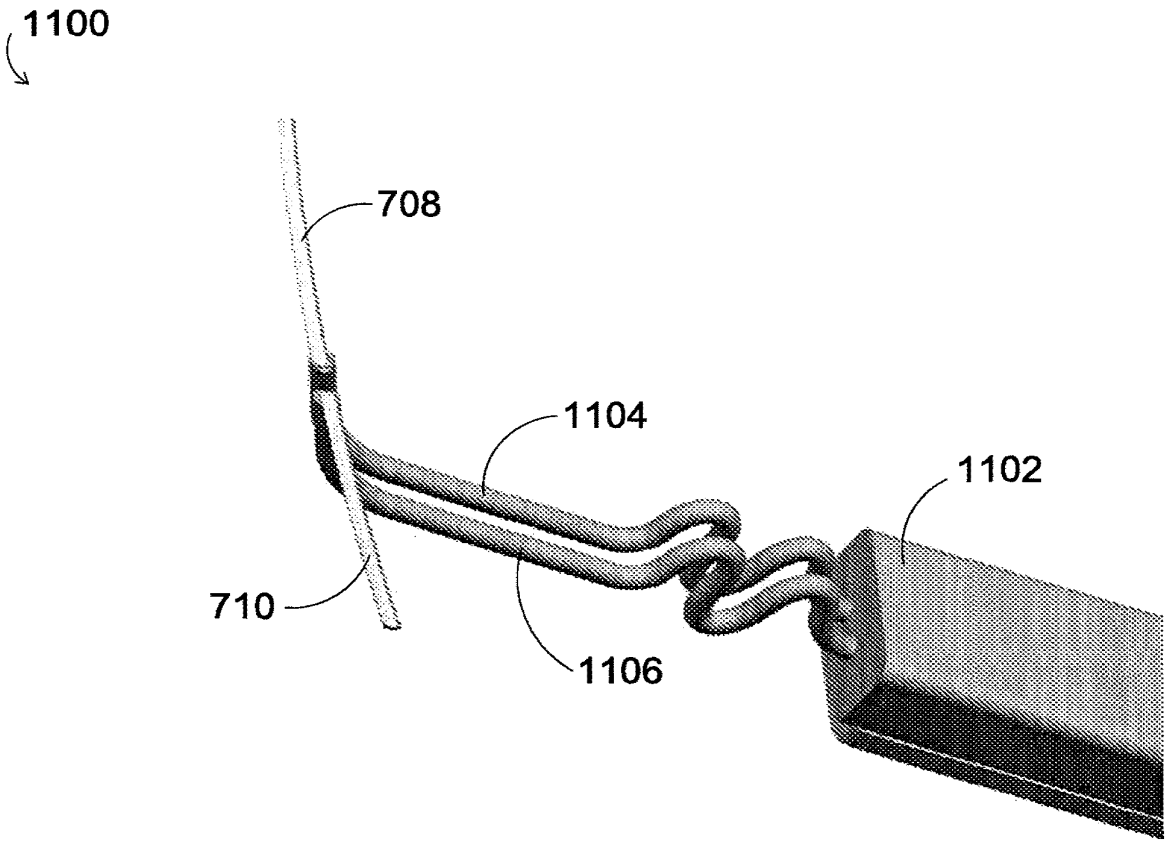


FIGURE 11

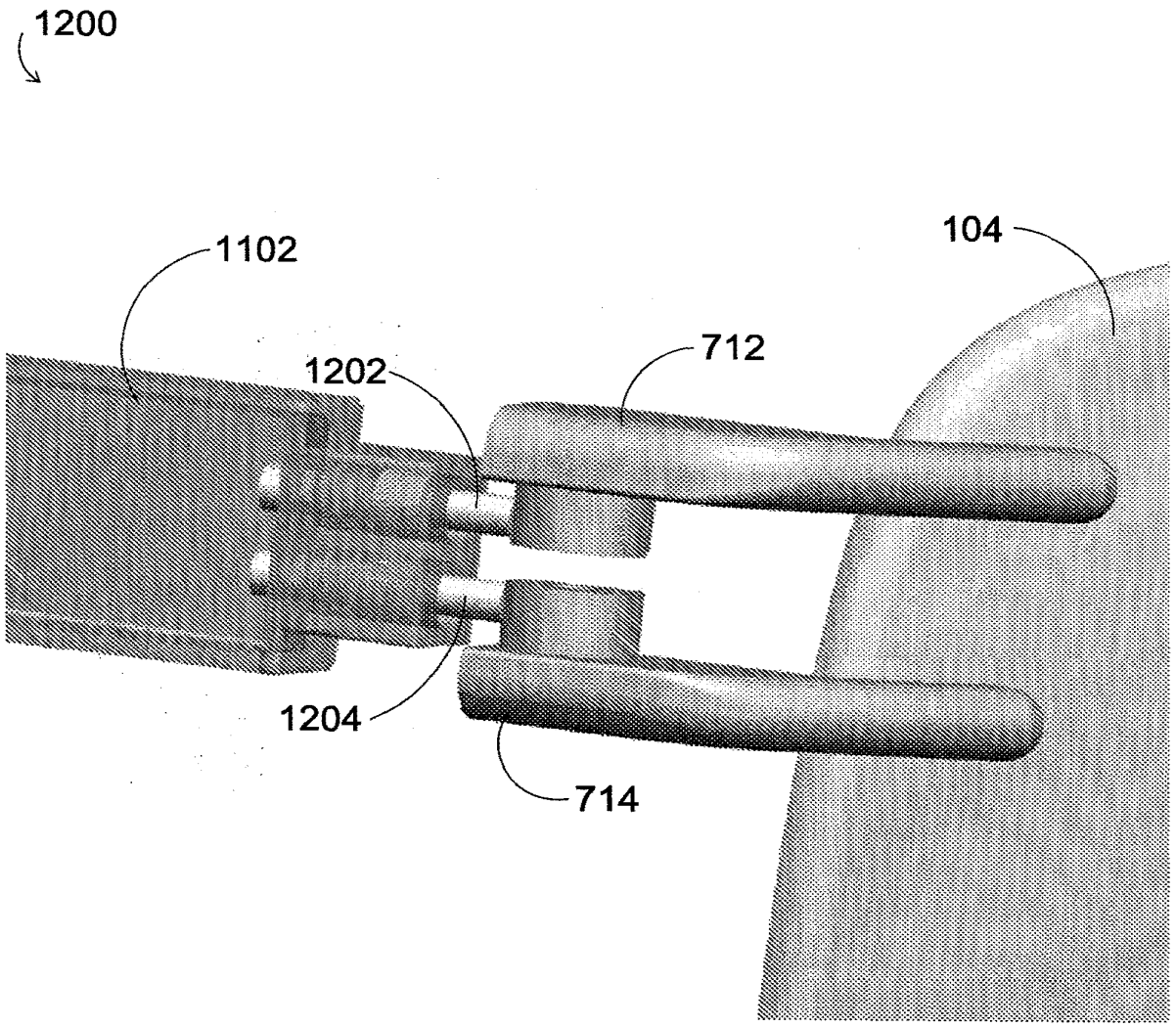


FIGURE 12

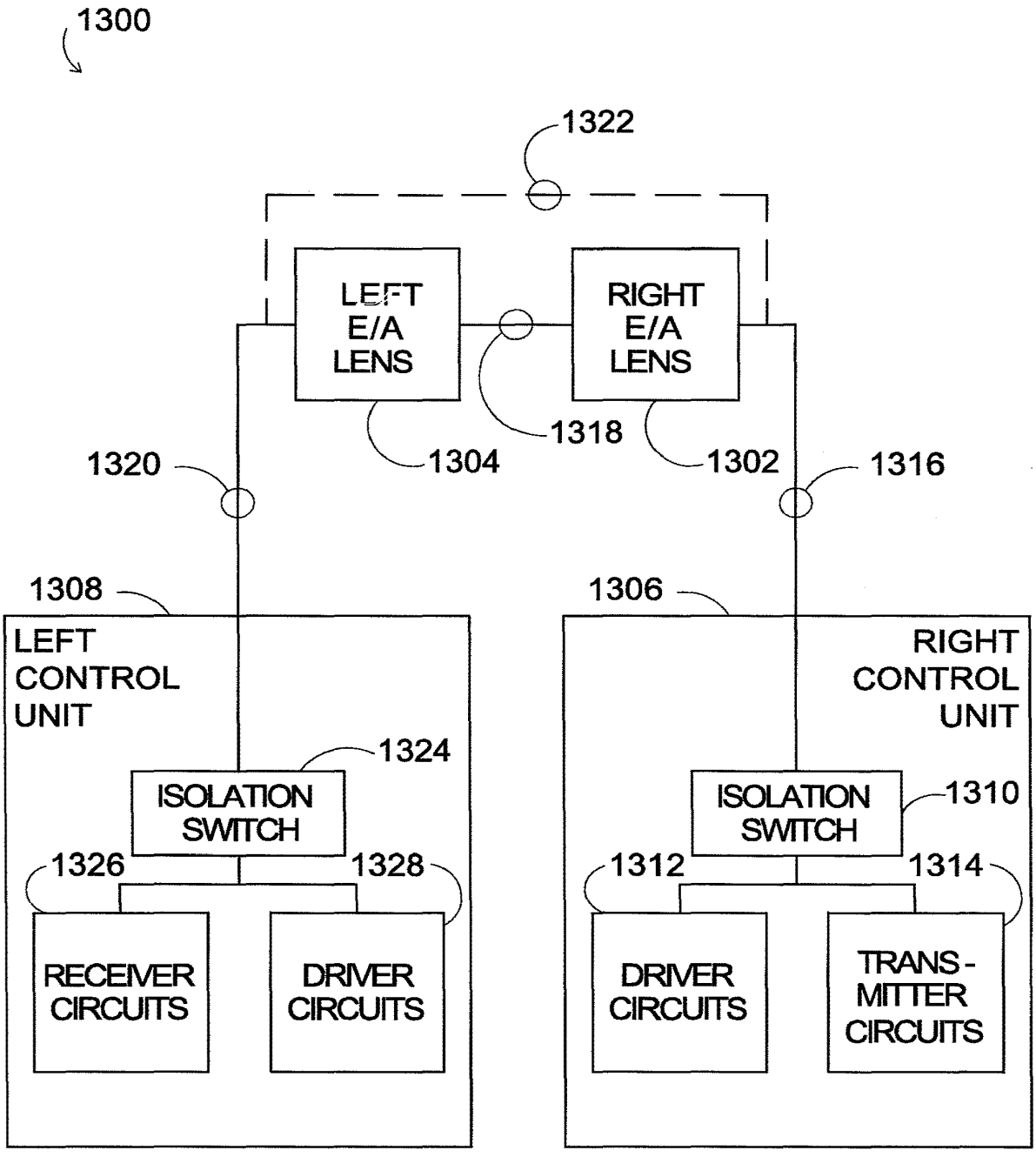
1300
1322
LEFT E/A LENS
RIGHT E/A LENS
1318
1304
1302
1320
1316
1308
1306
LEFT CONTROL UNIT
RIGHT CONTROL UNIT
1324
ISOLATION SWITCH
1310
ISOLATION SWITCH
1326
1328
1312
1314
RECEIVER CIRCUITS
DRIVER CIRCUITS
DRIVER CIRCUITS
TRANS-MITTER CIRCUITS

FIGURE 13

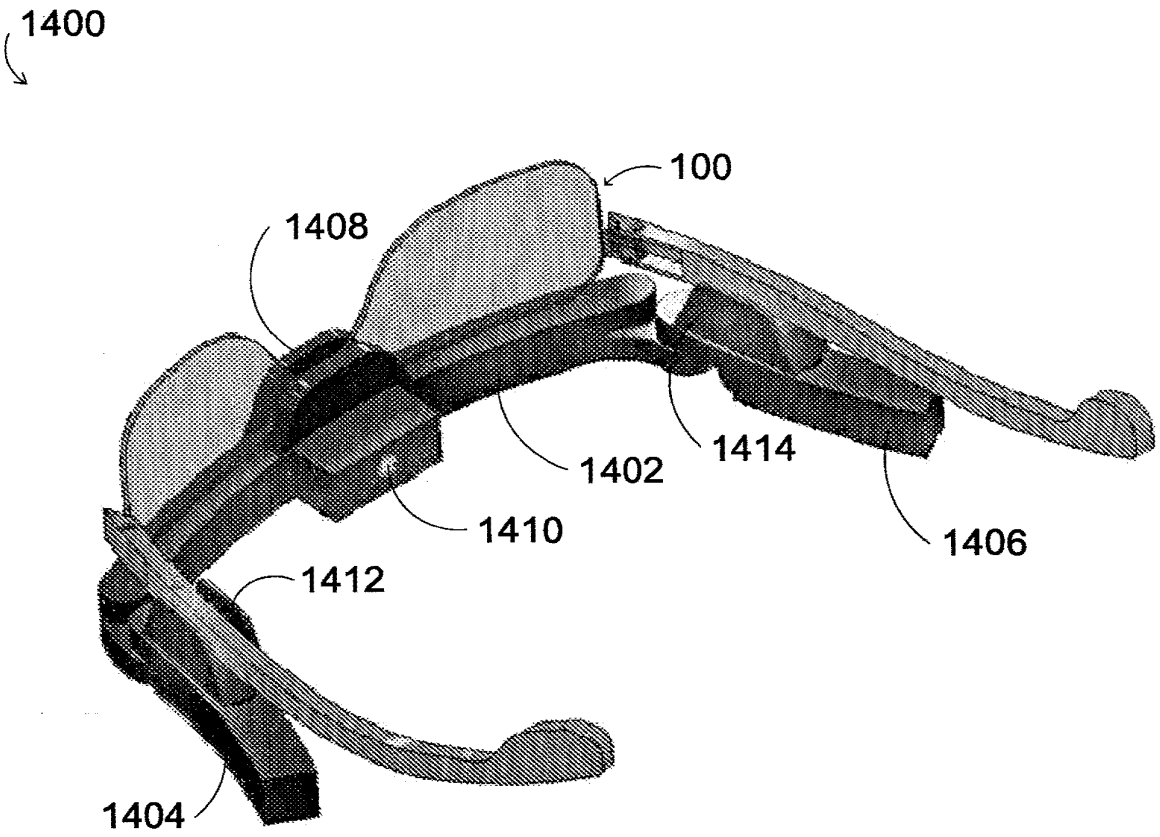


FIGURE 14

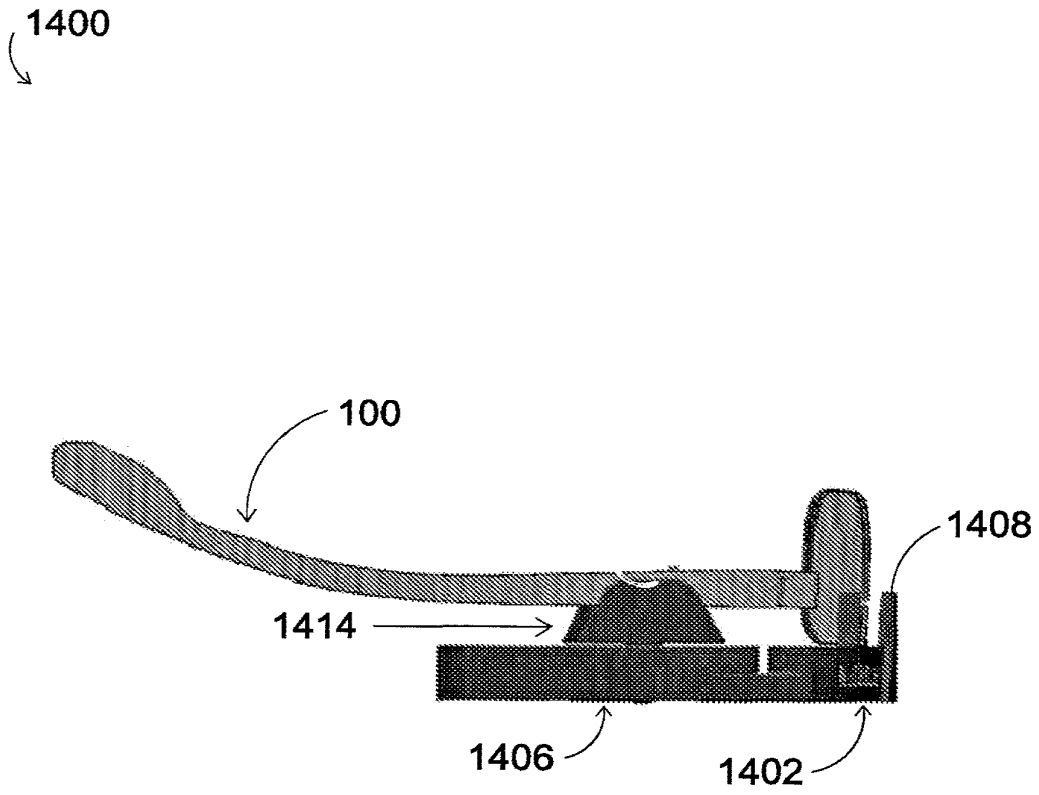


FIGURE 15

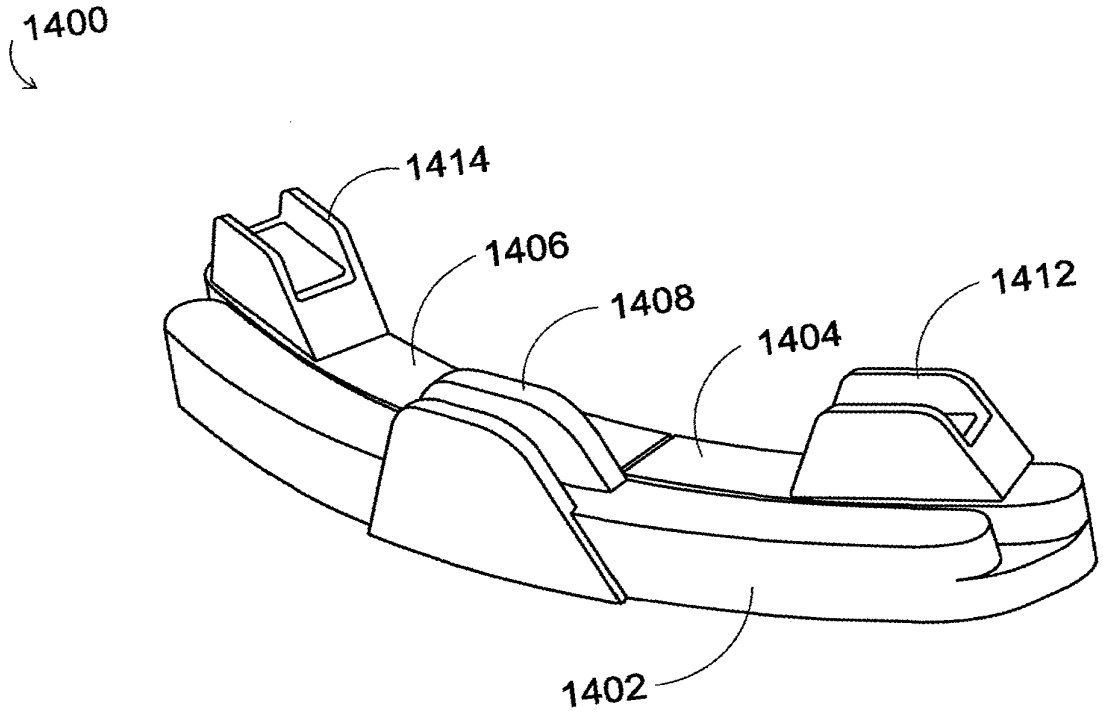


FIGURE 16

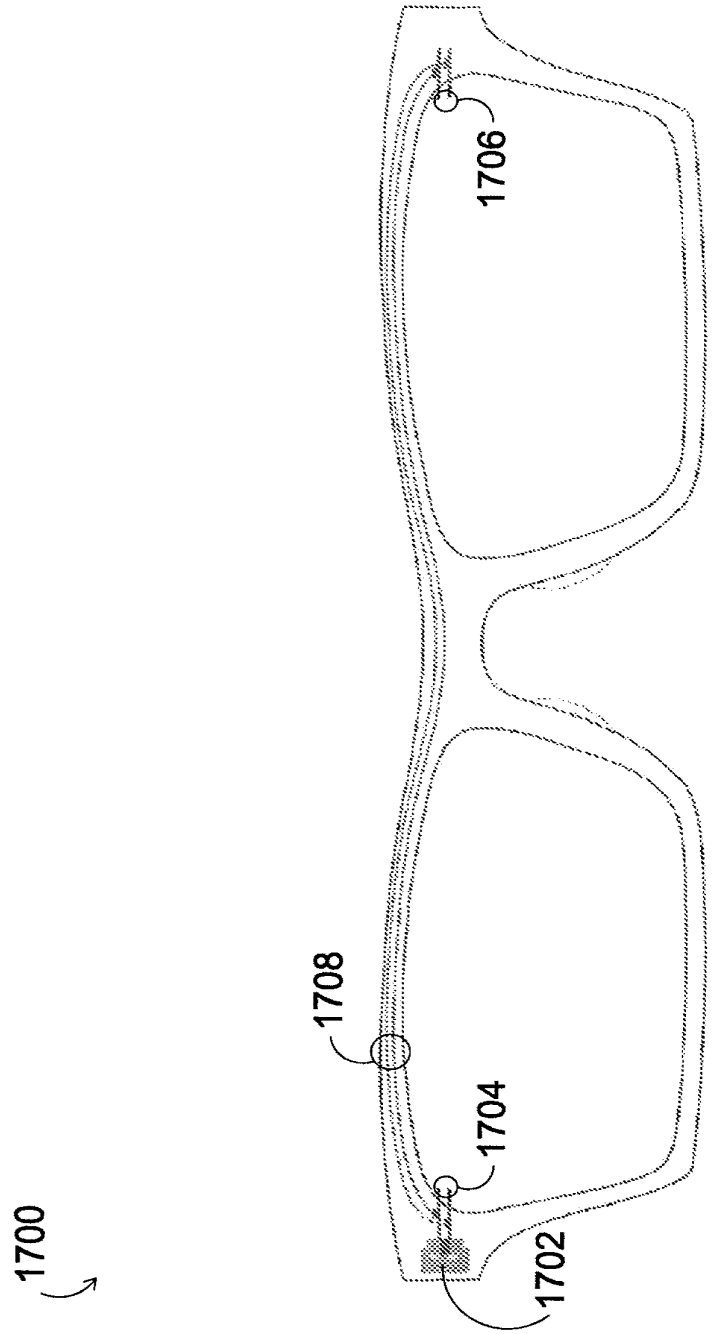


FIGURE 17

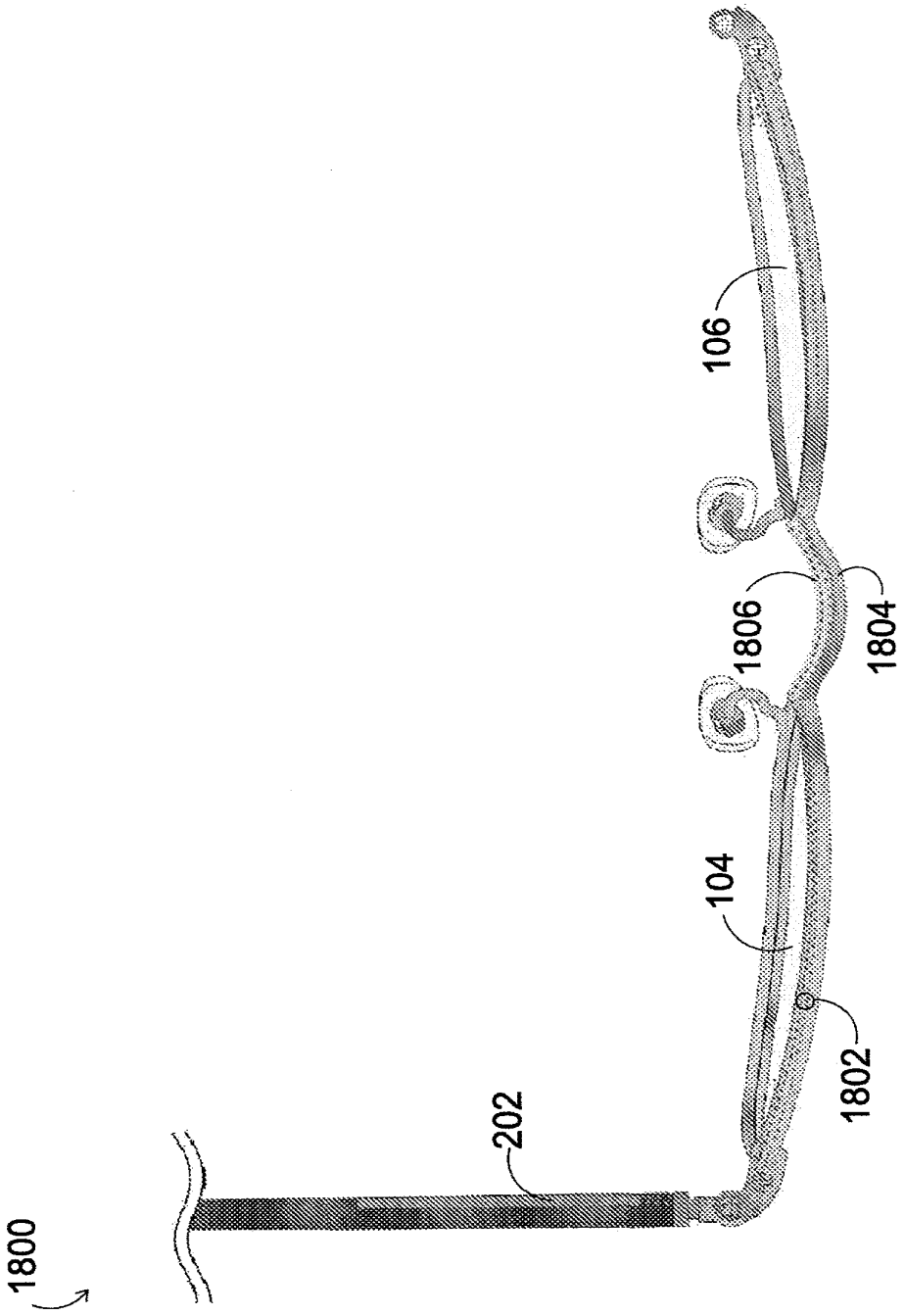


FIGURE 18

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

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| 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<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Girardin, François |

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)<br>page 4, line 9 - line 14<br>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)<br>figure 9A<br>page 20, line 22 - page 21, line 13<br>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)<br>* abstract<br>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)<br>paragraphs [0036], [0045] | 1-14,23 |
| A | WO 2006/086155 A2 (COLGATE PALMOLIVE CO [US]; WAGUESPACK KENNETH [US])<br>17 August 2006 (2006-08-17)<br>* abstract | 17,18 |
| A | WO 2008/051520 A2 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; BOCHNOWSKI JAMES J [US];) 2 May 2008 (2008-05-02)<br>the whole document | 15-22 |
| A | US 2004/156012 A1 (JANNARD JAMES [US] ET AL) 12 August 2004 (2004-08-12)<br>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.

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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.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/020498

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | EP 1849226 A2 | 31-10-2007 |
| | | KR 20070108228 A | 08-11-2007 |
| | | RU 2378752 C2 | 10-01-2010 |
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| WO 2008051520 A2 | 02-05-2008 | US 2008106695 A1 | 08-05-2008 |
| US 2004156012 A1 | 12-08-2004 | US 2006197907 A1 | 07-09-2006 |

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(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 August 2009 (13.08.2009)

PCT

(10) International Publication Number
WO 2009/098719 A1

(51) International Patent Classification:
*G02C 11/04* (2006.01)

(21) International Application Number:
PCT/IT2008/000069

(22) International Filing Date:
5 February 2008 (05.02.2008)

(25) Filing Language: Italian

(26) Publication Language: English

(71) Applicant and
(72) Inventor: **COZZANI, Laura Maria** [IT/IT]; Via Anzani, 16, 22040 Alzate Brianza (IT).

(74) Agents: **PELLEGRI, Alberto** et al.; c/o Società Italiana Brevetti S.p.A., Via Avegno, 6, I-21100 Varese (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: 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, 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, 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).

**Published**:

— *with international search report (Art. 21(3))*

WO 2009/098719 A1

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

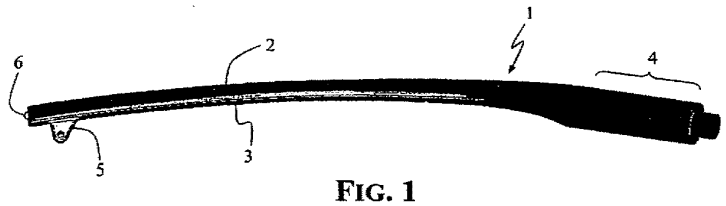


FIG. 1

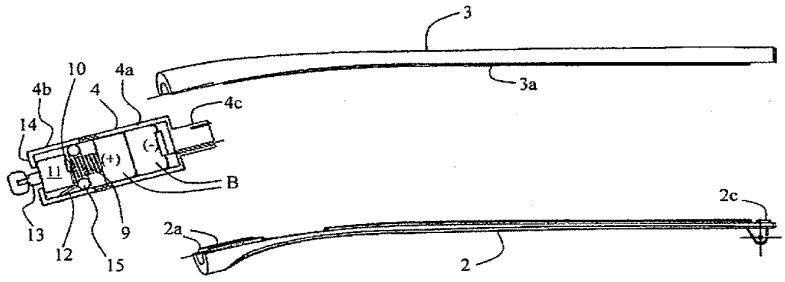


FIG. 2

(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.

# "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.

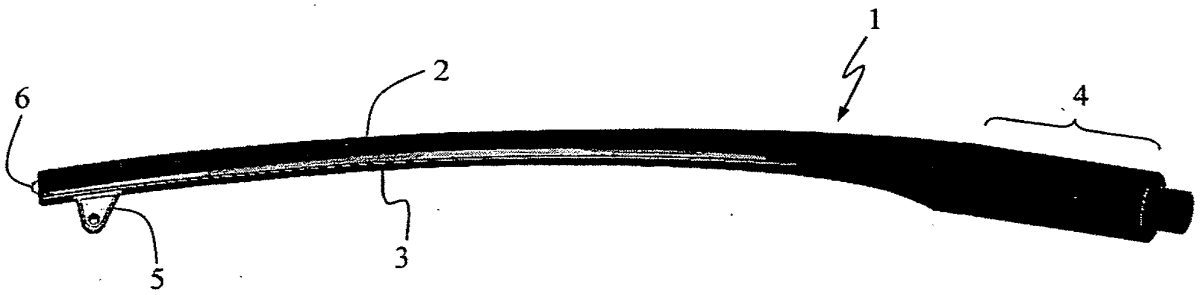


FIG. 1

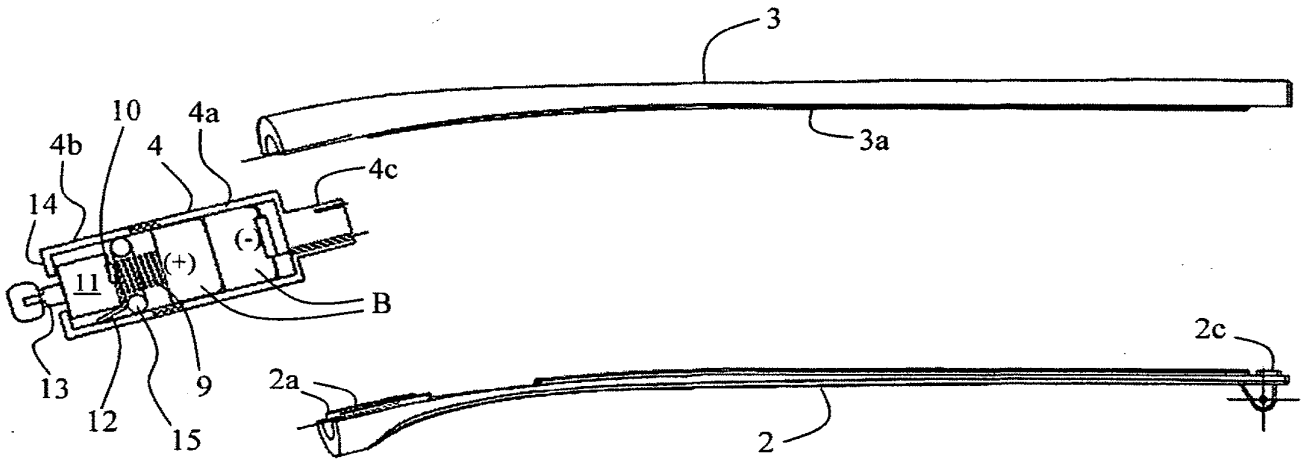


FIG. 2

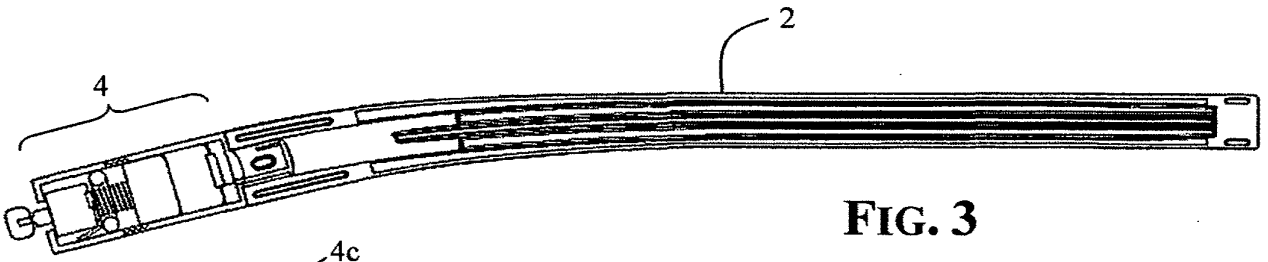


FIG. 3

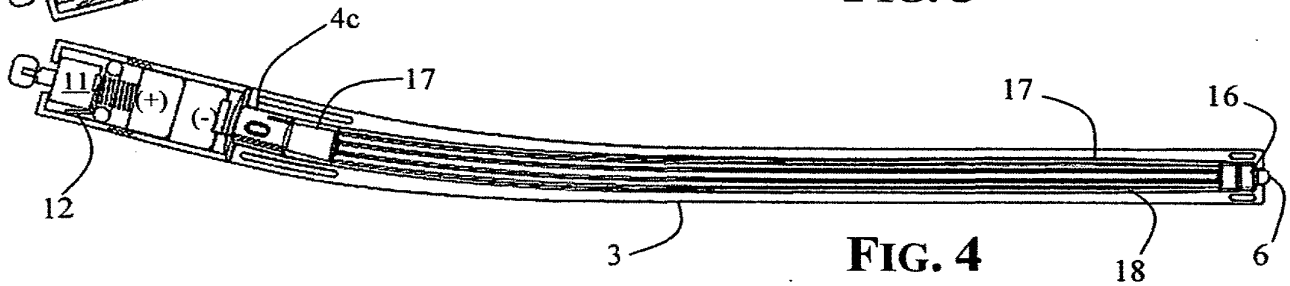


FIG. 4

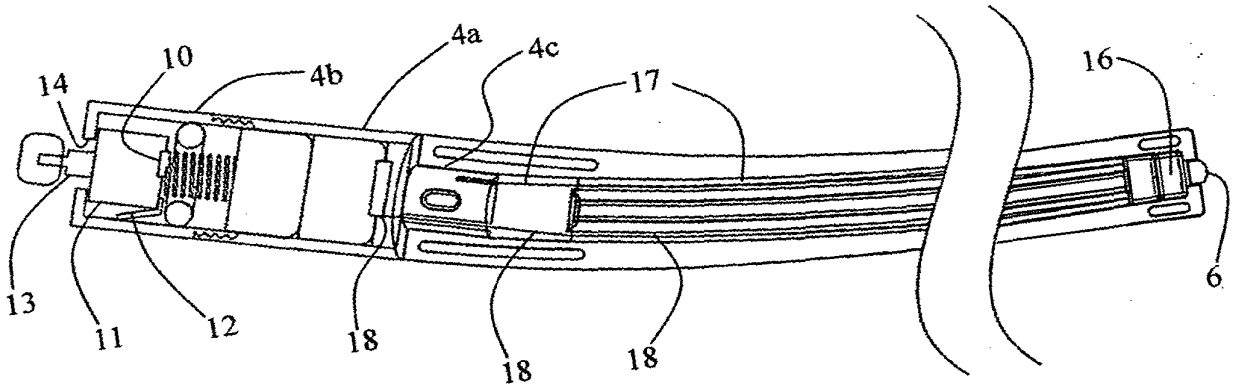


FIG. 5

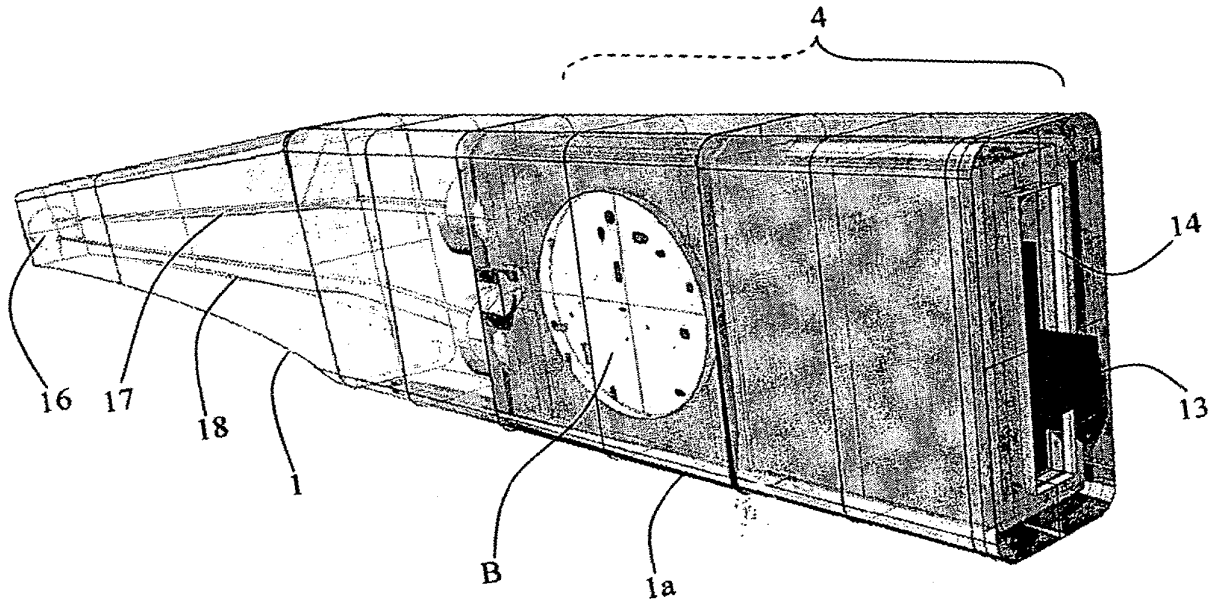


FIG. 6

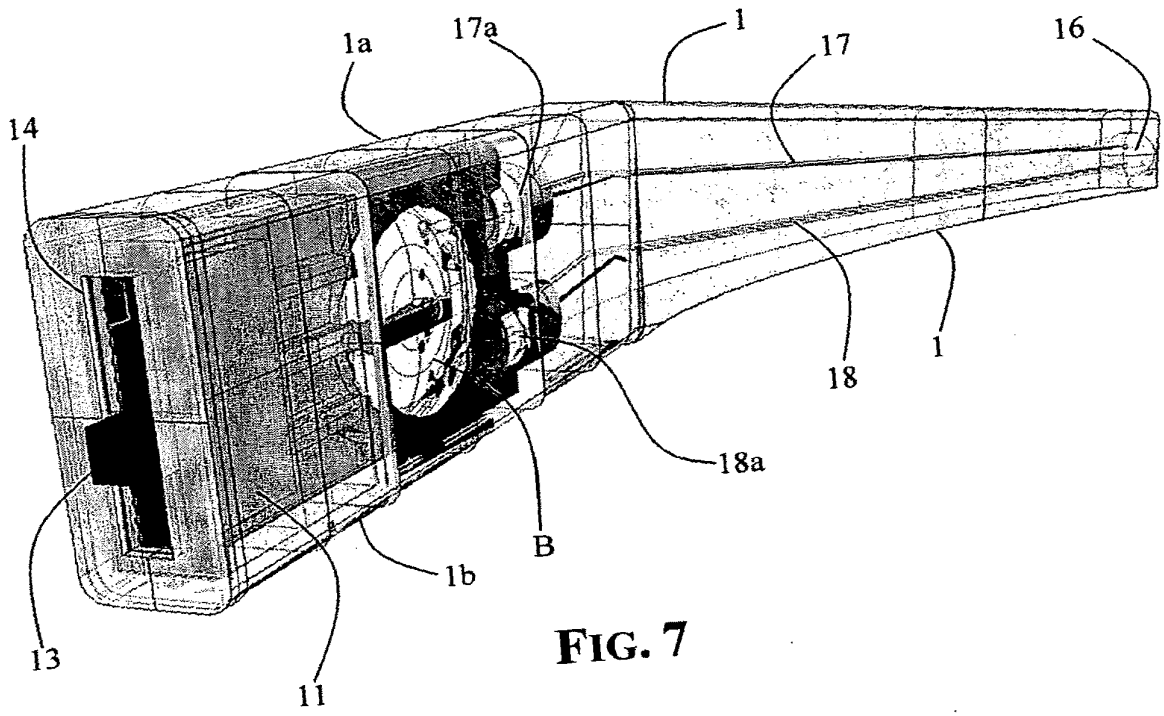


FIG. 7

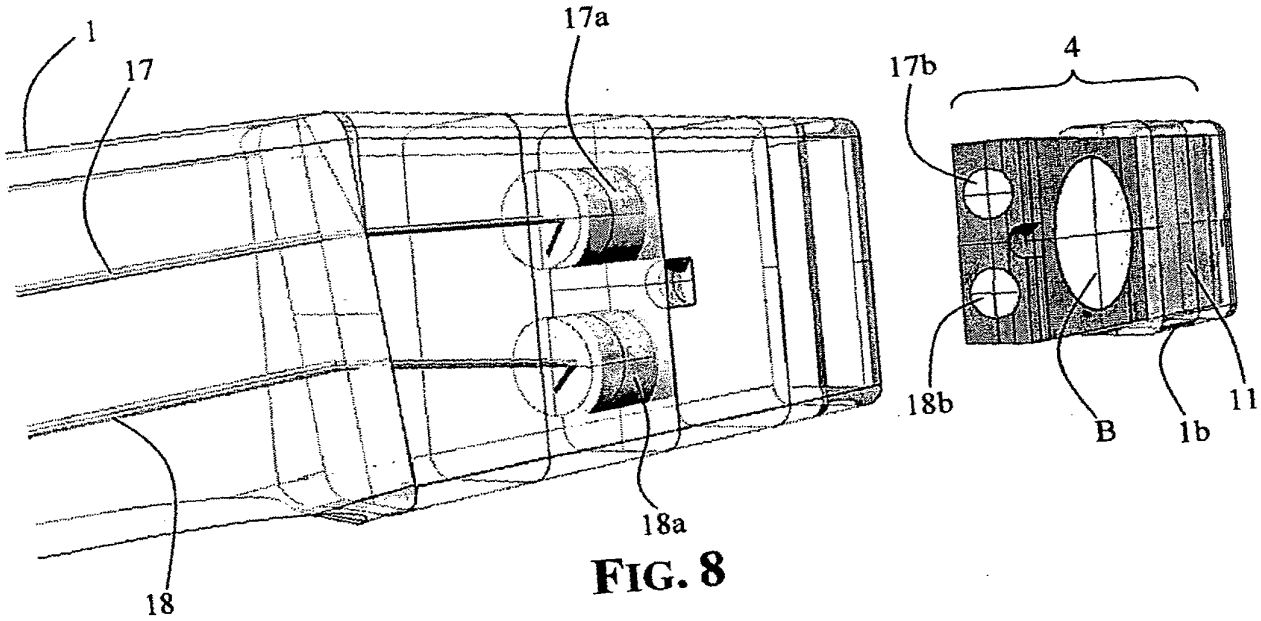


FIG. 8

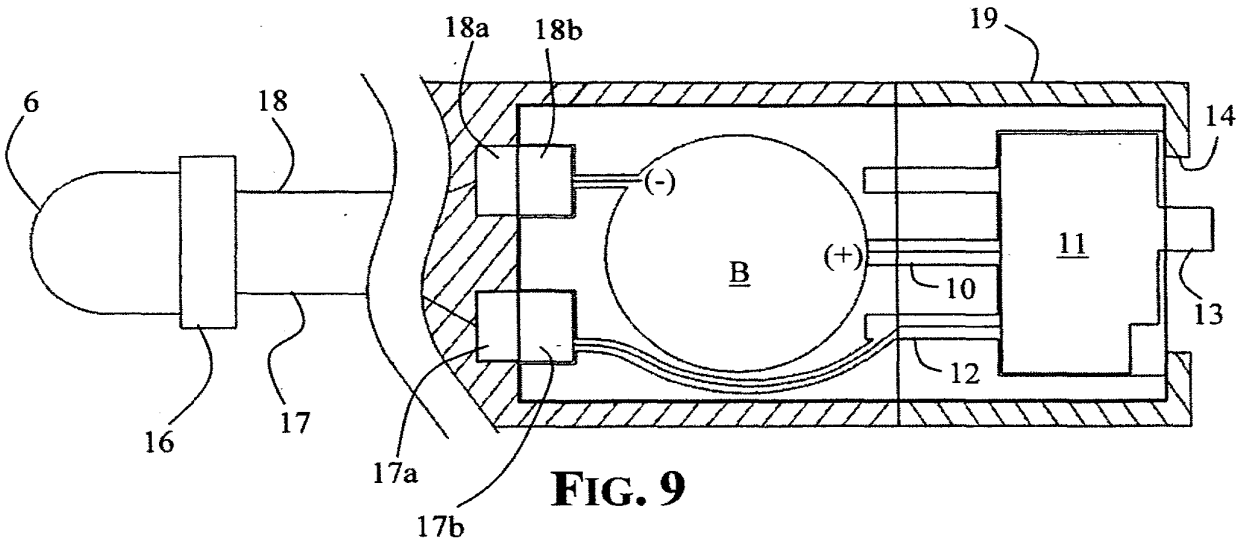


FIG. 9

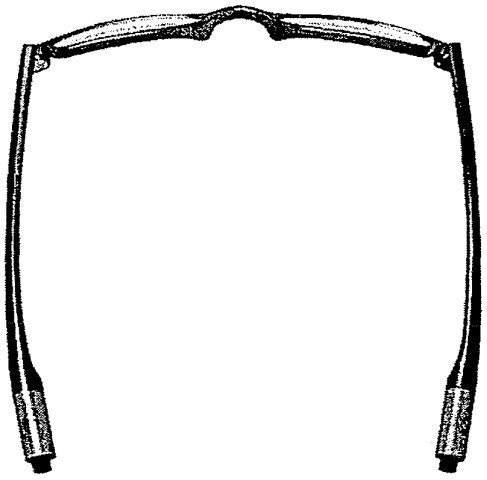

FIG. 10

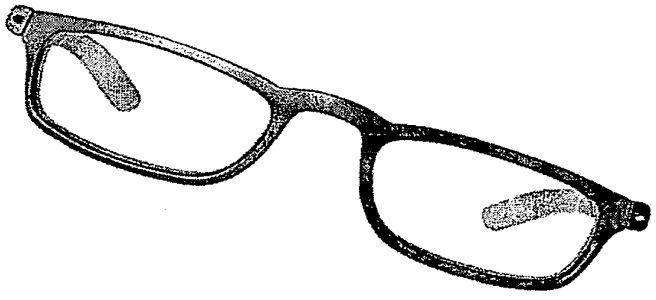

FIG. 11

# 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<br>Y | WO 2007/008062 A (SPEEKENBRINK ADRIANUS [NL]) 18 January 2007 (2007-01-18)<br>figures 2,4D<br><br>page 4, lines 5-9,15,16,19,20 | 1,5,6,8, 12,13<br>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)<br>figure 13B<br>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)<br>figures 1-4<br>paragraph [0029] | 2,3,9,10 |

-/--

[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 September 2008 | 02/12/2008 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | de Lajarte, Gilles |

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])<br>11 October 2007 (2007-10-11)<br>figures 5,6<br>paragraphs [0016] - [0024] | 1,5,8,12 |
| A | DE 101 17 446 A1 (OPTIK SOMMER [DE])<br>17 October 2002 (2002-10-17)<br>the whole document | 1,5,8,12 |
| A | GB 2 127 254 A (HEANEY JAMES)<br>4 April 1984 (1984-04-04)<br>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.

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

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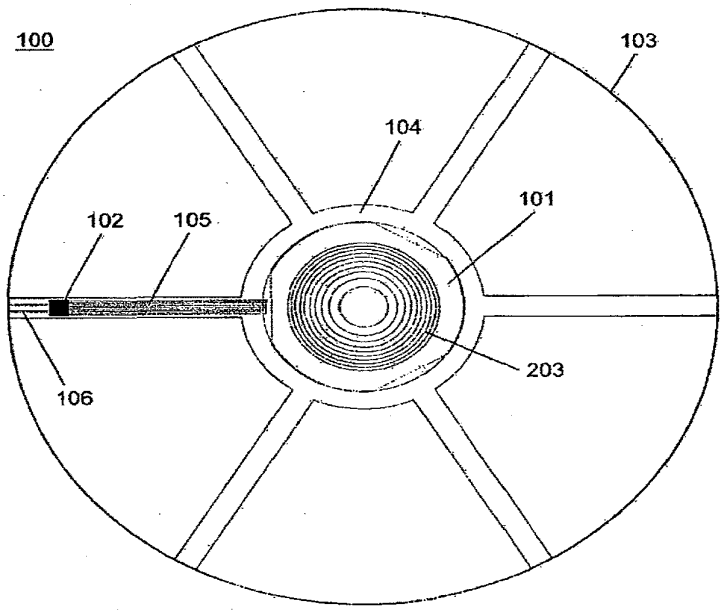
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, 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:**
— *without international search report and to be republished upon receipt of that report*

*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.

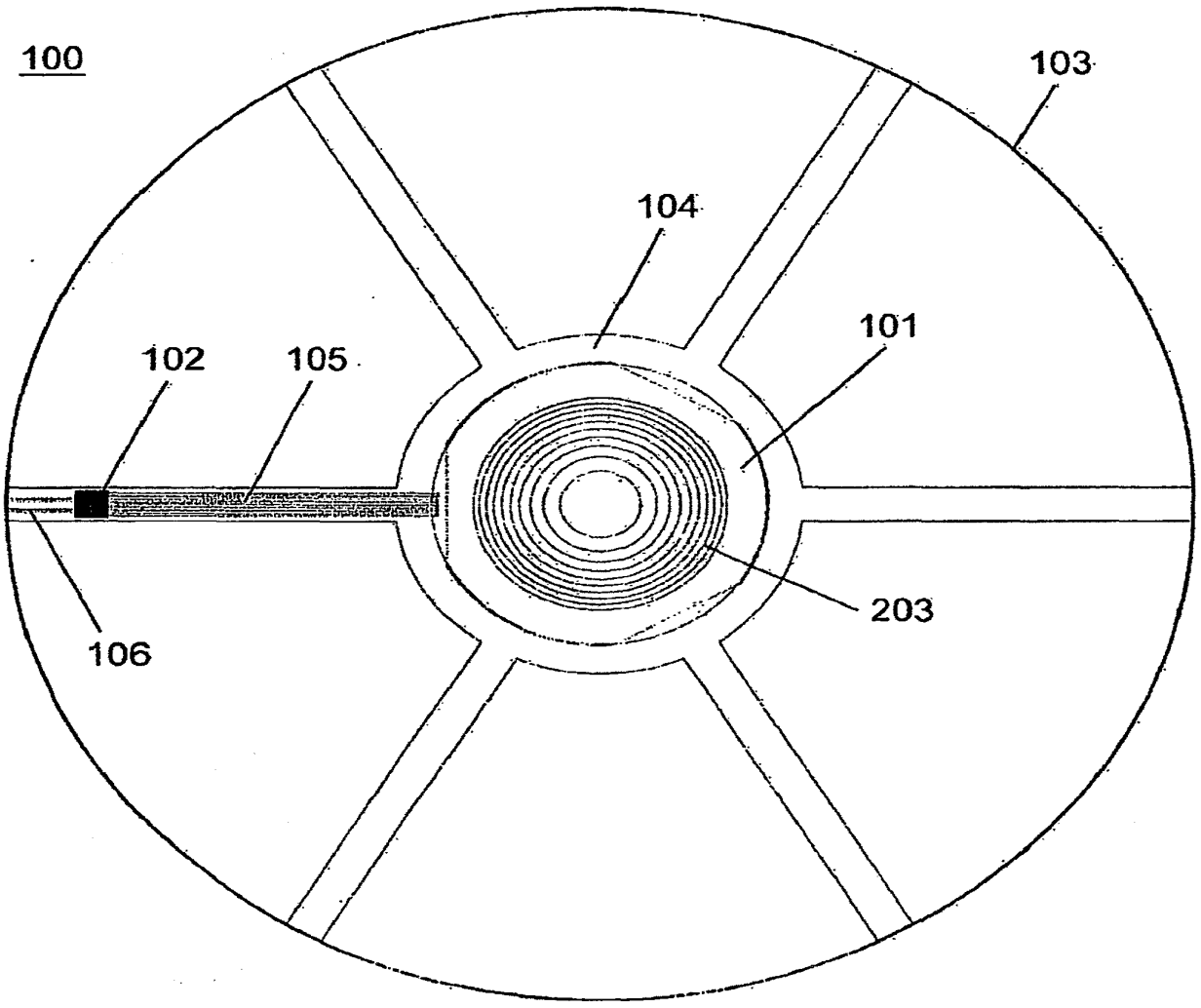



FIG. 1

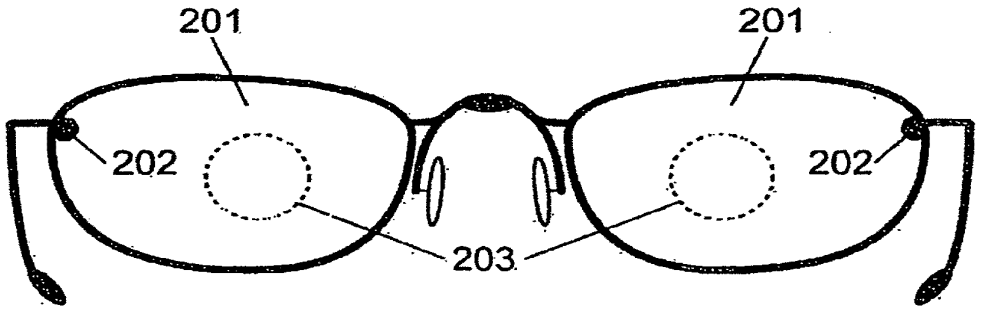



FIG. 2A

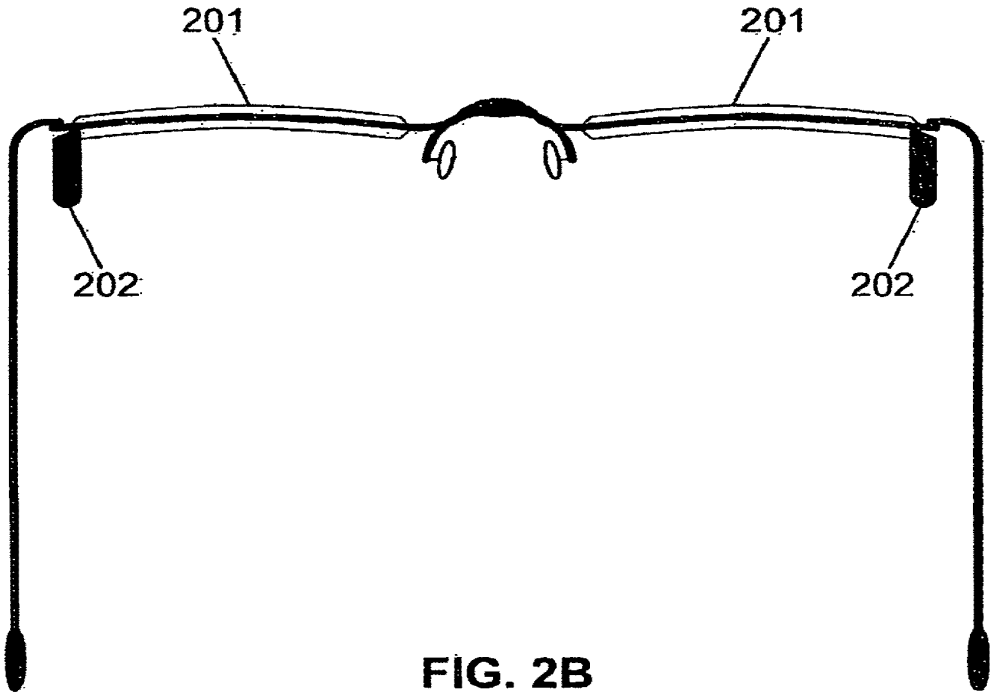



FIG. 2B

FIG. 3A

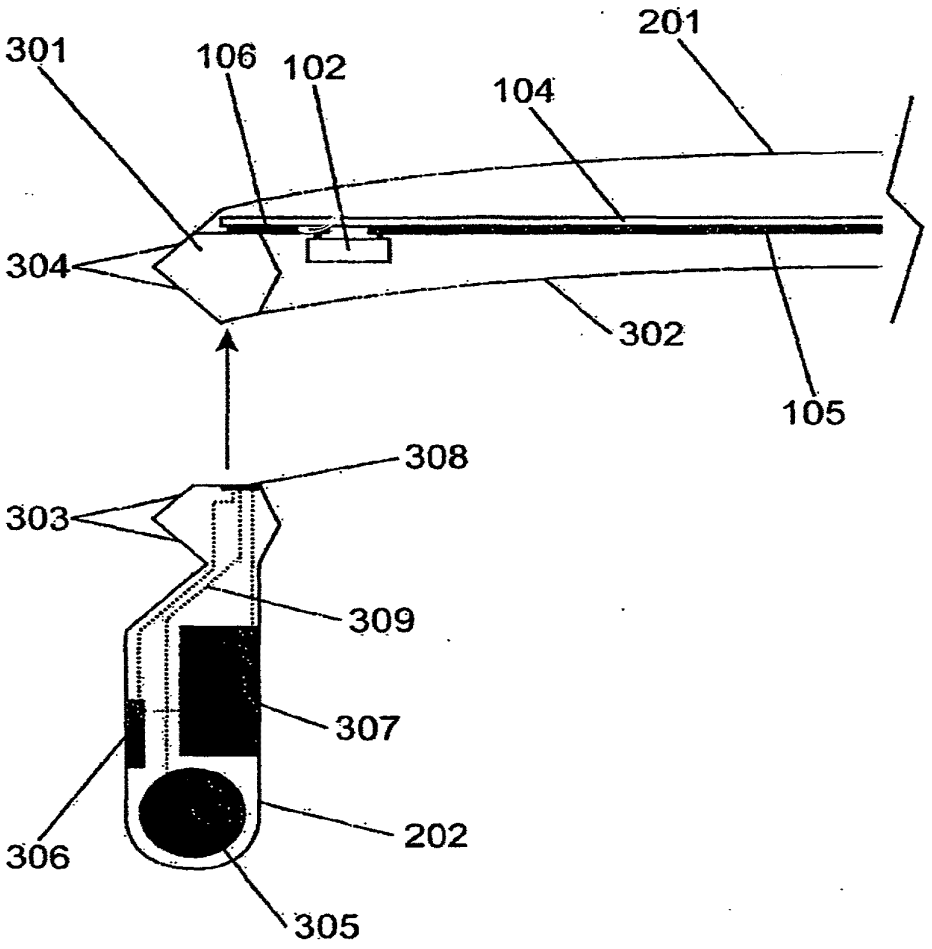



FIG. 3B

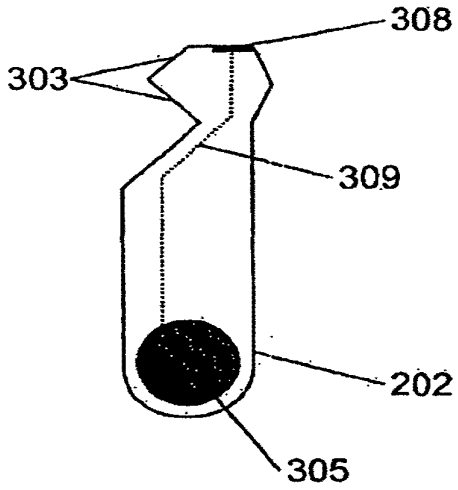



FIG. 3C

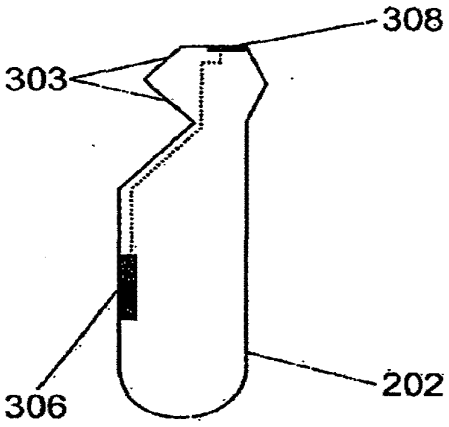



FIG. 3D

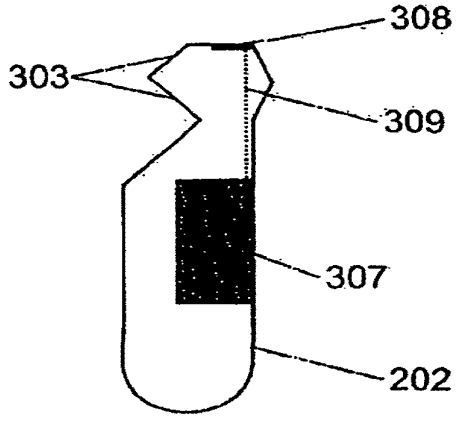



FIG. 3E

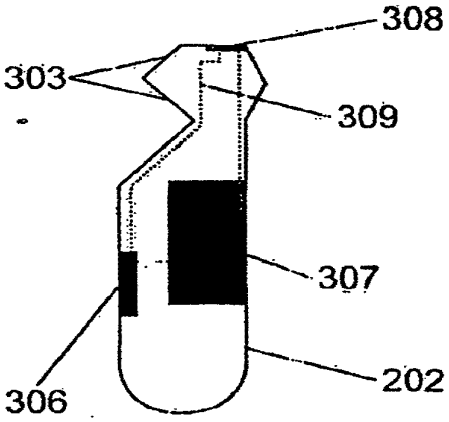



FIG. 3F

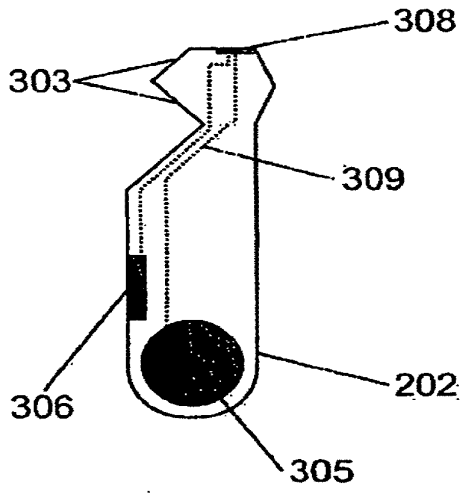



FIG. 3G

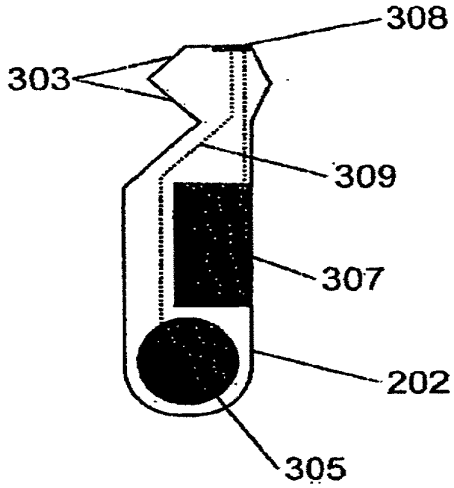



FIG. 3H

FIG. 3I

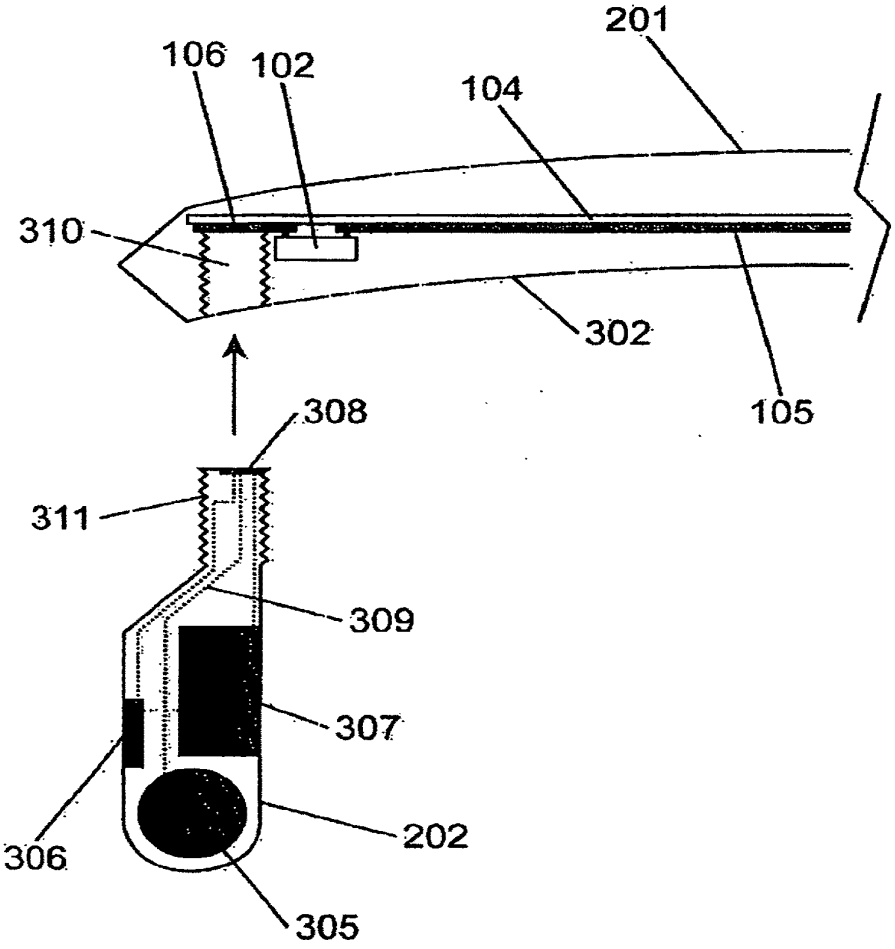



FIG. 3J

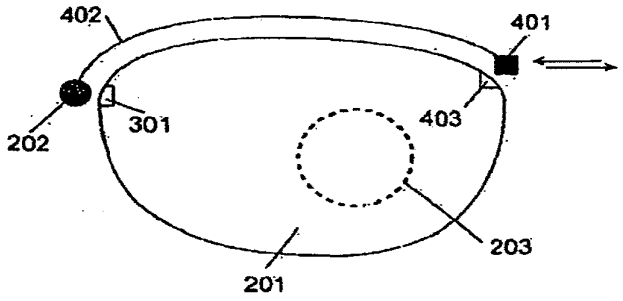



FIG. 4

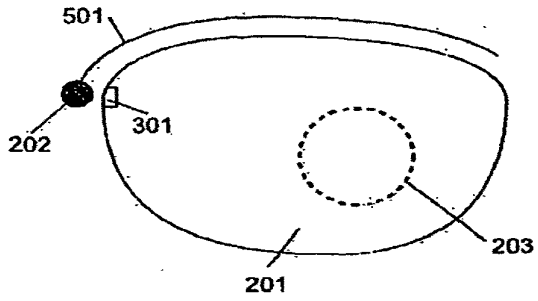



FIG. 5

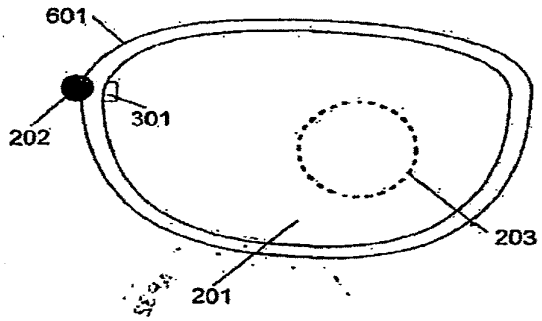



FIG. 6

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

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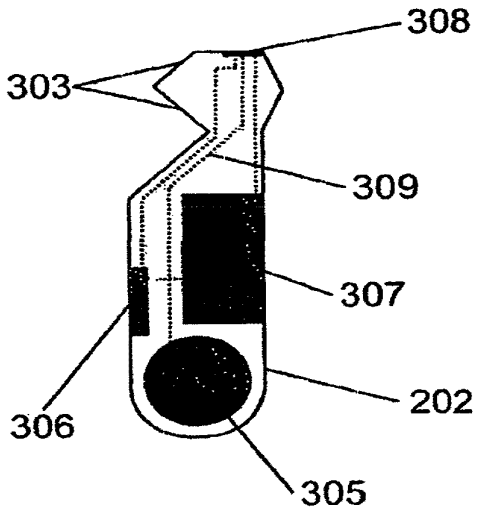
(54) Title: ELECTRONIC ADAPTER FOR ELECTRO-ACTIVE SPECTACLE LENSES




(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.

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# 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 |

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|---|---|
| 27 February 2008 (27.02.2008) | 04 MAR 2008 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, Virginia 22313-1450<br>Facsimile No. (571) 273-3201 | Authorized officer<br>Loha Ben<br>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))

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**Kokonaski et al.**

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(54) **ELECTRONIC EYEGLASS FRAME**

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**NEW YORK, NY 10036 (US)**

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

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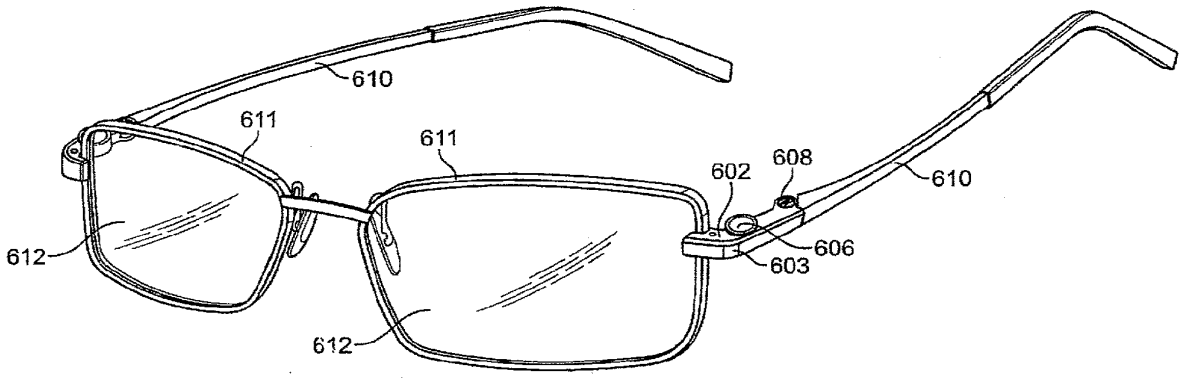
**Publication Classification**

(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.



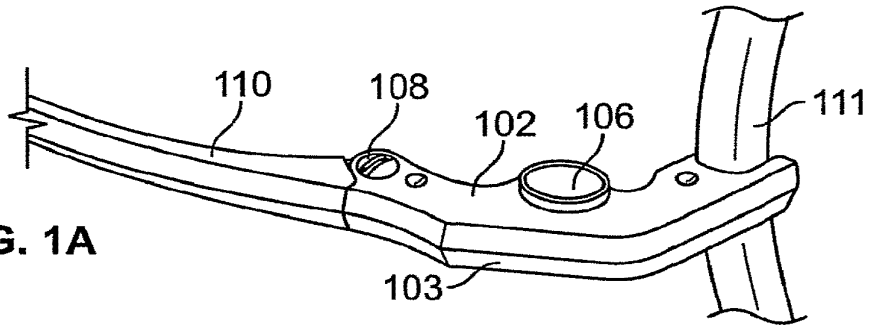



FIG. 1A

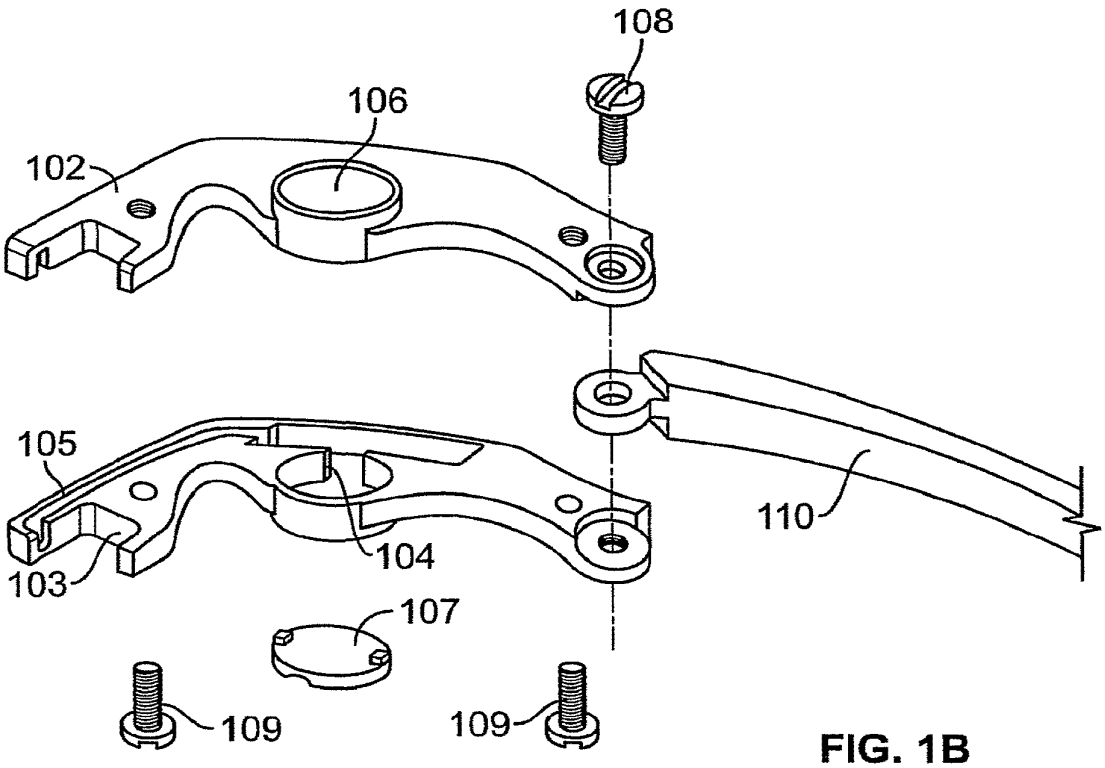



FIG. 1B

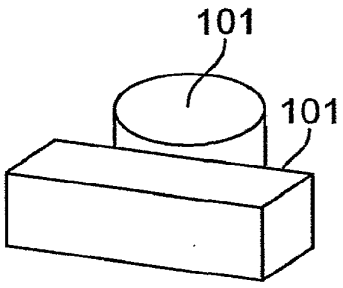



FIG. 1C

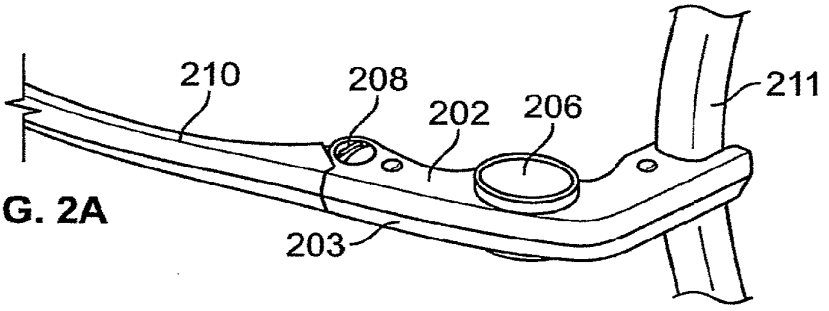



FIG. 2A

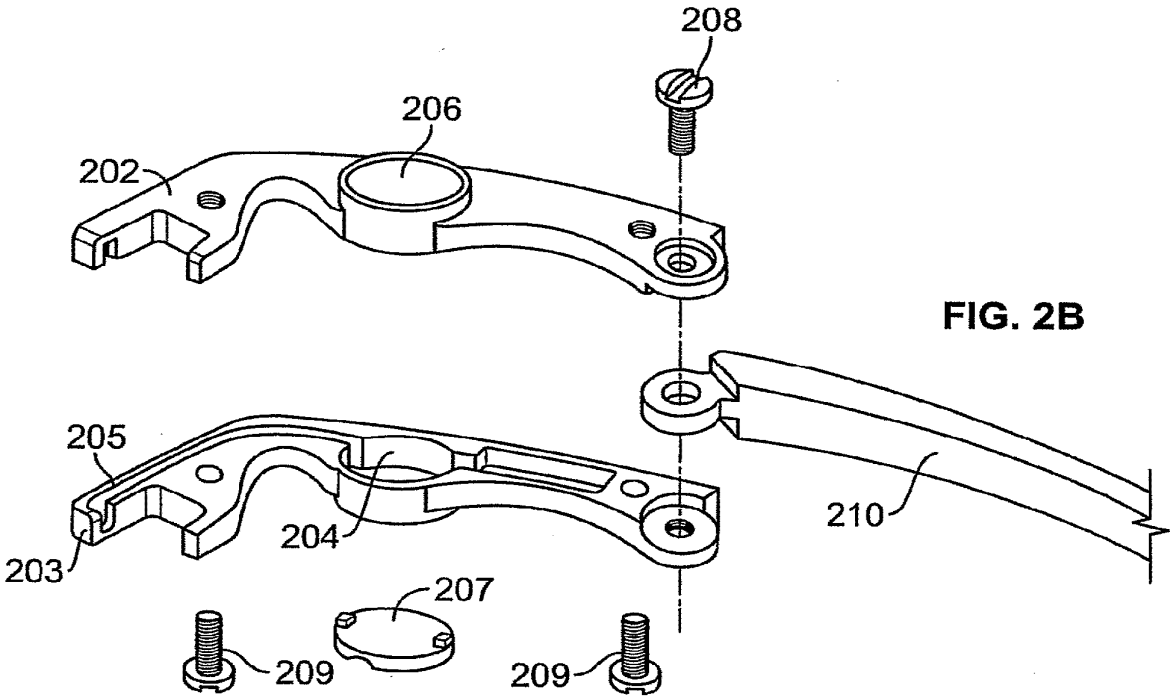



FIG. 2B

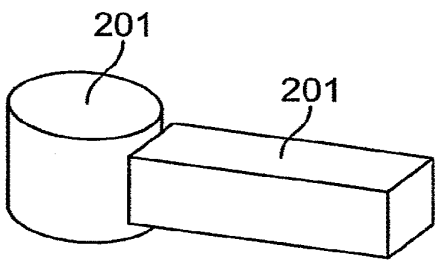



FIG. 2C

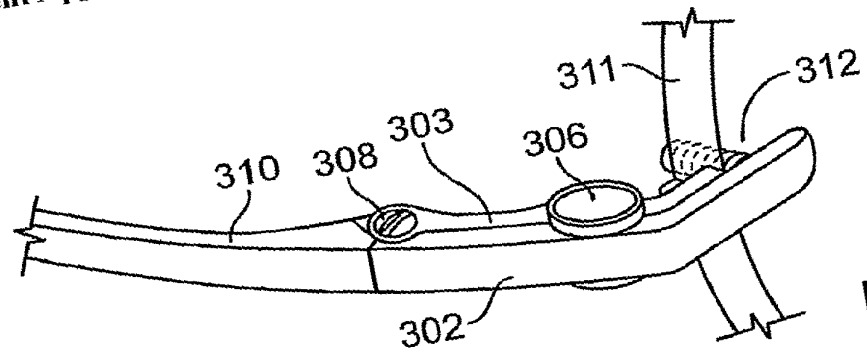



FIG. 3A

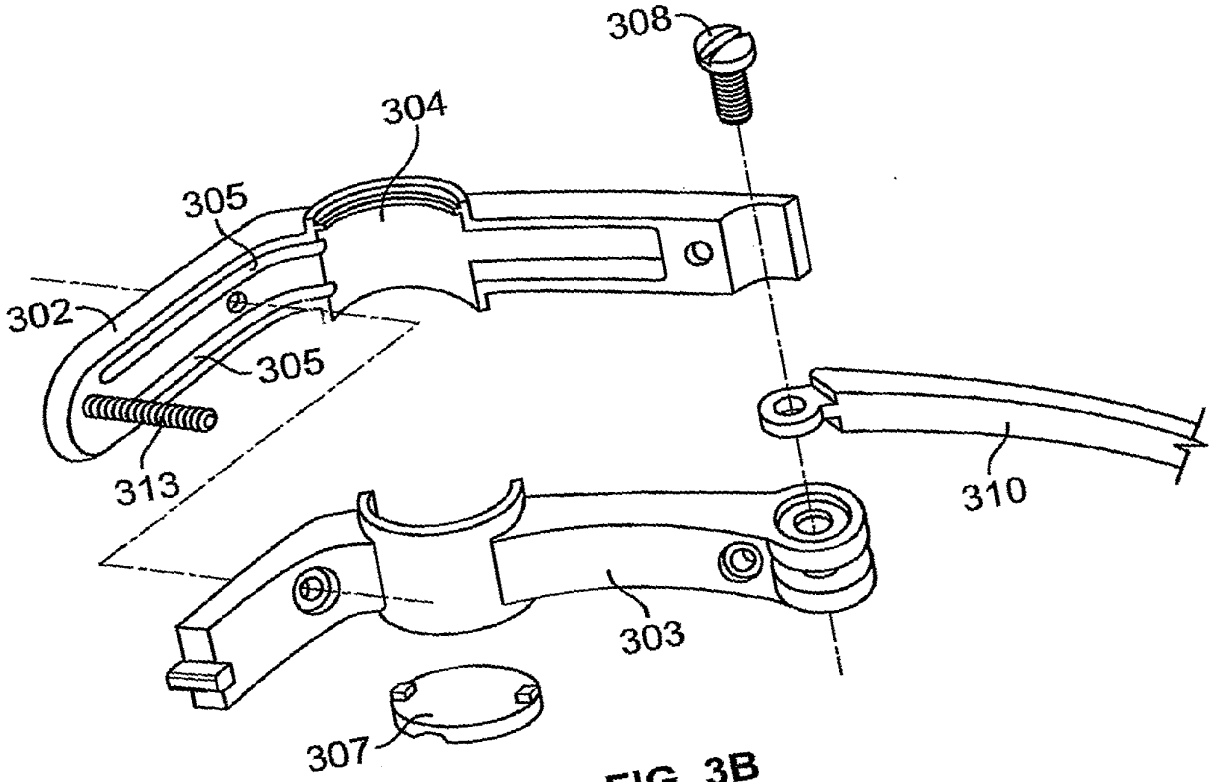



FIG. 3B

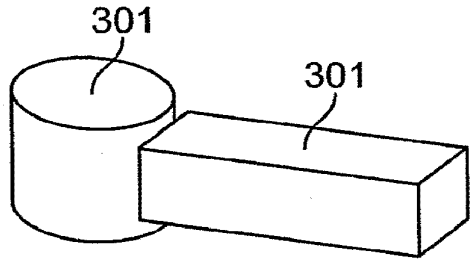



FIG. 3C

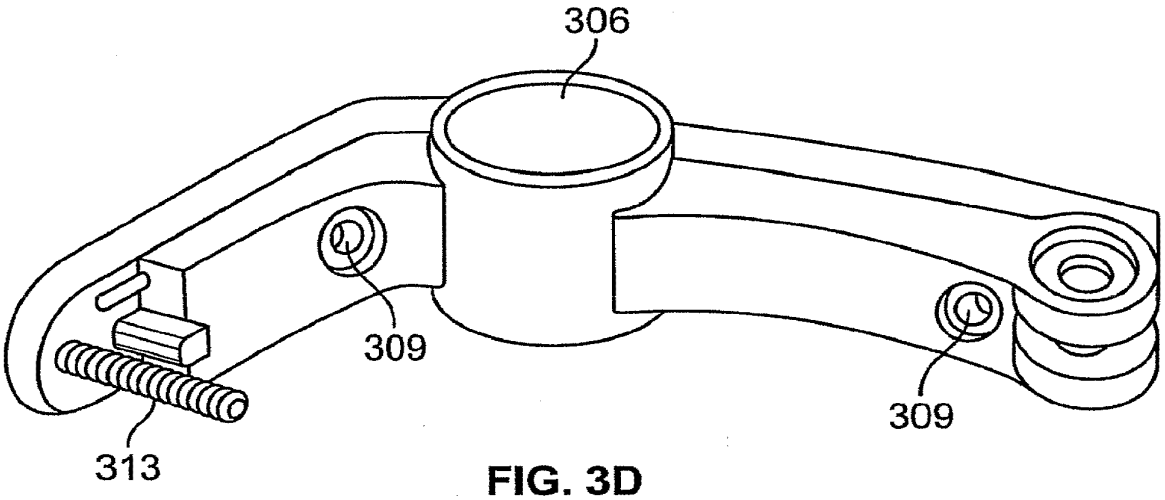



FIG. 3D

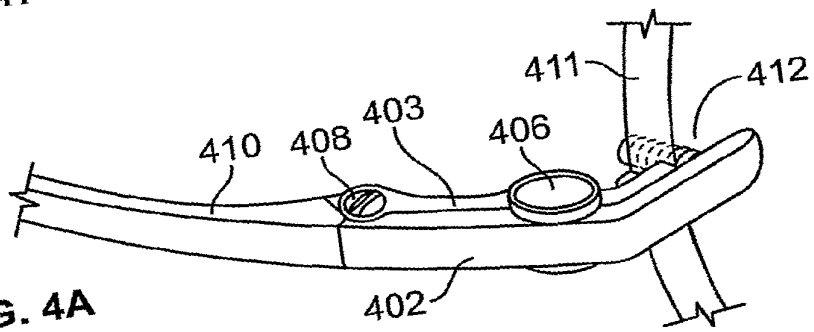



FIG. 4A

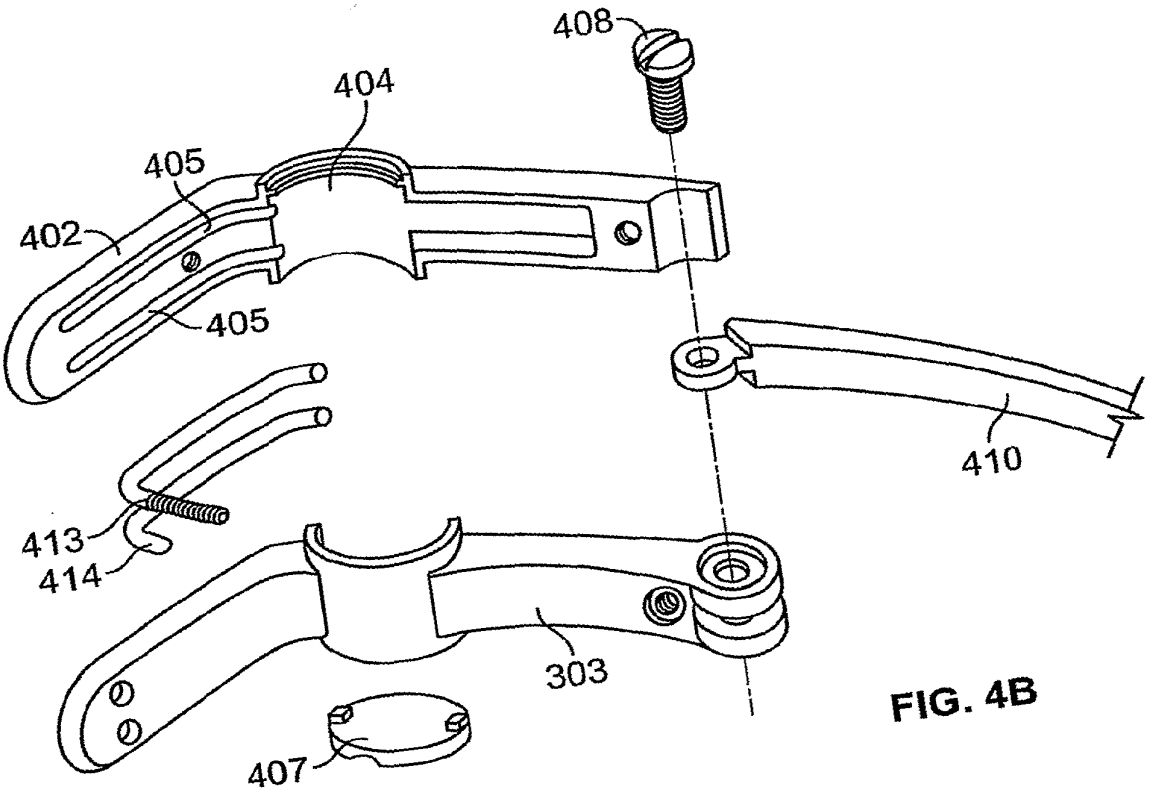



FIG. 4B

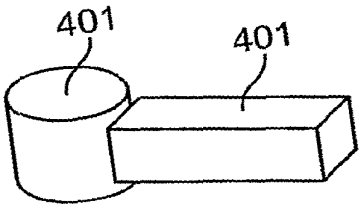



FIG. 4C

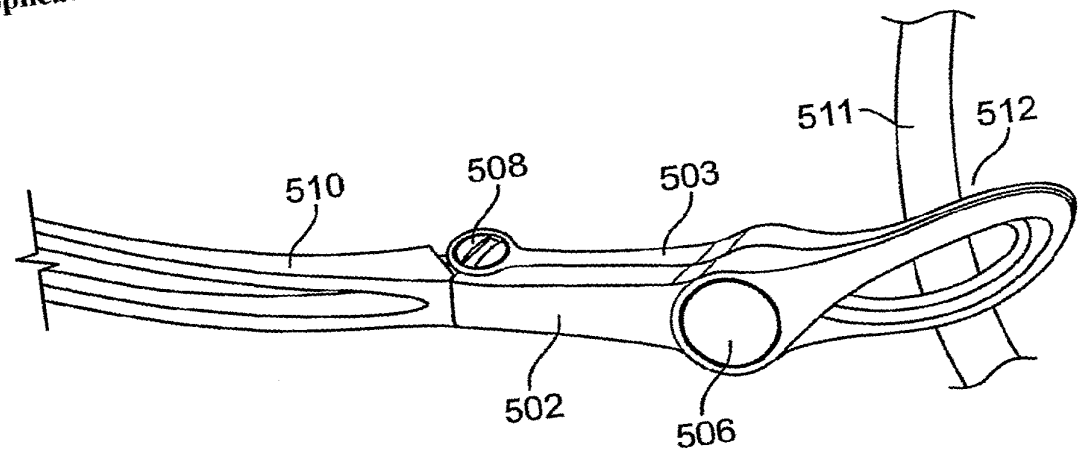



FIG. 5A

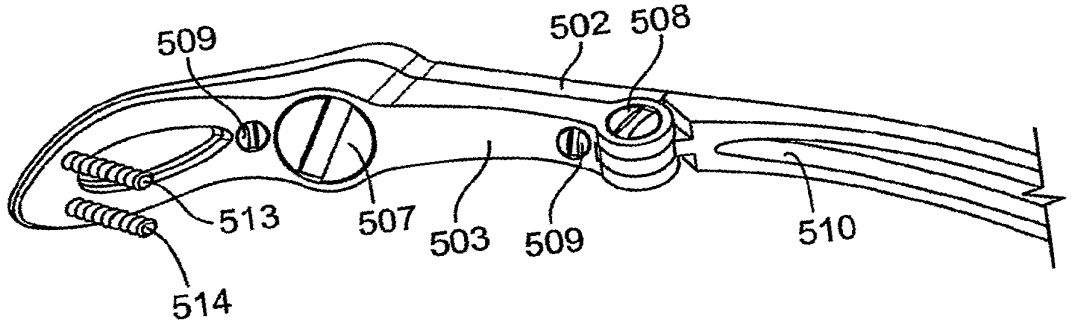



FIG. 5B

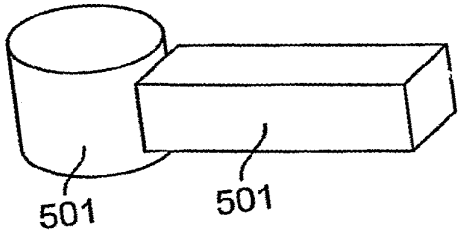



FIG. 5C

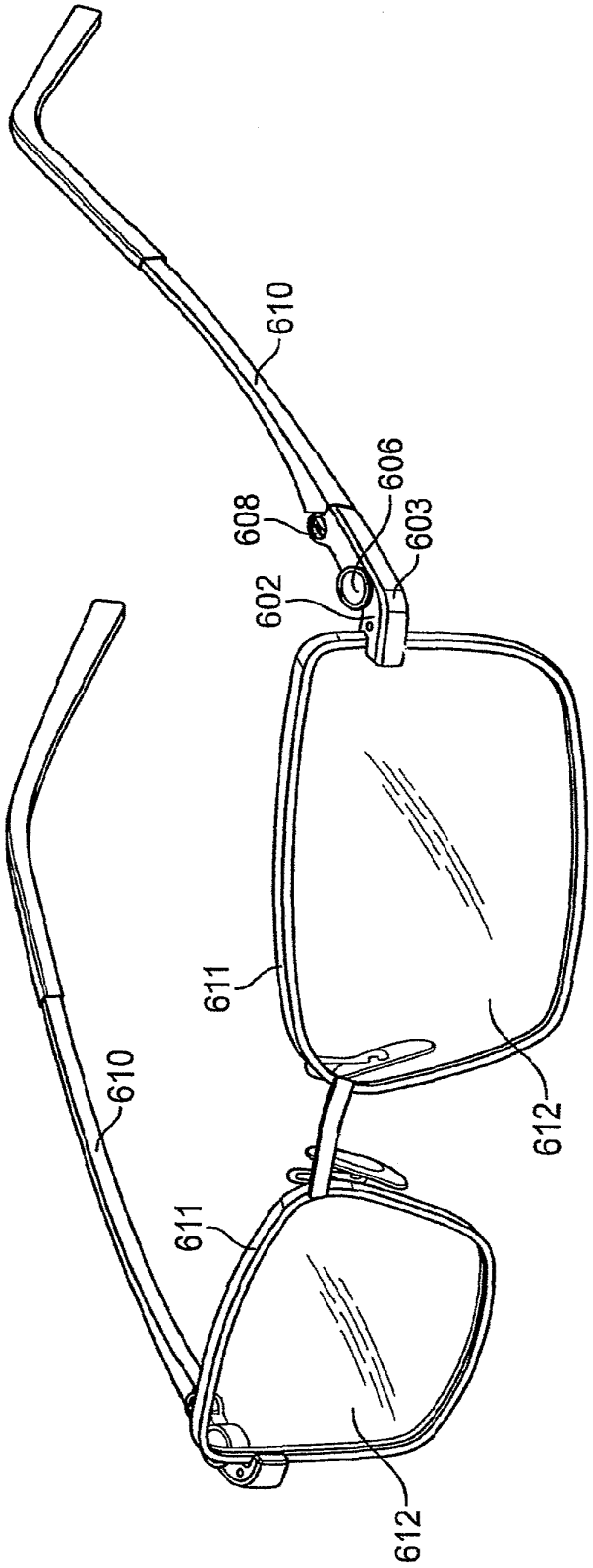



FIG. 6

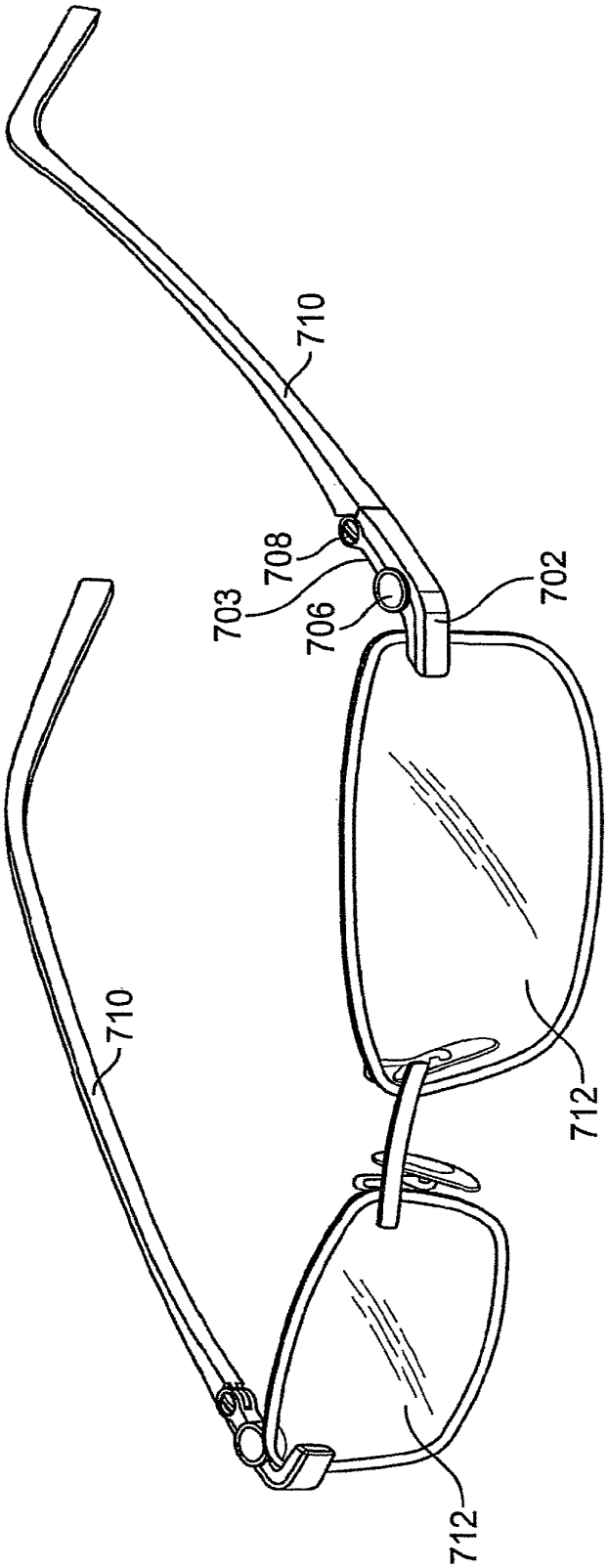



FIG. 7

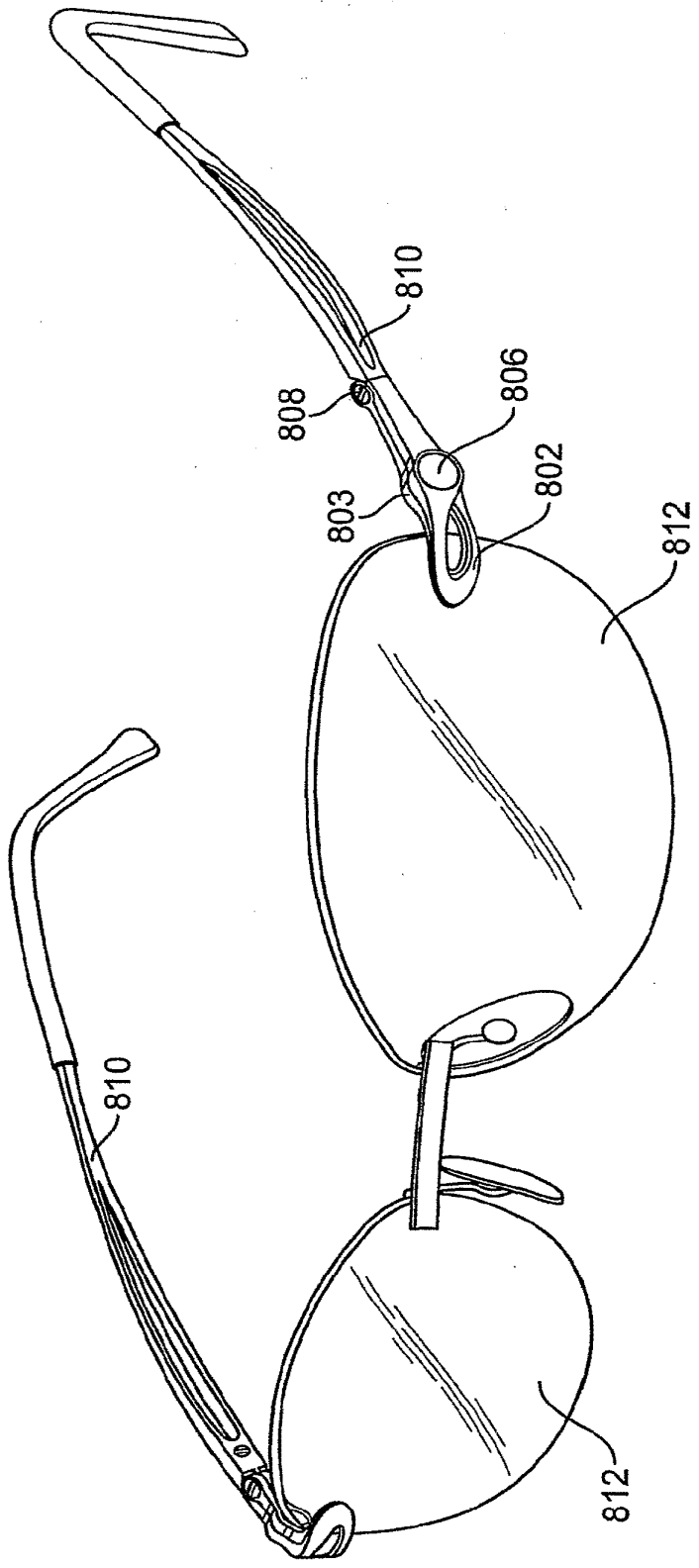



FIG. 8A

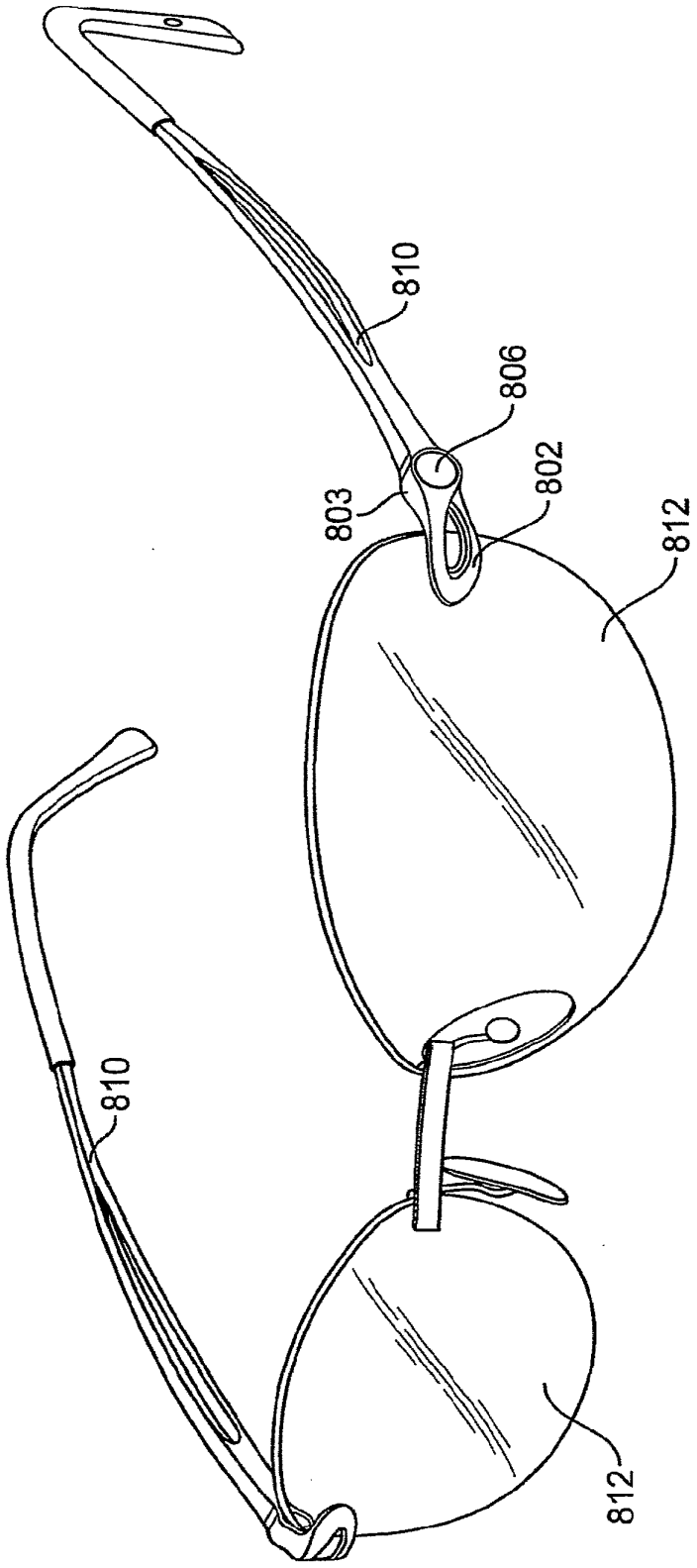



FIG. 8B

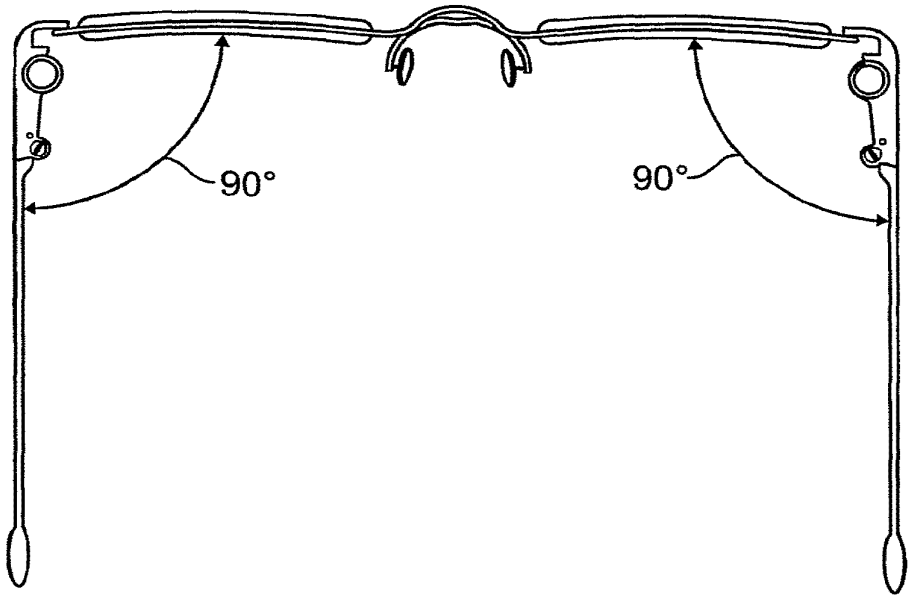



FIG. 9A

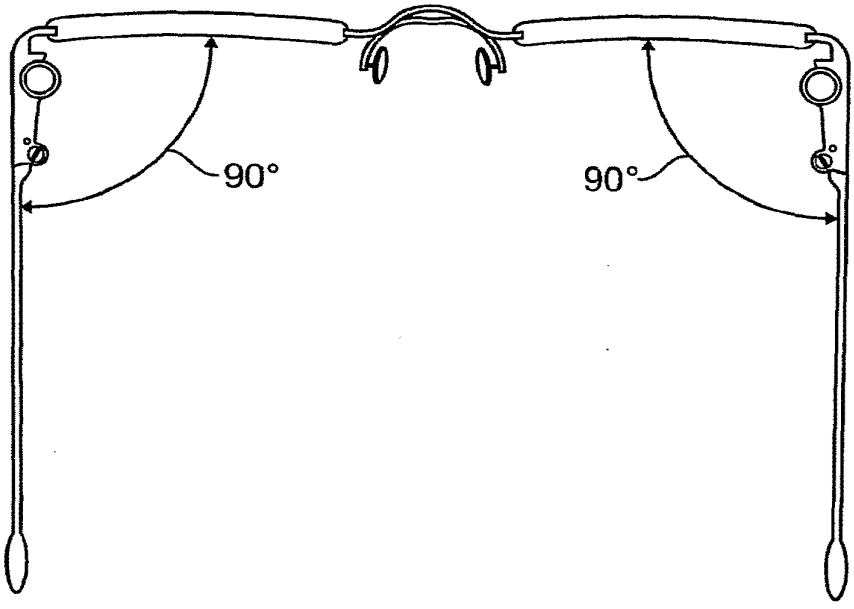



FIG. 9B

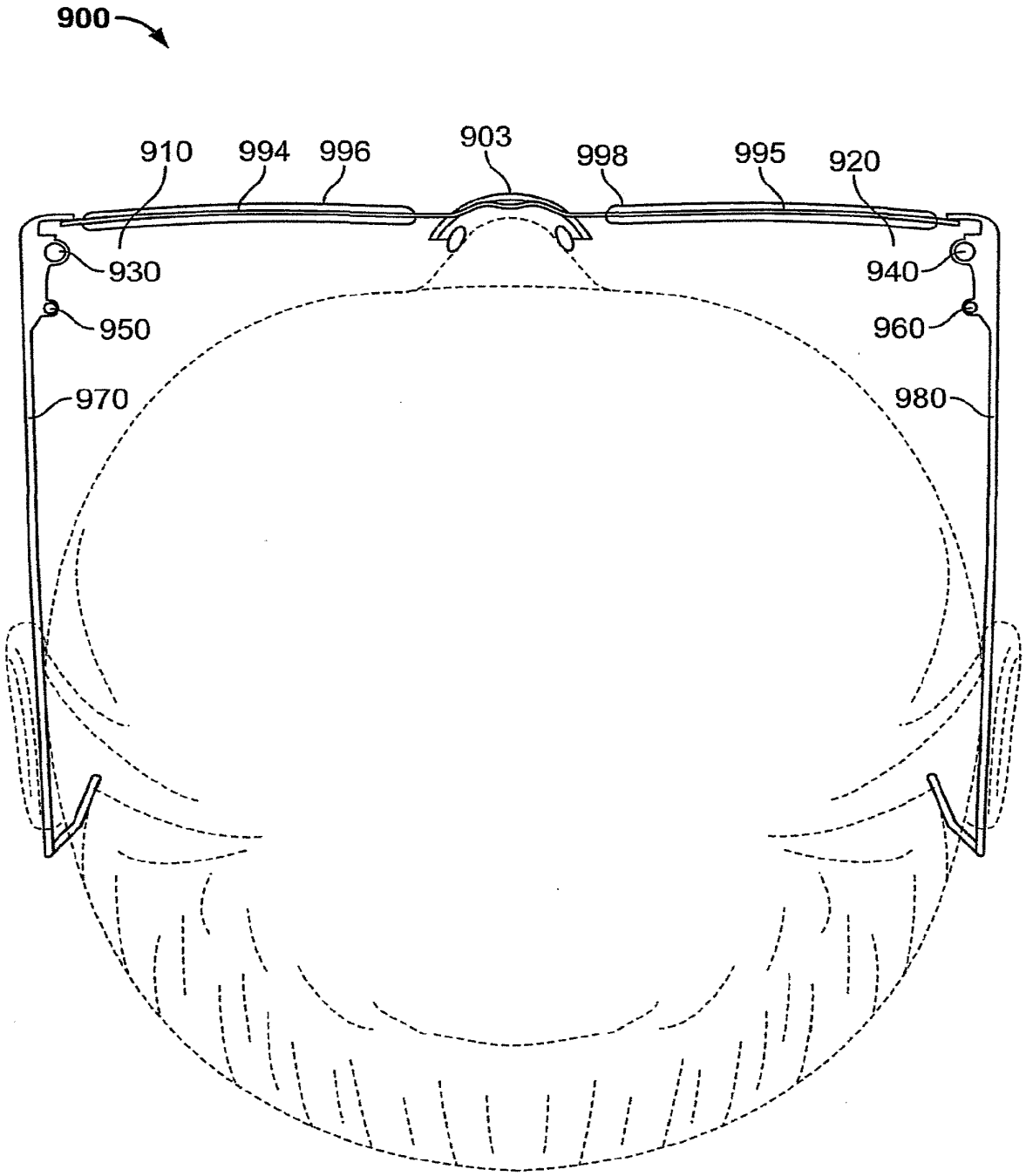



FIG. 9C

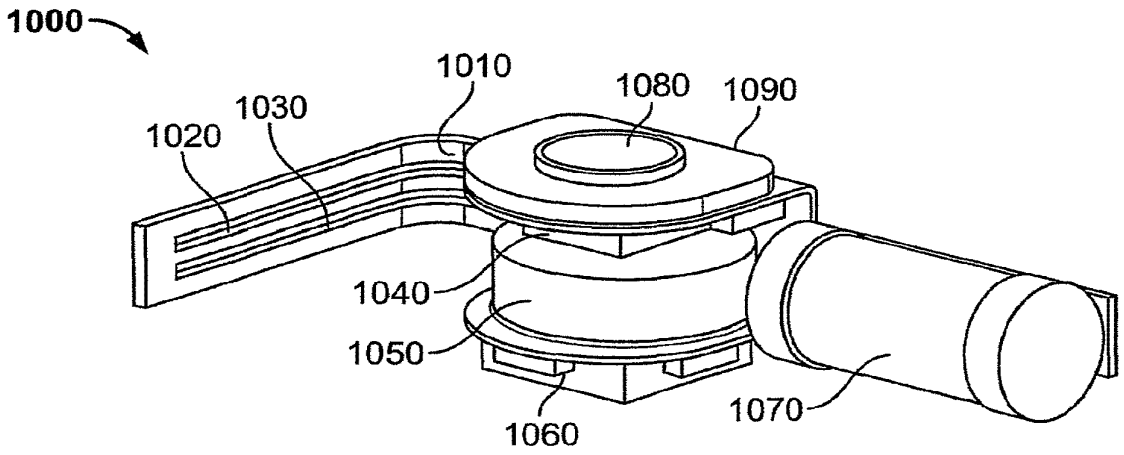

1000
1010
1080
1090
1030
1020
1040
1050
1060
1070

FIG. 10

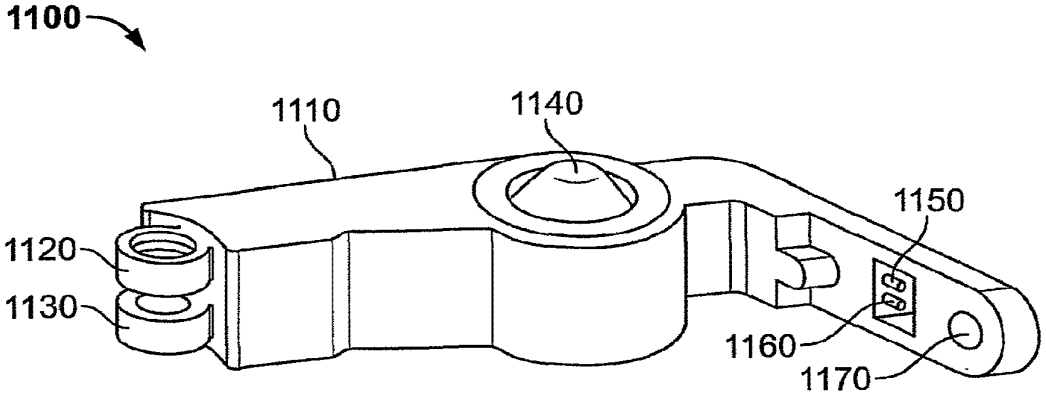

1100
1110
1140
1150
1120
1130
1160
1170

FIG. 11

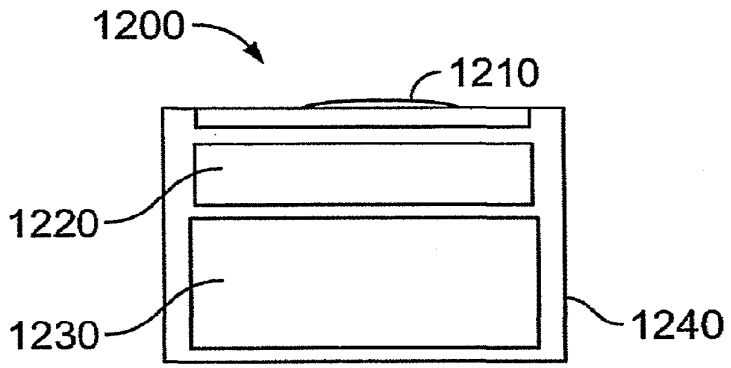



FIG. 12A

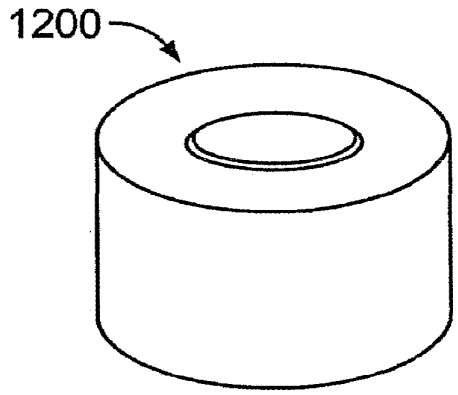



FIG. 12B

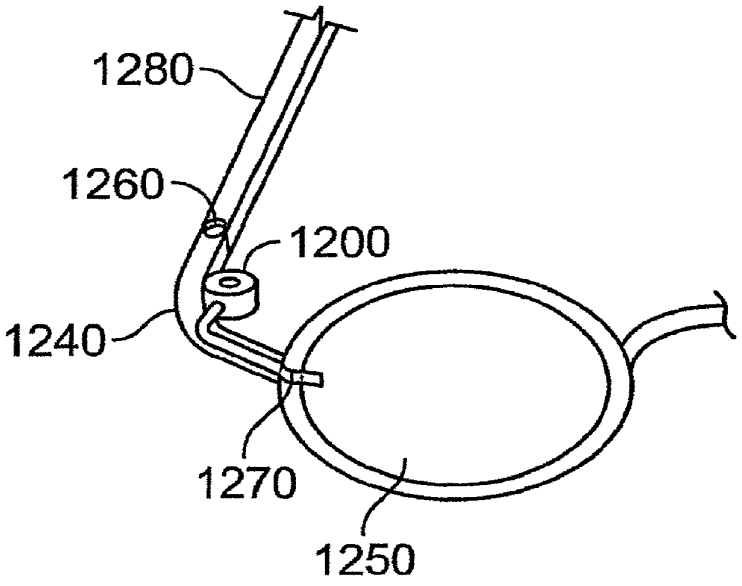



FIG. 12C

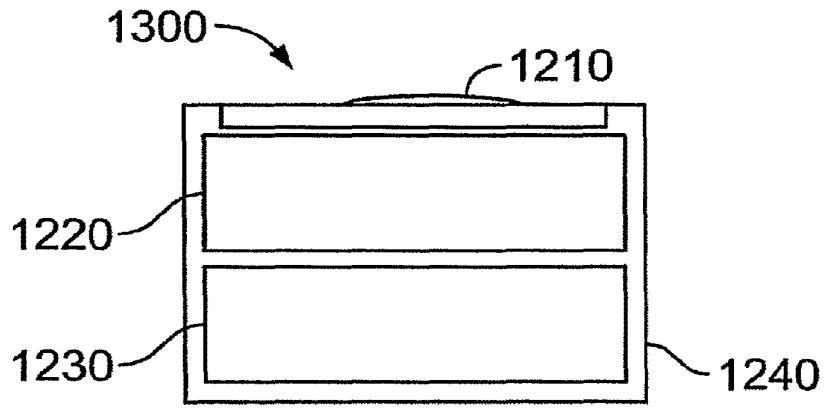



FIG. 13A

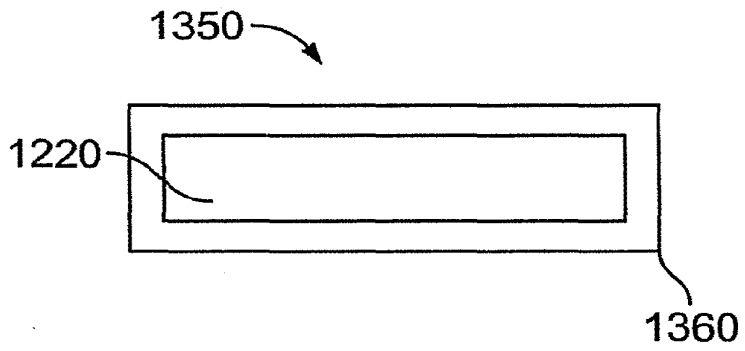



FIG. 13B

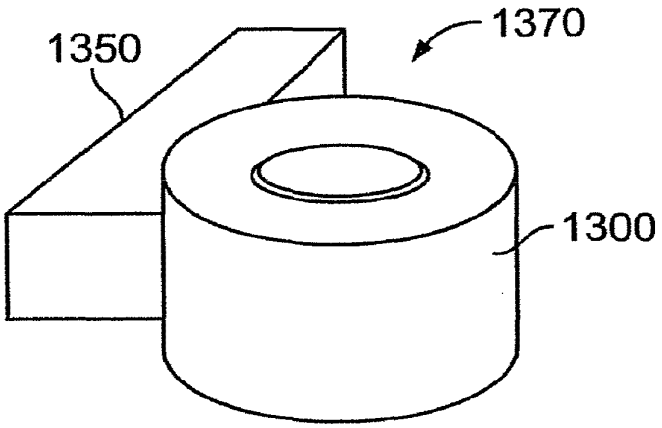



FIG. 13C

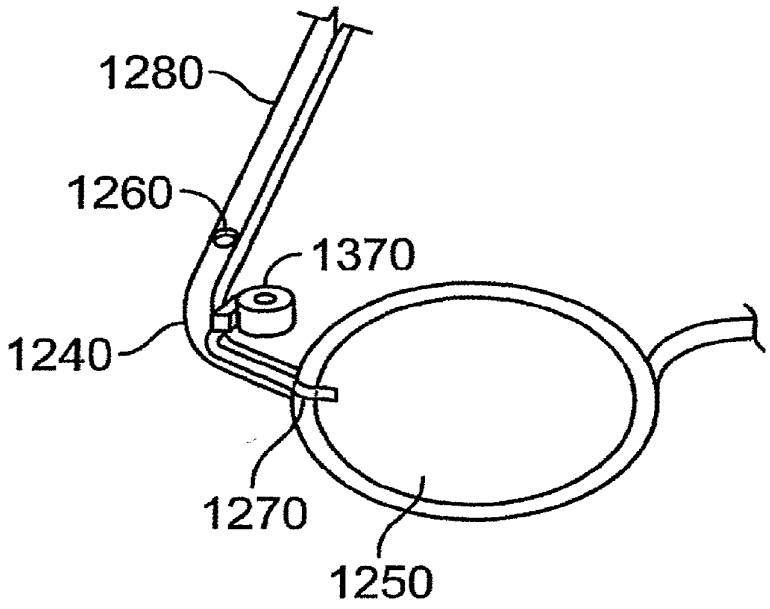



FIG. 13D

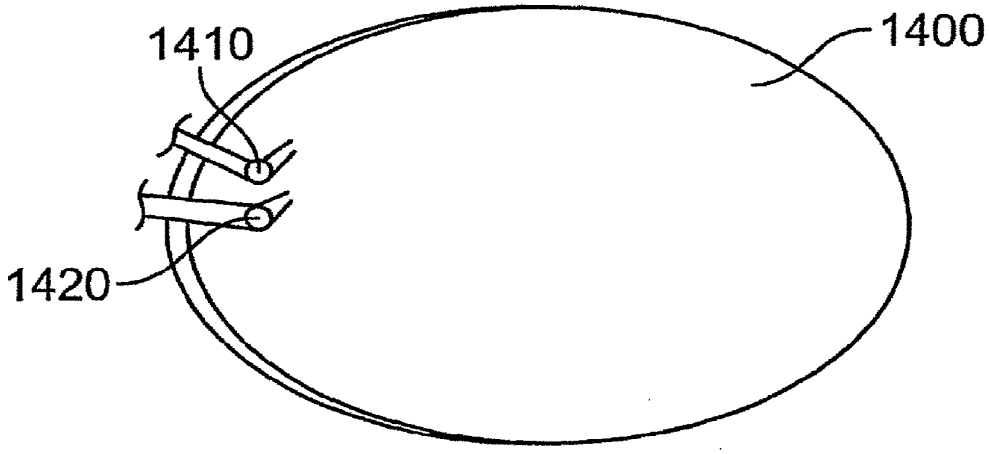



FIG. 14

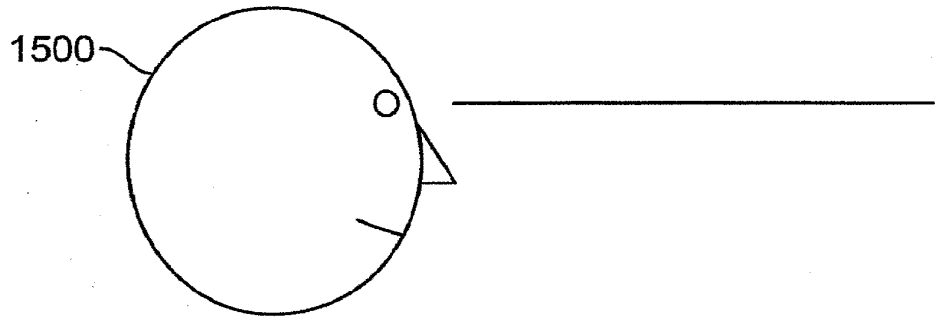



FIG. 15A

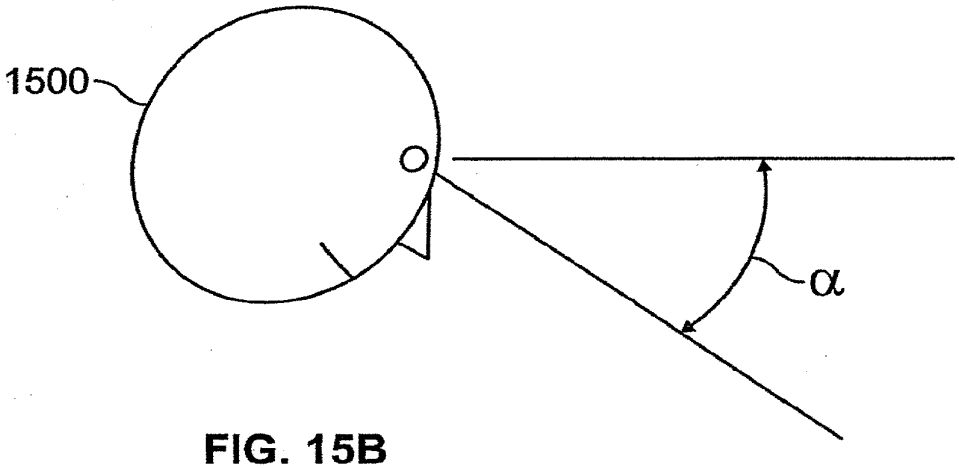



FIG. 15B

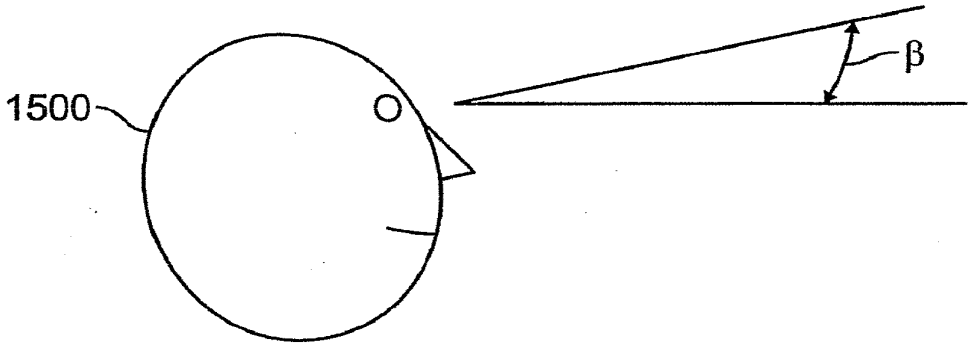



FIG. 15C

# 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 $\alpha$ 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 $\beta$ 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. **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 $\alpha$, the electro-active lens would be deliberately turned off. In this illustration, the angle $\alpha$ may be a large angle, perhaps as large as 45 degrees or more. In preferred embodiments, angle $\alpha$ 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 $\alpha$, the electro-active lens would remain in its on state until the person raises his head above the angle $\beta$, as illustrated in FIG. **15**C. In preferred embodiments, angle $\beta$ 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:
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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<br>91904-12910P | Date of mailing<br>*(day/month/year)*<br>29 February 2012 (29-02-2012)<br>**FOR FURTHER ACTION** See paragraphs 1 and 4 below |
| International application No.<br>PCT/US2011/061495 | International filing date<br>*(day/month/year)*<br>18 November 2011 (18-11-2011) |
| Applicant<br>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<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL-2280 HV Rijswijk<br>Tel. (+31-70) 340-2040<br>Fax: (+31-70) 340-3016 | Authorized officer<br>CALAFUS, Florentina<br>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<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>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<br>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<br>D-80298 Munich<br>Tel. +49 89 2399 - 0<br>Fax: +49 89 2399 - 4465 | see form PCT/ISA/210 | de Lajarte, Gilles<br>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).<br><br>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 |

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 July 2010 (15.07.2010)

PCT

(10) International Publication Number
WO 2010/080999 A1

(51) International Patent Classification:
*G02C 7/10* (2006.01) *H02J 7/00* (2006.01)

(21) International Application Number:
PCT/US2010/020498

(22) International Filing Date:
8 January 2010 (08.01.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

| | | |
|---|---|---|
| 61/143,459 | 9 January 2009 (09.01.2009) | US |
| 61/152,140 | 12 February 2009 (12.02.2009) | US |
| 61/157,579 | 5 March 2009 (05.03.2009) | US |
| 61/157,580 | 5 March 2009 (05.03.2009) | US |
| 61/170,222 | 17 April 2009 (17.04.2009) | US |
| 61/242,406 | 15 September 2009 (15.09.2009) | US |
| 61/252,770 | 19 October 2009 (19.10.2009) | US |


(71) Applicant *(for all designated States except US)*: **PIXELOPTICS, INC.** [US/US]; 5241 Valleypark Drive, Roanoke, Virginia 24019 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KOKONASKI, William** [US/US]; 1807 44th Street Court, N.W., Gig Harbor, Washington 98335 (US). **WANG, Yongping** [US/US]; 2601 Pennsylvania Avenue, room 945, Philadelphia, Pennsylvania 19130 (US). **BLUM, Ronald D.** [US/US]; 5320 Silver Fox Road, Roanoke, Virginia 24018 (US). **GRAHAM, Mark** [US/US]; 474 Amelon Road, Madison Heights, Virginia 24572 (US). **DALLA LONGA, Claudio** [IT/IT]; VIV Ponteggio, 33A, Treviso, I-31049 Valdobbiadene (IT). **HE, Sambo S.** [US/US]; 16649 Morning Mist Court, Riverside, California 92503 (US). **KRUTZIK, Christian** [US/US]; 2741 Starbird Drive, Costa Mesa, California 92626 (US).

(74) Agents: **MCGROARTY, John P.** et al.; Townsend and Townsend and Crew, LLP, Two Embarcadro Center, Eighth Floor, San Francisco, CA 94111 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published**:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: ELECTRO-ACTIVE SPECTACLES AND ASSOCIATED ELECTRONICS

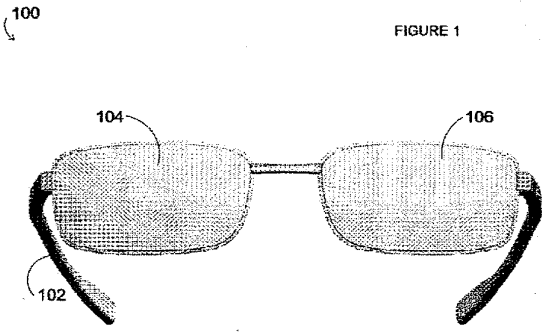


FIGURE 1

(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.

WO 2010/080999 A1

# 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.

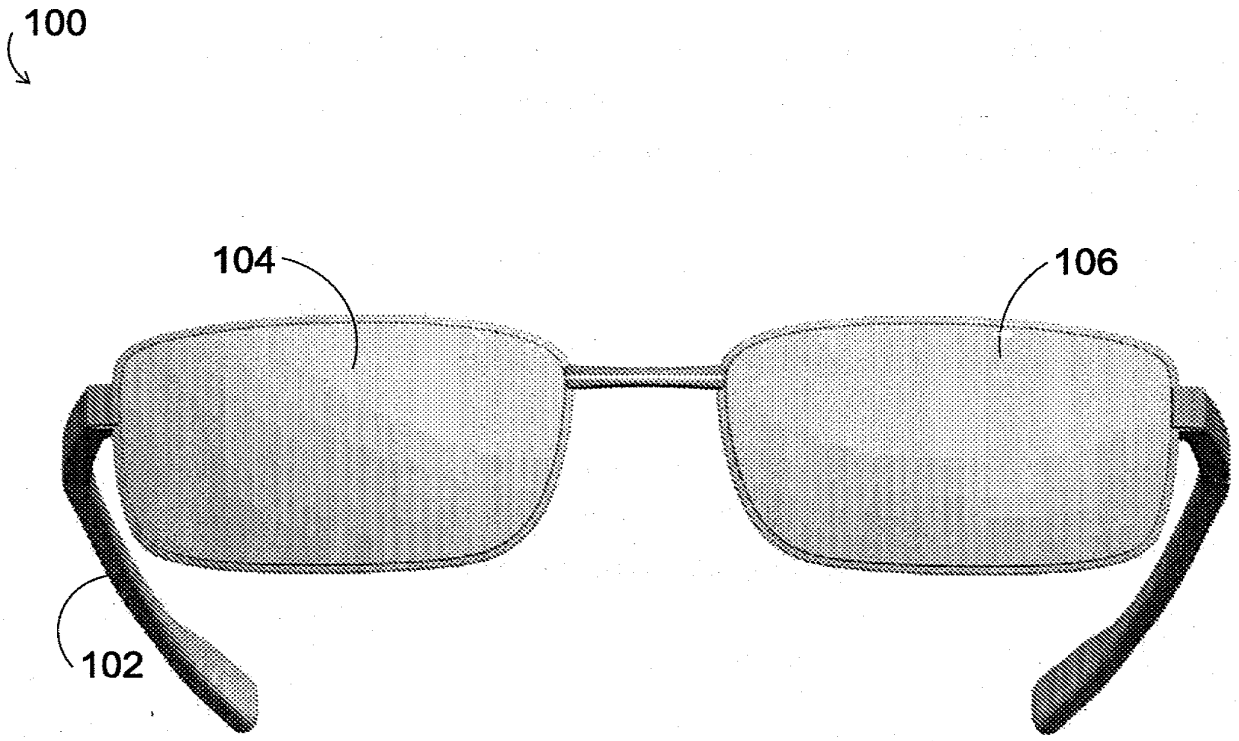


FIGURE 1

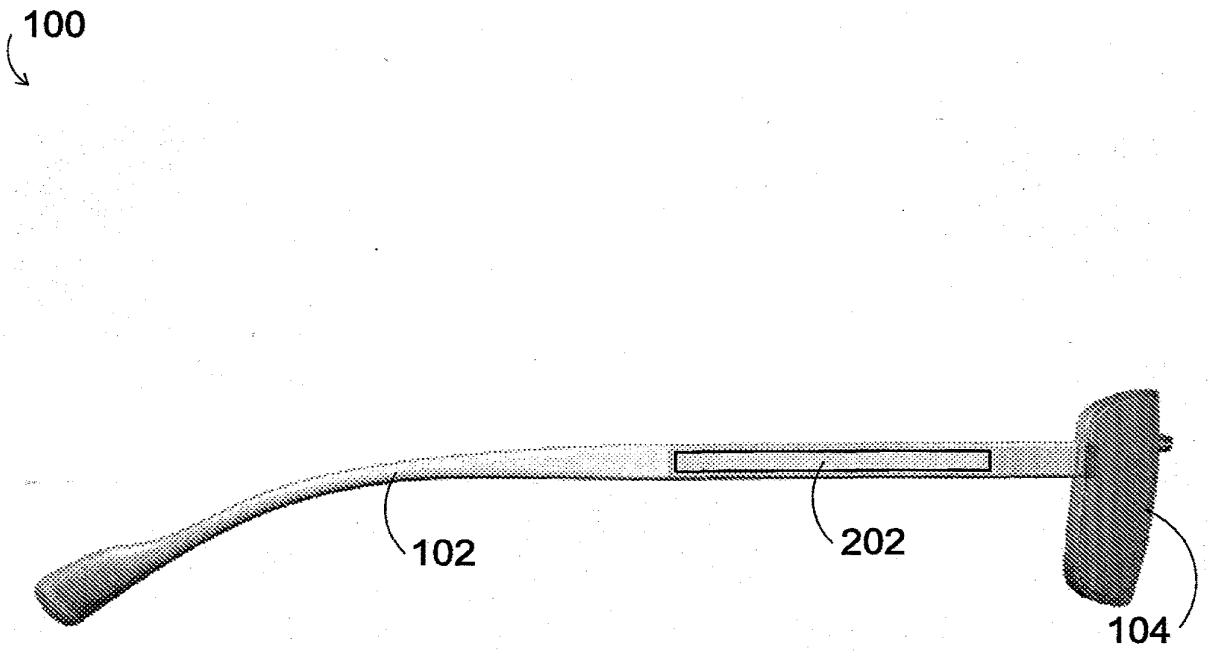


FIGURE 2

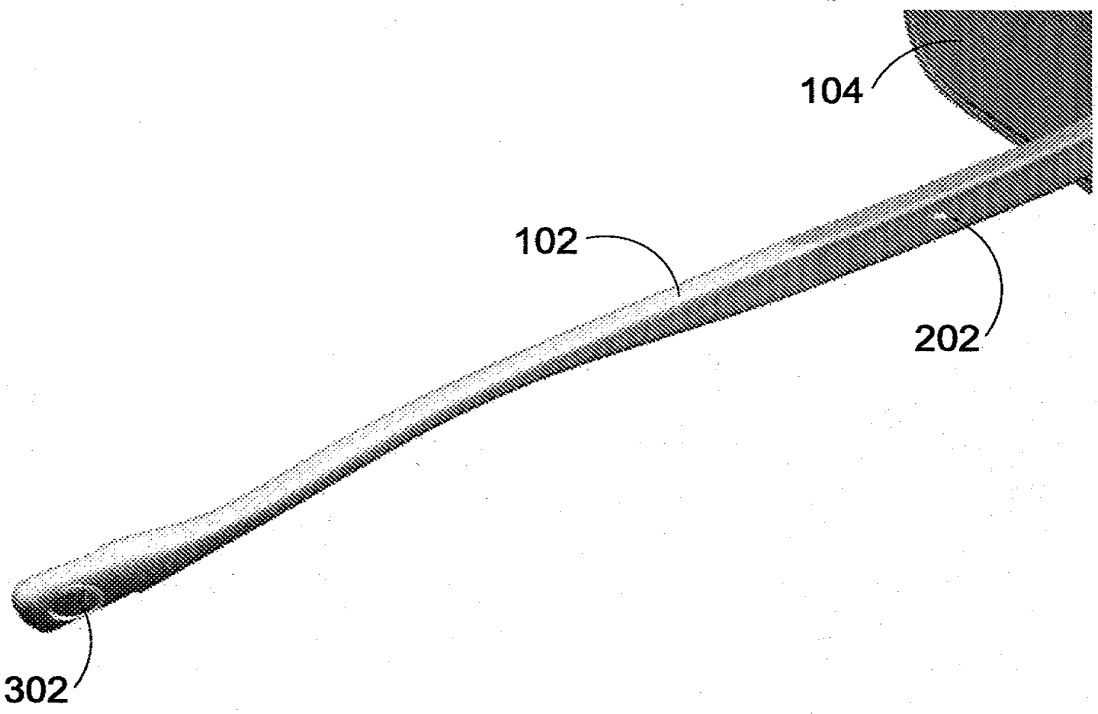


FIGURE 3

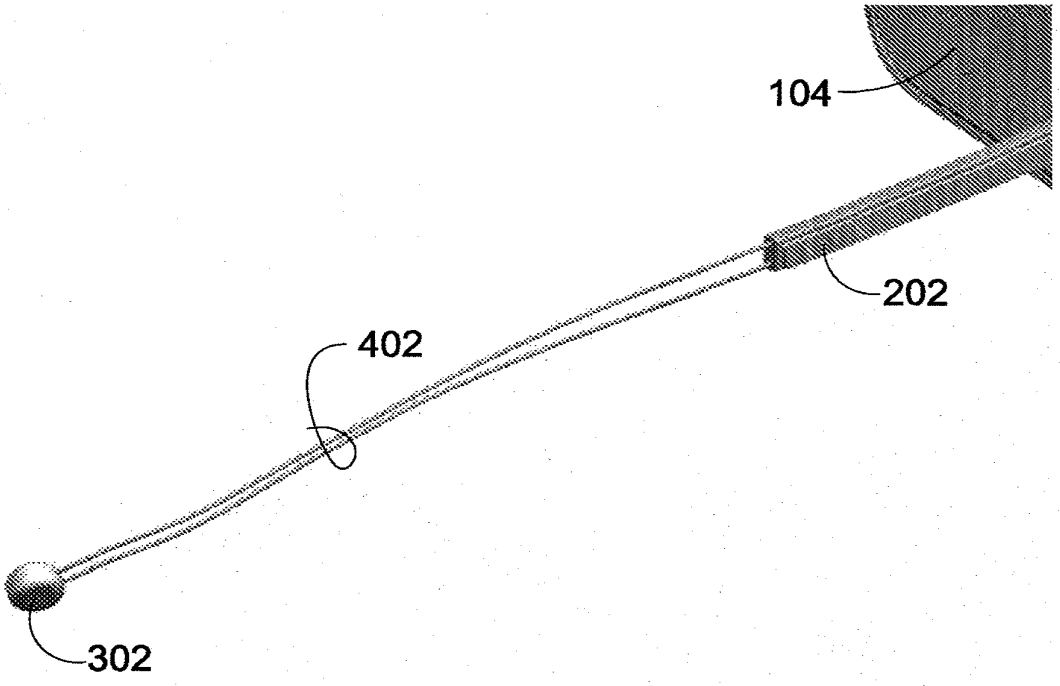


FIGURE 4

202



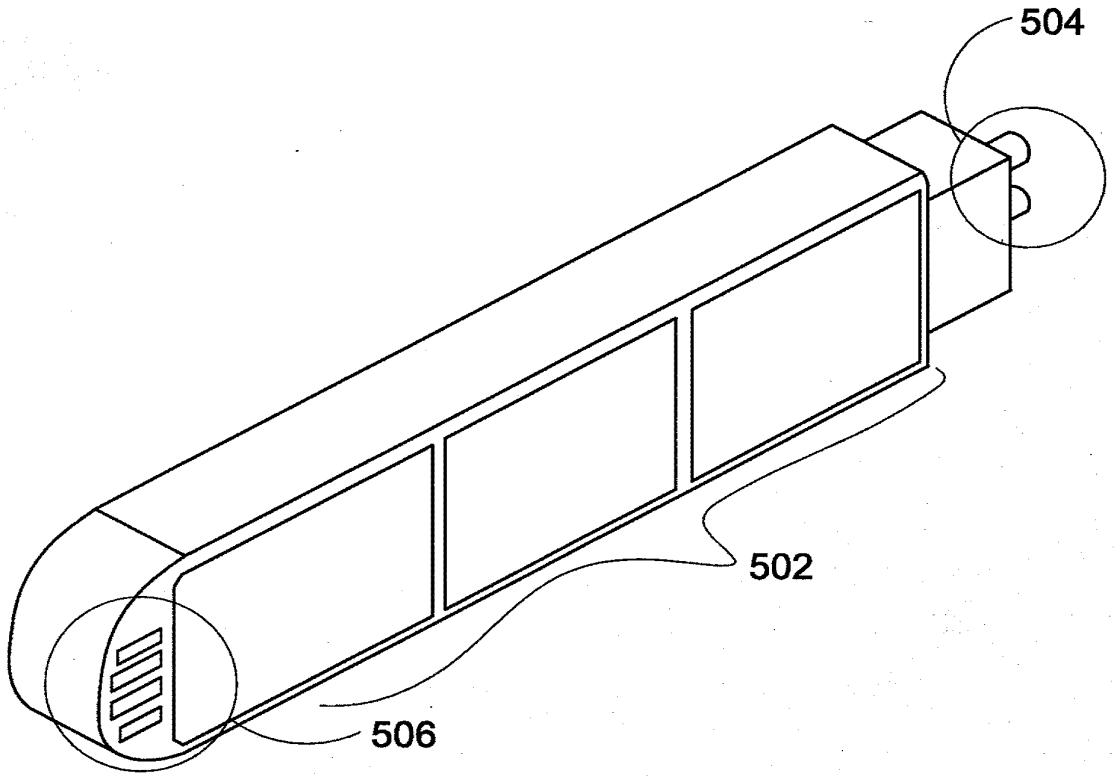


FIGURE 5

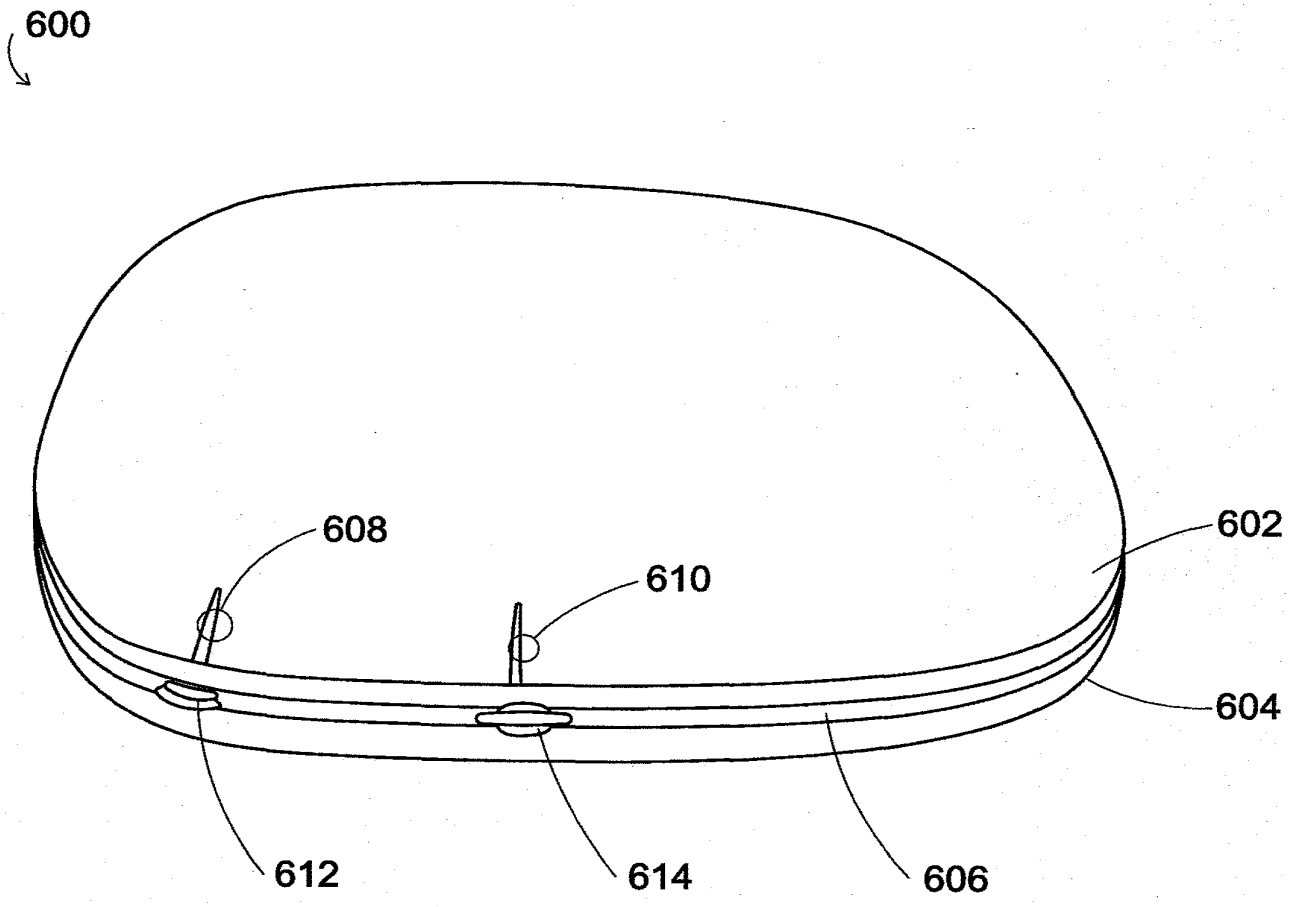


FIGURE 6

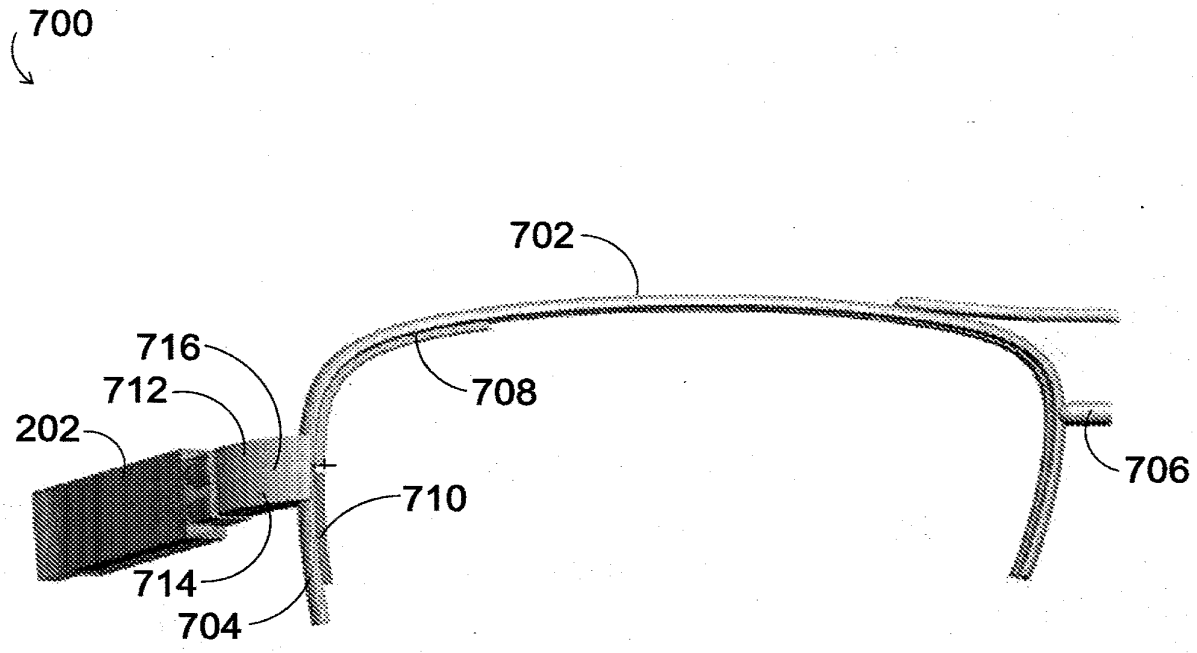


FIGURE 7

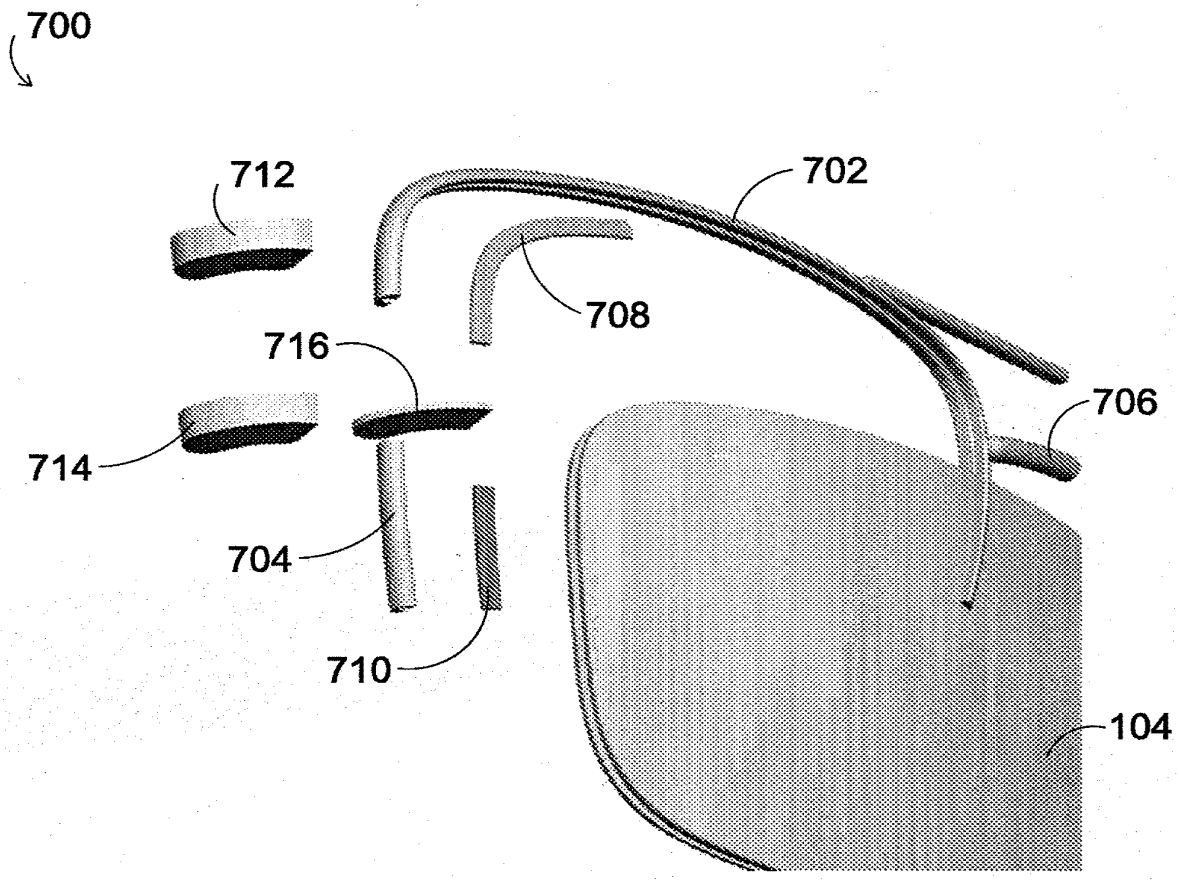


FIGURE 8

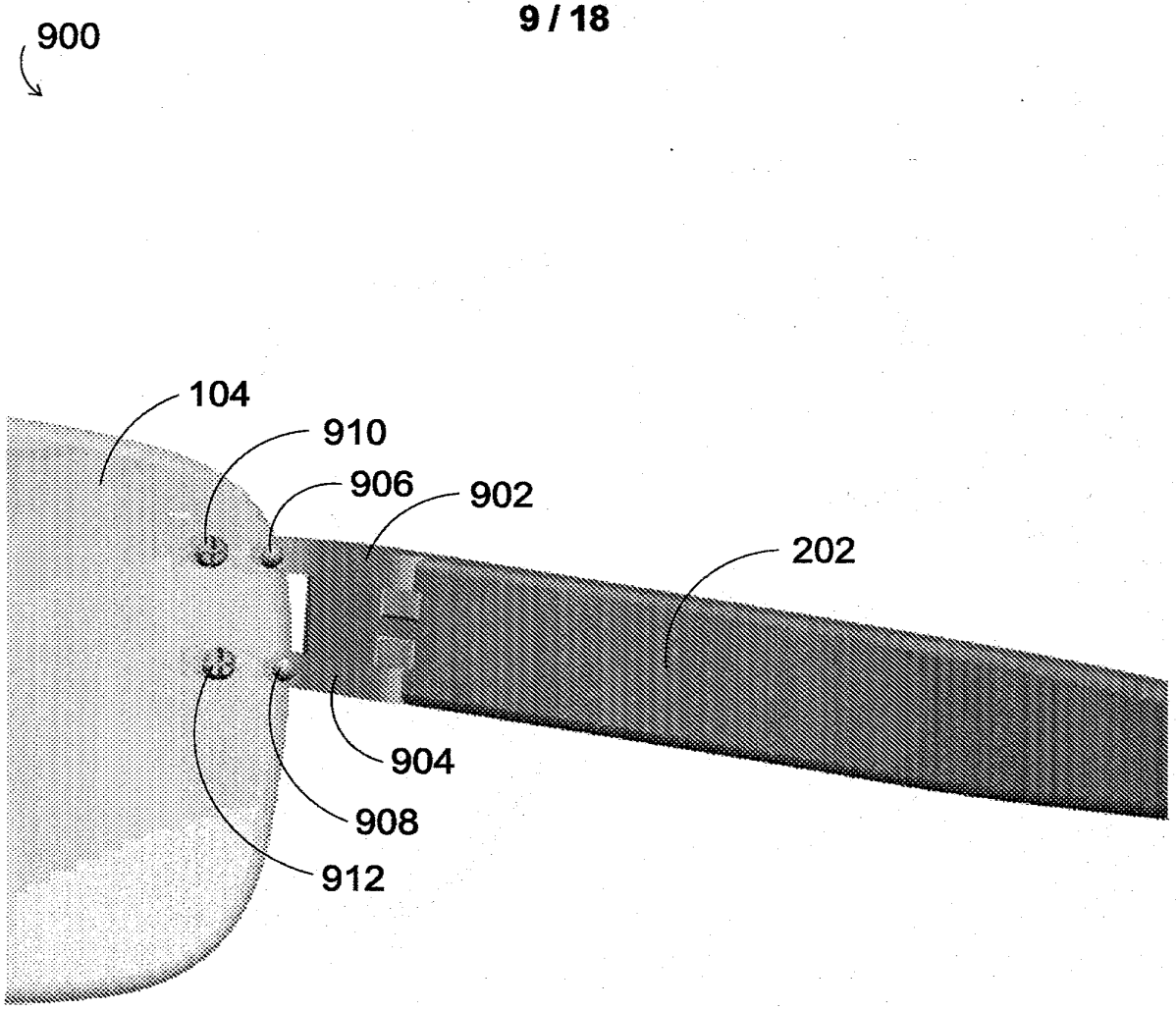


FIGURE 9

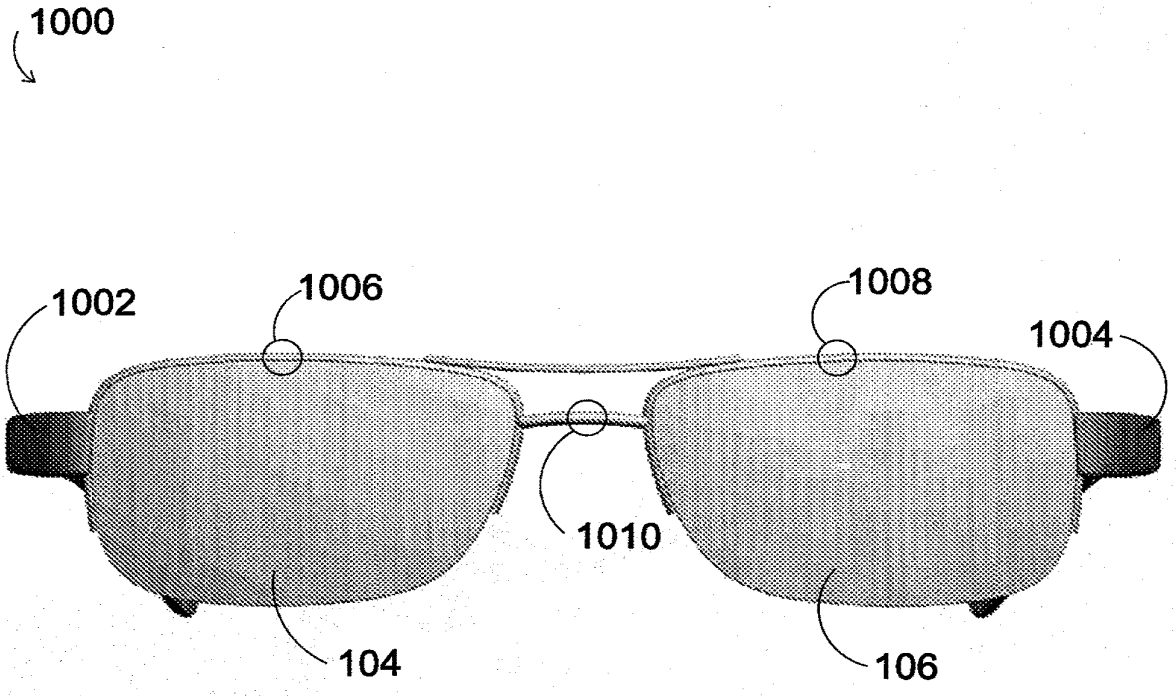


FIGURE 10

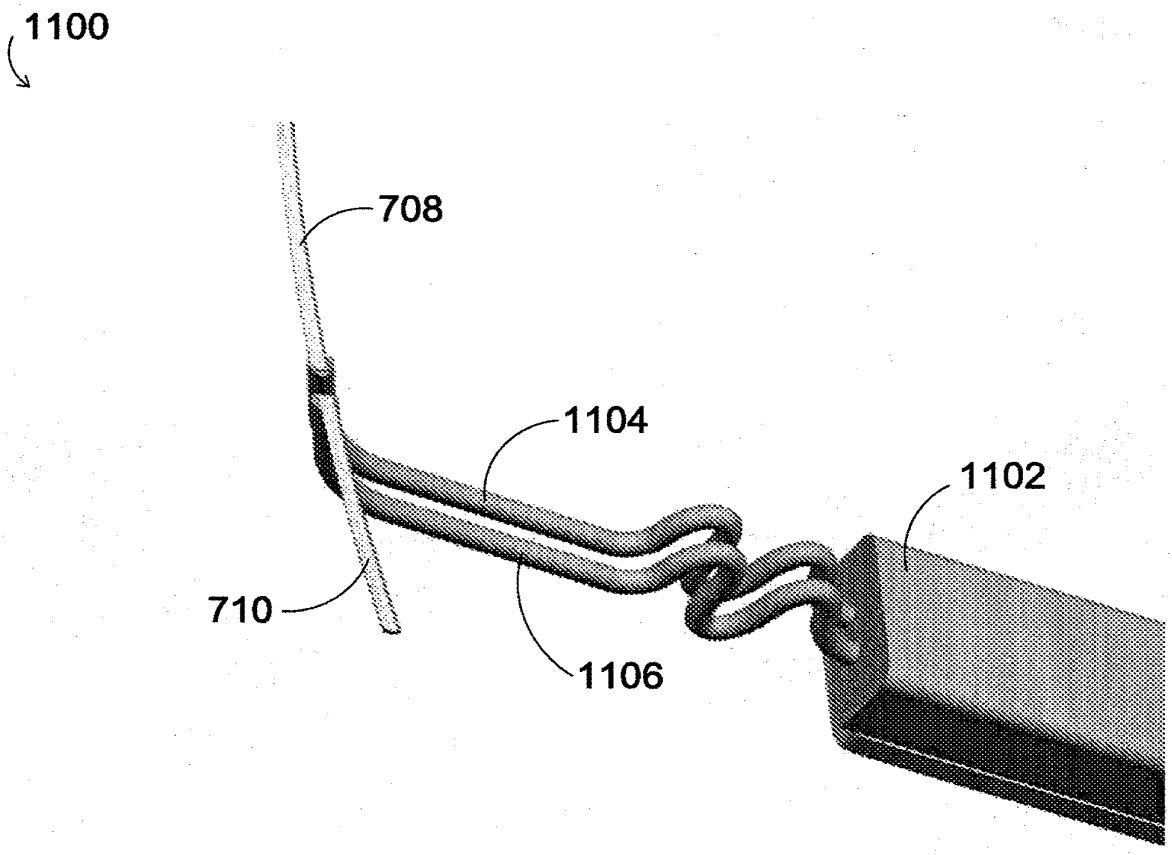


FIGURE 11

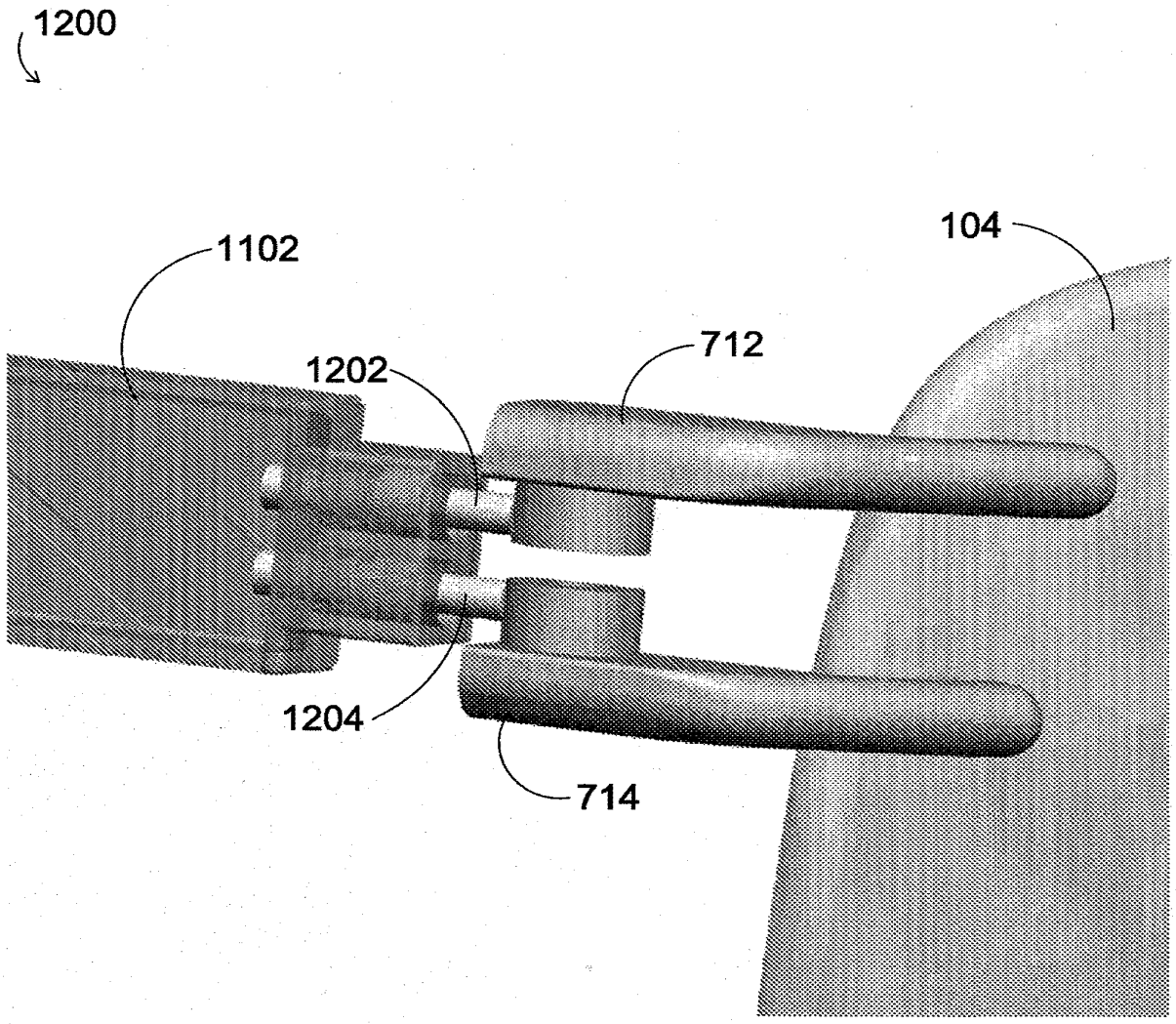


FIGURE 12

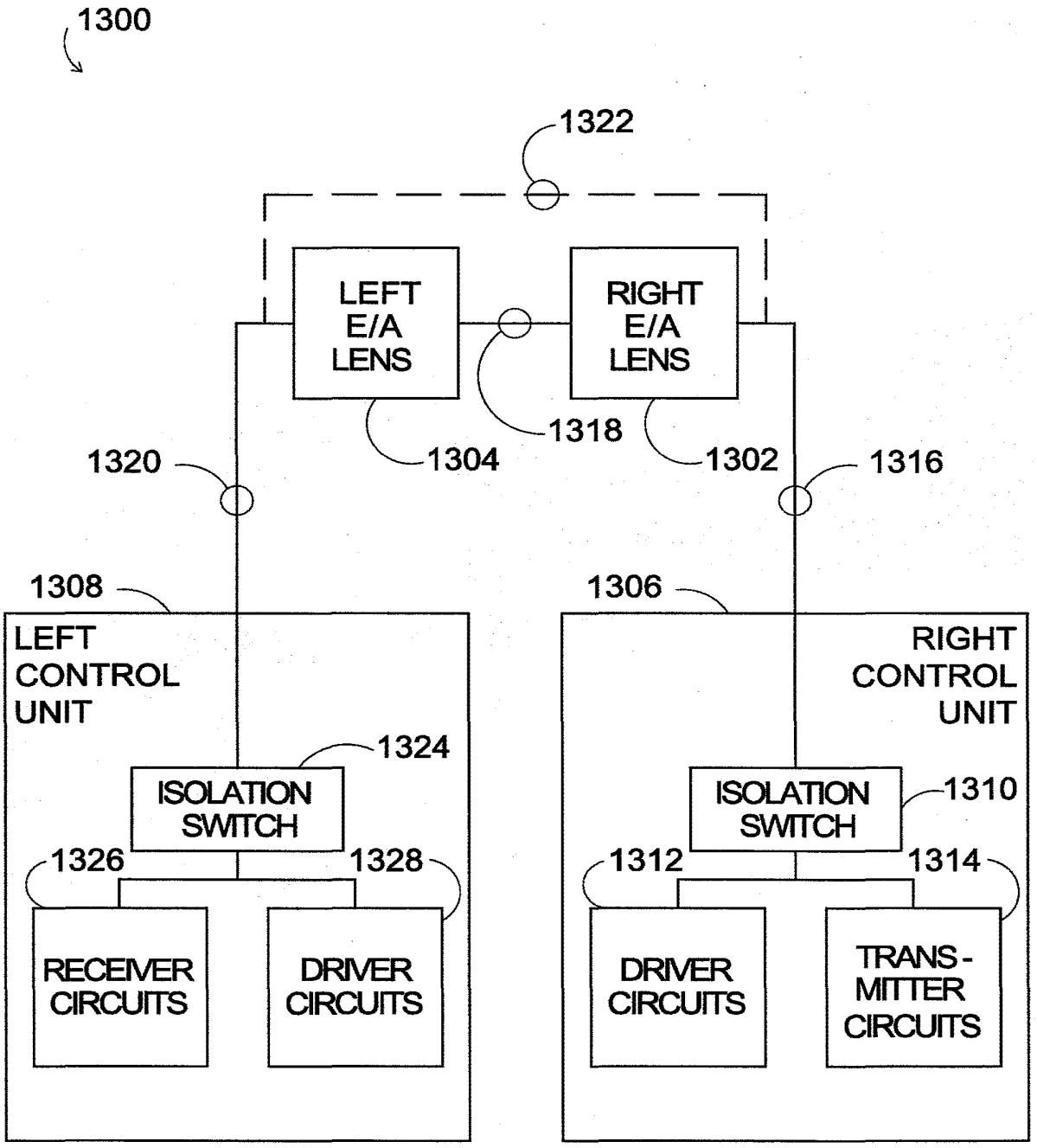
1300
1322
LEFT E/A LENS
RIGHT E/A LENS
1318
1304
1302
1320
1316
1308
1306
LEFT CONTROL UNIT
RIGHT CONTROL UNIT
1324
ISOLATION SWITCH
1310
ISOLATION SWITCH
1326
1328
1312
1314
RECEIVER CIRCUITS
DRIVER CIRCUITS
DRIVER CIRCUITS
TRANS-MITTER CIRCUITS

FIGURE 13

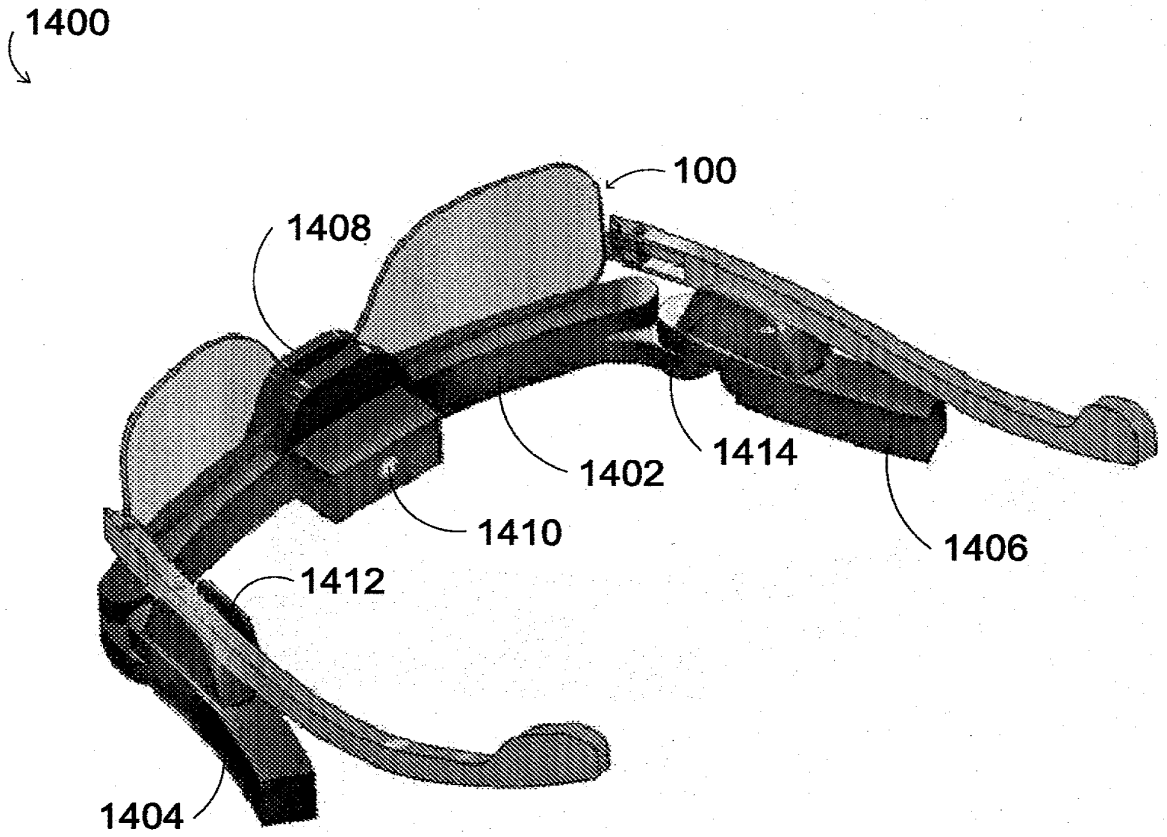


FIGURE 14

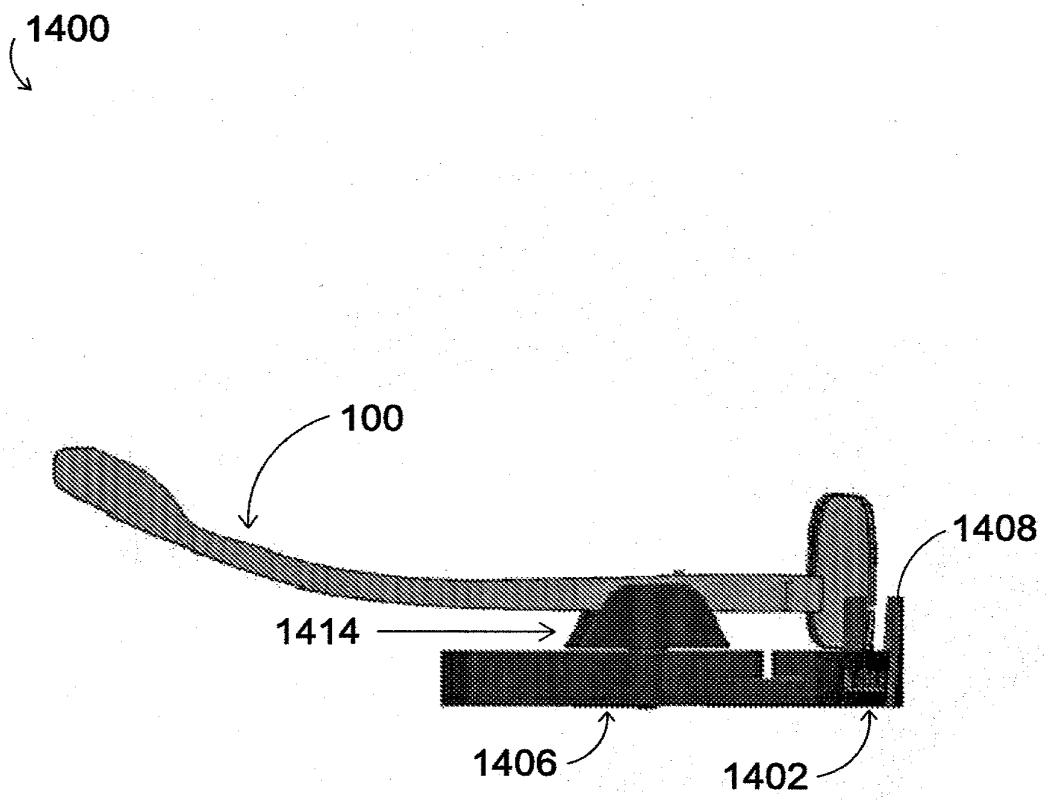


FIGURE 15

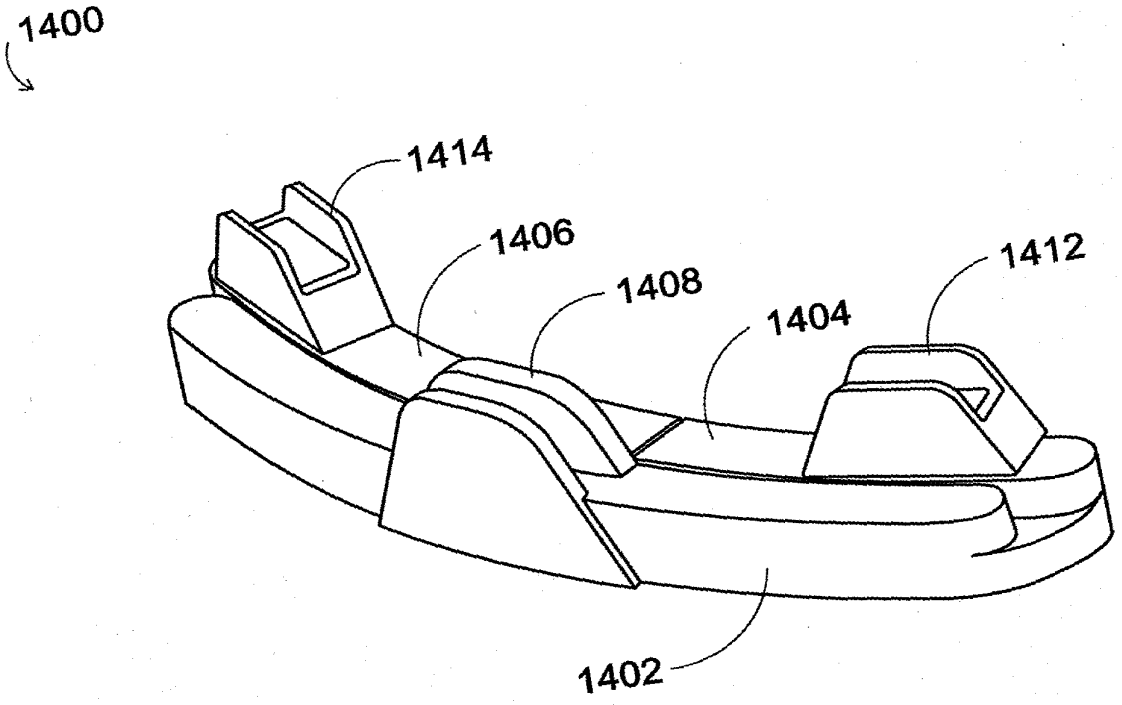


FIGURE 16

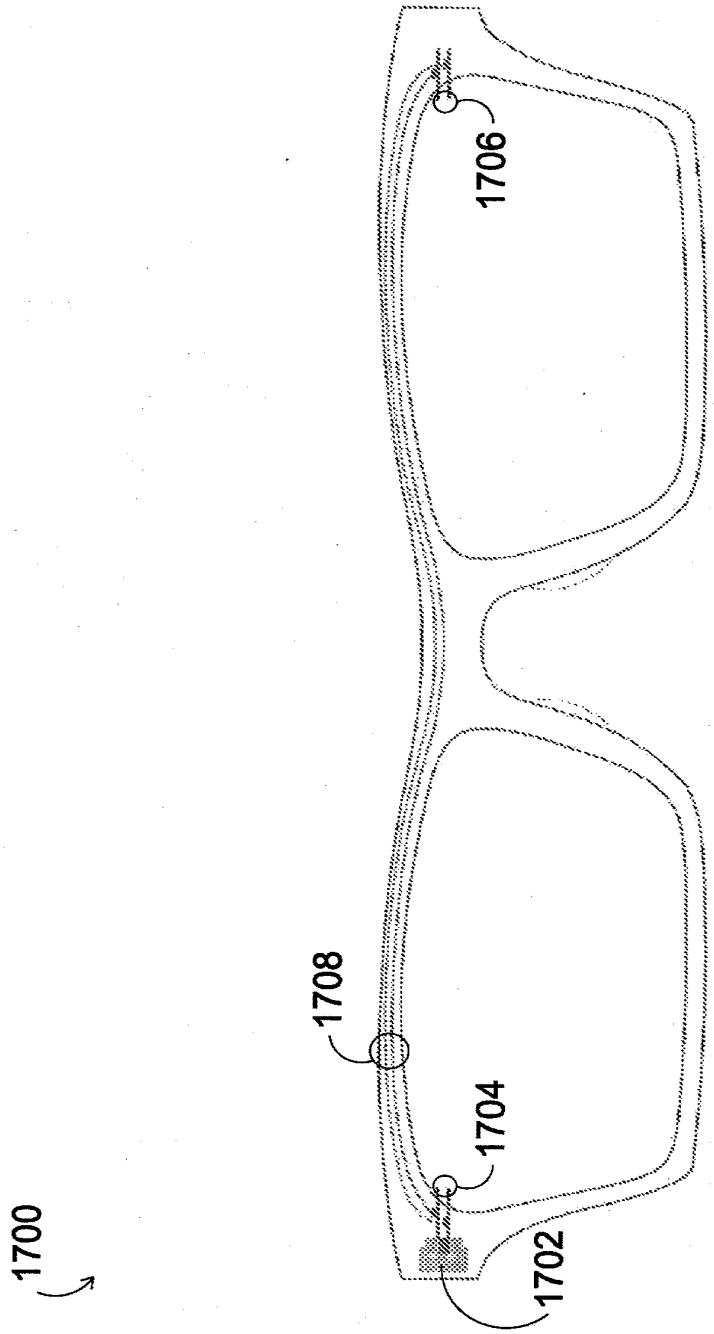


FIGURE 17

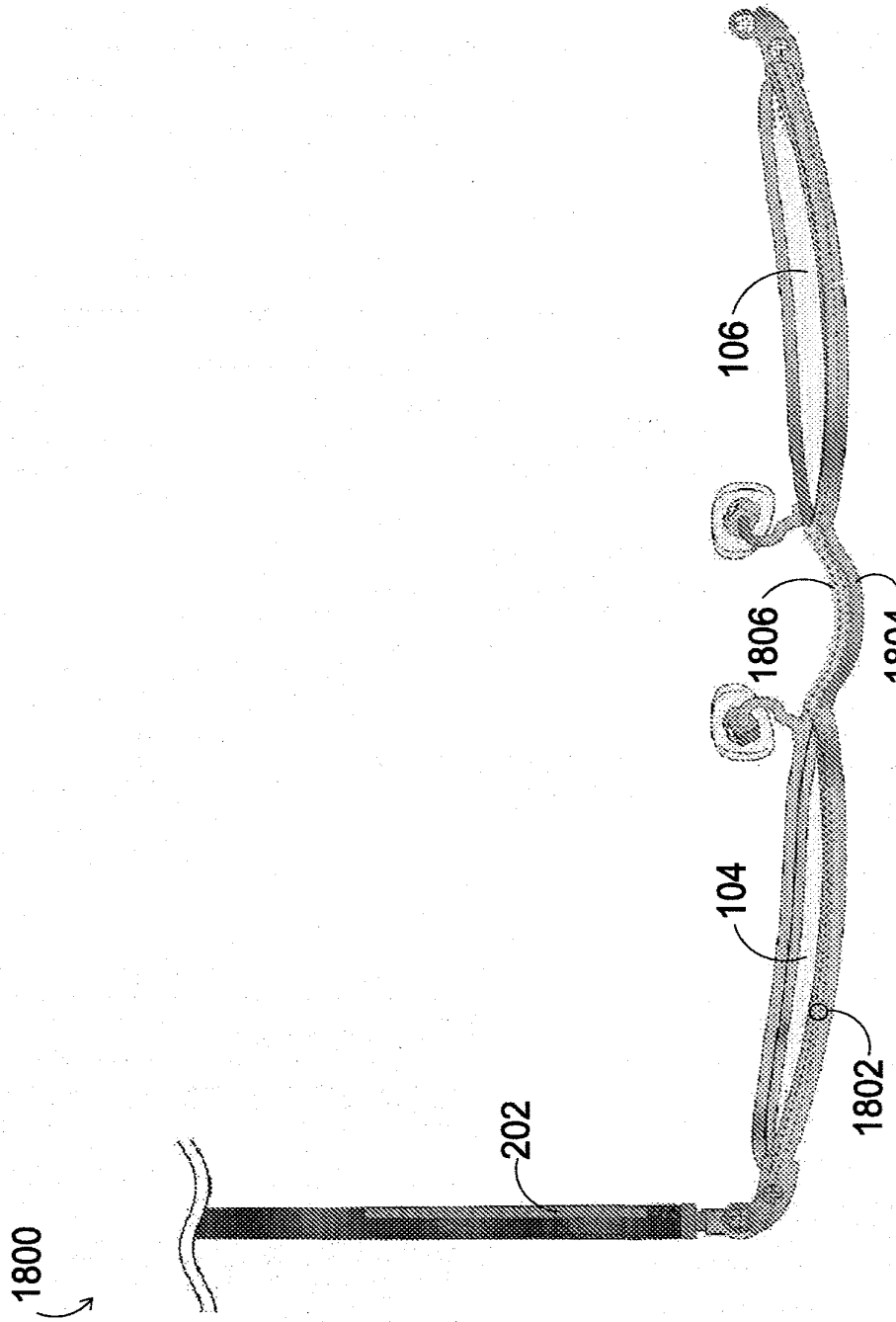


FIGURE 18

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

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[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<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Girardin, François |

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)<br>page 4, line 9 - line 14<br>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)<br>figure 9A<br>page 20, line 22 - page 21, line 13<br>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)<br>* abstract<br>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)<br>paragraphs [0036], [0045] | 1-14,23 |
| A | WO 2006/086155 A2 (COLGATE PALMOLIVE CO [US]; WAGUESPACK KENNETH [US])<br>17 August 2006 (2006-08-17)<br>* abstract | 17,18 |
| A | WO 2008/051520 A2 (PIXELOPTICS INC [US]; KOKONASKI WILLIAM [US]; BOCHNOWSKI JAMES J [US];) 2 May 2008 (2008-05-02)<br>the whole document | 15-22 |
| A | US 2004/156012 A1 (JANNARD JAMES [US] ET AL) 12 August 2004 (2004-08-12)<br>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.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/020498

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | CN 101185220 A | 21-05-2008 |
| | | EP 1849226 A2 | 31-10-2007 |
| | | KR 20070108228 A | 08-11-2007 |
| | | RU 2378752 C2 | 10-01-2010 |
| | | US 2006176017 A1 | 10-08-2006 |
| WO 2008051520 A2 | 02-05-2008 | US 2008106695 A1 | 08-05-2008 |
| US 2004156012 A1 | 12-08-2004 | US 2006197907 A1 | 07-09-2006 |

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.

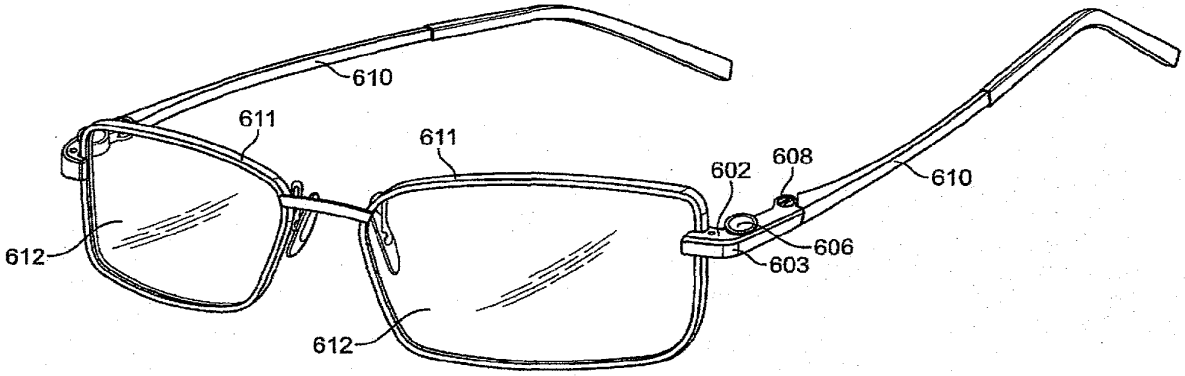
**Publication Classification**

(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.



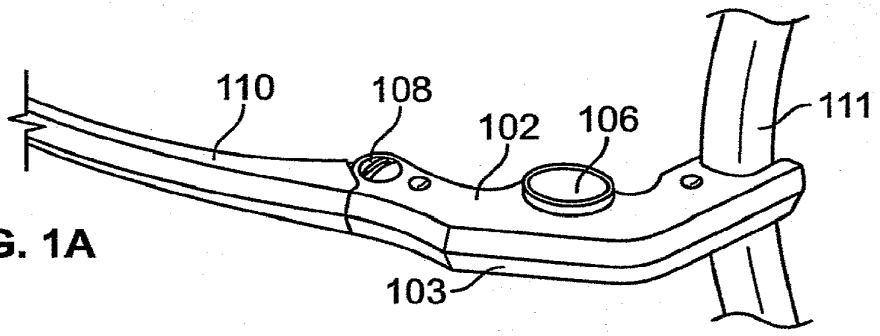



FIG. 1A

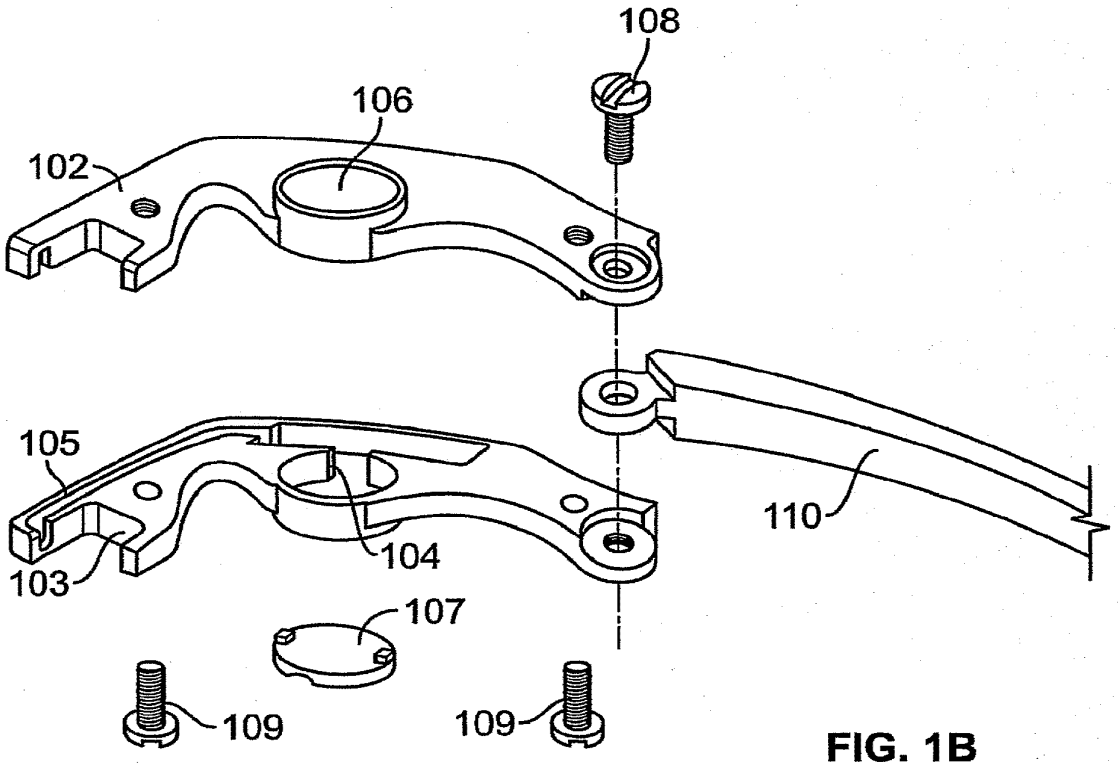



FIG. 1B

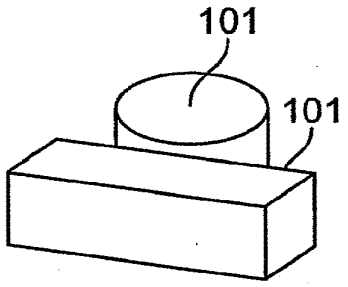



FIG. 1C

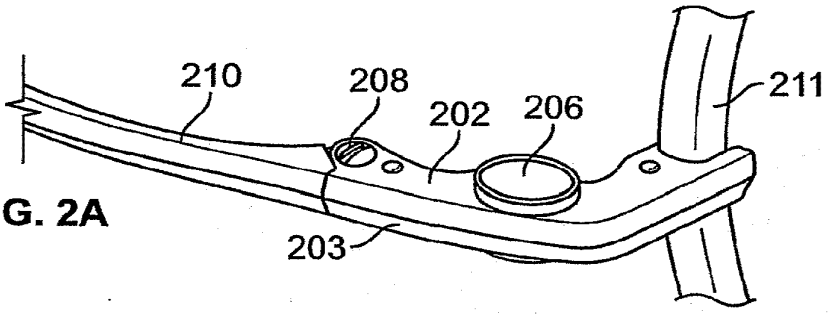



FIG. 2A

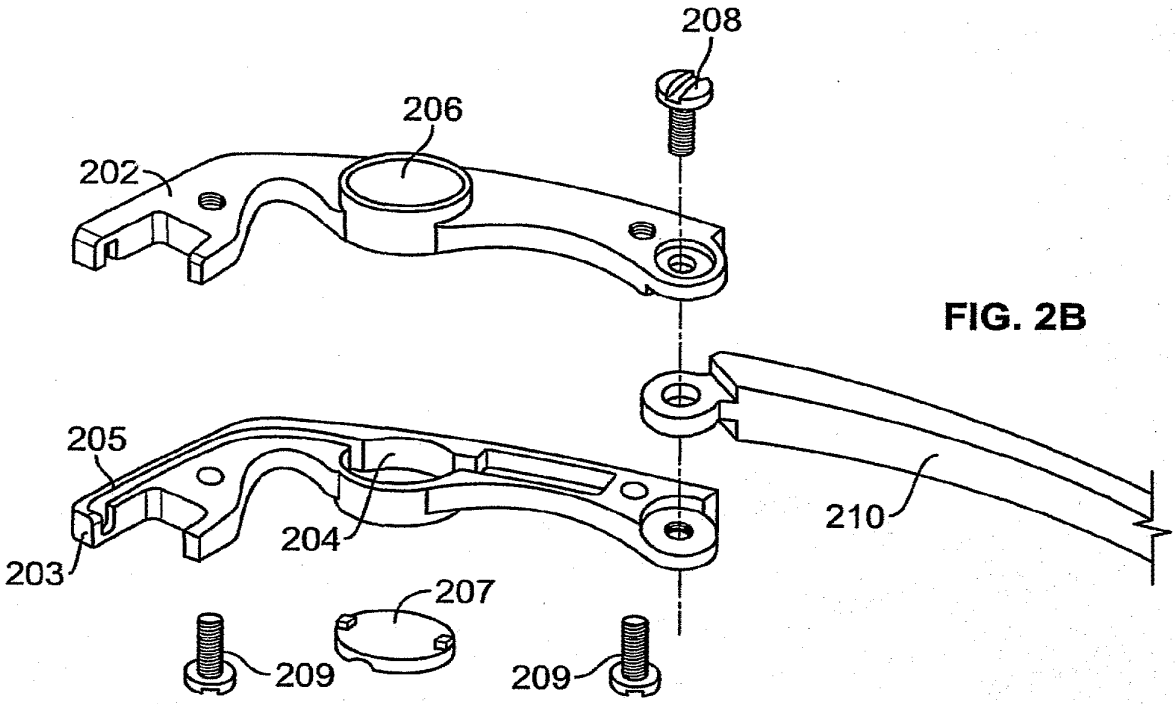



FIG. 2B

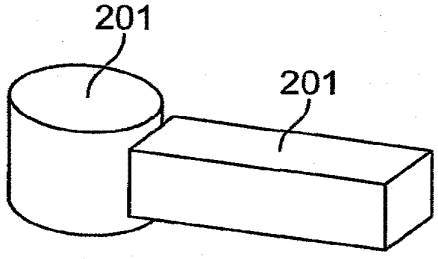



FIG. 2C

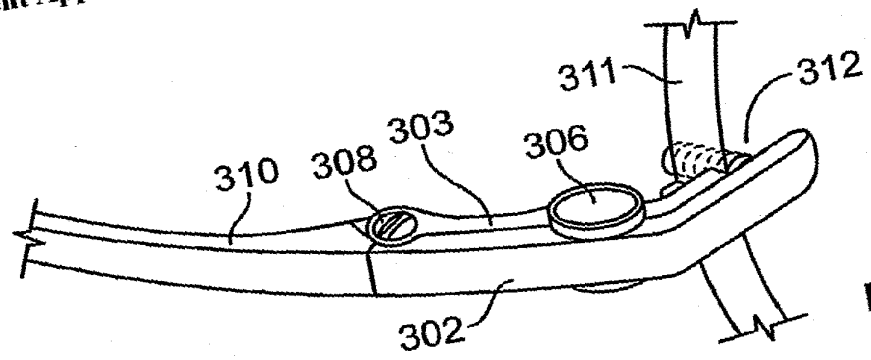



FIG. 3A

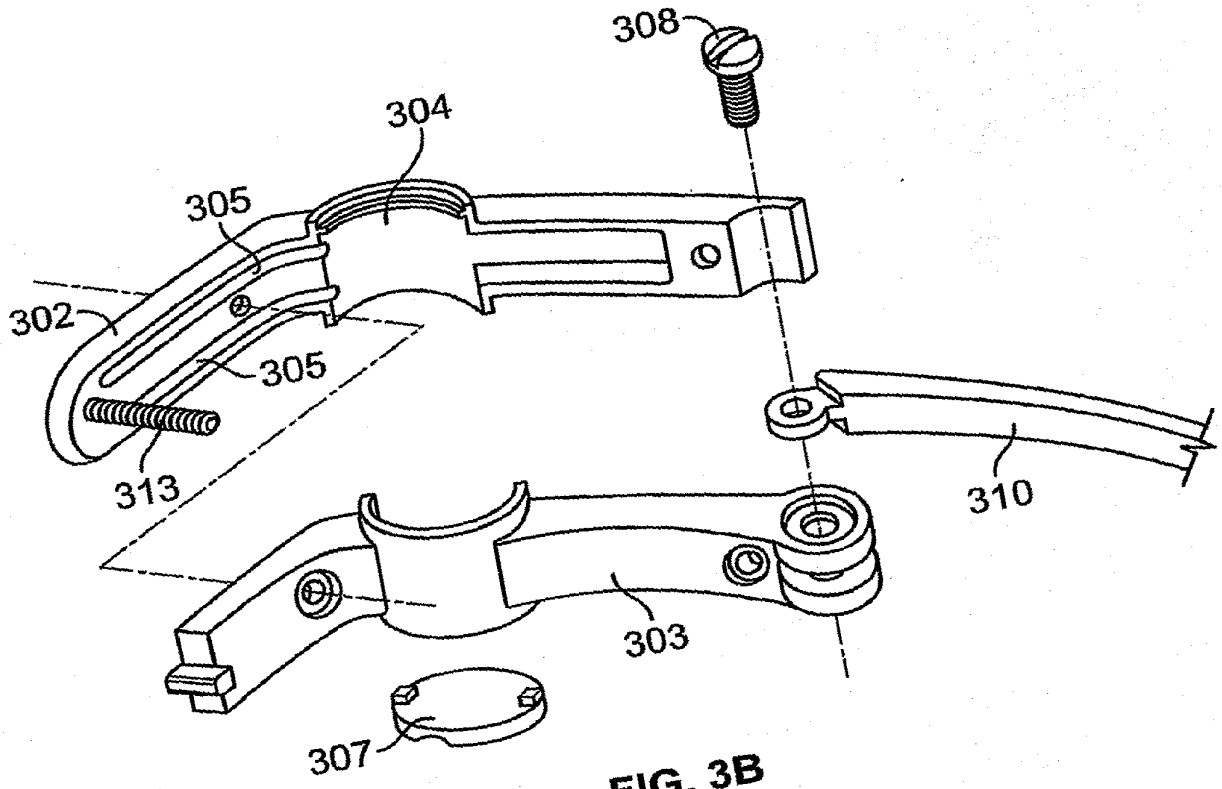



FIG. 3B

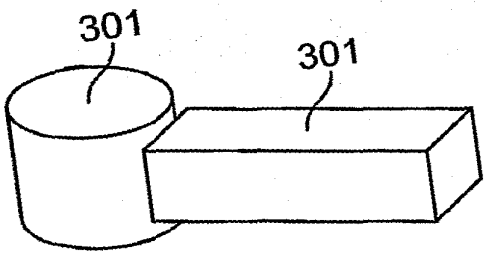



FIG. 3C

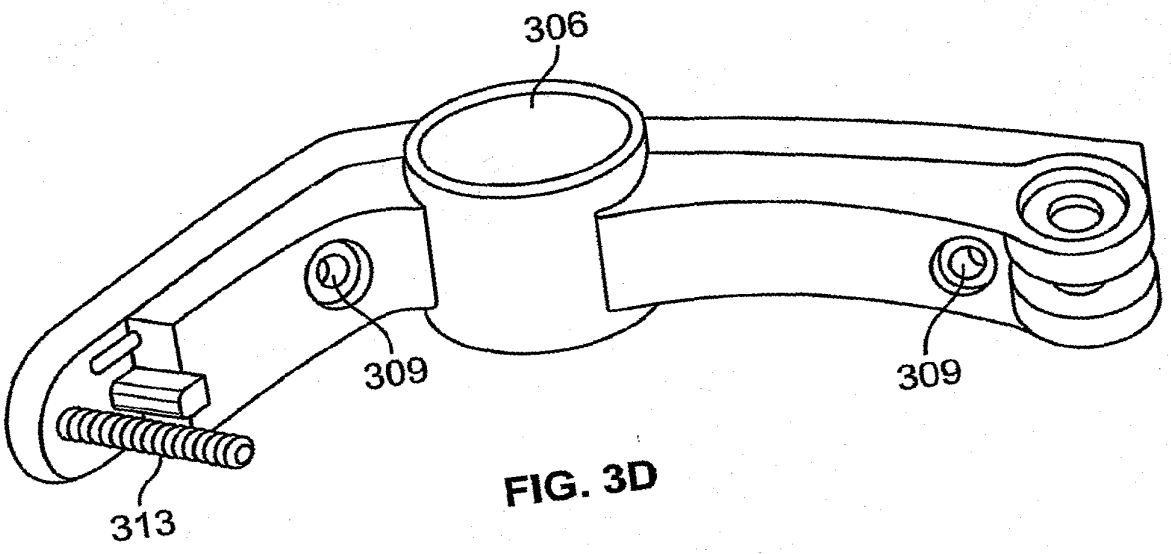



FIG. 3D

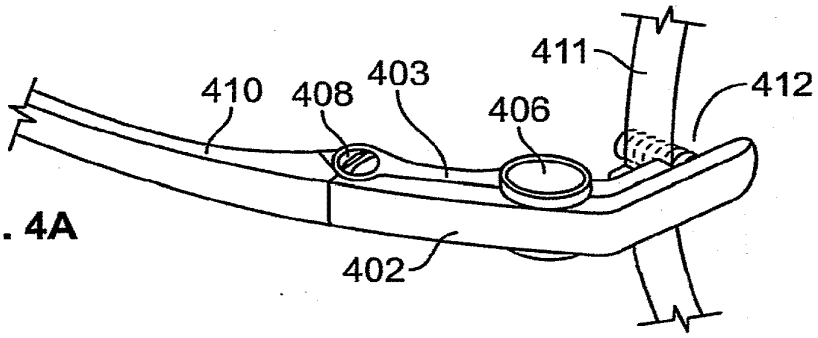



FIG. 4A

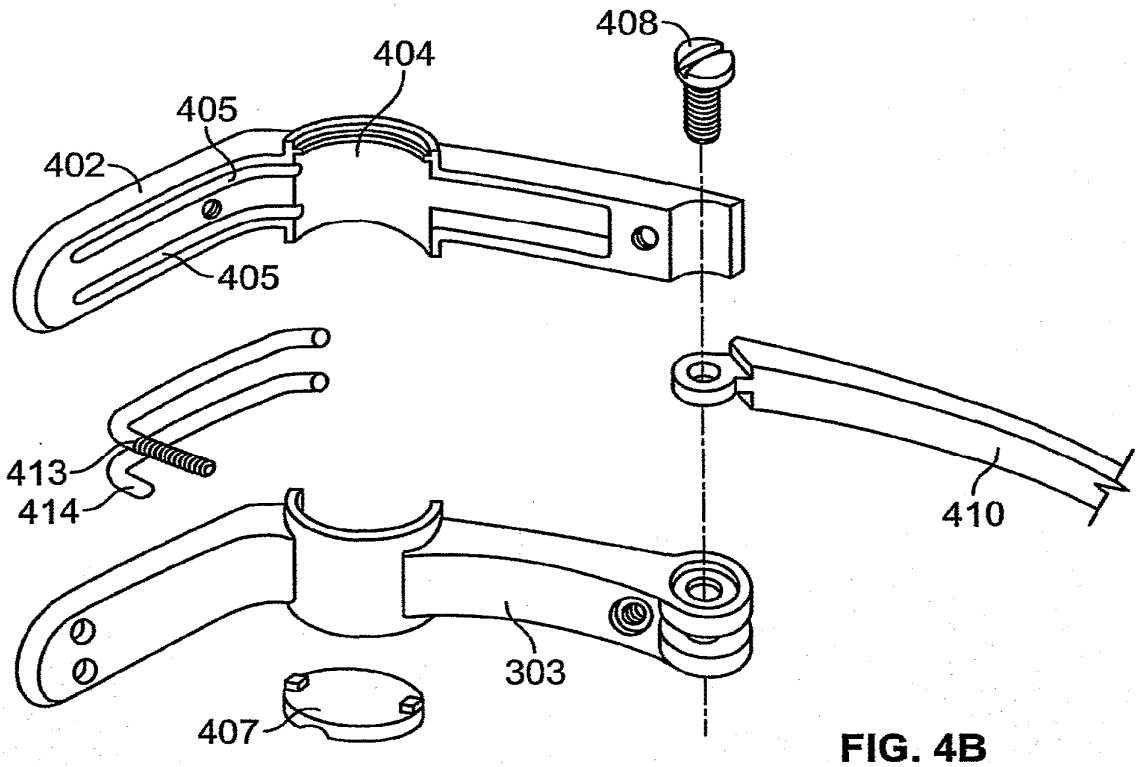



FIG. 4B

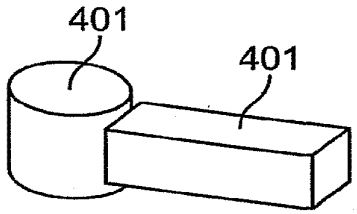



FIG. 4C

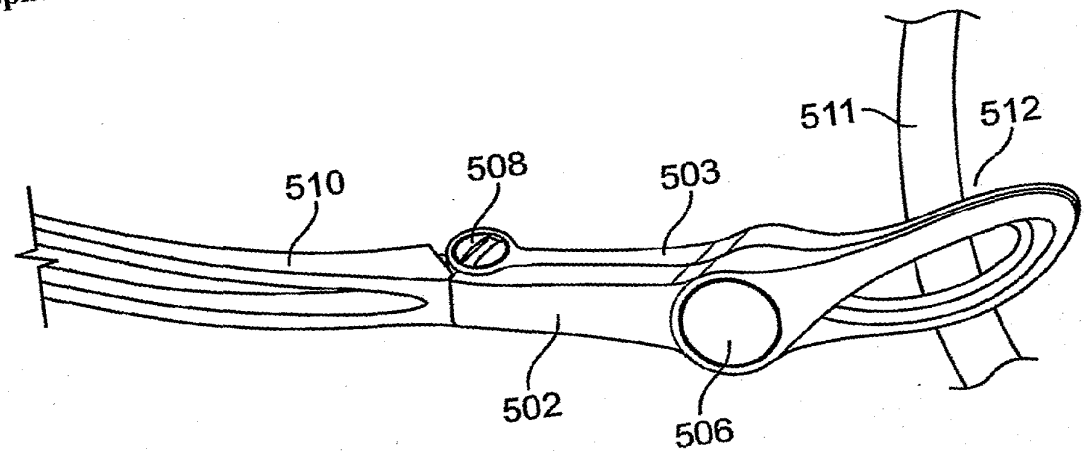



FIG. 5A

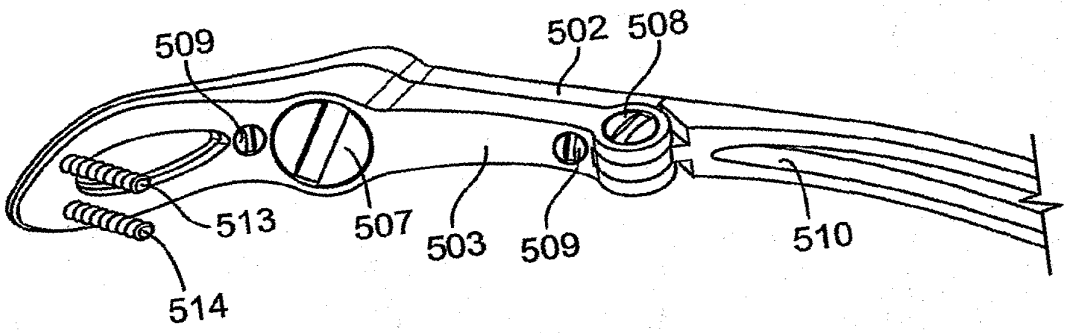



FIG. 5B

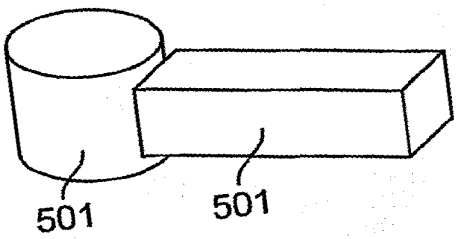



FIG. 5C

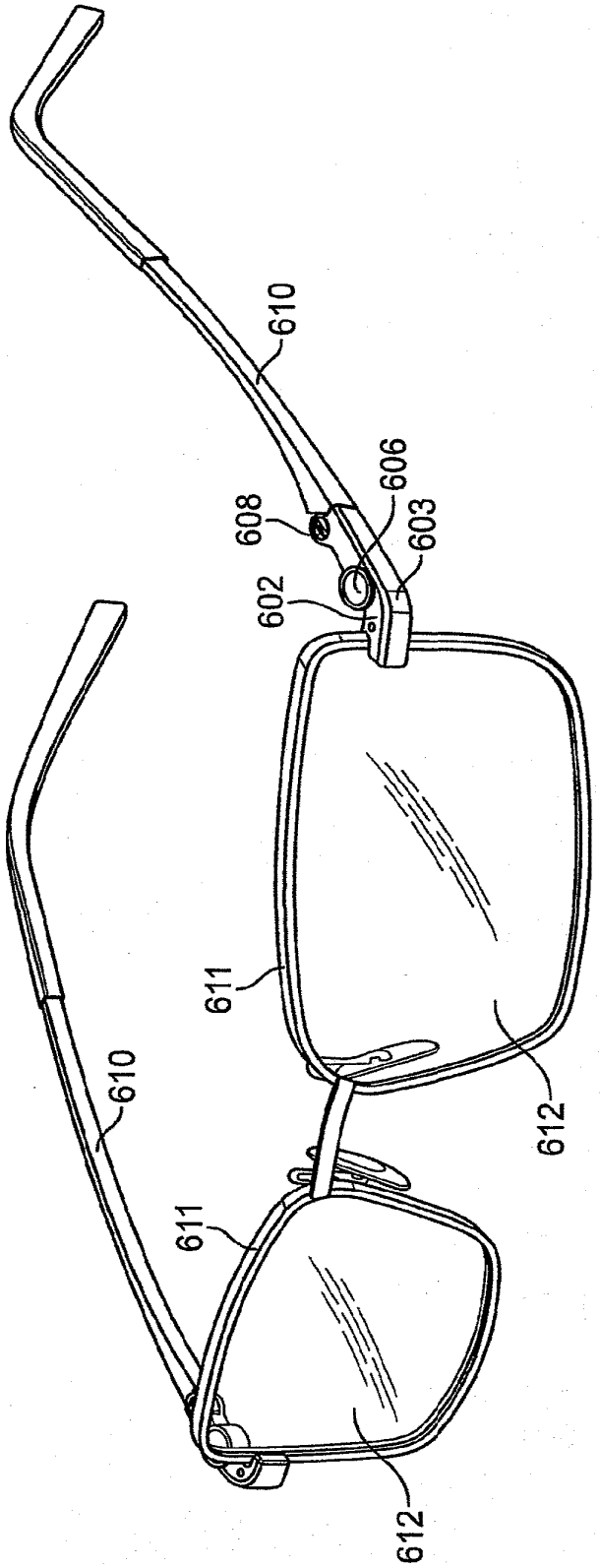



FIG. 6

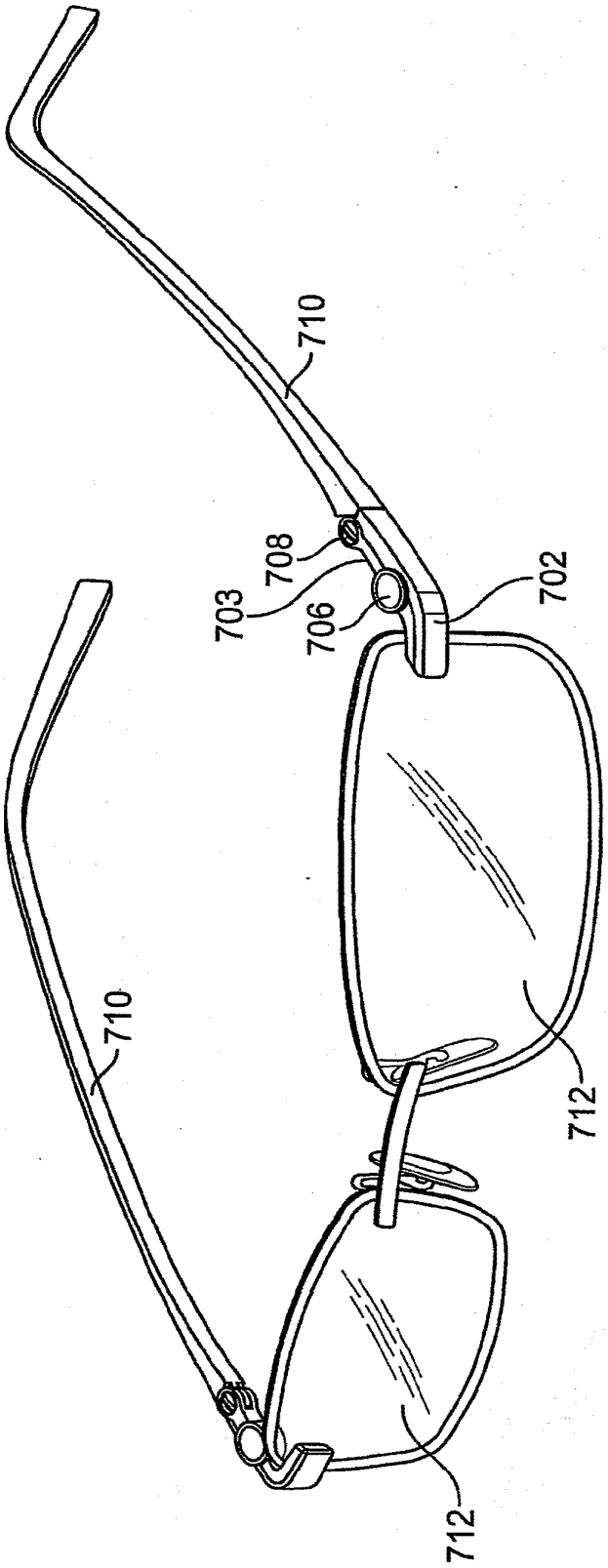



FIG. 7

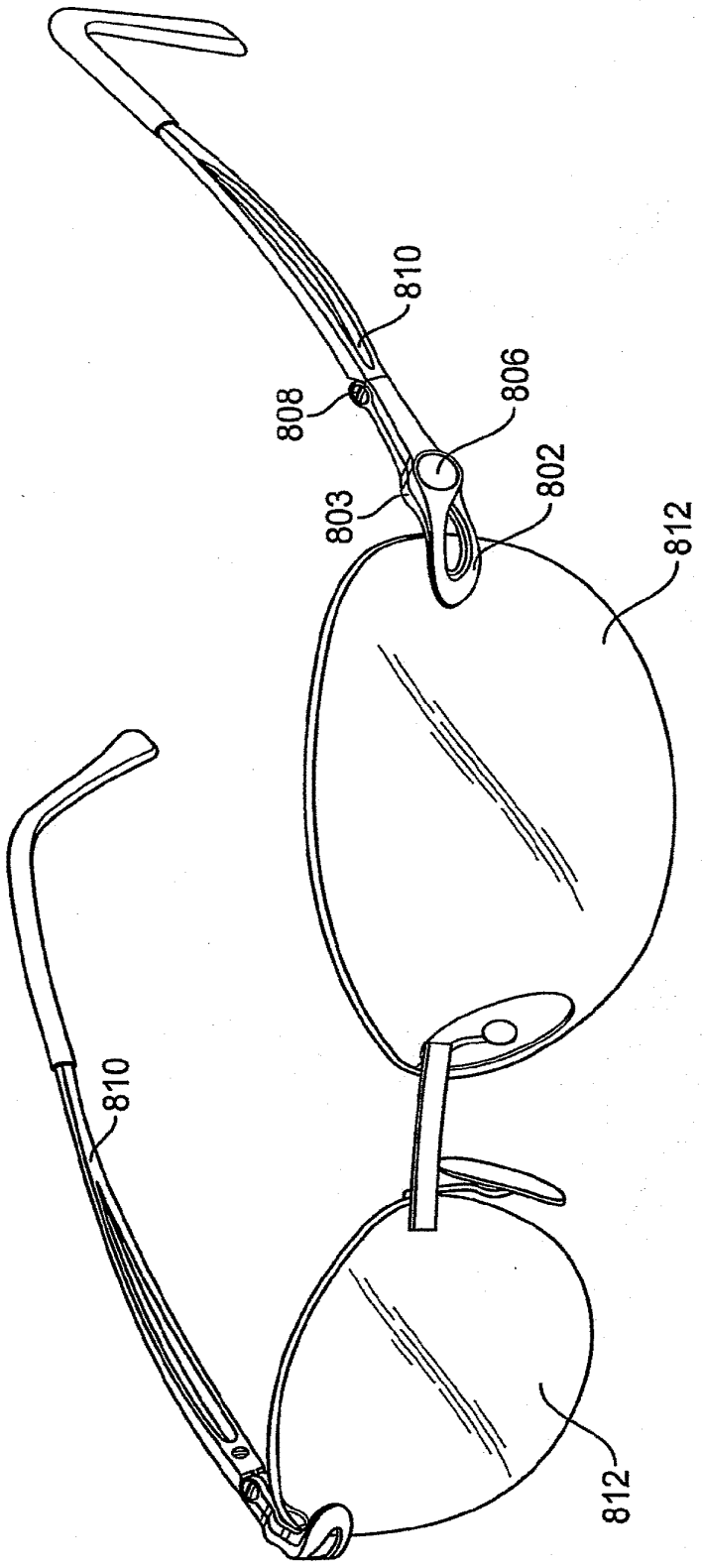



FIG. 8A

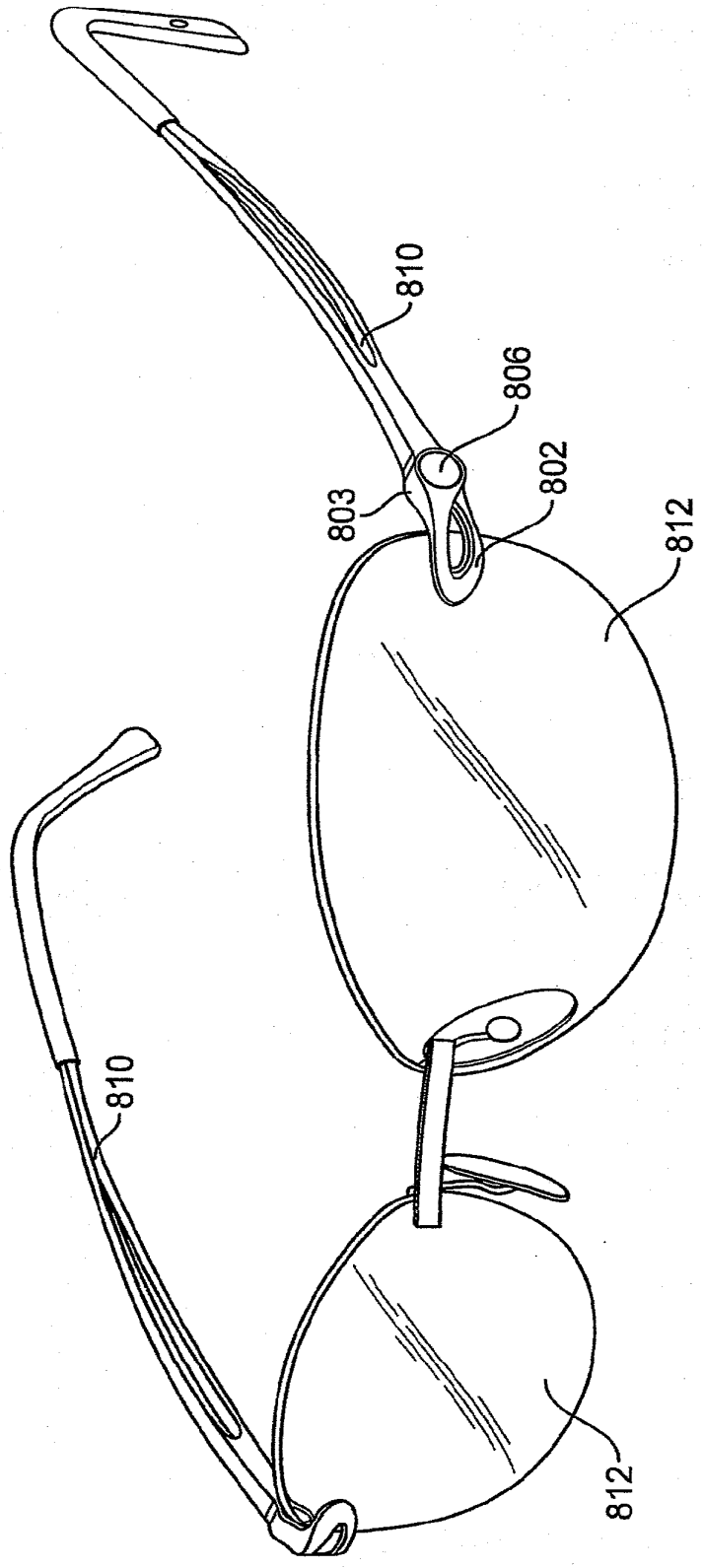



FIG. 8B

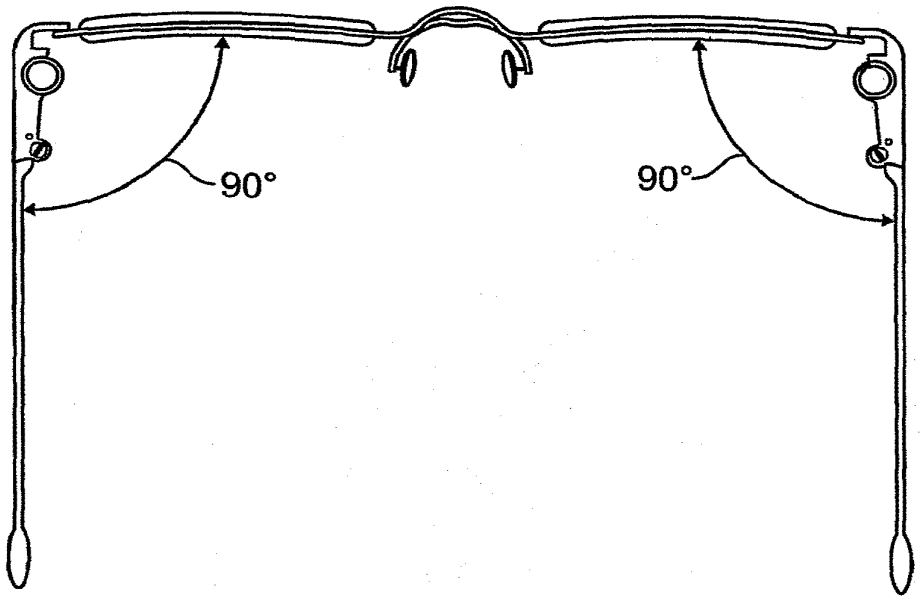



FIG. 9A

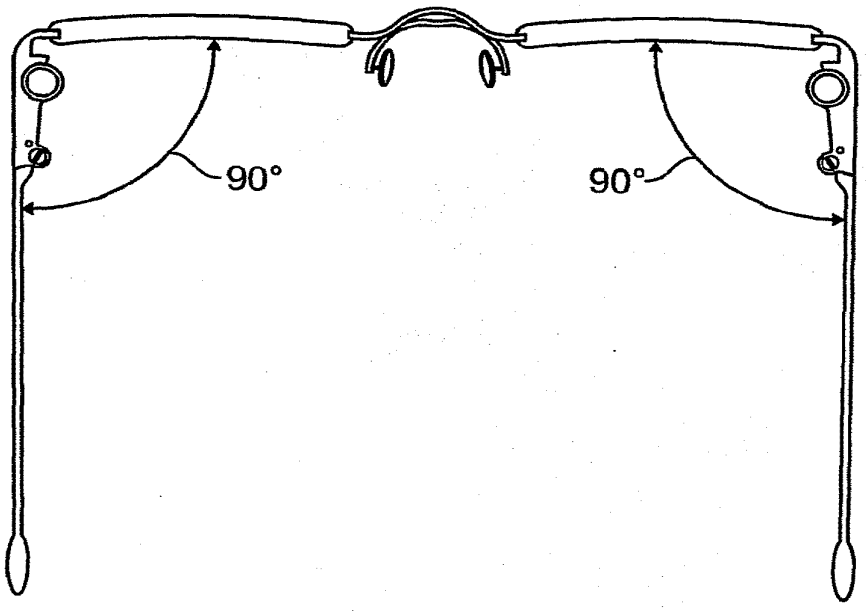



FIG. 9B

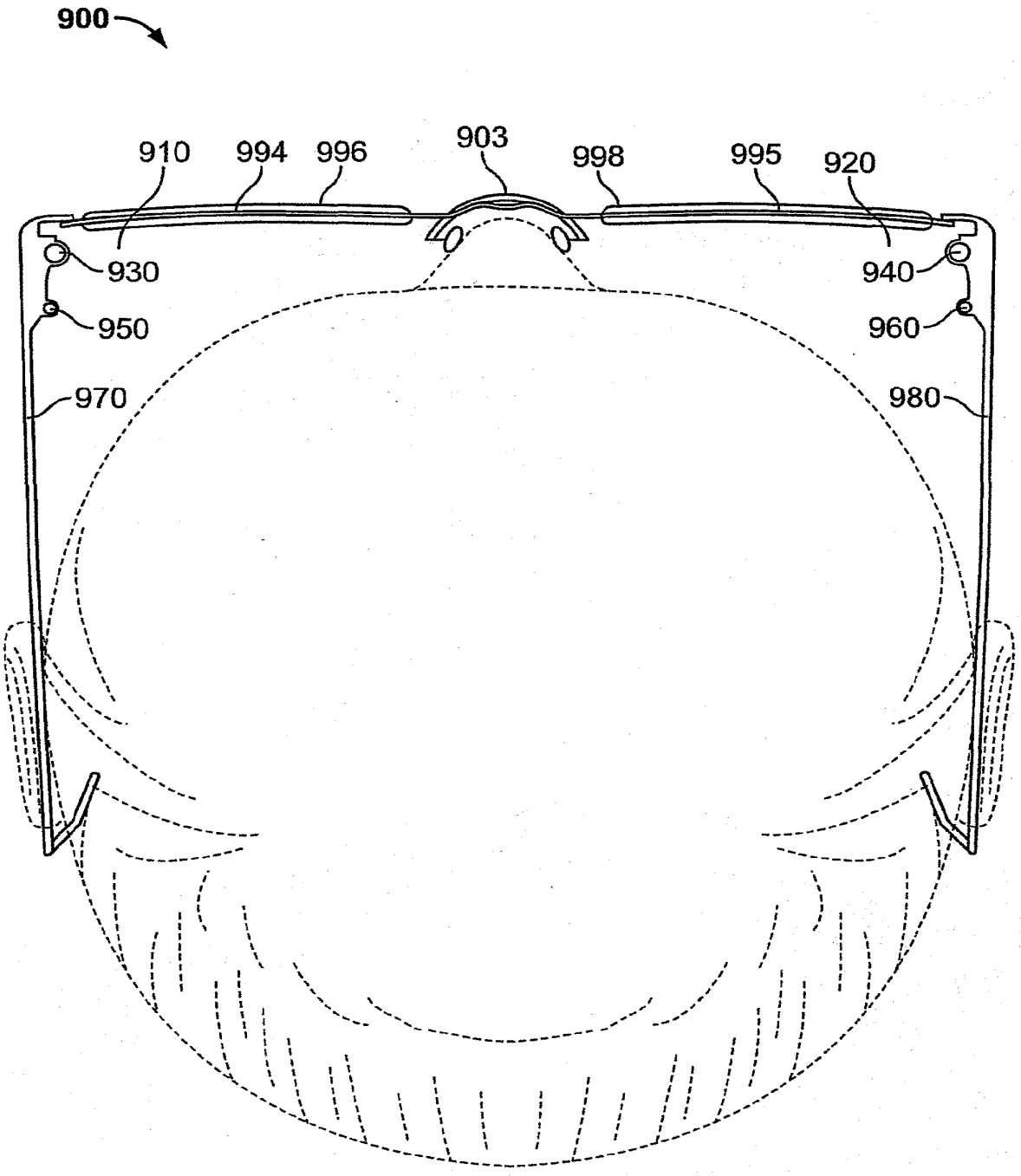



FIG. 9C

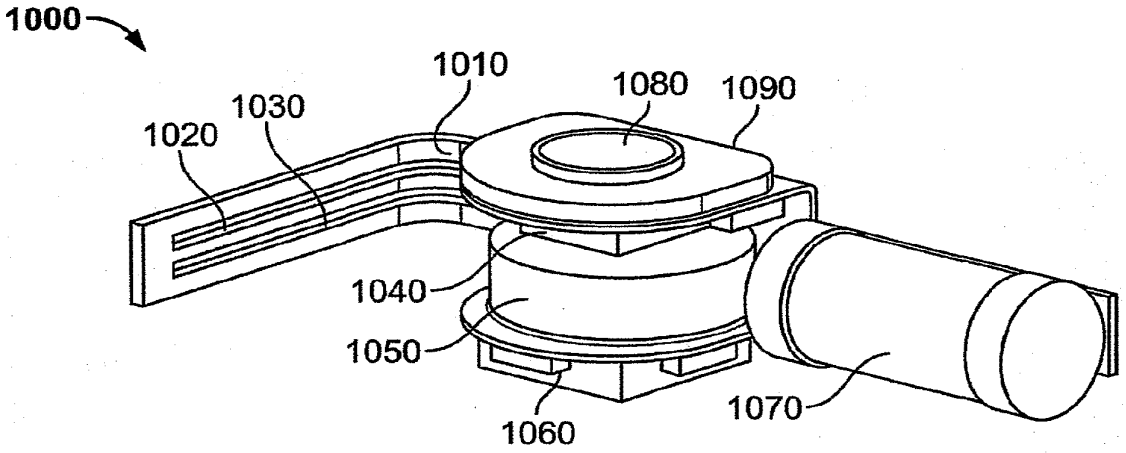

1000
1010
1080
1090
1030
1020
1040
1050
1060
1070

FIG. 10

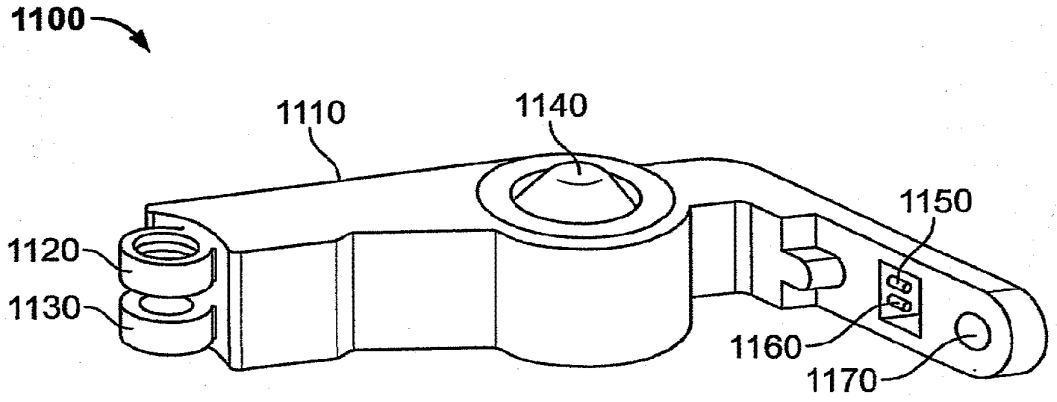

1100
1110
1140
1150
1120
1130
1160
1170

FIG. 11

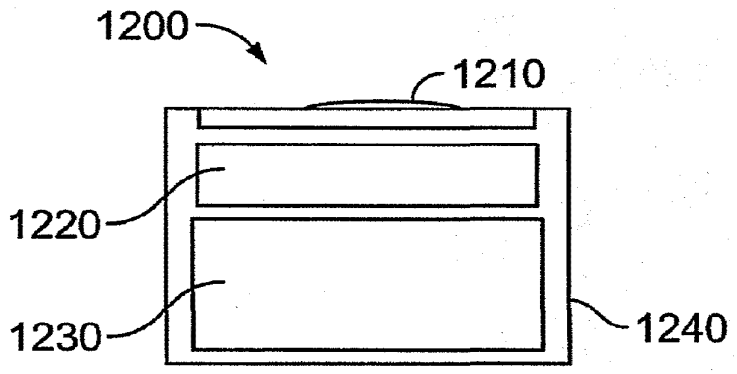



FIG. 12A

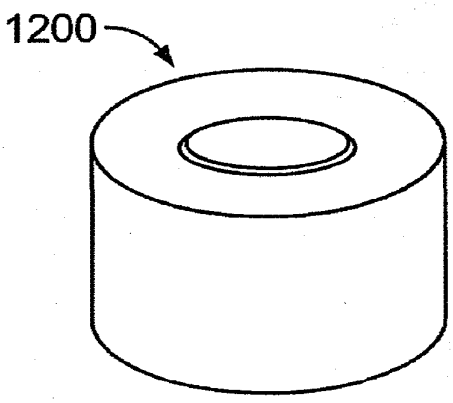



FIG. 12B

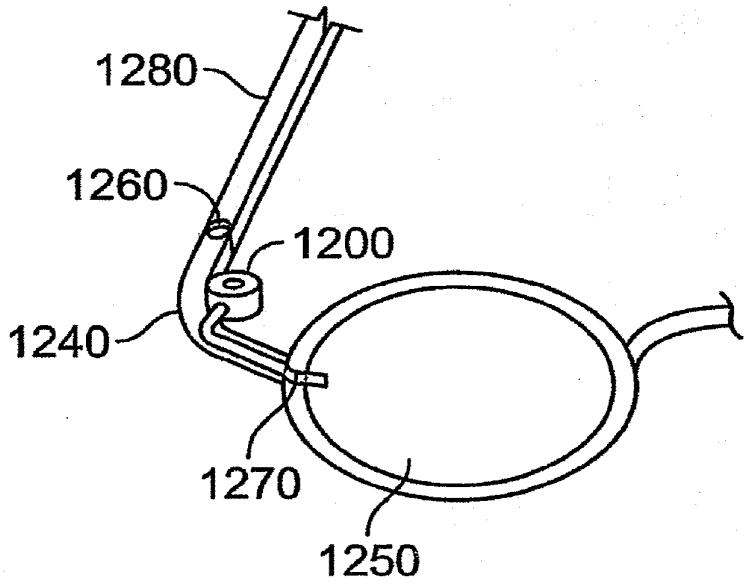



FIG. 12C

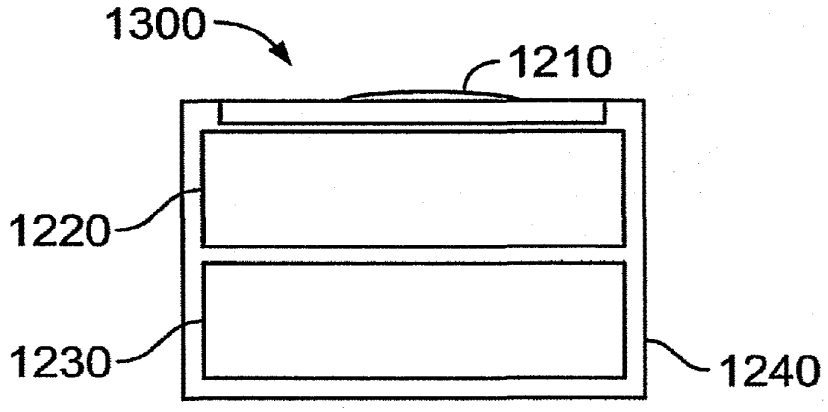



FIG. 13A

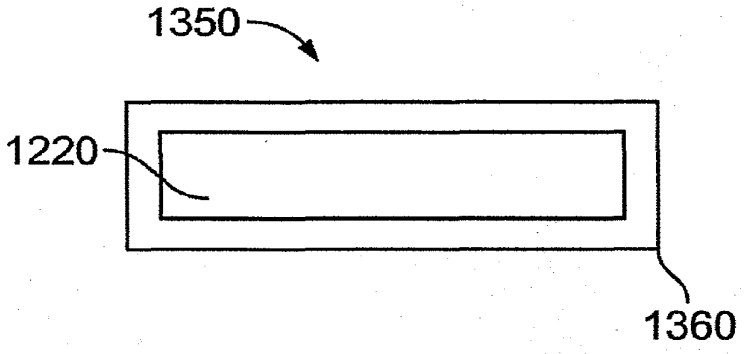



FIG. 13B

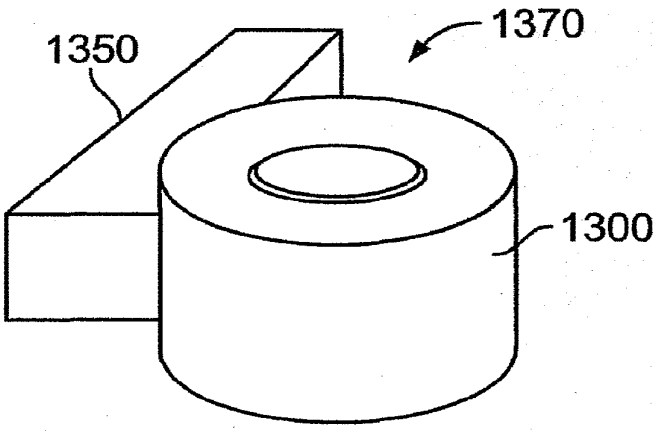



FIG. 13C

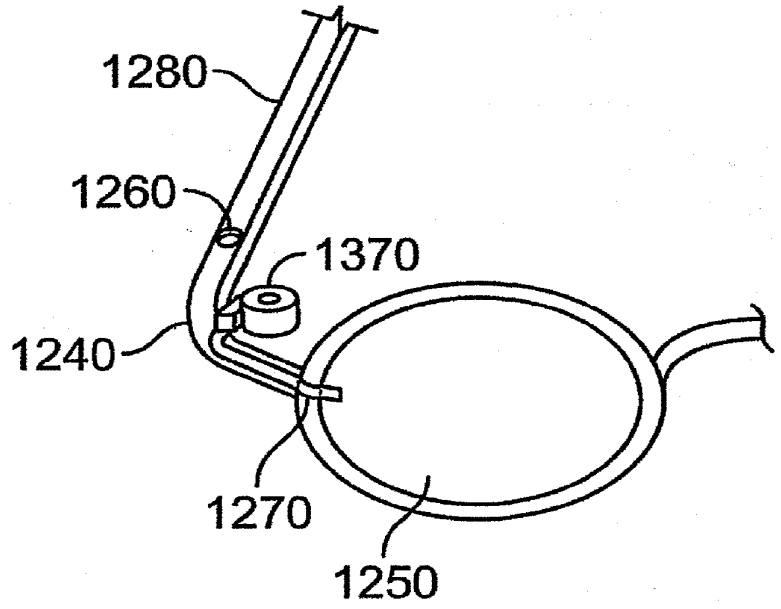



FIG. 13D

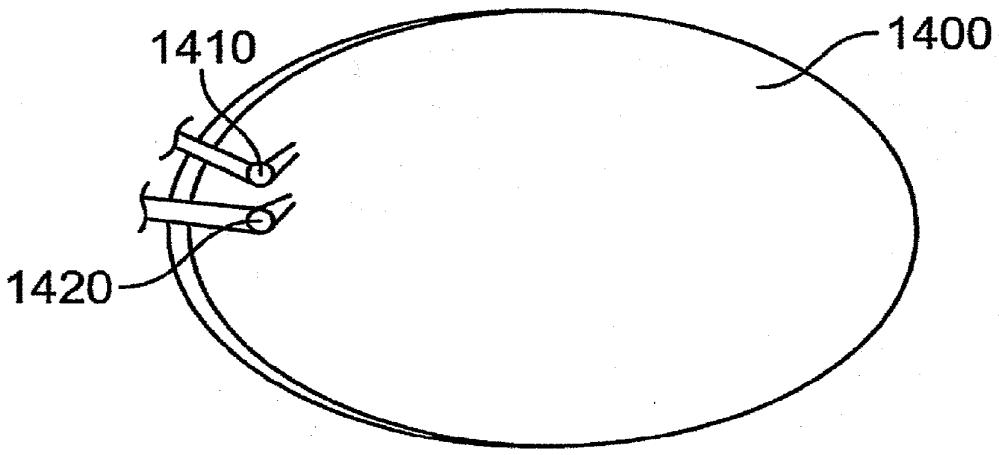



FIG. 14

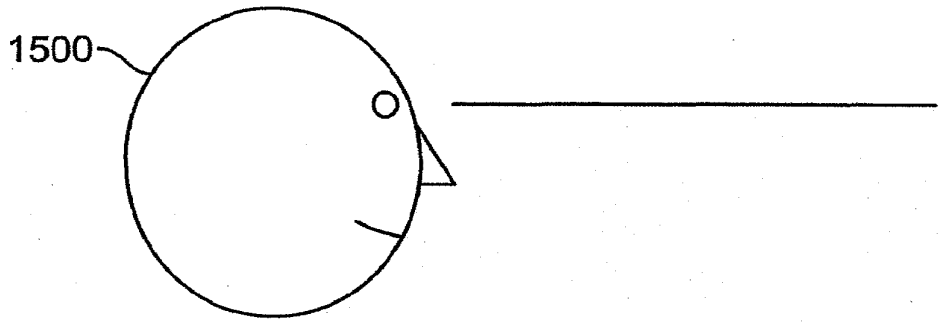



FIG. 15A

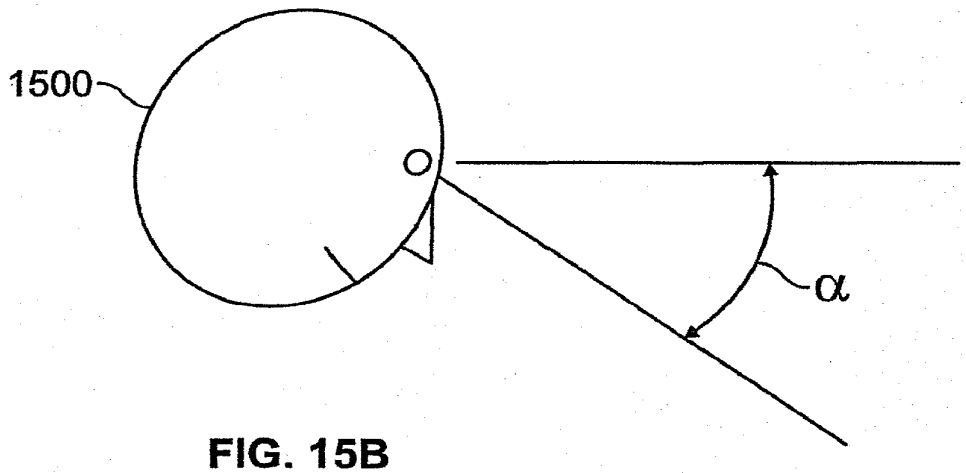



FIG. 15B

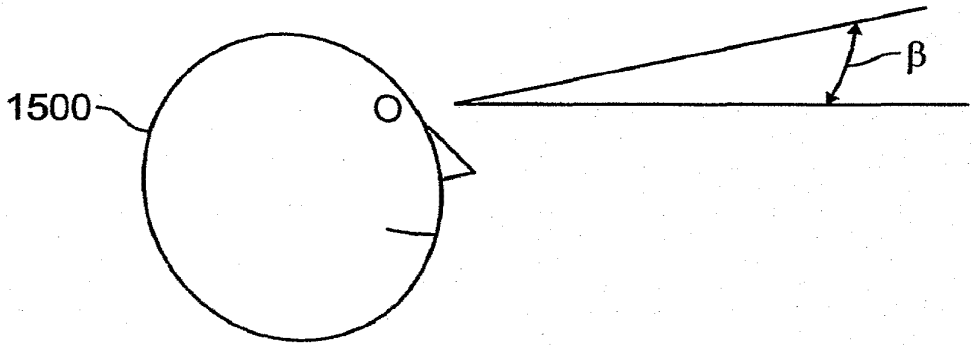



FIG. 15C

# 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 $\alpha$ 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 $\beta$ 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. 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 $\alpha$, the electro-active lens would be deliberately turned off. In this illustration, the angle $\alpha$ may be a large angle, perhaps as large as 45 degrees or more. In preferred embodiments, angle $\alpha$ 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 $\alpha$, the electro-active lens would remain in its on state until the person raises his head above the angle $\beta$, as illustrated in FIG. **15**C. In preferred embodiments, angle $\beta$ 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.

* * * * *

US005463428A

# United States Patent [19]

Lipton et al.

[11] Patent Number: 5,463,428

[45] Date of Patent: Oct. 31, 1995

[54] **WIRELESS ACTIVE EYEWEAR FOR STEREOSCOPIC APPLICATIONS**

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[73] Assignee: **StereoGraphics Corporation**, San Rafael, Calif.

[21] Appl. No.: **193,279**

[22] Filed: **Feb. 8, 1994**

[51] **Int. Cl.**[6] ..... **G02C 1/00**

[52] **U.S. Cl.** ..... **351/158**; 351/41; 359/36

[58] **Field of Search** ..... 351/41, 45, 158; 359/36, 85, 88, 257

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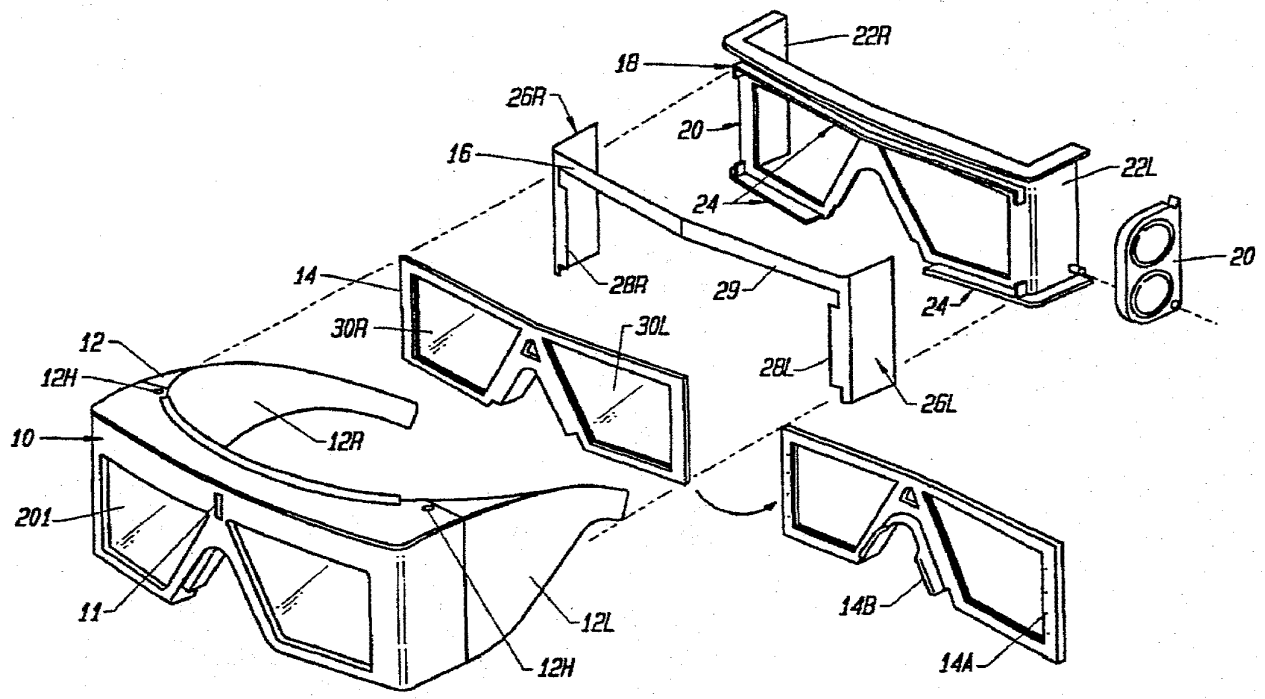
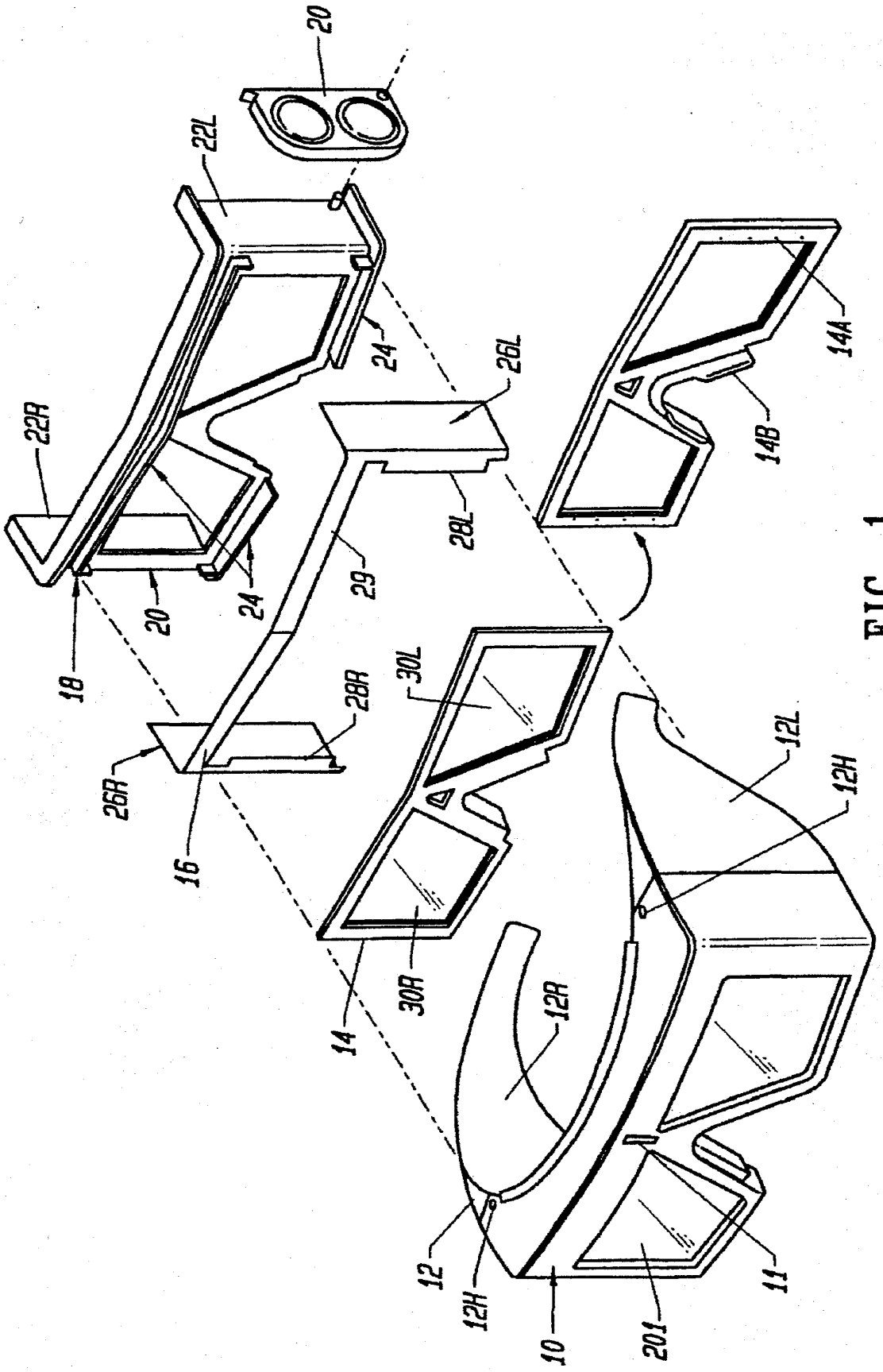
*Primary Examiner*—William L. Sikes
*Assistant Examiner*—Huy Mai
*Attorney, Agent, or Firm*—Limbach & Limbach

[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**

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12H
10
201
11

FIG. 1

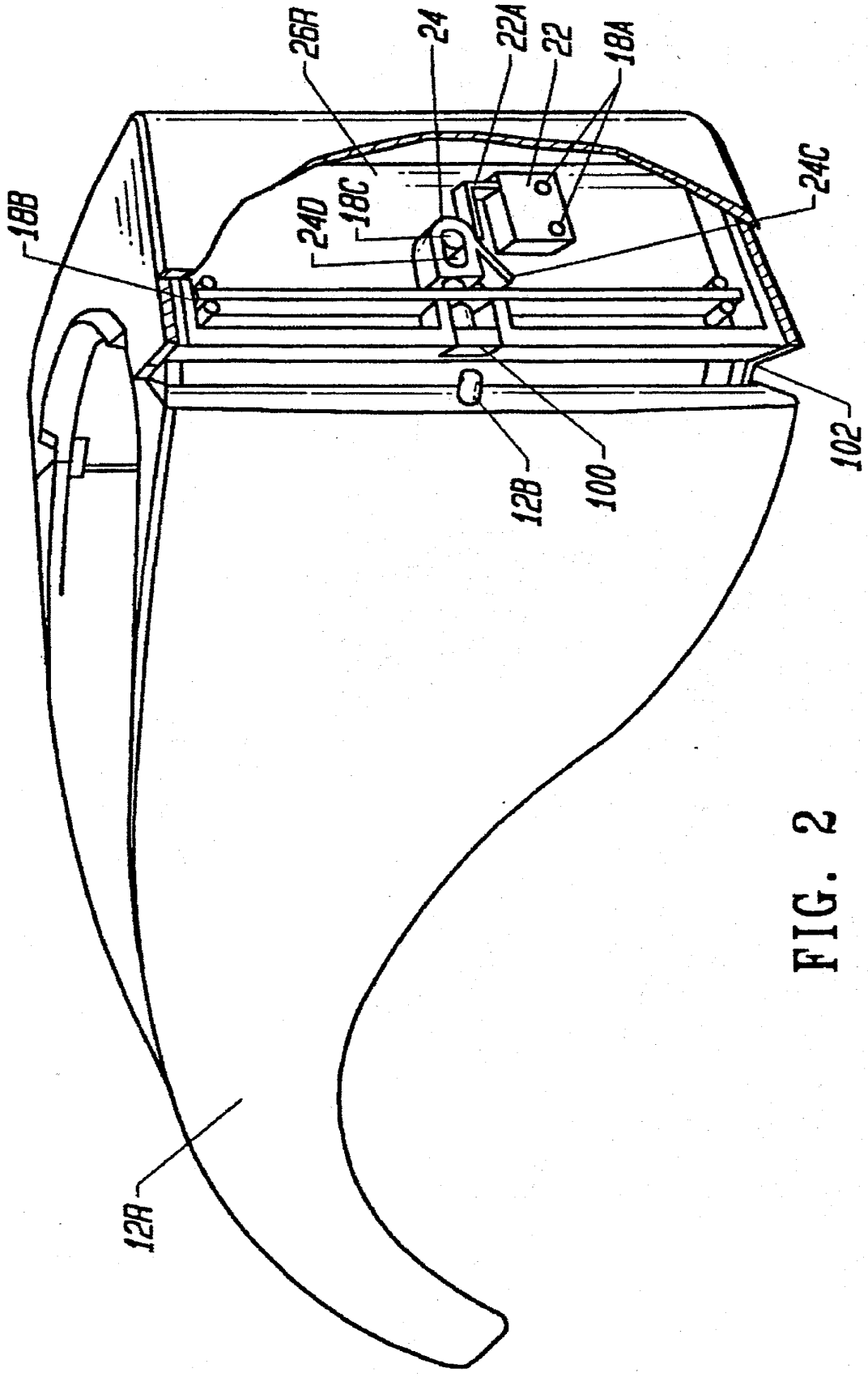


FIG. 2

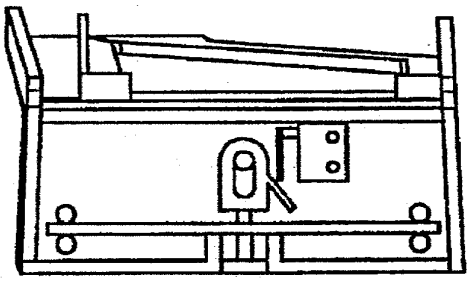

FIG. 3B

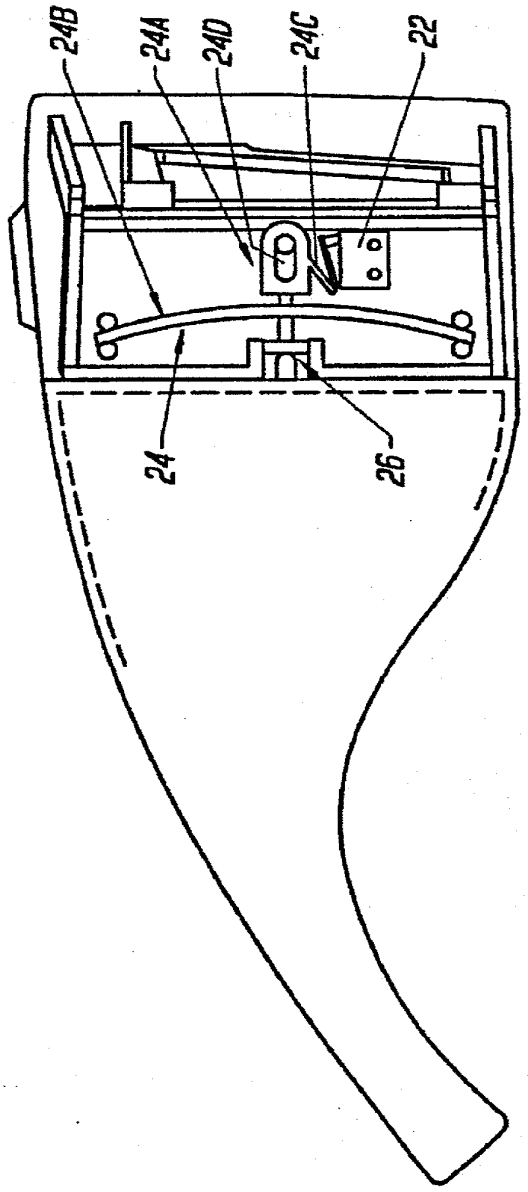


FIG. 3A

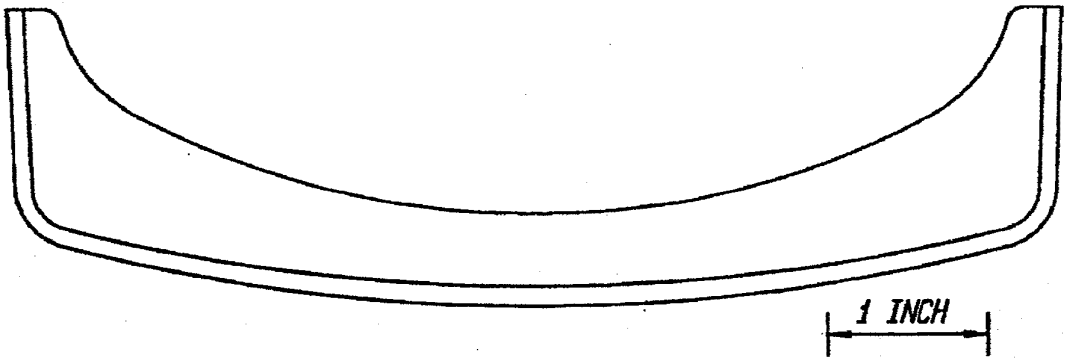


FIG. 4A

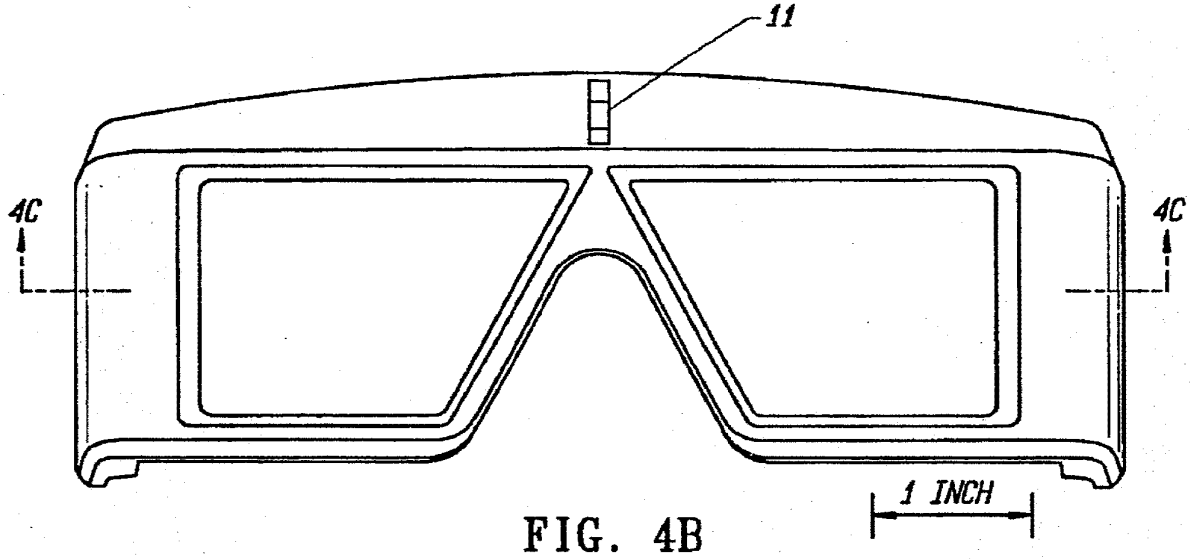


FIG. 4B

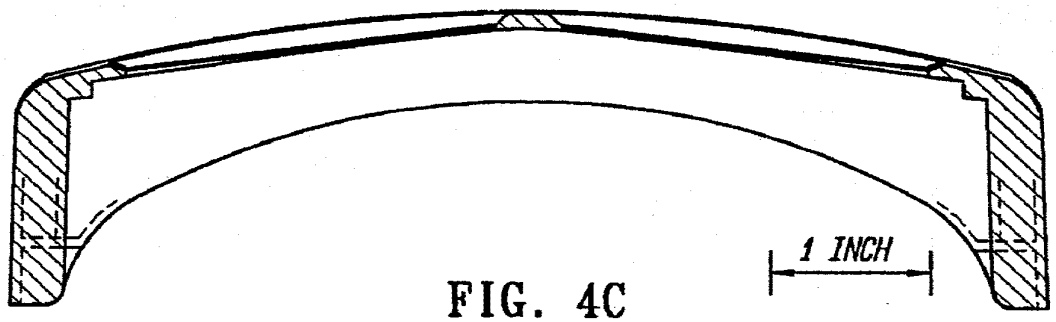


FIG. 4C

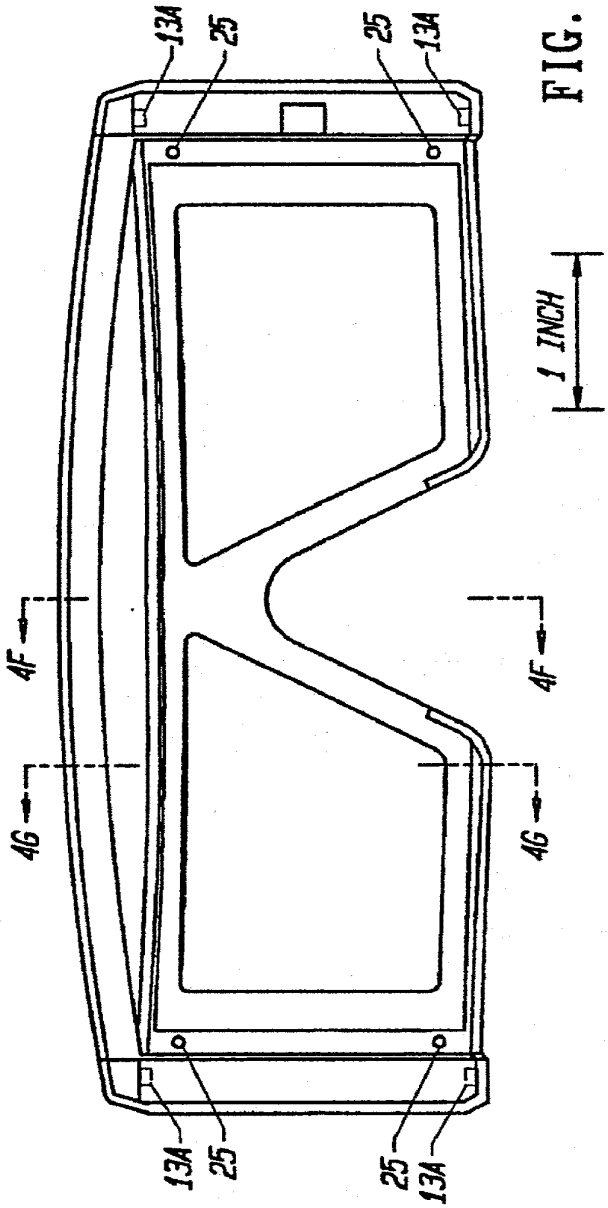


FIG. 4D

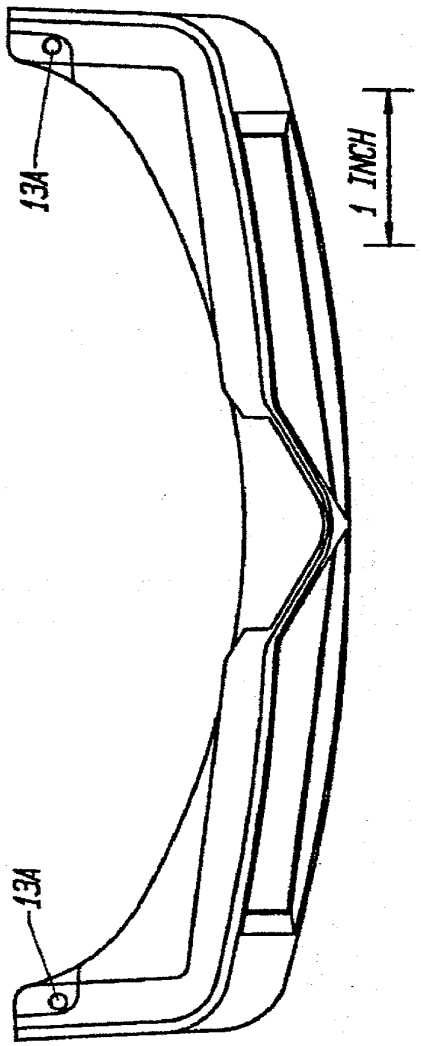


FIG. 4E

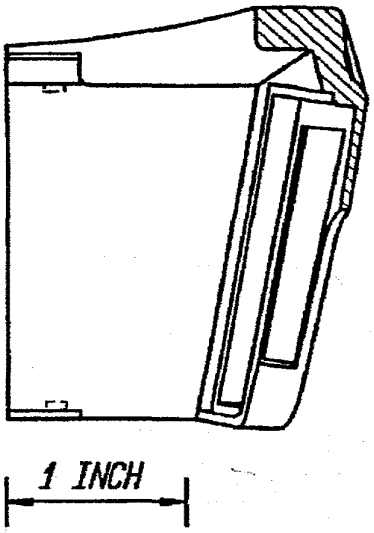


FIG. 4F

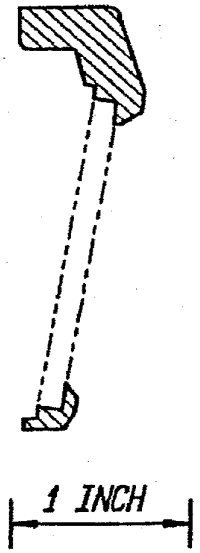


FIG. 4G

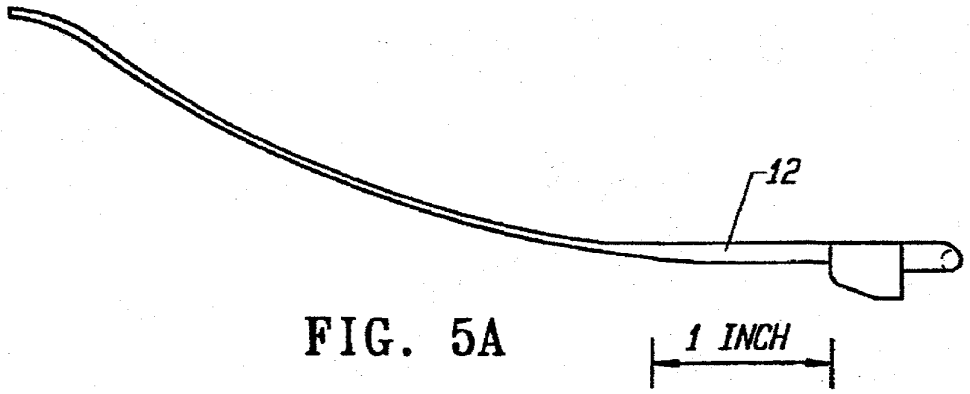


FIG. 5A

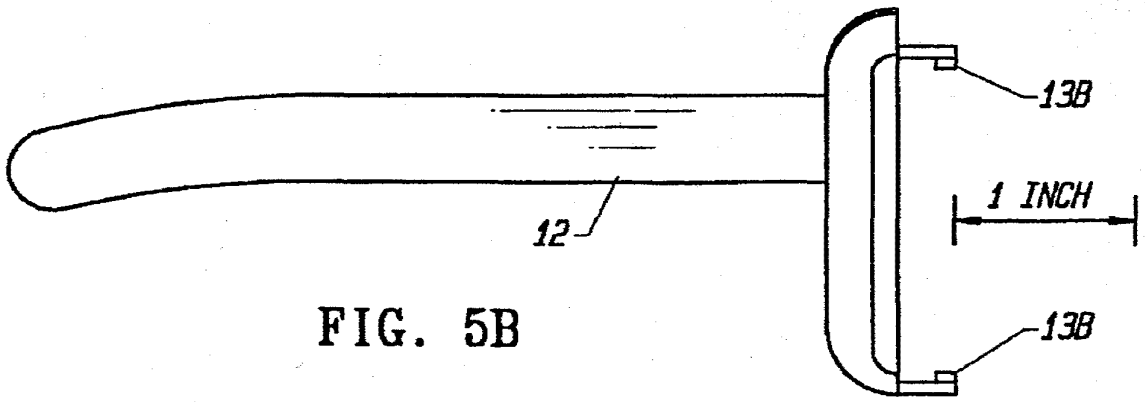


FIG. 5B

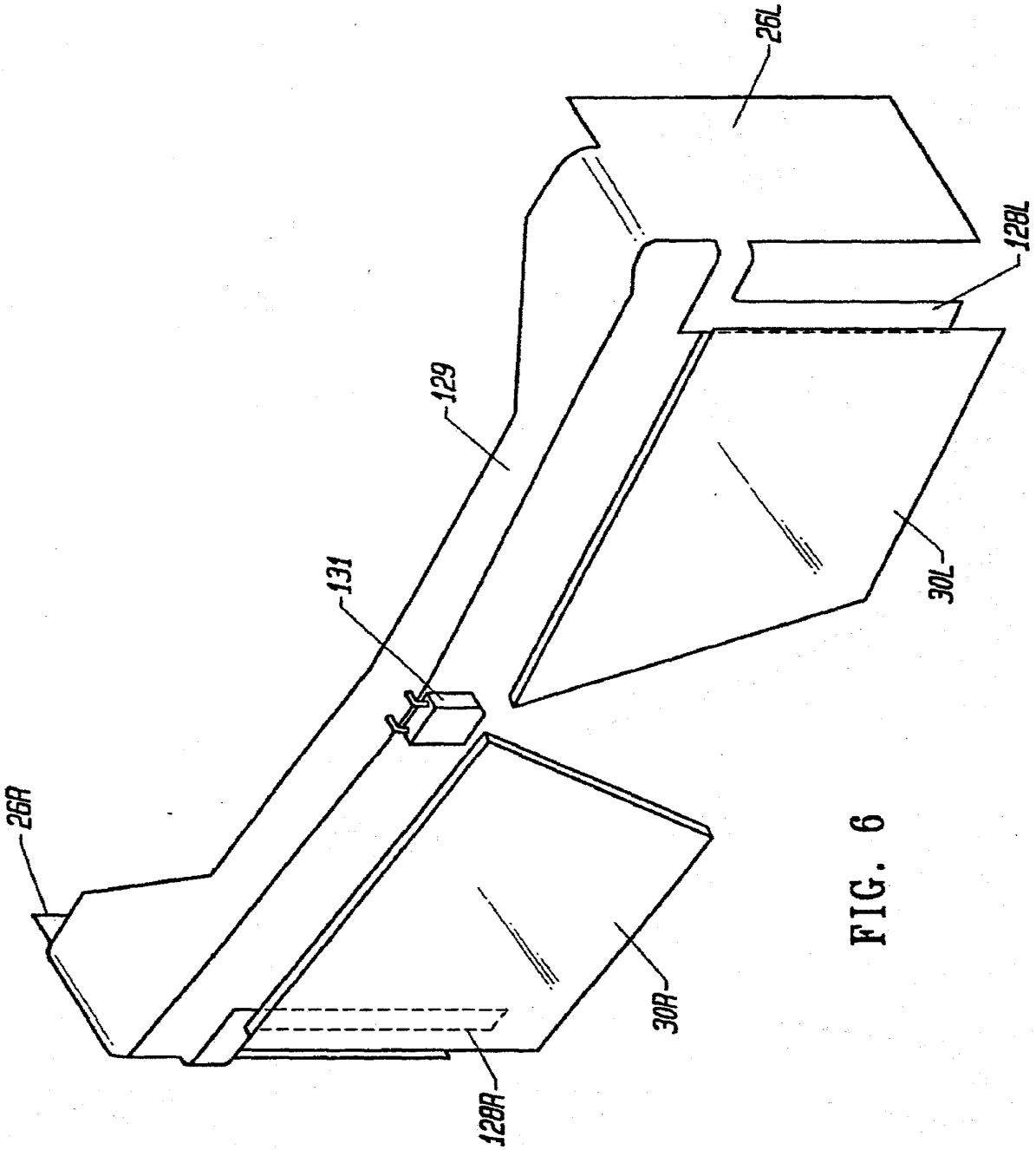


FIG. 6

# 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. **4**A is a top plan view of another embodiment of wireless active eyewear according to the present invention.

FIG. **4**B is a front plan view of the eyewear shown in FIG. **4**A.

FIG. **4**C is a sectional view of the eyewear taken across section **4**C—**4**C of FIG. **4**B.

FIG. **4**D is a rear plan view of the eyewear shown in FIG. **4**B.

FIG. **4**E is a bottom plan view of the eyewear shown in FIG. **4**B.

FIG. **4**F is a sectional view of the eyewear taken across section **4**F—**4**F of FIG. **4**D.

FIG. **4**G is a sectional view of the eyewear taken across section **4**G—**4**G of FIG. **4**D.

FIG. **5**A is a top plan view of a typical temple arm of the preferred embodiment of wireless active eyewear according to the present invention.

FIG. **5**B is a side plan view of the temple arm of FIG. **5**A.

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 **12**L, **12**R 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 **128**R and **128**L 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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(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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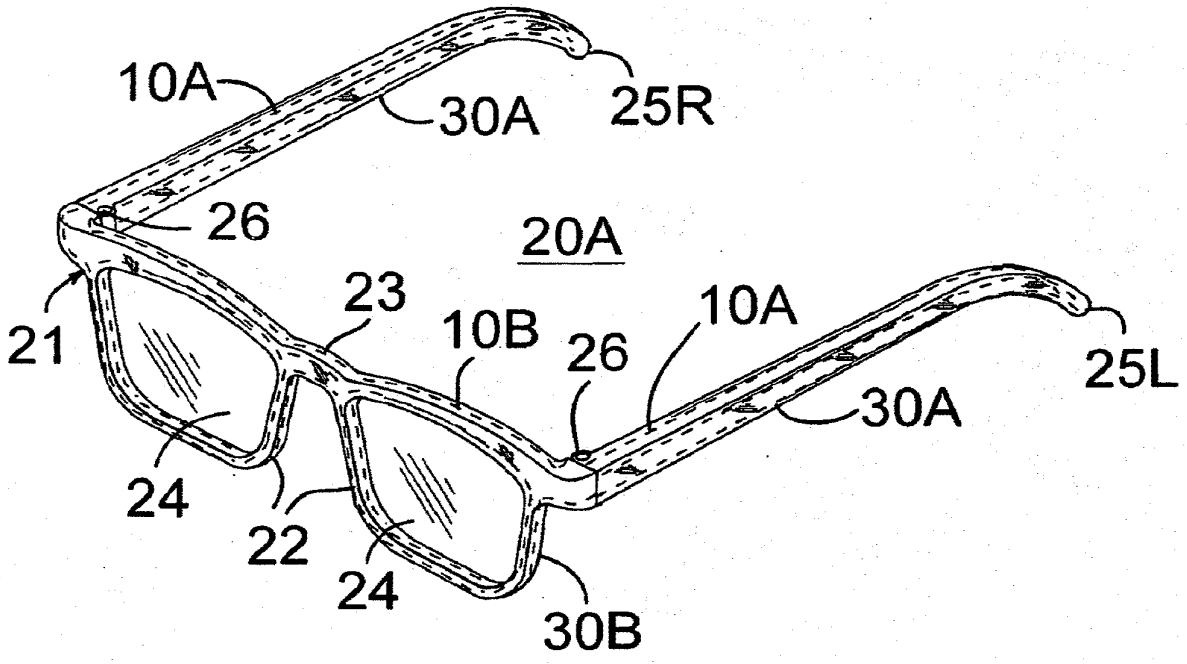
**Publication Classification**

(51) **Int. Cl.**
*G02C 5/00* (2006.01)

(52) **U.S. Cl.** ..... **351/41**

(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.



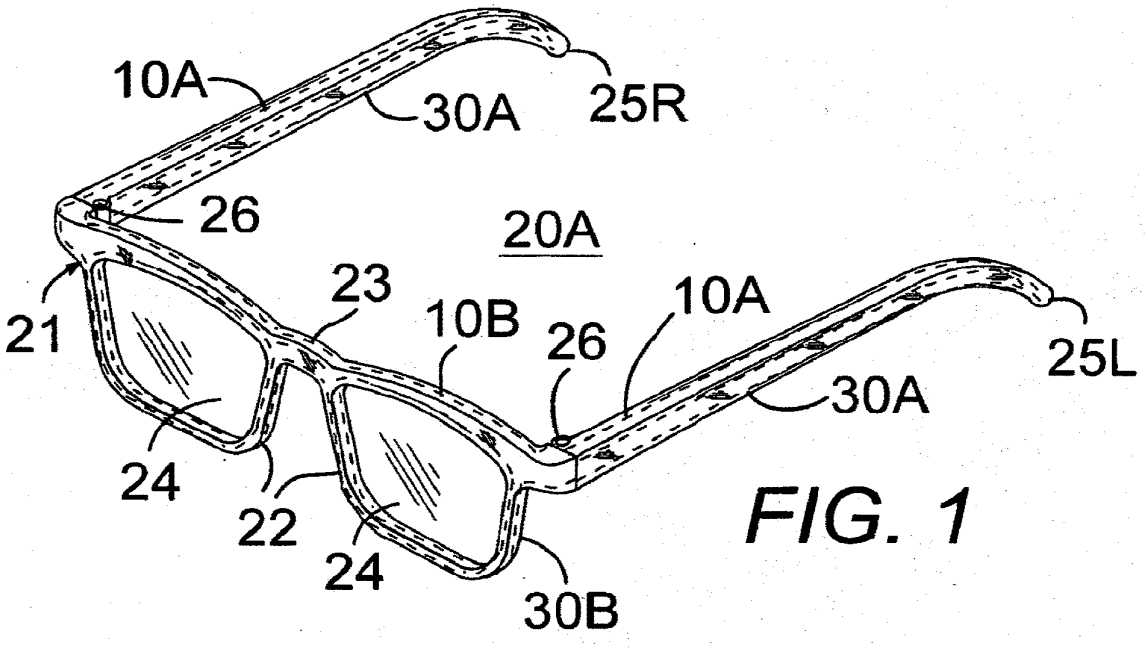
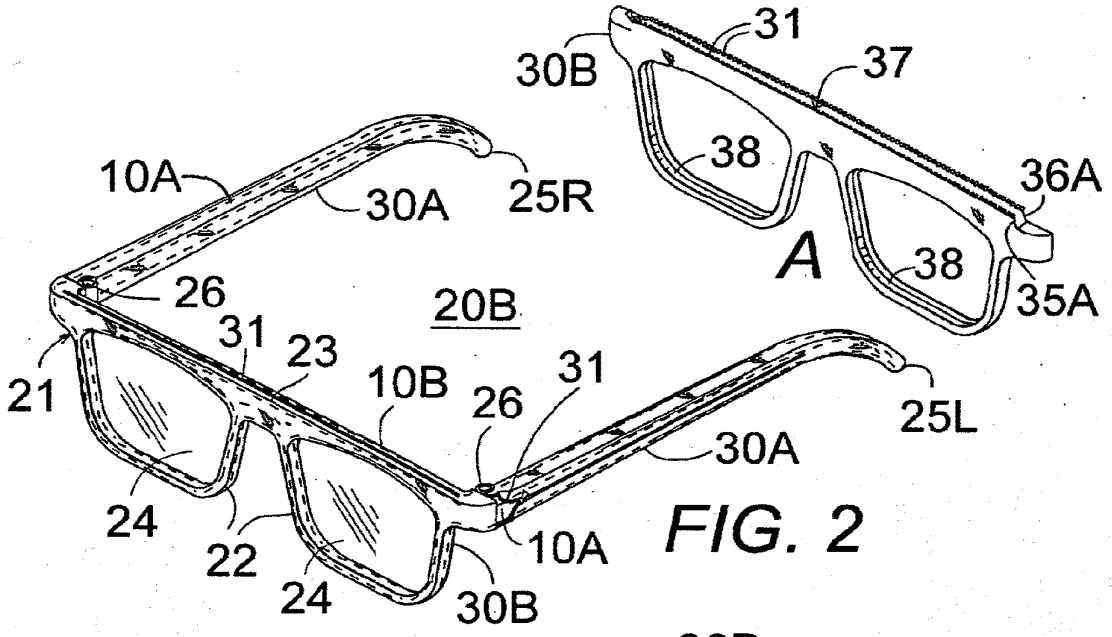



FIG. 1


31
30B
37
10A
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25R
A
38
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26
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25L
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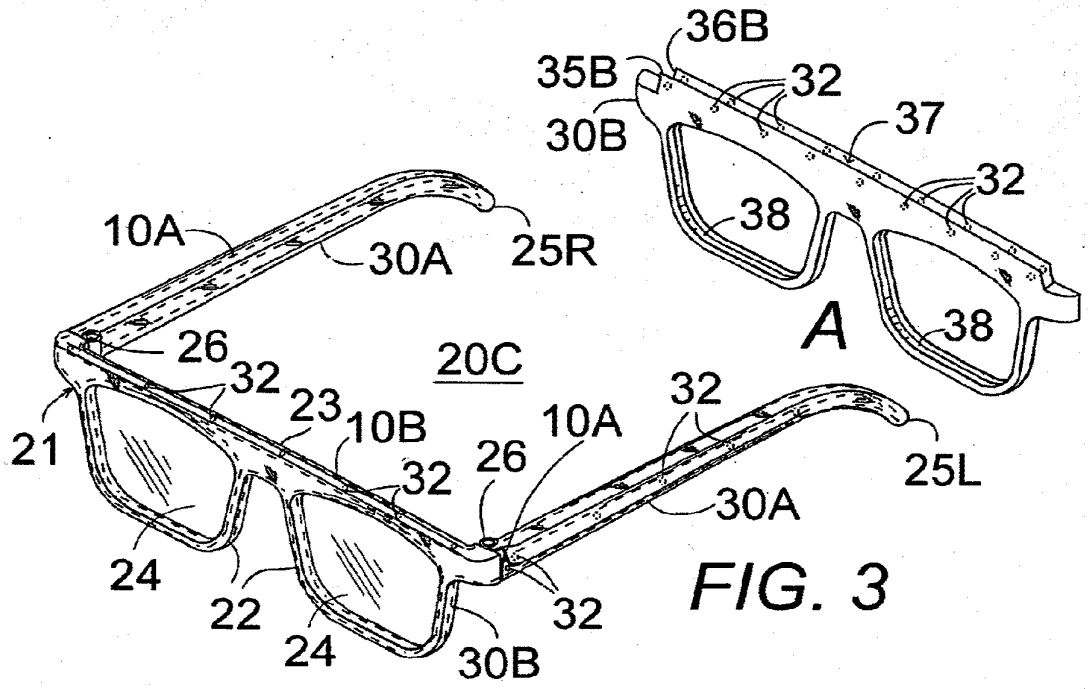
10A
24
30B

FIG. 2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25R
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30B

FIG. 3

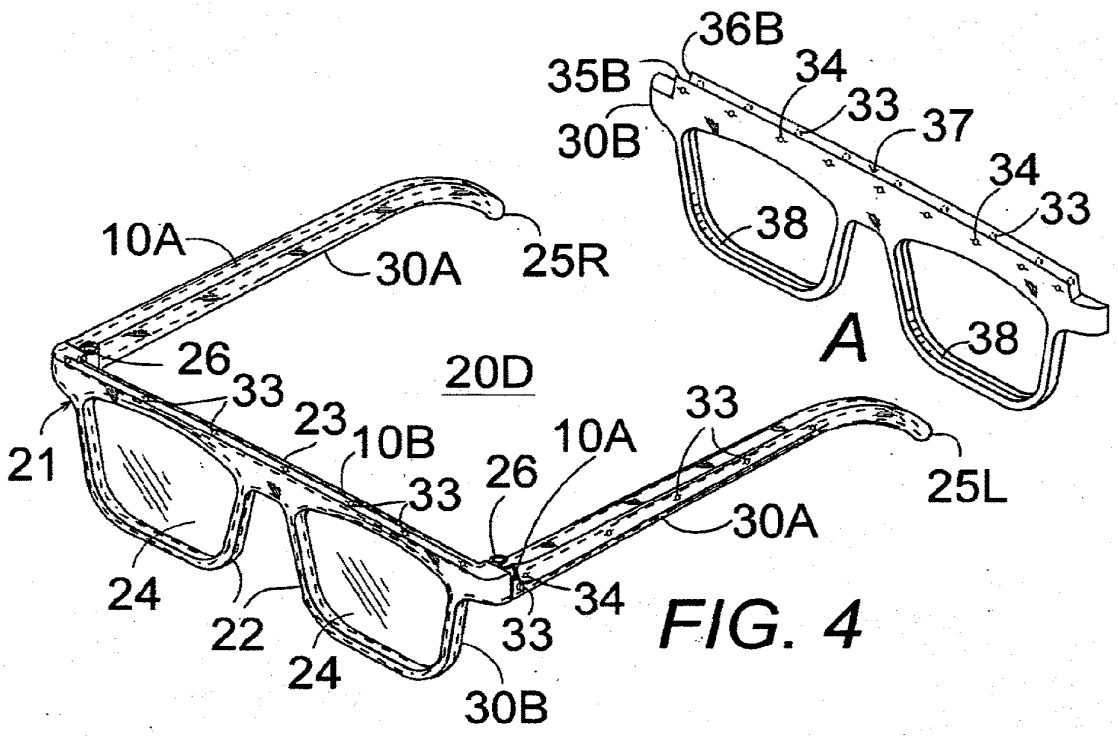
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FIG. 4

# 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 2A, a finished leather covering, including patent leather or other materials, as a frame covering 30B or temple arm covering 30A is attached to an interior eyewear frame 10B and interior pair of temple arms 10A by zippers 31. Outer temple arm sleeve covers 30A are zipped on by zippers 31, preferably along the sides, as shown in FIG. 2, and outer frame sleeve covers 30B, as shown in FIGS. 2 and 2A, with form-fitting frame sleeves 34 and a top opening 37 is pulled up over the inner frame 10B and the two flaps 35A and 36A 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 20B.

[0074] In FIGS. 3 and 3A, a finished leather covering, including patent leather or other materials, as a frame covering 30B or temple arm covering 30A is attached to an interior eyewear frame 10B and interior pair of temple arms 10A by snaps 32. Outer temple arm sleeve covers 30A are snapped on by snaps 31, preferably along the outside, as shown in FIG. 3, and outer frame sleeve covers 30B, as shown in FIGS. 3 and 3A, with form-fitting frame sleeves 34 and a top opening 37 is pulled up over the inner frame 10B and the two flaps 35B and 36B 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 20B.

[0075] In FIGS. 4 and 4A, a finished leather covering, including patent leather or other materials, as a frame covering 30B or temple arm covering 30A is attached to an interior eyewear frame 10B and interior pair of temple arms 10A by metal buttons 33 through slotted openings 34. Outer temple arm sleeve covers 30A are buttoned by metal buttons 33, preferably along the outside, as shown in FIG. 3, and outer frame sleeve covers 30B, as shown in FIGS. 3 and 3A, with form-fitting frame sleeves 34 and a top opening 37 is pulled up over the inner frame 10B and the two flaps 35B and 36B 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 20B.

[0076] In FIG. 1, the finished leather coverings 30A and 30B are attached to the inner temple arms 10A and inner frames 10B during mass production of new eyewear devices 20A.

[0077] In FIGS. 2-4, the finished leather coverings 30A and 30B may be attached to the inner temple arms 10A and inner frames 10B during mass production of new or existing eyewear devices 20B-20D, so that a user may buy just the coverings 30A and 30B 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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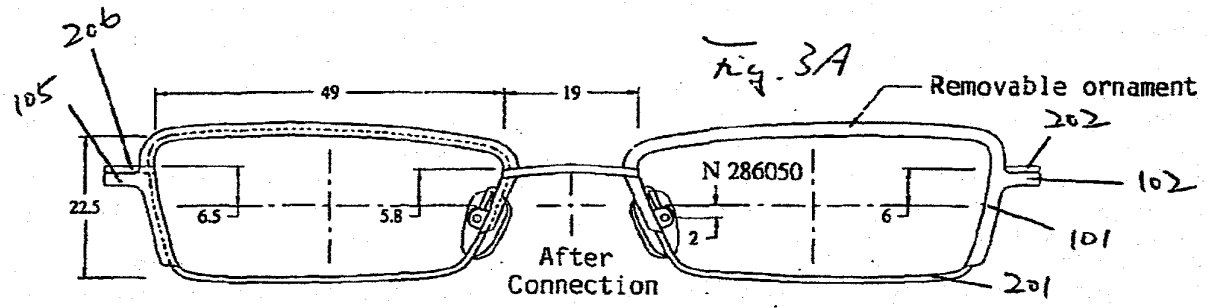
## (54) Ornamentation for eyeglasses

(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.

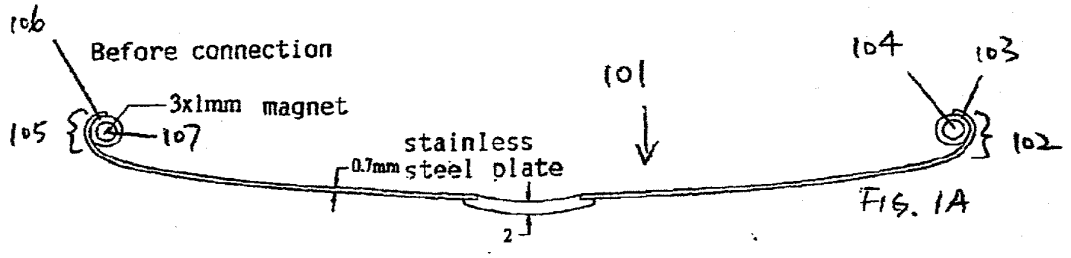



FIG. 1A

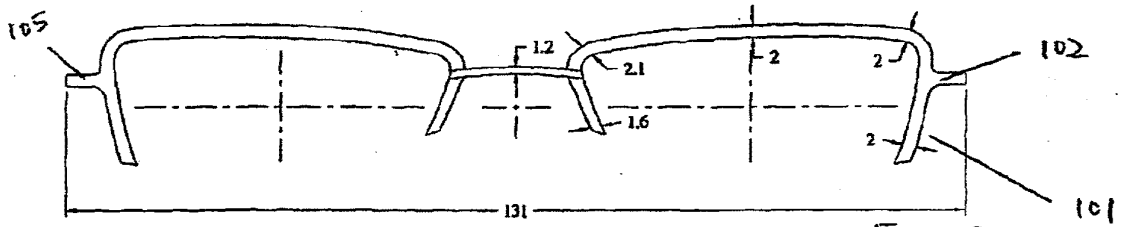



FIG. 1B

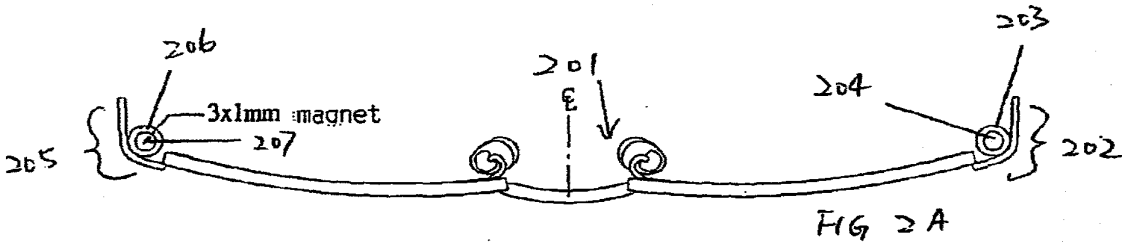



FIG 2A

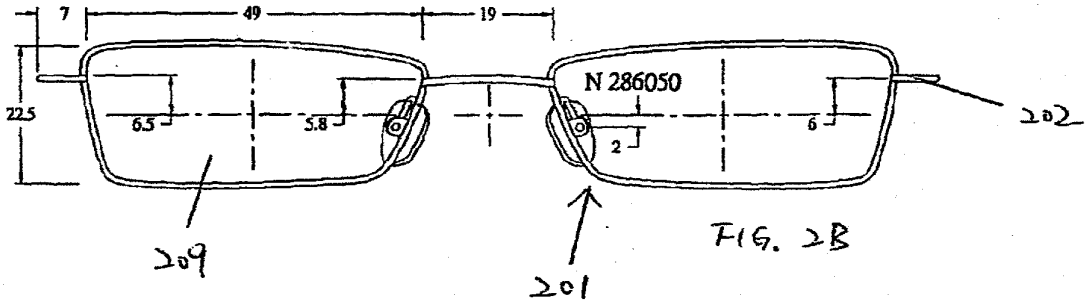



FIG. 2B

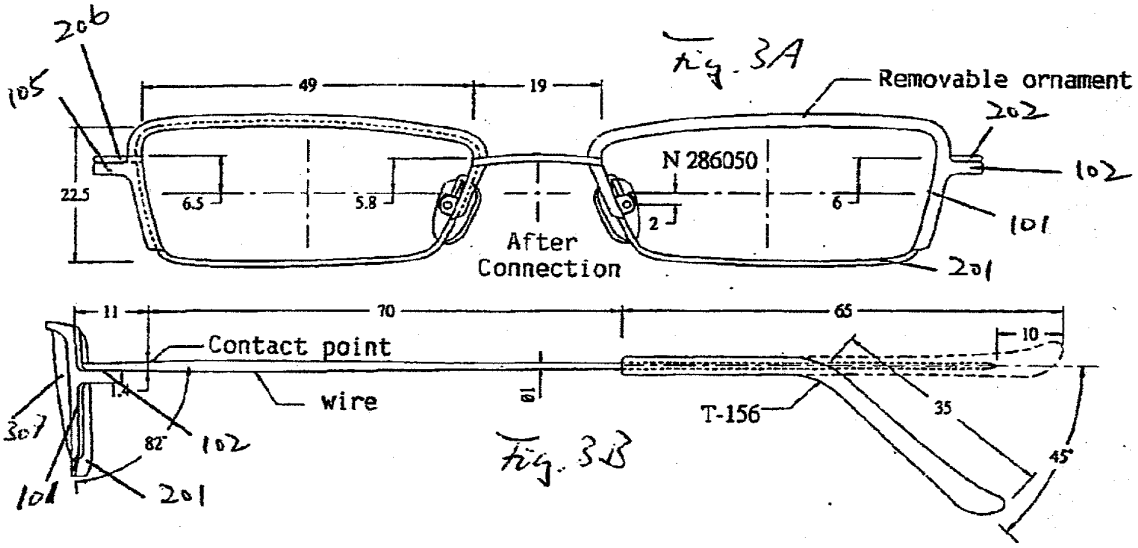



Fig. 3A




Fig. 3B

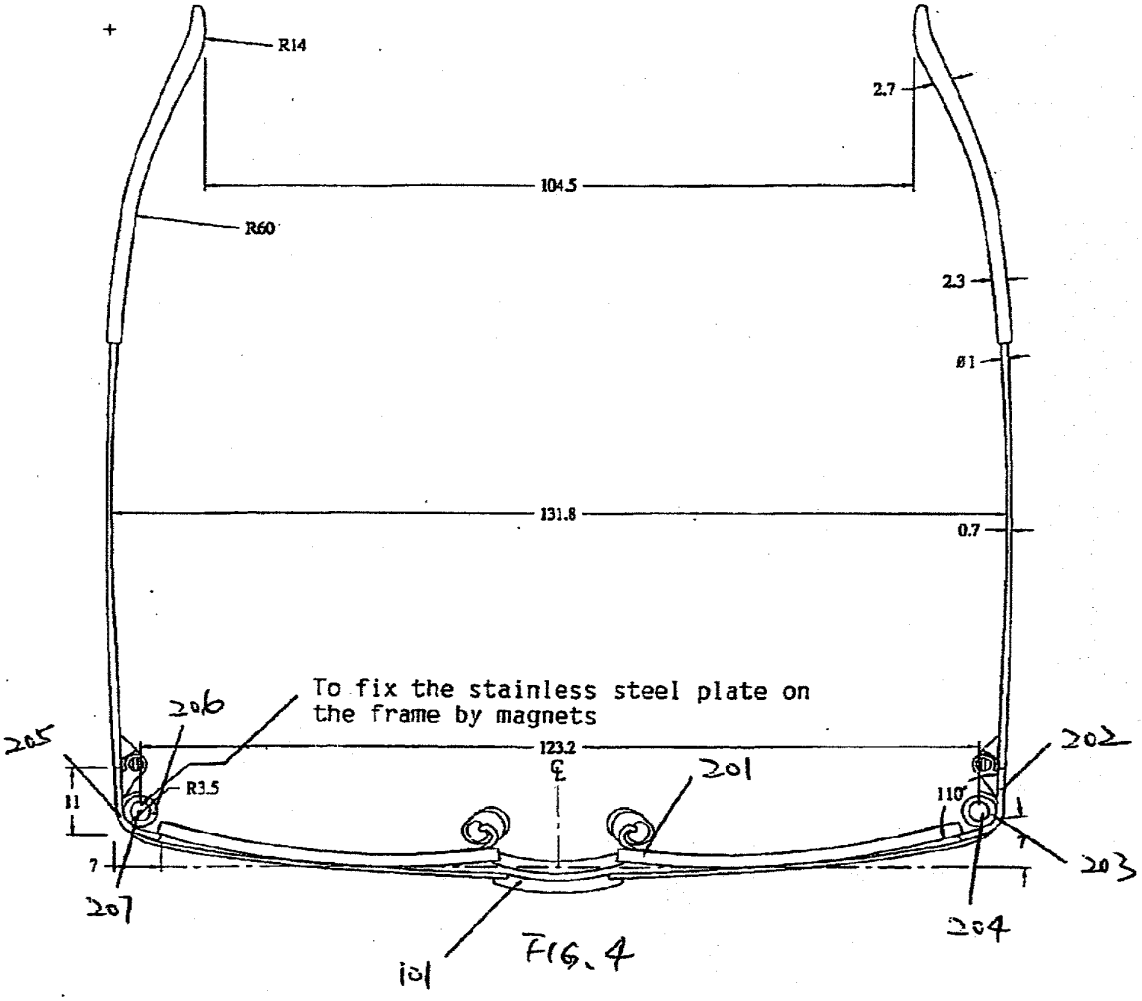



FIG. 4

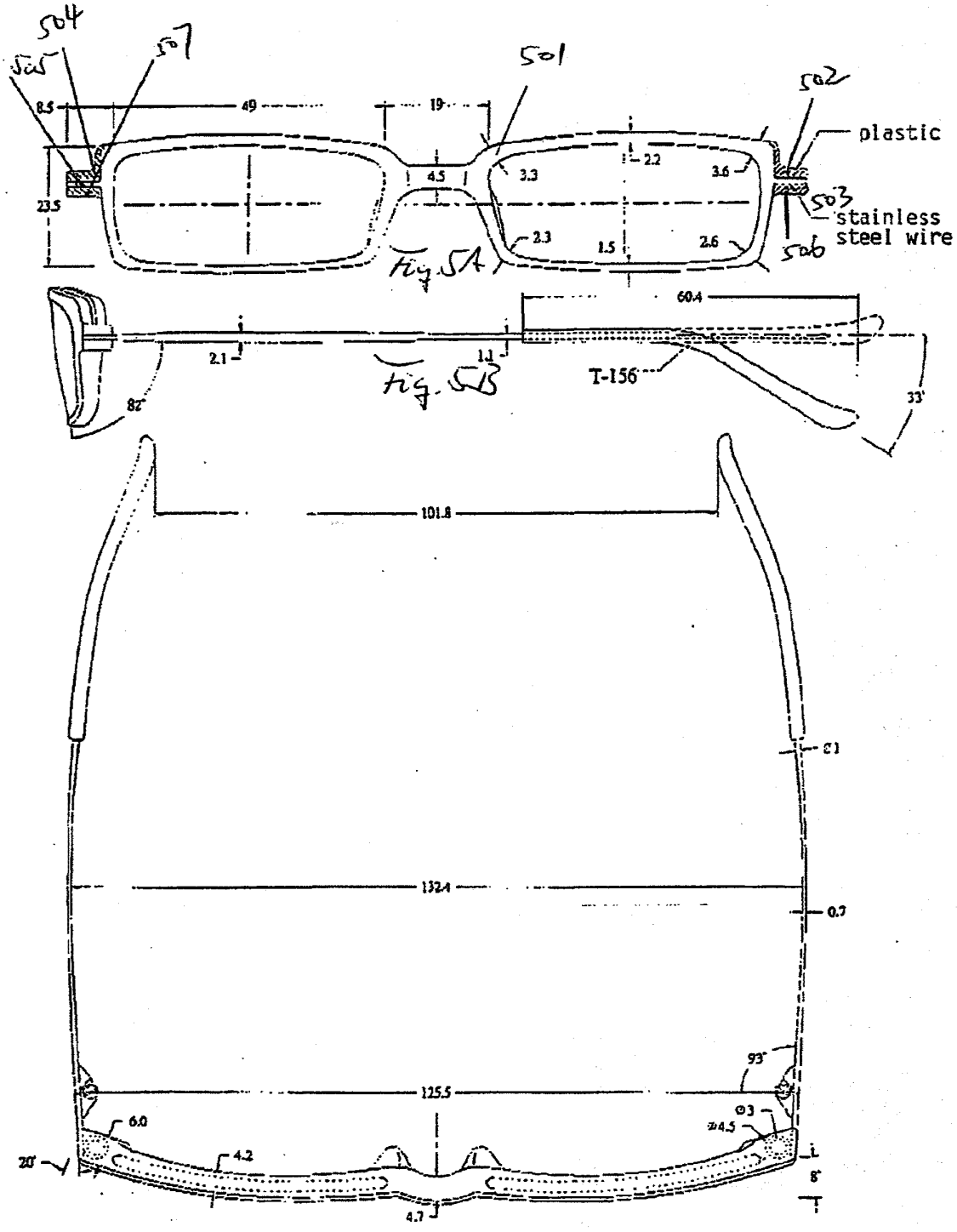



Fig. 5A

Fig. 5B

FIG. 6

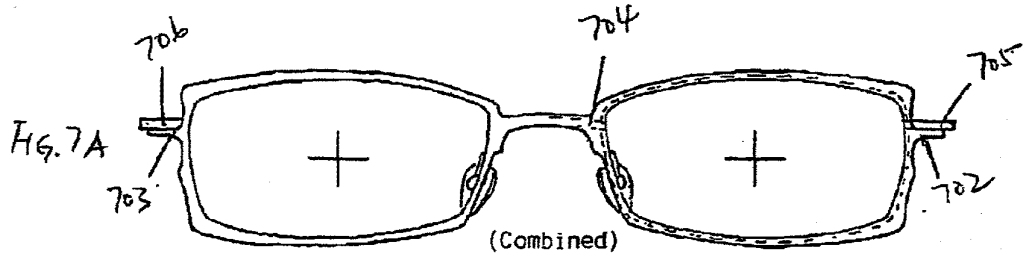



FIG. 7A

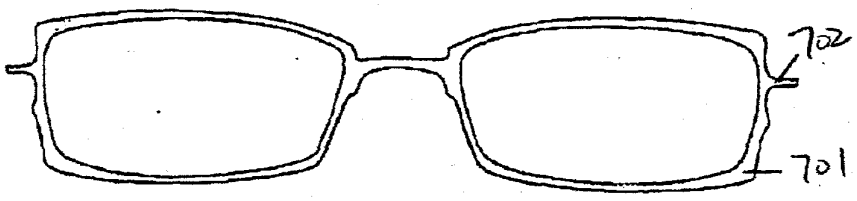



FIG. 7B

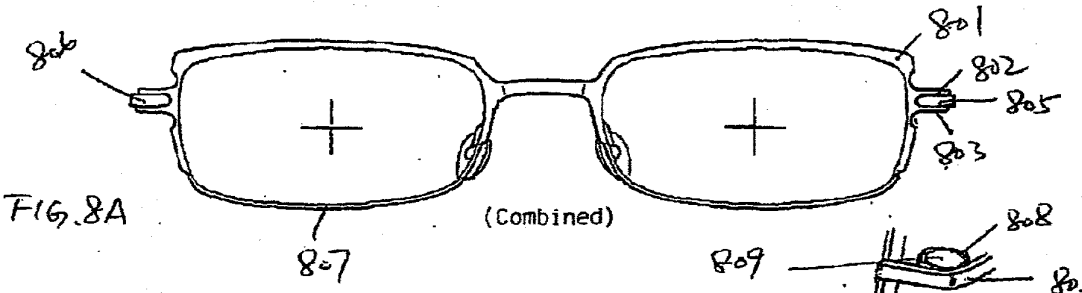



FIG. 8A

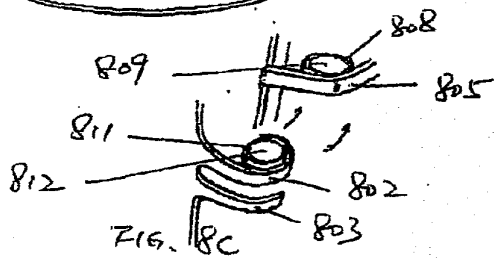



FIG. 8C

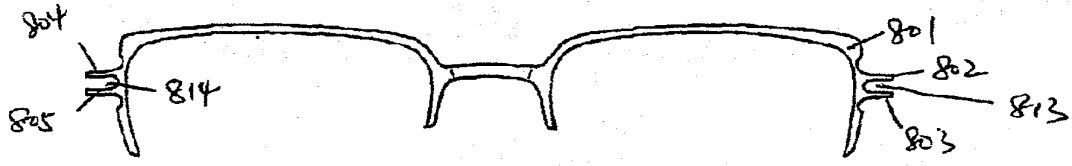



FIG. 8B

FIG. 9

FIG. 9A

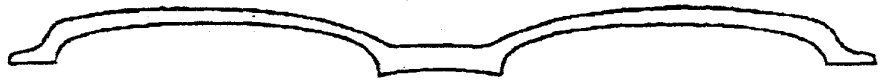
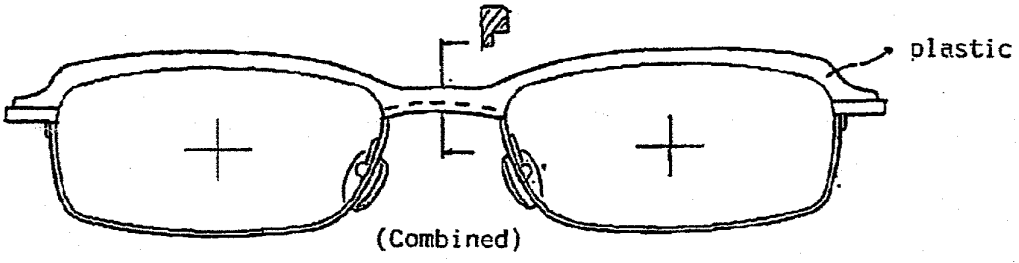


FIG. 9B



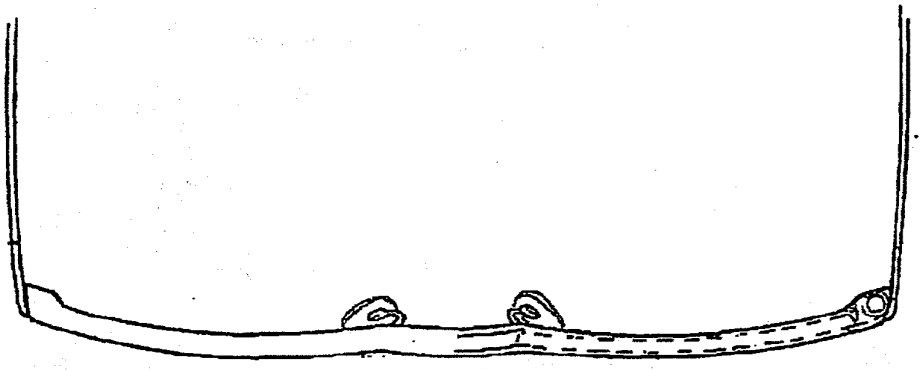



FIG. 9C

FIG. 10

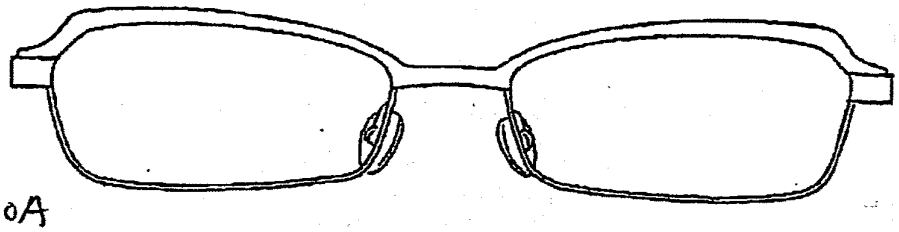


FIG. 10A

FIG. 10B

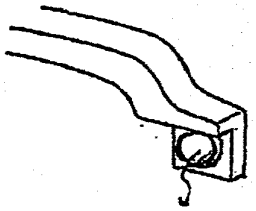



FIG. 10C

FIG. 11

FIG. 11A

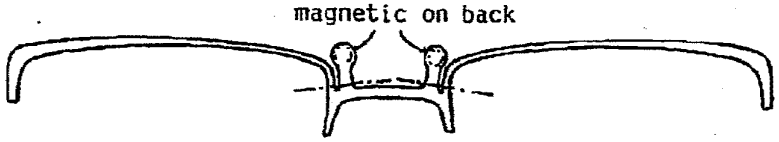



FIG. 11B

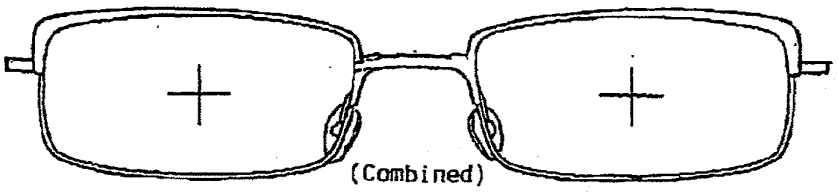



FIG. 11C

FIG. 11D

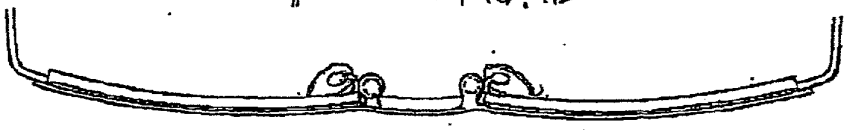


FIG. 12

FIG. 12A

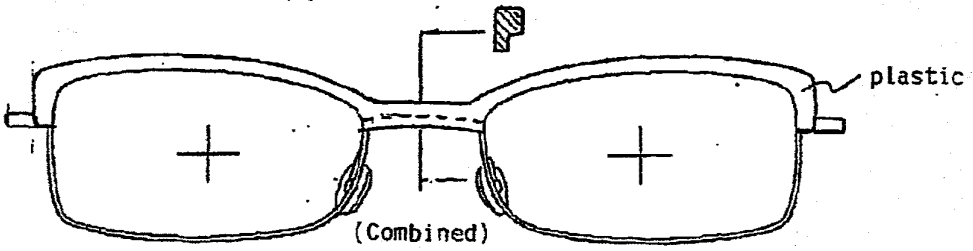
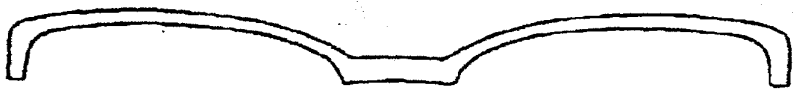



FIG. 12B



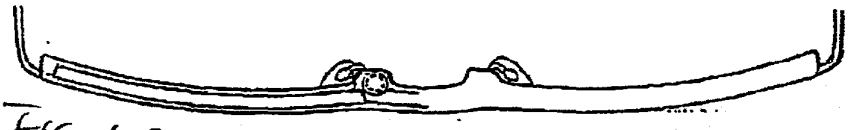


FIG. 12C

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 04 40 0067

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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
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
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& : member of the same patent family, corresponding document

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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| 4,968,128 | 11/1990 | Mendola | 351/52 |
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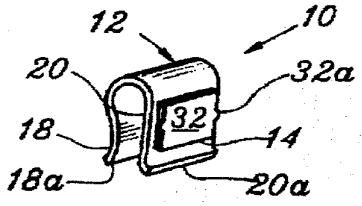
*Primary Examiner*—Huy Mai

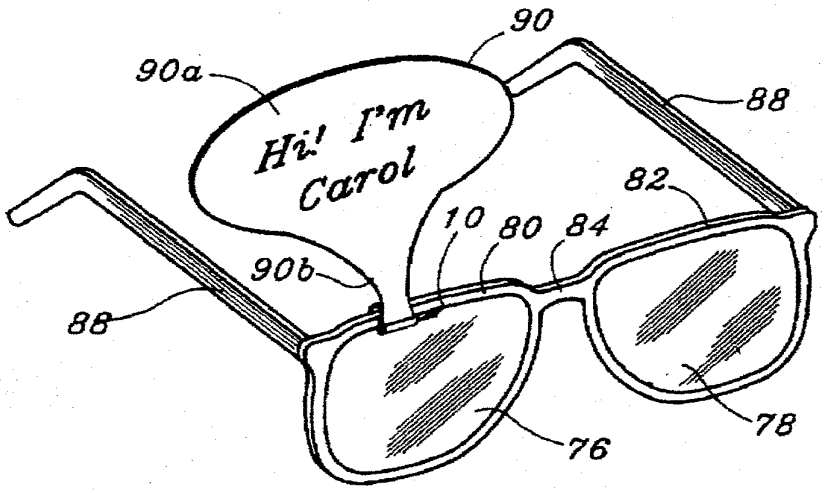
*Attorney, Agent, or Firm*—William C. Crutcher

[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**



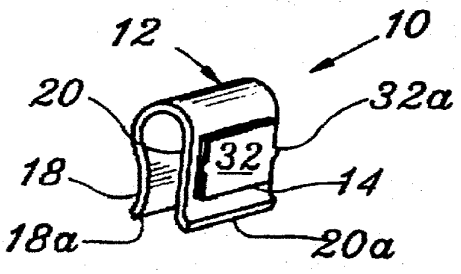



Fig. 1

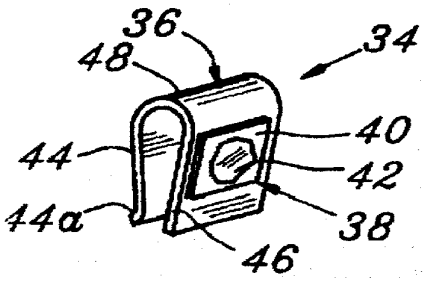



Fig. 4

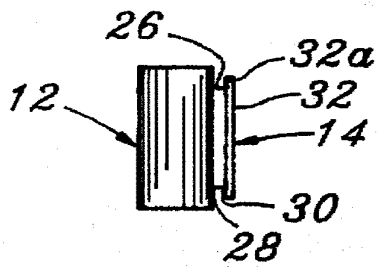



Fig. 2

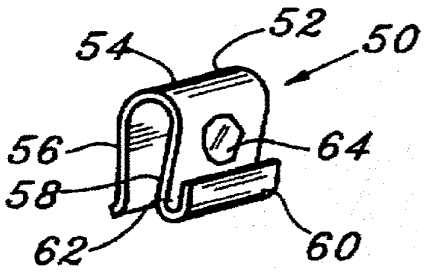



Fig. 5

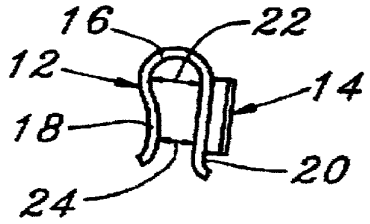



Fig. 3

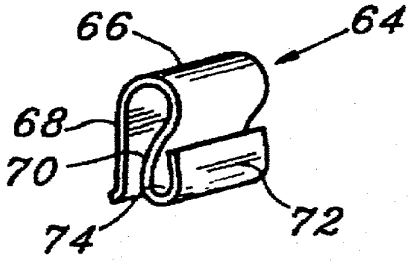



Fig. 6

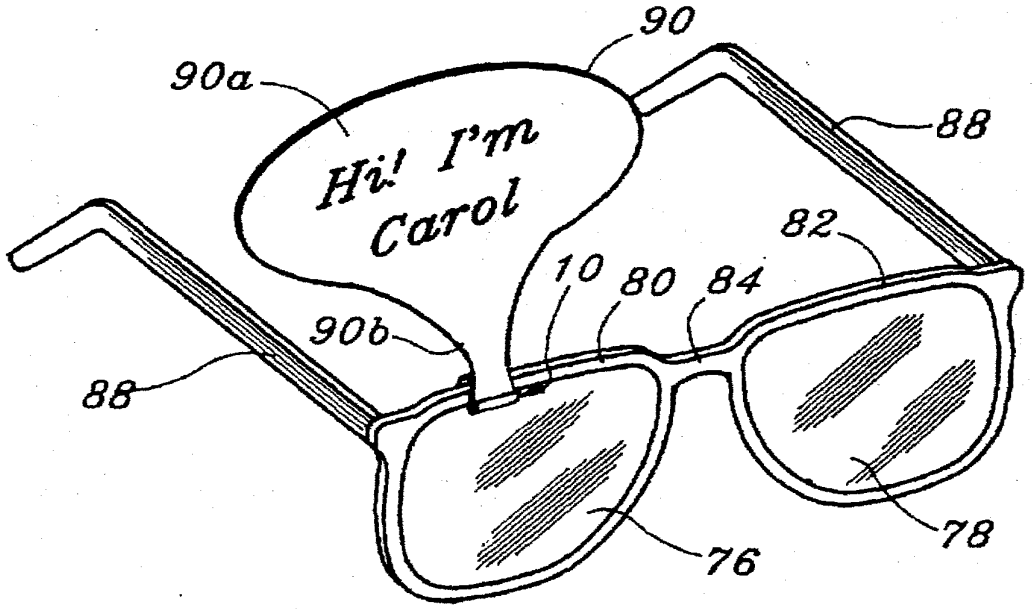



Fig. 7

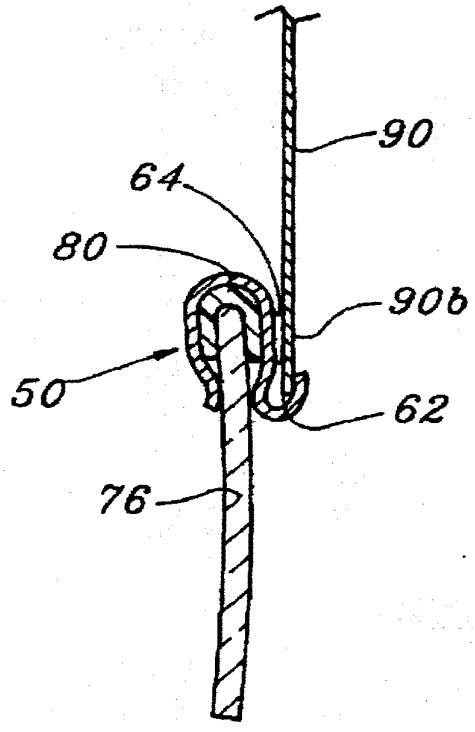



Fig. 8

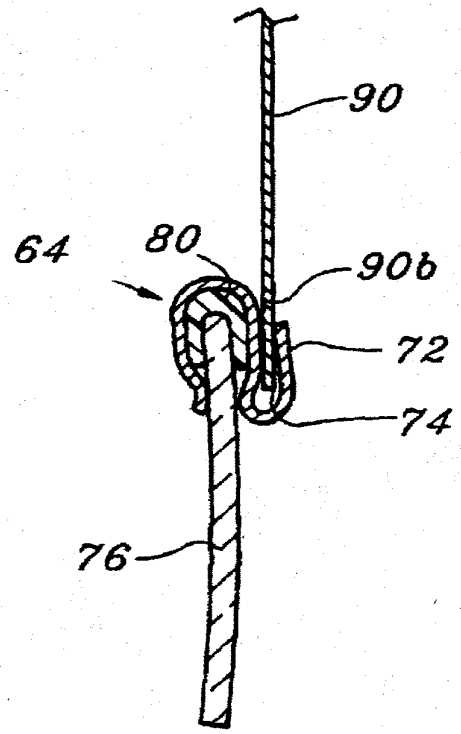



Fig. 9

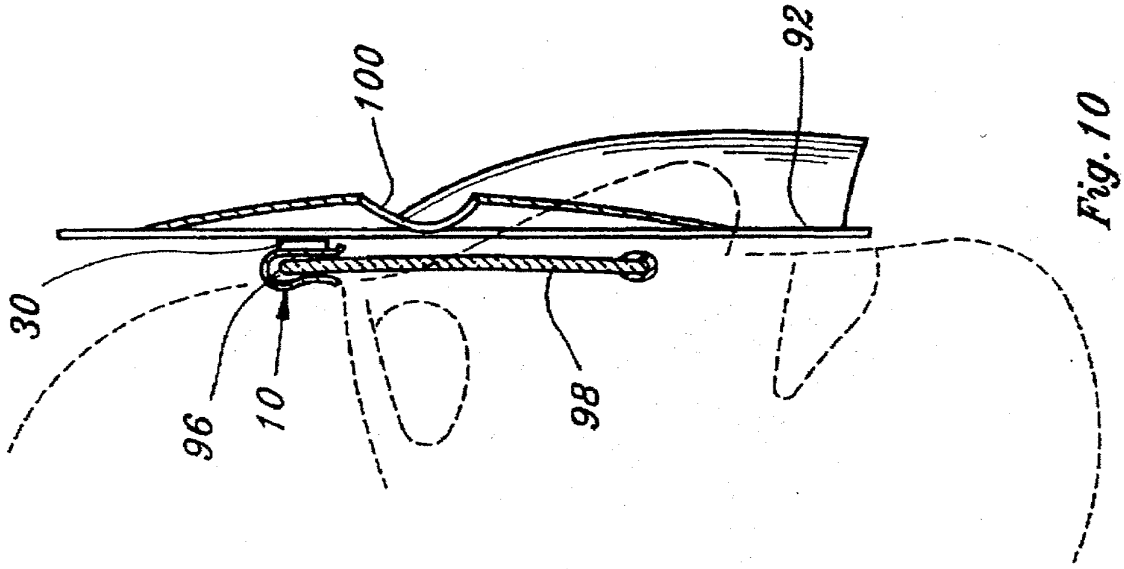



Fig. 10

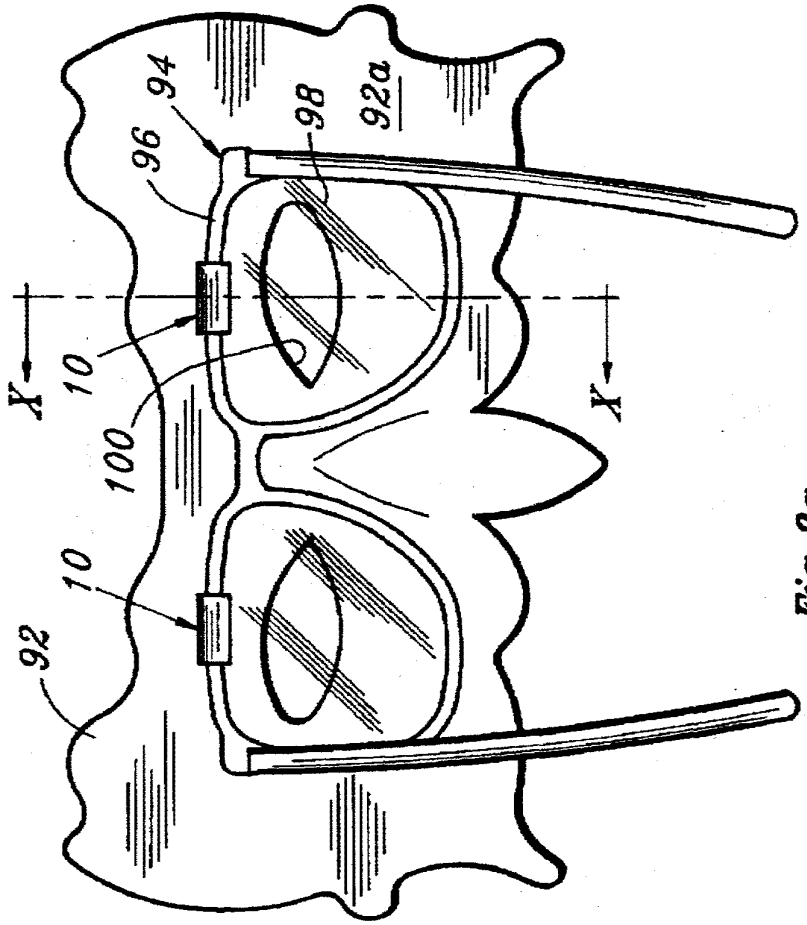



Fig. 8a

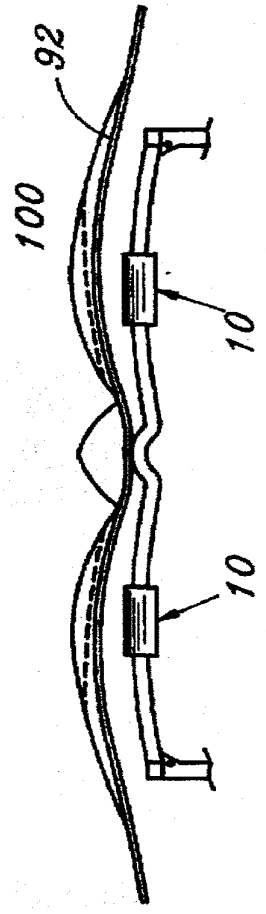



Fig. 9a

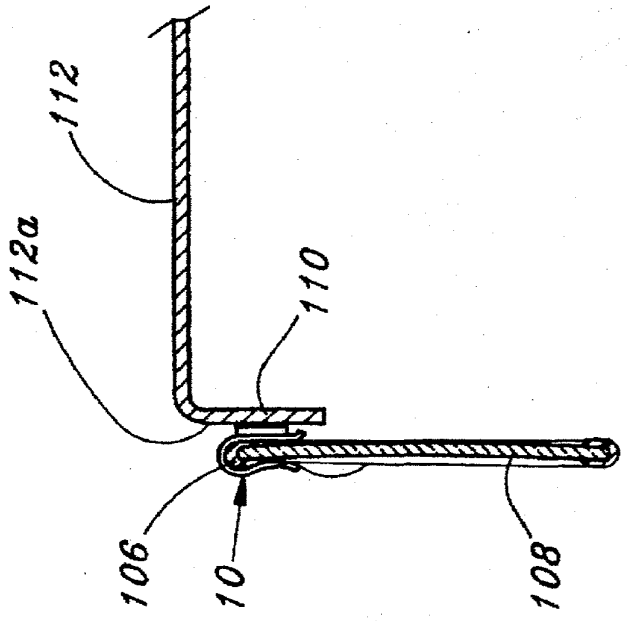



Fig. 13

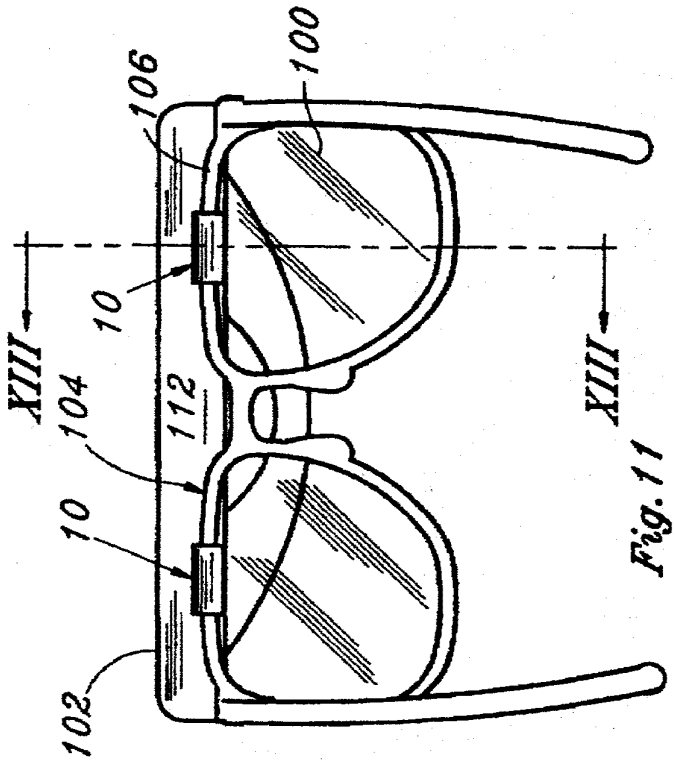



Fig. 11

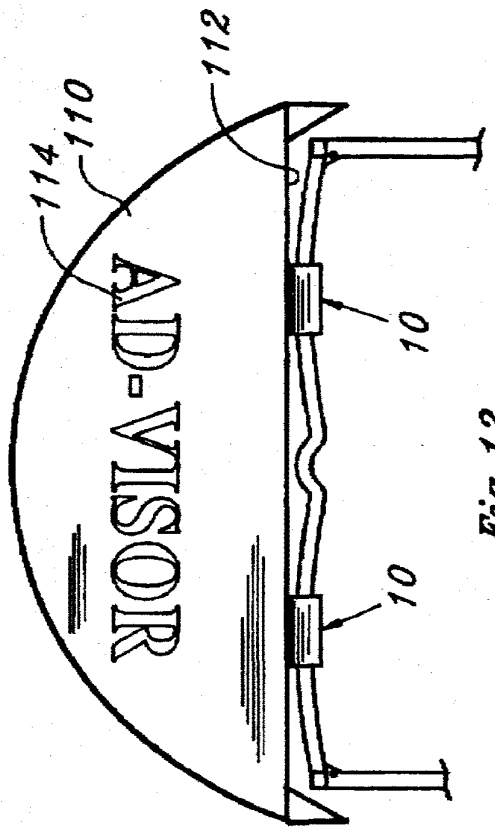



Fig. 12

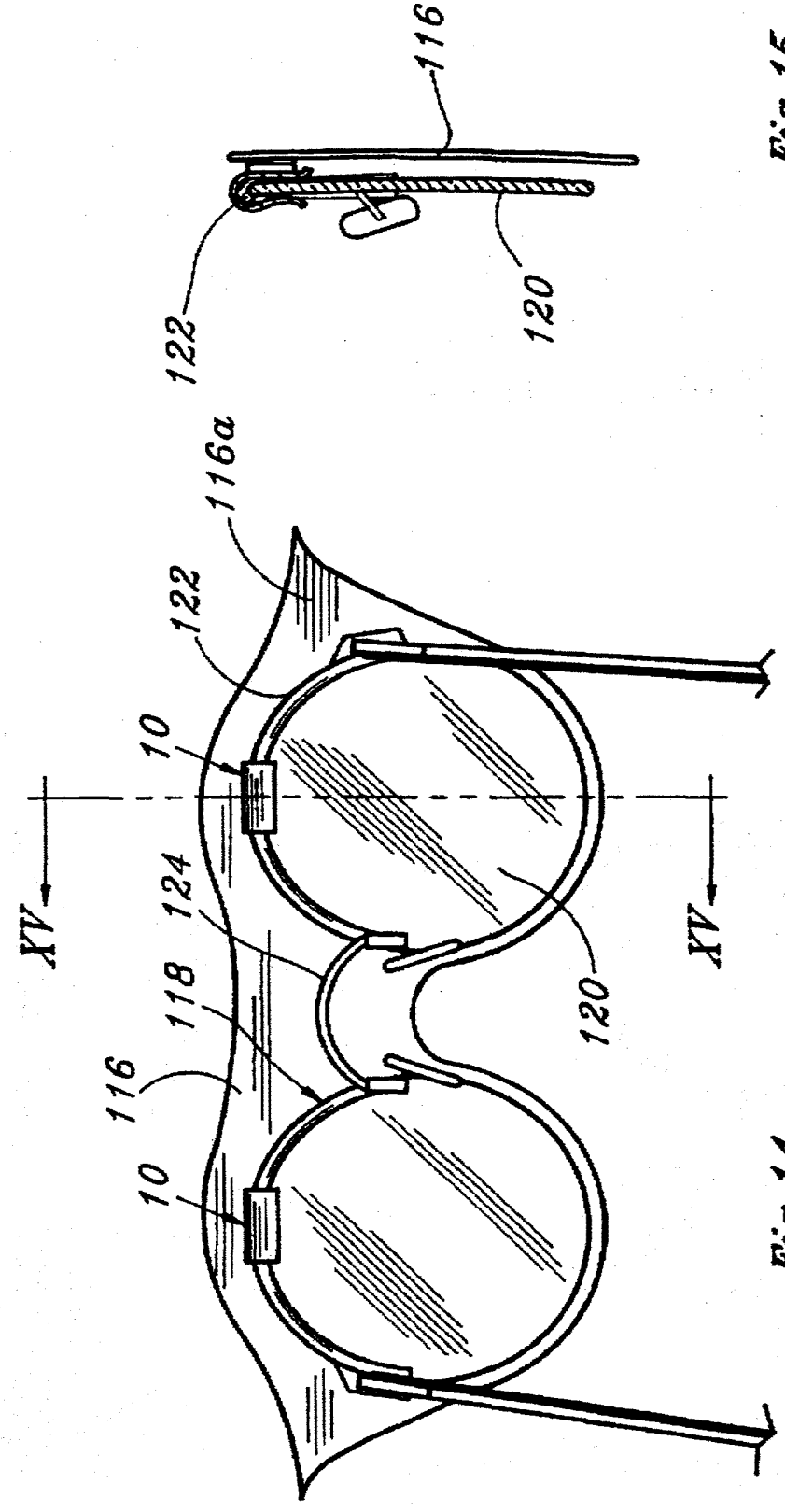



Fig. 15

Fig. 14

# 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<br>NL-2280 HV Rijswijk<br>Tel. (+31-70) 340-2040<br>Fax: (+31-70) 340-3016 | LUUKKONEN, Kirsi<br>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<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>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 | |

**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<br>D-80298 Munich<br>Tel. +49 89 2399 - 0<br>Fax: +49 89 2399 - 4465 | see form PCT/ISA/210 | de Lajarte, Gilles<br>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:** | 12376678 |
| **Application Number:** | 13372240 |
| **International Application Number:** | |
| **Confirmation Number:** | 8374 |
| **Title of Invention:** | ELECTRONIC FRAMES COMPRISING ELECTRICAL CONDUCTORS |
| **First Named Inventor/Applicant Name:** | Charles Willey |
| **Customer Number:** | 20350 |
| **Filer:** | John P. McGroarty/Aneta Xhiku |
| **Filer Authorized By:** | John P. McGroarty |
| **Attorney Docket Number:** | 91904-831532 |
| **Receipt Date:** | 23-MAR-2012 |
| **Filing Date:** | 13-FEB-2012 |
| **Time Stamp:** | 11:02:19 |
| **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_IDS_91904-831532.pdf | 179975<br>f5c9087e0f125043f21c2959305e45a357065a9d | yes | 7 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | Document Description | | Start | End | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 7 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | wo2009081542.pdf | 3389446<br>f58226e4cd2eb4ed8c6f2efd0ede02a4ad5348ab | no | 73 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | GB1563929.pdf | 366119<br>e6c060135063279482 9b10c0519fd7a210997b6f | no | 4 |
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| **Information:** | | | | | |
| 4 | Foreign Reference | wo2010062504.pdf | 803225<br>403b2ff8727d30ac26e30b4d65dc137da2f083be | no | 22 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Foreign Reference | de2304134.pdf | 396244<br>aa6bfee912bbc7da4fcefc2d62ccefc885751834 | no | 9 |
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| **Information:** | | | | | |
| 6 | Foreign Reference | WO08002388.pdf | 601551<br>a2f75118a95a4bdd1d7a2953289ea5b32f3bb527 | no | 17 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Foreign Reference | gb2170613.pdf | 390249<br>14f87ec232f421e4dd8f66a7a3ab29fe80a3f816 | no | 7 |
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| **Information:** | | | | | |
| 8 | Foreign Reference | wo2007142520.pdf | 557267<br>e1ea316dca509535d57e884da50a7f10df948a06 | no | 14 |
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| 9 | Foreign Reference | ep1916561.pdf | 1694506<br>5c1a97f30bcfcc53bffb66504c0a5fa1a3d514a59 | no | 33 |
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| 10 | Foreign Reference | ep1727393.pdf | 1423506<br>d030e527dff2f688d810769770396666b018e93b6 | no | 29 |
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| 11 | Foreign Reference | wo9921400.pdf | 677859<br>265000353a4339ee3499522d351a7cb395fb9cba | no | 18 |
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| 12 | Foreign Reference | wo2004028203.pdf | 2678013<br>5b687203e0c09d9fad35b78c3702ebbe1aa697f0 | no | 52 |
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| 13 | Foreign Reference | wo2008046858.pdf | 1884763<br>e9c18a3fefddb2379c7f55d4c4fce894962caf06 | no | 29 |
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| 14 | Foreign Reference | jp09294654.pdf | 410211<br>df3a12008f75cf44b17ff7d2c45432faa203c33b | no | 17 |
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| 15 | Foreign Reference | wo2009136667.pdf | 1793793<br>7a9d2b04f7594ad597084b92afdcc8b388751685 | no | 35 |
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| 16 | Foreign Reference | WO10080999.pdf | 2653291<br>47ea51b5e572f6a93358f67c79b524b508d8b633 | no | 62 |
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| 17 | Foreign Reference | EP1647854.pdf | 494291<br>21e114664282b874c68ac68299351fdc75a89ebd | no | 14 |
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| 18 | Foreign Reference | WO09098719.pdf | 1085712<br>55e805f44f9dc494574508a4a6387a260a9832b7 | no | 22 |
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| 19 | Foreign Reference | EP2233964.pdf | 2659831<br>32b622c351a6e7d2c6aab6e59f85c7923860c332 | no | 53 |
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| 20 | Foreign Reference | WO09126946.pdf | 3028023<br>8649634a56c593cae53c2887fb1c9175f60d0562 | no | 77 |
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| 21 | Foreign Reference | EP61002.pdf | 262813<br>fb64b04f31913ab2d3dd5eb3da198a17a115fdb5 | no | 7 |
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| 22 | Foreign Reference | JP2008083299.pdf | 339131<br>230d3a79272712e631cc8c5bface40f88967046c | no | 9 |
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| **Information:** | | | | | |
| 23 | Non Patent Literature | isr1.pdf | 94955<br>9fbdddb792173c37729430404e3f066e4b4f9042 | no | 2 |
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| 24 | Non Patent Literature | isr2.pdf | 205050<br>aa19d4e53d1f41e9ccd5564ca643308e07e60c41 | no | 4 |
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| 25 | Non Patent Literature | isr3.pdf | 470839<br>71e855ee1b66b72eb8446505e78eb4126e6a49f2 | no | 7 |
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| 26 | Non Patent Literature | isr4.pdf | 215141<br>8c34333ac754416b7f7e60c8edd2b0f6b9263376 | no | 3 |
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| 27 | Non Patent Literature | EPisr.pdf | 224485<br>9578a40b9bbd6e7d8478933a1e636cb33a2dad64 | no | 7 |
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| 28 | Non Patent Literature | mojo.pdf | 345477<br>f8d04ba84fda5e3af719945370cb57e5f27bd076 | no | 5 |
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| 29 | Non Patent Literature | isr5.pdf | 6127312<br>6de9f15249de153a8754e462d4fce95eef5fdced | no | 138 |
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| **Information:** | | | | | |
| 30 | Non Patent Literature | isr6.pdf | 7686072<br>e9ee5e15267765e23335172fc0d84454faac9bba | no | 148 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 31 | Non Patent Literature | isr7.pdf | 666897<br>d4aea75b684cd6be727c19d06e345fae2b671d0a | no | 16 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 43806047 | | |

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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.**

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.: 91904-831532(011310US)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of:

Charles Willey

Application No.: 13/372,240

Filed: February 13, 2012

For: ELECTRONIC FRAMES COMPRISING ELECTRICAL CONDUCTORS

Customer No.: 20350

Confirmation No.: 8374

Examiner: TBA

Art Unit: TBA

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 PCT applications.

Copies of the U.S. 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, U.S. provisional patent application no. 61/481,353 filed on May 2, 2011, and U.S. provisional patent application no. 61/441,817 filed on February 11, 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

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64038089 v1

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 13/372,240 | 02/13/2012 | Charles Willey | 91904-831532 |

**CONFIRMATION NO. 8374**

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

**FORMALITIES LETTER**

*OC000000052783362*

Date Mailed: 02/29/2012

# 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 $**1200** 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 $**2580** 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.
- Total additional claim fee(s) for this application is $**1200**
  - $**1200** for **20** total claims over 20.

Replies should be mailed to:

Mail Stop Missing Parts
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P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

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/ltaba/

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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: 13/372,240

### 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)) | 40 minus 20 = | * 20 | | | OR | x 60 = | 1200 |
| 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). | | | | | | 0.00 |
| 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 | 2450 |

### 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 |
|---|---|---|---|---|---|---|
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**CONFIRMATION NO. 8374**

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**FILING RECEIPT**

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Date Mailed: 02/29/2012

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**Applicant(s)**

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**Assignment For Published Patent Application**

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**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This appln claims benefit of 61/441,817 02/11/2011

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/372,240**

**Projected Publication Date:** To Be Determined - pending completion of Missing Parts

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

ELECTRONIC FRAMES COMPRISING ELECTRICAL CONDUCTORS

**Preliminary Class**

351

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# Electronic Frames Comprising Electrical Conductors

## CROSS-REFERENCES TO RELATED APPLICATIONS

**[0001]** This application claims benefit under 35 U.S.C. § 119(e) of U.S. provisional patent application no. 61/441,817, filed on February 11, 2011, the entire disclosure of which 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 trend concerning the inclusion of electronic components and devices 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 increasingly relevant to find ways to incorporate electronics into eyewear without harming the aesthetics and functionality of the eyewear. In addition, it may be desirable that the inclusion of electronics not limit the fashion design of the eyeglass frame or limit the materials of eyeglass frame. It may also be desirable to reduce the number of stock keeping units (SKUs) of completed eyeglass frames or eyeglass frame components (frame fronts, bridges, temples, etc.), and to allow for robust placement of the electronics on or within the frames. It is also generally desirable to provide for efficient design and manufacturing of the eyeglass frames and components.

## BRIEF SUMMARY OF THE INVENTION

**[0004]** Some embodiments provided herein may include a device or apparatus (such as eyeglass frames) having one or more conductors that may be utilized to form a part of a conductive path from the temple to the lens housing of the frames. The one or more conductors may be coupled to one of the temples of the frames and may be configured in such a way so that they may hold the electronic components of the frames (or an electronics module that comprises one or more electronic components) in place, such as within a cavity of the temple. Some embodiments provided herein may also include a method of manufacturing a device or apparatus such as an electronic eyeglass frame that includes disposing electronic components on a

capacitive touch switch and then coupling the capacitive touch switch to an enclosure (such as an electronics module) in such a way that the electronic components that were disposed on the capacitive touch switch are substantially enclosed by the enclosure.

**[0005]** In some embodiments, a first device may be provided. The first device may comprise a lens housing adapted to support a first lens and a second lens, a first temple movably coupled to the lens housing, a second temple movably coupled to the lens housing, an electronics module disposed at least partially within the first temple, and a first electrical conductor coupled to the first temple. A first conductive path may be provided from the first temple to the lens housing at least in part by the first electrical conductor. The first electrical conductor may be configured to couple the electronics module to the first temple. In some embodiments, the first electrical conductor may be configured to constrain the electronics module.

**[0006]** In some embodiments, in the first device as described above, the first electrical conductor may be integrally coupled to the first temple. In some embodiments, the first electrical conductor may be insert-molded with the first temple. In some embodiments, in the first device as described above, the first electrical conductor may comprise a lug.

**[0007]** In some embodiments, in the first device as described above, the first device may further comprise a second electrical conductor coupled to the first temple. A second conductive path may be provided from the first temple to the lens housing at least in part by the second electrical conductor. The second conductive path may be electrically isolated from the first conductive path. The second electrical conductor may be configured to couple (*e.g.* constrain) the electronics module. In some embodiments, the second electrical conductor may be integrally coupled to the first temple. In some embodiments, the second electrical conductor may be insert-molded with the first temple. In some embodiments, in the first device as described above, the second electrical conductor may comprise a lug.

**[0008]** In some embodiments, in the first device as described above, the electronics module may comprise any two of: a power source, a controller, and a sensor. In some embodiments, where the electronics module comprises a sensor, the sensor may comprise a touch switch. In some embodiments, the touch switch is any one of a membrane switch or a capacitive touch switch.

**[0009]** In some embodiments, in the first device as described above, the first electrical conductor may be electrically coupled to a slip ring. In some embodiments, the first device may further comprise a hinge and the slip ring may be disposed substantially within the hinge. In some embodiments, the slip ring may comprise a part of the hinge.

**[0010]** In some embodiments, in the first device as described above, the electronics module may be configured to be removably coupled to the first temple. In some embodiments, the electronics module or a component thereof may be removably coupled to the first electrical conductor.

**[0011]** In some embodiments, in the first device as described above, the electronics module may include an opening. In some embodiments, the first electrical conductor may have a first portion that extends a first distance of at least approximately 1 cm into the electronics module through the opening. In some embodiments, the first electrical conductor may have a second portion that extends a second distance of at least approximately 1 cm outside of the electronics module away from the opening. In some embodiments, the first distance that the first portion of the first electrical conductor extends into the electronics module may be at least approximately 2 cm. In some embodiments, the second distance that the second portion of the first electrical conductor extends away from the opening may be at least approximately 2 cm.

**[0012]** In some embodiments, in the first device as described above, the first electrical conductor may comprise a single structural element. In some embodiments, in the first device as described above, the first electrical conductor may be configured to maintain the first conductive path as the first temple is moved relative to the lens housing.

**[0013]** In some embodiments, in the first device as described above, the first device may further comprise a first lens coupled to the lens housing. In some embodiments, the first lens may include a first electrical contact. The first conductive path may be electrically coupled to the first electrical contact. In some embodiments, where the first device further comprises a second electrical conductor coupled to the first temple and a second conductive path is provided from the first temple to the lens housing at least in part by the second electrical conductor, the lens may further include a second electrical contact. The second conductive path may be electrically coupled to the second electrical contact.

**[0014]** In some embodiments, a first method may be provided. The first method may include the steps of providing a capacitive touch switch, disposing a plurality of electronic components on the capacitive switch, and coupling the capacitive touch switch to a partial enclosure.

**[0015]** In some embodiments, in the first method as described above, the first method may further include the step of electrically coupling one or more of the plurality of electronic components to the capacitive touch switch. In some embodiments, the step of electrically coupling one or more of the plurality of electronic components to the capacitive touch switch may comprise reflow soldering.

**[0016]** In some embodiments, in the first method as described above, the first method may further include the step of electrically coupling one of the plurality of electronic components to another of the plurality of electronic components.

**[0017]** In some embodiments, in the first method as described above, the first method may further include the step of coupling the enclosure to a temple of an eyeglass frame. In some embodiments, the step of coupling the enclosure to the temple of the eyeglass frame may comprise disposing the enclosure substantially within the temple of the eyeglass frame. In some embodiments, the eye glass frame may comprise an electro-active eyeglass frame. In some embodiments, the eyeglass frame may comprise a first conductive path and the first method may further comprise the step of electrically coupling at least one of the electronic components to the first conductive path. In some embodiments, the first conductive path may be electrically coupled to an electro-active lens. In some embodiments, the first conductive path may comprise anyone of, or some combination of: a slip ring and a pogo pin. In some embodiments, where the first conductive path includes a slip ring, the first conductive path may further comprise a lug coupled to the slip ring. In some embodiments, the lug may be integrally coupled to the temple. In some embodiments, the first method may further include the step of insert molding the lug into the eye glass frame. In some embodiments, the lug may be disposed on the capacitive touch switch.

**[0018]** In some embodiments, in the first method as described above, the enclosure may comprise an electronics module. In some embodiments, the enclosure may comprise a temple of an eyeglass frame.

**[0019]** In some embodiments, in the first method as described above, the first method may further comprise the step of applying a conformal coating to the plurality of electronic components. In some embodiments, the conformal coating may comprise brushed, spray, or dip applied acrylic, silicone, or epoxy. In some embodiments, the first method may further include the step of masking a portion of the electronic components such that an electrical contact is exposed through the conformal coating. In some embodiments, the first method may further include the step of removing a portion of the conformal coating to expose an electrical contact of one or more of the plurality of electronic components.

**[0020]** In some embodiments, in the first method as described above, the plurality of electronic components may comprise any one of, or some combination of: a flexible circuit, a printed circuit board, or an electrical connector. In some embodiments, the plurality of electronic components may include a power source.

**[0021]** In some embodiments, in the first method as described above, the capacitive touch switch and the enclosure may be configured to be pressure fitted.

**[0022]** In some embodiments, in the first method as described above, the capacitive touch switch may be coupled to the enclosure using any one of, or some combination of: a fastener or an adhesive.

**[0023]** In some embodiments, in the first method as described above, the capacitive touch switch may comprise a stiff material. In some embodiments, in the first method as described above, the capacitive touch switch may comprise a rigid, molded plastic such as a liquid crystal polymer or other plastic engineered for ablation and plating.

**[0024]** In some embodiments, a method may be provided. The method may include the steps of providing a substrate (such as a surface of touch switch), disposing a plurality of electronic components on the substrate, electrically coupling one of the plurality of electronic components to another of the plurality of electronic components, coupling the substrate to a partial enclosure, and coupling the enclosure to a temple of an eyeglass frame. In some embodiments, the step of coupling the enclosure to the temple of the eyeglass frame may comprise disposing the enclosure substantially within the temple of the eyeglass frame.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** FIG. 1 is an illustration of exemplary electronic eyewear from a front view in accordance with some embodiments.

**[0026]** FIG. 2 is an illustration of exemplary electronic eyewear from a front view in accordance with some embodiments. The temple of the eyewear is transparent to show the components disposed therein.

**[0027]** FIG. 3 is an illustration of exemplary electronic eyewear from a front view in accordance with some embodiments. The temple of the eyewear is transparent to show the components disposed therein.

**[0028]** FIG. 4 is an illustration of the temple of exemplary electronic eyewear in accordance with some embodiments. The temple of the eyewear is transparent to show the components disposed therein.

**[0029]** FIG. 5 is close-up illustration of the first and second electrical conductors coupled to the temple of the exemplary electronic eyewear in accordance with some embodiments. The outer side of the temple (*i.e.* the portion of the temple that faces away from the wearer when the eyewear is worn) is shown, but the temple of the eyewear is transparent to show the components disposed therein.

**[0030]** FIG. 6 is a close-up illustration of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The inner side of the temple (*i.e.* the portion of the temple that faces the wearer when the eyewear is worn) is shown as having a cavity with a portion of the first and second electrical conductors disposed therein.

**[0031]** FIG. 7 is a close-up illustration of a side-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The temple is shown as being transparent to illustrate the electrical conductors disposed within the temple.

**[0032]** FIG. 8 is a close-up illustration of a side-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The inner side of the temple (*i.e.* the portion of the temple that faces the wearer when the eyewear is worn) is shown as having a cavity with a portion of the first and second electrical conductors disposed therein.

**[0033]** FIG. 9 is a close-up illustration of a side-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The outer side of the temple (*i.e.* the portion of the temple that faces away from the wearer when the eyewear is worn) is shown, but the temple is transparent to illustrate the electrical conductors disposed therein.

**[0034]** FIG. 10 is a close-up illustration of a top-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The temple is transparent to illustrate the electrical conductors disposed therein.

**[0035]** FIG. 11 is a close-up illustration of a top-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The temple is transparent to illustrate the electrical components disposed therein.

**[0036]** FIG. 12 is a close-up illustration of a side-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The inner side of the temple (*i.e.* the portion of the temple that faces the wearer when the eyewear is worn) is shown as having a cavity with a portion of the first and second electrical conductors disposed therein. An exemplary electronics module is shown as being inserted within the cavity.

**[0037]** FIG. 13 is a close-up illustration of a side-view of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The exemplary electronics module is shown as being disposed within a portion of the temple.

**[0038]** FIG. 14 is an illustration an exemplary electronics module coupled to the electrical conductors in accordance with some embodiments.

**[0039]** FIG. 15 is an illustration of the components of the exemplary eyewear as they may be disposed within the temple of the eyewear in accordance with some embodiments.

**[0040]** FIG. 16 is an illustration of the components of the exemplary eyewear as they may be disposed within the temple of the eyewear in accordance with some embodiments. FIG. 16 further shows the outline of the temple.

**[0041]** FIG. 17 is an illustration of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. The inner side of the temple (*i.e.* the portion of the temple that faces the wearer when the eyewear is worn) is shown as having a cavity with a portion of the first and second electrical conductors disposed therein.

**[0042]** FIGS. 18(a)-(c) include illustrations of a portion of the temple of the exemplary electronic eyewear in accordance with some embodiments. FIG. 18(a) shows the exemplary eyewear having a plurality of electronic components disposed within the temple and coupled therein by electrical conductors. FIG 18(b) shows an embodiment where an electronics module is disposed within the temple and coupled thereto by electrical conductors. FIG. 18(c) shows a transparent view of the electronics module shown in FIG. 18(b) to illustrate the electrical conductors coupling to an electronic component therein.

**[0043]** FIG. 19 is an illustration of the various components that comprise a current electronics module, including a capacitive touch switch.

**[0044]** FIG. 20(a) is an illustration of a top view and FIG. 20(b) is a cross-sectional view of the electronics module and component shown in FIG. 19.

**[0045]** FIG. 21 is an illustration of the various components that could comprise an exemplary electronics module that includes a capacitive touch switch in accordance with some embodiments.

**[0046]** FIG. 22 is an illustration of an exemplary capacitive touch switch comprising reflow solder in accordance with some embodiments.

**[0047]** FIG. 23 is an illustration of an exemplary flex circuit which may be included in an electronics module in accordance with some embodiments.

**[0048]** FIG. 24 is an illustration of an exemplary electronics module outer casing in accordance with some embodiments.

**[0049]** FIG. 25 is an illustration of an exemplary molded capacitive touch switch which further shows exemplary traces in accordance with some embodiments.

**[0050]** FIG. 26 shows the exemplary molded capacitive touch switch of FIG. 25 having exemplary electrical components disposed thereon in accordance with some embodiments.

**[0051]** FIG. 27 is an illustration of an exemplary printed circuit board in accordance with some embodiments.

**[0052]** FIG. 28 shows the exemplary molded capacitive touch switch in the above figures having additional exemplary electrical components including the exemplary printed circuit board of FIG. 28 disposed thereon in accordance with some embodiments.

**[0053]** FIG. 29 shows the exemplary molded capacitive touch switch having exemplary electrical components disposed thereon disposed within in electronics module in accordance with some embodiments.

**[0054]** FIG. 30 is a flow chart of an exemplary fabrication method in accordance with some embodiments.

## DETAILED DESCRIPTION OF THE INVENTION

**[0055]** Some terms that are used herein are described in further detail as follows:

**[0056]** 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.

**[0057]** 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 when used in a claim. 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. This is consistent with the use of the term throughout the specification.

**[0058]** 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 (or within) some or all of the components.

**[0059]** 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. 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.

**[0060]** As used herein, a "dynamic lens" may refer to a lens with an optical power which is alterable with the application of electrical energy, mechanical energy or force. Either the entire lens may have an alterable optical power, or only a portion, region or zone of the lens may have an alterable optical power. The optical power of such a lens is dynamic or tunable such that the optical power can be switched between two or more optical powers. The switching may comprise a discrete change from one optical power to another (such as going from an "off" or inactive state to an "on" or active state) or it may comprise continuous change from a first optical power to a second optical power, such as by varying the amount of electrical energy to a dynamic element (*e.g.* tunable). One of the optical powers may be that of substantially no optical power. A dynamic lens may also be referred to as a dynamic optic, a dynamic optical element, a dynamic optical zone, dynamic power zone, or a dynamic optical region.

**[0061]** 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 whereby the eyeglass frames house some, most, or all of the electronics and/or the lens comprises a component or components that may be activated and/or deactivated by an electrical current or voltage. Examples include: 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.). It should be understood that the above is not intended to be an exhaustive list, and that any functionality or components may be included in such frames.

**[0062]** As used herein, an "electronic component" or "electrical component" may refer to any electronic device or component thereof, including a power source, a controller (such as a microprocessor or application-specific integrated circuit (ASIC)), a sensing mechanism (such as a touch switch -*e.g.* capacitive switch or membrane switch-, optical sensor, accelerometer, gyroscope, vibration sensor, etc.), flexible circuit, printed circuit board, electrical connectors, or any other device or component that may be coupled to, and/or disposed on, an electronic frame.

**[0063]** As used herein, an "electronics module" may refer to a housing or container that may comprise one or more electronic components disposed therein. 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). In some embodiments, an electronics module may comprise an outer casing that may substantially encircle or encapsulate the one or more electronic components. By "substantially encapsulate," it is generally meant that in some embodiments, the outer casing may have one or more openings that enable interaction with the electronic components that are

disposed therein, such as one or more conductive paths that may be provided from an electronic component or components disposed on the frame or lens housing to one or more components within the electronics module. The electronics module may also comprise an opening or openings that allow a user to interact with the components therein, such as to provide access to a touch sensitive switch.

**[0064]** 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, a lens housing that is configured to support the spectacle lenses, one or more hinges, and any other related component.

**[0065]** 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. In some embodiments, the hinge may be considered a part of, or disposed within the temple or the lens housing.

**[0066]** As used herein, a "lens" may refer to any device or portion of a device that causes light to converge or diverge. The device may be static or dynamic. A lens may be refractive or diffractive. A lens may be concave, convex or plano on one or both surfaces. A lens may be spherical, cylindrical, prismatic or a combination thereof. A lens may be made of optical glass, plastic or resin. A lens may also be referred to as an optical element, an optical zone, an optical region, an optical power region or an optic. It should be noted that within the optical industry a lens can be referred to as a lens even if it has zero optical power. Moreover, a lens may refer to both intra-ocular and extra-ocular components.

**[0067]** As used herein, a "lens blank" refer to an optical material that may be shaped into a lens. A lens blank may be finished meaning that the lens blank has been shaped to have an optical power on both external surfaces. A lens blank may be semi-finished meaning that the lens blank has been shaped to have an optical power on only one external surface. A lens blank may be unfinished meaning that the lens blank has not been shaped to have an optical power on either external surface. A surface of an unfinished or semi-finished lens blank may be finished by means of a fabrication process known as free-forming or by more traditional surfacing and polishing.

**[0068]** 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.

**[0069]** As used herein, an "ophthalmic lens" may refer to a lens suitable far vision correction which includes a spectacle lens, a contact lens, an intra-ocular lens, a corneal in-lay, and a corneal on-lay.

**[0070]** As used herein, "optical communication" may refer to the condition whereby two or more optics of given optical power are aligned in a manner such that light passing through the aligned optics experiences a combined optical power equal to the sum of the optical powers of the individual elements.

**[0071]** As used herein, a "temple" may refer to a side piece of a frame that connects to the lens housing (or directly to the lens), and further provides stability by resting on the wearer's ears when worn. The temple may be a "hinge-less temple" *(i.e.* a side piece of a frame that connects to the lens housing (or directly to the lens) without a hinge attachment mechanism) or a "hinged temple" (*i.e.* a side piece of a frame that connects to the lens housing (or directly to the lens) using a hinge attachment mechanism). As noted above, in some embodiments, a hinge may be considered to be part of the temple. The temples may comprise any material, including metal or plastic.

**[0072]** 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.

**Coupling Electrical Conductor Embodiments**

**[0073]** In general, electronic eyeglasses may include electronic components that may be located on different parts of the frames or may include electro-active lenses that utilize electrical power and/or control signals. In many instances, the power source, controllers, and/or sensors may be located in different locations than the electronic devices that they may control or power. Thus, conductive paths are generally provided within the electronic eyeglass frames, including within the temples and the lens housing, or between different portions of the frames. Given the daily stress and forces that are consistently applied to eyeglass frames, as well as the aesthetic demands of eyewear, there is a general need to design and effectuate electrical connections that provide robust performance, as well as potentially limiting or reducing the visibility of such connections on the frames themselves.

**[0074]** Some embodiments provided herein may comprise an electrical conductor (such as a lug) that may be disposed in, or coupled to, one of the temples of an electronic eyeglass fame that may both provide a part of a conductive path from the temple to the lens housing, as well as securing electronic components (or an electronics module that may hold one or more electronic components) to the temple. That is, for example, the electrical conductor may be configured in such a way that it may hold (or secure) an electronics module in place on the frames (*i.e.* coupled to and/or within the temple). In this manner, the inventors have found that, in some embodiments, such electrical conductors may provide for a more robust electrical connection from the electrical components disposed within the electronics module to other components on the frame (such as those that may be located on the lens housing). This may be due, in part, to the configuration of the electrical conductors to apply a force to the electronic module or the components therein, which may thereby maintain the electrical contact even when the eyewear is in use. Moreover, utilizing a conductor in this manner may also reduce the need to use multiple fasteners for the electronics module because, for instance, at least a portion (*e.g.* one side of) the electronics module may be held in place by the electrical conductor. In addition, in some embodiments, manufacturing and fabrication costs may be reduced because the conductors may

be formed with, and or coupled to, the temple prior to coupling or disposing the electronics module in the temple. This may enable machine fabrication methods, thereby reducing costs and manufacturing time as well as potential human error.

**[0075]** In some embodiments, a first device may be provided. The first device may comprise a lens housing adapted to support a first lens and a second lens, a first temple movably coupled to the lens housing, a second temple movably coupled to the lens housing, an electronics module disposed at least partially within the first temple, and a first electrical conductor coupled to the first temple. A first conductive path may be provided from the first temple to the lens housing at least in part by the first electrical conductor. The first electrical conductor may be configured to couple the electronics module to the first temple. Exemplary embodiments are illustrated in FIGS. 1-18 and described in more detail below.

**[0076]** The first electrical conductor may couple the electronics module to the temple in any suitable manner. For example, the electrical conductor may apply a force to the electronics module and/or the first electrical conductor may be configured to structurally connect (or interconnect/interlock) with the electronics module (*i.e.* a structural component of the electronics module) or a component therein (*e.g.* an electrical connector, circuit board, or electronic device or component). For example, the electronics module may have an opening through which the first electrical conductor may be inserted into the electronics module, and may thereby apply a force to hold the electronics module in place and thus coupled to the first temple. This is illustrated in the exemplary embodiments shown in FIGS. 12-14 and described in more detail below. The force may be applied, for instance, based in part on the rigidity of the first electrical conductor, which may be based on both the material that comprises the first electrical conductor as well as the manner in which the first electrical conductor is coupled to the temple (for instance, if the first conductor is insert molded into the temple, then the first electrical conductor may provide more structural rigidity in coupling the electronics module to the temple). The first electrical conductor need not continually apply a force to the electronics module or the components therein, but could apply a force when the electronics module begins to move in a particular direction – *e.g.* a restraining force – and thereby restrict the movement of the module and thus couple the module to the temple. In some instances, the electrical conductor may couple the electronics module to the first temple alone or in combination with other components or means. For instance, the electrical conductor may couple one side of the electronics module to the first temple, and the other side may be coupled to the temple using an adhesive, a screw, or

it may be structurally connected (*e.g.* pressure fitted) to the temple. However, any suitable manner of coupling the electronics module or portions thereof may be utilized.

**[0077]** In some embodiments, one or more electrical contacts may be disposed within the electronics module, which may be electrically coupled to the first electrical conductor. These electrical contacts may comprise separate conductors (*e.g.* wires or other conductive material), electrical connectors, or could comprise portions of the electronic components, such as portions of a printed circuit board or flexible circuit. It should be noted that, as used herein, an "electrical conductor" may refer to any material or component that can be used to conduct electric signals or power. The conductor may comprise a single component or a plurality of components.

**[0078]** The term "disposed at least partially within the first temple" as used in this context is meant to include embodiments where the electronics module may be contained within the periphery of the structure of the temple, as well as embodiments in which a portion of the electronics module may not be disposed within the periphery of the temple. That is, for example, in some embodiments portions of the electronics module may protrude through, or be disposed outside of, the structure of the temple. One such example (which is provided for illustration purposes) may be when the electronics module comprises a touch sensitive switch, such as a capacitive switch or a membrane switch, that has at least a portion that is exposed through the temple such that it may interact with a user (such as a user's finger). It should be noted that, although the electronics module may be disposed within the temple, it need not be "covered" by the temple. This is shown for instance in FIG. 13, where the electronics module is shown as being disposed within a cavity of the temple, but the module is not covered on one side (in this case the side of the electronics module that faces the wearer). This may correspond to embodiments that enable the wearer to couple and decouple the electronics module to the temple, which may provide for easier repair and maintenance as well as the flexibility to use multiple electronics module with a single electronic frame. In some embodiments, the device may include a cover that may be disposed over the exposed side of the electronics module so as to provide a finished appearance to the device, as well as to protect any components disposed within the temple from the external environment.

**[0079]** In some embodiments, the first electrical conductor may be configured to constrain or substantially constrain the electronics module. As used in this context, "constrain" may refer to when the first electrical conductor is configured to provide support (*i.e.* a restraining force) for

the electronics module to retain the module in a fixed position within the temple. That is, the first electrical conductor may be configured to hold the electronics module in place. As noted above, the first electrical conductor may be integrally coupled to the temple (such as insert molded or otherwise affixed to the temple), and may be inserted through an opening of the electronics module and apply pressure to a surface or a component therein, which thereby restricts the module from being removed from the temple or moved within the temple. In this manner, the conductor may hold or restrain one end of the electronics module in place (or substantially in place). The term "substantially constrain" is used in this context to account for some minor movement of the electronics module within the temple, but the conductor may generally hold the electronics module within the temple in place (such that it remains in an operative position).

**[0080]** In some embodiments, in the first device as described above, the first electrical conductor may be integrally coupled to the first temple. The term "integrally coupled" as used in this context may refer to when the first electrical conductor is coupled to the temple in such a manner that it cannot readily be removed without damaging or otherwise affecting the structure of the temple. In some embodiments, the first electrical conductor may be insert-molded into the first temple. As used in this context, "insert molded" may refer to when, for instance, during the manufacturing of the temple the material that comprises the temple (*e.g.* a plastic material in some embodiments) may be injected into a cavity (which is typically in the shape of the temple or a portion thereof) and around the first electrical conductor that is disposed in the cavity prior to the molding process. This may result in the first electrical conductor being encapsulated by the material that comprises the temple. A portion of the first electrical conductor may remain un-encapsulated so as to form electrical connections and/or couple the electronics module to the temple. Embodiments where the first electrical conductor is insert molded may provide the advantage of a more efficient manufacturing process because the first electrical conductor need not be separately coupled to the temple or other part of the frame. In addition, the portions of the first electrical conductor that may be encapsulated by the temple may be isolated from the external environment and thereby be less susceptible to failure (such as electrical shorts) or damage.

**[0081]** In some embodiments, in the first device as described above, the first electrical conductor may comprise a lug. As used in this context, a "lug" may refer to a copper, brass, or any other conductive material that constitutes a fitting to which electrical wires or conductors

may be soldered or otherwise electrically coupled to so as to form a conductive path. In other words, the first conductor may form an electrical connection between two other electrical components (such as wires, components of a slip ring, soldered components, PCB, electrical circuits, etc.).

**[0082]** In some embodiments, in the first device as described above, the first device may further comprise a second electrical conductor coupled to the first temple. A second conductive path may be provided from the first temple to the lens housing at least in part by the second electrical conductor. The second conductive path may be electrically isolated from the first conductive path. That is, for instance, embodiments may provide more than one conductive path from the components of an electronics module to other components on the electronic frame. This may enable the components of the electronics module to provide power, control signals, or both to components disposed outside of the electronics module. The second electrical conductor may also be configured to couple the electronics module to the first temple. For example, both the first electrical conductor and the second electrical conductor may each provide a portion of the force that holds or restrains the electronics module within the temple. This may provide for increased stability, as there may be multiple components providing a force to the electronics module or the components thereof in different locations to constrain the electronics module within the temple. In some embodiments, the second electrical conductor may be integrally coupled to the first temple – *e.g.* the second electrical conductor may be insert-molded into the first temple. In some embodiments, in the first device as described above, the second electrical conductor may comprise a lug.

**[0083]** In some embodiments, in the first device as described above, the electronics module comprises any two of: a power source, a controller, and a sensor. A power source could include, by way of example only, a battery or a capacitor. The controller may be configured to receive a signal from a sensor and determine whether to activate or deactivate an electronic device, or otherwise be configured to control the functionality of an electronic component. A controller could include, by way of example, a micro-processor or an ASIC. In some embodiments, where the electronics module comprises a sensor, the sensor may comprise a touch switch. In some embodiments, the touch switch is any one of a membrane switch or a capacitive touch switch. However, any suitable sensor may be utilized such as, by way of example, a membrane switch, an analog switch, a gyroscope, or an accelerometer.

**[0084]** In some embodiments, in the first device as described above, the first electrical conductor may be electrically coupled to a slip ring. A slip ring may comprise any device or combination of devices designed to make an electrical connection through a rotating assembly. An example of a slip ring connection is shown and described with respect to FIGS. 15 and 16. In some embodiments, the electrical conductor may comprise a part of a slip ring or slip ring component. In some embodiments, the first device may further comprise a hinge and the slip ring may be disposed substantially within the hinge. In some embodiments, the slip ring comprises a part of the hinge. For example, the temple may be connected to a portion of the lens housing by a hinge, where the hinge is electrically conductive (or a portion thereof is electrically conductive). Thus, as the hinge rotates (and thereby the temple moves from a first position relative to the lens housing to second position relative to the lens housing), the hinge may be configured to maintain electrical contract with the first electrical conductor (and thereby maintain the first conductive path). Embodiments may provide advantage of continuously providing electric power or signals from one or more components disposed within the electronics module to one or more components outside of the electronics module (*e.g.* disposed on the lens housing), particularly where the temples may not be perpendicular to the lens housing.

**[0085]** In some embodiments, in the first device as described above, the electronics module may be configured to be removably coupled to the first temple. That is, in some embodiments, the first electrical conductor may constrain the electronics module when it is disposed within the temple such that, during normal use, the electrics module remains in place. However, the electronics module and/or the electrical conductor may be configured such that the module may also be removed from the temple without damaging the temple. This may require that the wearer apply a force to the electronics module that would not be typical during regular use (*e.g.* when worn by a user, or even dropped or slept on) such as tilting the eyewear, applying a force in a particular direction to the electronics module, and/or removing or loosening one or more fasteners (such as removing a screw that may be holding a part of the electronics module in place). The removed electronics module (or a new electronics module) may be reinserted into the temple and again constrained by the first electrical conducted such that the module is again coupled to the temple and held in place. For instance, as described above, the electronics module may have an opening such that when the module is placed into the first temple, a portion of the first electrical conductors are inserted through the opening and apply a force to the module to hold it against, or disposed within, a cavity of the first temple. Similarly, in some embodiments,

the electronics module or a component thereof may be removably coupled to the first electrical conductor.

**[0086]** In some embodiments, in the first device as described above, the electronics module may include an opening. As noted above, the opening in the electronics module may not only be used to enable the first electrical conductor to couple the electronics module to the first temple in some embodiments, but may also enable the first electrical conductor to establish an electrical connection with, or otherwise interact with, the electronic components disposed therein. In some embodiments, the first electrical conductor may have a first portion that extends a first distance of at least approximately 1 cm into the electronics module through the opening. In some embodiments, the first electrical conductor may have a second portion that extends a second distance of at least approximately 1 cm outside of the electronics module away from the opening. That is, for example, in some embodiments, the first electrical conductor has a portion that is disposed within the electronics module and a second portion that is not disposed within the electronics module. The first portion that extends into the electronics module may for an electrical contact to one or more electronic components disposed therein, and may also provide the force or pressure that couples the electronics module to the temple. The portion of the first electrical conductor that extends away from the opening of the electronics module may be directly coupled to the temple (*e.g.* insert molded into the temple) and may electrically contact a slip ring or other electrical components on the frame. In general, the inventors have found that the larger the portion of the first electrical conductor that extends into the electronics module, the better it may couple the electronics module to the temple (*i.e.* the module may be less likely to be removed from the temple when not desired, or move inside the temple). In some embodiments, the first distance that the first portion of the first electrical conductor extends into the electronics module may be at least approximately 2 cm. In some embodiments, the second distance that the second portion of the first electrical conductor extends away from the opening may be at least approximately 2 cm.

**[0087]** In some embodiments, in the first device as described above, the first electrical conductor may comprise a single structural element. That is, for instance, the electrical conductor may comprise a single contiguous piece of material (*i.e.* unlike other electrical connectors such as a pogo pin that may include one or more springs that may expand or contract the conductor so as to maintain an electrical contact between two contact by providing an axial force). Such electrical conductors may be less expensive to manufacture and may be less

susceptible to failure (*e.g.* because the single structural element may not comprise a mechanism that could fail, such as when a pogo pin no longer applies sufficient force to maintain the electrical contact while the temple is rotated). However, embodiments are not so limited, and in some embodiments, in the first device as described above, the first electrical conductor may be generally configured to maintain the first conductive path as the first temple is moved relative to the lens housing. That is, the electrical conductor may comprise a single structure or a plurality of structures so long as it is configured to maintain the conductive path between the lens housing and the temple as the temple is moved relative to the lens housing.

**[0088]** In some embodiments, in the first device as described above, the first device may further comprise a first lens coupled to the lens housing. In some embodiments, the first lens may include a first electrical contact. That is, for instance, the lens may comprise an electro-active lens, such as a dynamic or electro-chromic lens. The first conductive path may be electrically coupled to the first electrical contact. For example, the electronics module may comprise one or more components that may provide power or control signals to the electro-active lens. The first conductive path (which includes the first electrical conductor) may electrically couple the electronic components disposed within the electronics module to the first electrical contact of the electro-active lens. In some embodiments, where the first device further comprises a second electrical conductor coupled to the first temple and a second conductive path is provided from the first temple to the lens housing at least in part by the second electrical conductor, the lens may further include a second electrical contact. The second conductive path may be electrically coupled to the second electrical contact. By providing a second conductive path that is electrically isolated from the first conductive path, embodiments may provide for power and/or control signals to be sent from the electronics module to the electro-active lens.

**[0089]** With reference to FIGS. 1-18, exemplary embodiments of electronic eyewear comprising a first electrical conductor that couples an electronics module and a temple of the eyewear are shown. Provided below is a more detailed description of these figures. These exemplary devices are provided for illustration purposes and are not intended to be limiting.

**[0090]** FIG. 1 shows exemplary eyewear **101** that comprises a first temple **102**, a lens housing **103** coupled to the first temple, a lens **104** that is supported by the lens housing **103**, and a fastener **105**. In general, the temple **102** and the lens housing **103** may comprise any suitable materials such as plastic (*e.g.* acetate) or a metal. Moreover, the temple **102** and the lens housing

**103** may, but need not, comprise the same material. The lens **104** may be an electronic lens, such as a dynamic lens or an electro-chromic lens, and may utilize power and/or control signals received from an electronic component(s) disposed on, or within, the temple **102** or the lens housing **103**. As shown, the exemplary eyewear **101** may be designed so to not have an appearance that it comprises any electronic devices (or to minimize the appearance of such electronic components). That is, for instance, to an outside viewer of this exemplary embodiment, the electronics module and the conductive path from the temple to the lens housing are not apparent.

**[0091]** FIG. 2 shows the same exemplary eyewear **101** of FIG. 1, but with a transparent view of the temple **102**. As shown, the temple **102** comprises an electronics module **106**, which may comprise a plurality of electronic components such as a power source (*e.g.* a battery), a controller, and/or a sensor. The electronics module **106** is coupled to the temple **102** in part by two electrical conductors: a first electrical conductor **107** and a second electrical conductor **108**. As shown in this example, the first **107** and second **108** electrical conductors are each coupled to the temple **102** (and in this case, are shown as being disposed within a portion of the temple **102**). The fastener **105** is shown in this example as being adapted to compress or hold the first **107** and second **108** electrical conductors in electrical contact with a first conductive path **109** and a second **110** conductive path, respectively. For instance, when the fastener **105** is tightened, it applies a force to a portion of each of the electrical conductors **107** and **108**, as well as the material comprising a portion of the conductive paths **109** and **110**, thereby moving each of these components into electrical contact (or maintaining the electrical contact) based on the threading of the fastener **105**. An insulator material **111** is shown as being disposed between the first **109** and the second **110** conductive paths so as to electrically isolate the paths. In general, the conductive paths **109** and **110** may comprise any suitable conductive material or materials, and may in some instances comprise electrical components, connectors, and/or portions of a hinge. The first **109** and second **110** conductive paths are shown in this example as connecting to the lens housing **103**, where the conductive paths may further electrically connect to one or more electrical contacts of an electro-active lens **104** or perhaps to electronic devices disposed on the lens housing **103** or on the other temple of the eyewear **101**.

**[0092]** FIG. 3 illustrates the same exemplary electronic eyewear described above, except that the electronics module **106** has been removed from a cavity **112** of the first temple **102**. This may correspond to a step in the manufacturing process of the eyewear **101** (*e.g.* prior to

disposing the electronics module **106** within the temple **102)**, or perhaps corresponds to a situation in which a wearer may have removed the electronics module **106** to repair or replace the module. As shown below in FIGS. 4-9 and described in more detail, the first **107** and second **108** electrical conductors may have a first portion disposed in the cavity **112** as well as a second portion that is not disposed within the cavity **112 (***e.g.* the second portion may be embedded or directly coupled to the temple **102)**. FIG. 3 also shows the first **109** and second **110** conductive paths from the temple **102** to the lens housing **103**, where one or both of the conductive paths may electrically connect (via a conductor disposed on or within the lens housing **103**, or through the lens housing **103** itself for embodiments where it comprises a conductive material) to the lens **104** or other electronic components not shown.

**[0093]** FIG. 4 is a close-up view of the temple **102** of the exemplary eyewear **101**. As shown, the first electrical conductor **107** and the second electrical conductor **108** may be disposed within the temple **102** (*e.g.* couple to the temple **102**). In the exemplary embodiment shown in FIG. 4, the first **107** and second **108** electrical conductors may each have a portion (portions **112** and **114**, respectively) that forms an electrical contact with the first **109** and second **110** conductive paths (not shown). In this example embodiment, the electrical contacts **113** and **114** are shown as having an opening in which the fastener **105** may be inserted so as to apply a force to each of the electrical conductors **107** and **108**. To maintain electrical isolation between the first **107** and second **108** conductors while this force (and any other force that may result during the use of the eyewear), an insulator **120** may be coupled to each of the conductors **107** and **108** and/or disposed there between.

**[0094]** FIG. 5 is a close-up of the components shown in a section of the exemplary embodiment shown in FIG. 4. As can be seen in FIG. 5, the first **107** and second **108** electrical conductors may also have portions (**115** and **116**) that extend into the cavity **112** of the temple **102** of the eyewear **101**. Each of the portions **115** and **116** may be configured to form an electrical contact with one or more electrical components disposed within the cavity **112**, as well as to couple the electronic components (or an electronics module that may comprise a plurality of electronic components) to the temple **102**. In this manner, electronic components may be readily coupled and/or decoupled to the temple **102**. Moreover, as described above, embodiments may provide more robust electrical connections because of the force and electrical connections applied and created by the portions **115** and **116** of the conductors **107** and **108** to the electrical contacts of the electronic components. Moreover, coupling the electrical

conductors that form the electrical connections with the components in the cavity **112** may, in some instances, eliminate the need to include electrical connectors that extend out of an electronics module, which may be more susceptible to damage when, for instance, the module is being transported outside the frame. That is, for instance, the electrical conductors **107** and **108** may be at least partially protected by the temple **102**, even when no electronic components are disposed in the cavity **112**. In addition, it may also be more difficult to fixedly (*i.e.* permanently) couple such electrical connectors to the components disposed within an electronics module, as this may require, for example, hand soldering the components through a relatively small opening of the electronics module. In contrast, utilizing electrical conductors (*e.g.* conductors **107** and **108**) that are coupled to the temple **102** (and thereby need not necessarily be soldered or permanently coupled to the components disposed within an electronics module) may reduce the complexity, expense, and/or the chance of error or damage to the electronic components during this manufacturing process.

**[0095]** FIG. 6 shows a view of the inside surface (*i.e.* the surface that faces a wearer when the eyewear **101** is worn) of a portion of the temple **102** of the exemplary eyewear **101**. This view better illustrates the portions **115** and **116** of the electrical conductors **107** and **108**, respectively, which extend into the cavity **112**. As illustrated, the exemplary portions **115** and **116** are shown as elevated or raised above the inside surface of the cavity **112**. This may enable these portions of the electrical conductors to be inserted into an opening of an electronics module and apply a force that restrains the module in the cavity (*i.e.* holds the module in place and prevents the module from moving, particularly in a direction directly away from the frames). In some embodiments, the module may still be removable from the cavity **112** of the temple **102**, but this may require a force to be applied that may not be typical of those experienced during daily use (*e.g.* the module may need to be pulled away from the portions of the conductors **115** and **116** in a direction substantially parallel to the temple **102**) and/or require the removal of one or more fasteners that may also be coupled to the electronics module).

**[0096]** FIG. 7 shows a similar side view of the exemplary eyewear **101** as in FIG. 6; however, FIG. 7 shows the portions of the electrical conductors **107** and **108** that are encapsulated or disposed within the temple **102** (*i.e.* the temple **102** is transparent). As shown, the electrical insulator **120** that is coupled to the electrical conductors **107** and **108** so as to maintain electrically isolation may also be disposed within the temple **102**. In addition, the portions of the electrical conductors **113** and **114** (in this case comprising an opening to allow a fastener to be

inserted thereto and apply a tightening force) are also shown as being disposed within the temple **102** (and thereby an outside observer may not be able to perceive these components). In this regard, FIG. 8 shows the same side view of the exemplary eyewear **101** as in FIG. 7, except that the temple **102** is solid (rather than transparent). As can be seen, in this exemplary embodiment only the portions **115** and **116** of the electrical conductors **107** and **108** may be exposed to the external environment (although portions **113** and **114** appear to be exposed, in some embodiments, these portions may be in electrical contact with the conductive paths **109** and **110** (not shown) and/or encapsulated in the temple **102** and/or hinge as well. The other portions of the electrical conductors **107** and **108** may thereby be isolated from the external environment, thereby reducing the likelihood of damage or short circuits forming.

**[0097]** FIG. 9 shows a view from the outside surface (*i.e.* the surface that faces away from wearer when the eyewear **101** is worn) of a portion of the temple **102** of the exemplary eyewear **101**. This view illustrates the portions **115** and **116** of the electrical conductors **107** and **108**, respectively, which extend into the cavity **112**. As illustrated, the exemplary portions **115** and **116** are shown as elevated or raised above the inside surface of the cavity **112**. Moreover, as shown in this example, the insulator **120** may be disposed and coupled to one side of the electrical conductors **107** and **108**; however, embodiments are not so limited.

**[0098]** FIG. 10 shows a top-view of a portion of the temple **102** of the exemplary eyewear **101**. As shown in this example, the electrical conductor **107** may have different portions that extend in different directions relative to, for instance, a surface of the temple **102** (*e.g.* the outer surface **121**). As shown, a portion of the electrical conductor may extend parallel to the surface **121**, then extend perpendicular to the surface **121** (*e.g.* while still disposed within the temple **102**), and then the portion **115** may extend parallel to the surface **121** as it enters the cavity **112** of the temple **102**. In this manner, the electrical conductor **107** may provide sufficient support to adequately couple the electronic components (and/or electronics module) to the temple **102**. Also as shown in FIG. 10, in this exemplary embodiment, the portion **113** of the electrical conductor **107** comprises an opening **119** in which a fastener **105** (not shown) may be inserted and utilized to couple the electrical conductors **107** and **108** to the first **109** and second **110** conductive paths, respectively, in the other portions of the temple **102**. However, embodiments are not so limited and any suitable manner of making and maintaining these electrical connections may be used.

**[0099]** FIG. 11 shows the same top-view of the portion of the temple **102** of the exemplary eyewear **101** as shown in FIG. 10, except that additional components are now shown. In particular, FIG. 10 shows the fastener **105** inserted in the opening **119** of the portion **113** of the electrical conductor **107**. FIG. 10 also shows the first conductive path **109** coupled to the lens housing **104**, where the fastener **105** is utilized to maintain the electrical contact between the conductive path **109** and the portion **113** of the electrical conductor **107**. In addition, FIG. 10 also shows an electronics module **106** disposed in the cavity **112** of the temple **102**. The portion **115** of the electrical conductor **107** is shown as disposed within a portion of the electronics module **106**. As shown, the shape of the electrical conductor **107** such that it comprises a portion **115** that enters parallel with the outside surface **121** of the temple **102** may enable, in this exemplary embodiment, the portion **115** of the electrical conductor **107** to couple the electronics module **106** to the first temple **102** (*e.g.* it may provide a restraining force such that the electronics module **106** may be held in substantially place within the cavity **112).** However, embodiments are not so limited and any suitable shape or disposition of the electrical conductor **107** such that it couples the electronics module **106** and/or the components therein to the temple **102** may be utilized in accordance with some embodiments.

**[0100]** FIG. 12 shows a view of the inside surface (*i.e.* the surface that faces a wearer when the eyewear **101** is worn) of a portion of the temple **102** of the exemplary eyewear **101**. In particular, FIG. 12 illustrates the insertion of an electronics module **106** that may comprise a plurality of electronic components in the cavity **112** of the temple **102**. As shown, the electronics module **106** may comprise an opening **118** that may enable the portions **115** and **116** of the electrical conductors **107** and **108**, respectively, to be disposed into the electronics module **106** so as to (1) form one or more electrical connections with the electronic components disposed therein and/or (2) couple the electronics module **106** to the temple **102**. As illustrated, the exemplary portions **115** and **116** are shown as elevated or raised above the inside surface of the cavity **112**. This may enable these portions of the electrical conductors to be inserted into the opening **118** of the electronics module **106** and apply a force that restrains the electronics module **106** in the cavity **112** (*i.e.* holds the module in place and prevents the module from moving, particularly in a direction directly away from the frames). In some embodiments, the electronics module **106** may still be removable from the cavity **112** of the temple **102**, but this may require a force to be applied that may not be typical of those experienced during daily use (*e.g.* the module may need to be pulled away from the portions of the conductors **115** and **116** in a direction

substantially parallel to the length of the temple **102**) and/or require the removal of one or more fasteners that may also be coupled to the electronics module **106**). In this regard, the exemplary electronics module **106** shown in FIG. 12 includes a portion **117** comprising an opening in which a fastener may be inserted through to couple the one side of the electronics module **106** (*i.e.* the side opposite the one coupled by the portions **115** and **116** of the electrical conductors **107** and **108**) to the temple **102**.

**[0101]** FIG. 13 shows the exemplary device shown in FIG. 12 after the electronics module **106** has been disposed into the cavity **112** and coupled to the temple **102** by the portions **115** and **116** of the electrical conductors **107** and **108**, respectively. As shown, the portions **115** and **116** of the electrical conductors **107** and **108**, respectively, are disposed through the opening **118** of the electronics module **106** so as to (1) form one or more electrical connections with the electronic components disposed therein and/or (2) couple the electronics module **106** to the temple **102**. In addition, the portion **117** comprises an opening through which a fastener (not shown) is inserted through to hold the side of the exemplary electronics module **106** (*i.e.* the side opposite the one coupled by the portions **115** and **116** of the electrical conductors **107** and **108**) in place.

**[0102]** FIG. 13 shows an exemplary electronics module **106** and the manner in which it may be coupled by the electrical conductors **107** and **108** (and thereby to the temple **102** of the exemplary eyewear **101**). For illustration purposes, the temple **102** and other components have been removed from the figure. As shown, the portions **115** and **116** (not shown because they are disposed within the electronics module **106**) of the electrical conductors **107** and **108** are disposed through the opening **118** of the electronics module **106**. The portions **113** and **114** may be disposed in the temple **102** and may form an electrical contact with one or more conductive paths **109** and **110**, respectively, which may be maintained by the force applied by a fastener **105** through the opening in portions **113** and **114**. In addition, to maintain electrical isolation of the two electrical conductors, the insulating material **120** may be coupled to, and/or disposed between, the conductors. The electronics module **106** may also have a portion **117** that may be separately coupled to the temple **102** by a fastener, or any other suitable means.

**[0103]** FIG. 15 illustrates the exemplary electronic eyewear **101** as described above, except that temple has been removed **102** for illustration purposes. As shown, an electronics module **106** (which may comprise a plurality of electronic components such as a power source -*e.g.* a battery-, a controller, and/or a sensor) may be coupled to the temple **102** (not shown) in part by

the first electrical conductor **107** and the second electrical conductor **108**. As shown in this example, the first **107** and second **108** electrical conductors are each held in electrical contact with the first conductive path **109** and the second conductive path **110**, respectively, by the fastener **105**. For instance, when the fastener **105** is tightened, it applies a force to a portion of each of the electrical conductors **107** and **108**, as well as the material comprising a portion of the conductive paths **109** and **110**, thereby moving each of these components into electrical contact (or maintaining the electrical contact) based on the threading of the fastener **105**. An insulator material **111** is shown as being disposed between the first **109** and the second **110** conductive paths so as to electrically isolate the paths. The first **109** and second **110** conductive paths are shown in this example as connecting to the lens housing **103**, where the conductive paths may further electrically connect to one or more electrical contacts of an electro-active lens **104** or perhaps to electronic devices disposed on the lens housing **103** or on the other temple of the eyewear **101**.

**[0104]** FIG. 16 shows the same exemplary embodiment of eyewear **101** shown in FIG. 15, except that the structure of the temple **102** has been added as a wire frame to further illustrate how each of these exemplary components may be disposed within (or not disposed within) the structure of the temple **102**. In this regard, when the electronics module **106** is disposed within the cavity **112** of the temple **102**, the conductive paths and electronic components may have a minimum amount of exposure to the external environment, thereby potentially decreasing damage and shorting that could occur.

**[0105]** FIG. 17 shows the same exemplary eyewear **101** and, in particular, is a back-side view of the inside surface of the temple **102**. As shown, the temple a cavity **112** in which one or more electronic components (or an electronics module **106**, which may comprise a plurality of electronic components such as a power source (*e.g.* a battery), a controller, and/or a sensor) may be disposed therein. The first electrical conductor **107** and a second electrical conductor **108** are shown as having portions **115** and **116** disposed within the cavity **112**. The first **107** and second **108** electrical conductors are each coupled to the temple **102** (and in this case, they are disposed within a portion of the temple **102**). The fastener **105** is shown in this example as being adapted to compress or hold the first **107** and second **108** electrical conductors in electrical contact with a first conductive path **109** and a second **110** conductive path, respectively. For instance, when the fastener **105** is tightened, it applies a force to a portion of each of the electrical conductors **107** and **108**, as well as the material comprising a portion of the conductive paths **109** and **110**,

thereby moving each of these components into electrical contact (or maintaining the electrical contact) based on the threading of the fastener **105**. An insulator material **111** is shown as being disposed between the first **109** and the second **110** conductive paths so as to electrically isolate the paths. In general, the conductive paths **109** and **110** may comprise any suitable conductive material or materials, and may in some instances comprise electrical components, connectors, and/or portions of a hinge. The first **109** and second **110** conductive paths are shown in this example as connecting to the lens housing **103**, where the conductive paths may further electrically connect to one or more electrical contacts of an electro-active lens **104** or perhaps to electronic devices disposed on the lens housing **103** or on the other temple of the eyewear **101**.

**[0106]** FIGS. 18(a)-(c) show further examples of electrical conductors coupling one or more electronic components and/or an electronics module to the first temple of exemplary eyewear. With reference to FIG. 18(a), the exemplary device shown therein comprises electrical conductors **107** and **108** that are coupled to the electronic component **125,** which is disposed within a cavity of the temple **102**. The electronic component **125** may be coupled to the one or more other electronic components (*e.g.* through a printed circuit board, electrical connectors, or physical connections such as fasteners, adhesives, or soldering) that may also be disposed in the temple **102**, such as power source **126**. Thus, as shown, in some embodiments an electronics module need not be included, and the electrical conductors **107** and **108** may effectively couple the electronic components to the temple **102**. FIGS. 18(b) and 18(c) illustrate an embodiment in which an electronics module **106** may be included and disposed in a cavity of the temple **102**. As shown in FIG. 18(b), the conductors **107** and **108** may couple the electronics module **106** to the temple **102** by being disposed within an opening of the electronics module **106**. As shown in FIG. 18(c), the electronics module **106** may comprise electronic components (*e.g.* component **125**) similar to the embodiment shown in FIG. 18(a). The conductors **107** and **108** may couple to the same electronic component **125** (which is disposed within the electronics module), and thereby apply a force to maintain the electronics module **106** in place. The fastener **105** may be configured to maintain the electrical connection between the conductors (**107** and **108**) and the first **109** and second **110** conductive paths, which may be further electrically coupled to the lens housing **103**.

**Capacitive Touch Switch Embodiments**

**[0107]** In general, the manufacture of electronics module that may be used, for instance, to contain, transport, and/or couple a plurality of electronic components to the frames of electronic eyewear may be difficult and potentially expensive and time consuming. Often times the electronic components are disposed within the electronics module by hand because, for instance, the amount of space within the electronics module is relatively small. In addition, this limited work area within the module tends to make it extremely difficult to form the electrical connections between the electronic components while they are disposed within the module (the electrical connections are also generally established manually -*e.g.* through hand soldering the electrical connections), and typically result in shorts across electrical connections. This may lead to a large number of components having to be discarded during the manufacturing process or additional time must be spent attempting to disconnect the erroneous electrical connections.

**[0108]** The inventors have discovered a method of manufacturing that may enable more efficient and timely production of such electronics module, particularly those that may comprise a sensor such as a captive touch switch. In particular, the inventors have found that by utilizing a substrate (such as a surface of a touch sensor; preferably a capacitive touch switch) as a "back bone" (*e.g.* a platform) on which other electronic components may be disposed on, the electronic components may be more readily physically coupled together prior to being inserted into the more confining electronics module enclosure. The easier coupling may be due to the fact that the substrate (*e.g.* capacitive touch switch) on which the components are first disposed may only cover a small portion of the electronic components (*e.g.* potentially one side of the components), while allowing access to all of the other portions of the electronic components. Moreover, the electrical connections between the components may also be more readily established because this manufacturing process may no longer require that the soldering (or any other technique to form electrical connections) is performed while the electrical components are disposed within the confining electronics module (*i.e.* in a small workspace).

**[0109]** For example, each of the electronic components (such as a power source, controller, electrical connectors, etc.) may be disposed or coupled to a capacitive touch switch (*e.g.* through any suitable technique, including reflow soldering). The electrical connections between each of the electrical components may then be established (*e.g.* by soldering). The entire electronic assembly (comprising the capacitive touch switch (as the platform) and the electronic components disposed thereon) may then be disposed within the outer casing of an electronics module (or in some embodiments, directly into a cavity of a temple of electronic eyewear). The

capacitive touch switch may serve as the top surface of the electronics module, and may be coupled thereto in any suitable way (such as being molded or pressure fitted to the outer casing). In this way, the electrical connections need not be established while the electronic components are disposed in the module, thereby increasing efficiency and potentially allowing for automation of some or all of the process.

**[0110]** In general, the inventors have found that in some embodiments, any surface or substrate may be utilized to dispose the electronic components thereon prior to insertion into a partial enclosure. However, it may be preferred (such as when a touch switch is utilized as a sensor for the electronic eyewear) that the electronic components be disposed on a surface of the touch switch. As used in this context, a "touch switch" may refer to a type of switch that may be touched by an object to operate (or an object may come into close proximity to the switch). For embodiments comprising electronic eyewear, it may be preferred that a capacitive touch switch is used because such switches may be moisture resistant, which the inventors have found is advantageous given the typical exposure to, for example, perspiration from the wearer, environmental moisture (*e.g.* humidity, precipitation), moisture from the wearer's finger, etc.. A "capacitive touch switch" may refer to any sensor that may utilize an electrical field to detect, for instance, the presence of a human finger or other conducting object to activate a switch. For example, when a conductive object enters the field (*e.g.* comes into contact with, or in close proximity to, the device), the switch recognizes a change in the capacitance indicating an actuation. This may enable capacitive switches to be "sealed" (*i.e.* there may not need to be any physical interaction with the sensing components) such that, as noted above, the switches and components thereof need not be exposed to external conditions (*e.g.* moisture).

**[0111]** The inventors have also discovered that when using a capacitive touch switch as the platform (or "backbone") of the device, the typical material that may be used for a capacitive touch switch may not be firm enough to support each of the electronic components. Thus, in some embodiments, the capacitive touch switch may comprise a material that may be capable of supporting the force applied by the electronic components when disposed thereon. Moreover, the firmer material may be capable of specifically molding such that it may be structurally fitted to the enclosure, and thereby adhesives or fasteners may not be required to couple the two components together (*e.g.* after the electronic assembly of electronic components is disposed on the surface of the capacitive touch switch). For instance, the capacitive touch switch may be pressure fitted to the enclosure, such that it may be "snapped-in" or out (*i.e.* coupled and

decoupled). This may enable easy access to the components disposed therein, which could reduce maintenance and repair costs.

**[0112]** It should be noted that although embodiments described below may make reference to a capacitive touch switch because the inventors may have found that it has properties that make it well-suited in some instances for use on electronic eyewear as described above, embodiments are not so limited. For example, as noted above, other types of touch switches such as membrane switches may also be used. Thus, while the exemplary embodiments provided herein may be described with reference to a capacitive touch switch because of the advantages that the inventors have found such devices may provide in some embodiments, it should be understood that the methods described herein may also be utilized using other types of substrates as a platform for the electronic components.

**[0113]** Additional steps may also be performed as well in some embodiments. For instance, some embodiments include the step of depositing a conformal layer (*e.g.* an encasing or encapsulating layer) over the electronic assembly (*i.e.* comprising the capacitive touch switch and the electronic components disposed thereon) using a film or other protective material layer. This conformal layer may be utilized to seal the electronic components (and particularly the electrical connections between the electronic components) to protect them from damage, particularly external environmental damage. Thus, the conformal layer may generally be moisture proof in some embodiments. However, the entire assembly may not be covered by the conformal layer in some embodiments because one or more electrical connections may be needed to, for instance, electrically couple the electronic components in the electronics module to other electronic components on the electronic eyewear. Thus, during the deposition of the conformal layer (*e.g.* the encasing or encapsulation process) a mask may be disposed over the electrical contacts that will be used to make such connections. In some embodiments, rather than using a mask, the entire assembly may be encased or encapsulated, and the conformal layer may be selectively removed from portions of the assembly (*e.g.* portions of the layer that cover the electrical contacts) to expose the electrical contacts and allow one or more connections to be made. The electronic assembly may then be inserted into a partial enclosure (*e.g.* an electronics module outer casing) and then disposed within the cavity of a temple of the electronic eyewear.

**[0114]** It should be appreciated that additional steps may be utilized during the manufacturing process. Provided below are exemplary methods of manufacturing a device that may comprise

the steps of disposing one or more electronic components on a capacitive touch switch and then disposing the assembly into a partial enclosure. These example embodiments are provided for illustration purposes only and are not invented to be limiting.

**[0115]** In some embodiments, a first method may be provided. The first method may include the steps of providing a capacitive touch switch, disposing a plurality of electronic components on the capacitive switch, and coupling the capacitive touch switch to a partial enclosure.

**[0116]** As used in this context, a "partial enclosure" may refer to a component or components that may substantially surround the electronic components that are disposed on a surface of the capacitive touch switch. That is, for instance, the enclosure may surround the portions of the electronic components that are not covered by the capacitive touch switch. However, the enclosure need not completely enclose or encircle the electronic components. For example, the enclosure may have one or more openings that allow external components to interact with the components disposed within the enclosure. This may enable electrical connections to be made to the components therein.

**[0117]** As used in this context "disposing the electronic components" may comprise any suitable manner of coupling the electronic components to the capacitive touch switch. For example, any suitable adhesive could be used. In some embodiments one or more electrical connectors may be coupled to the capacitive touch through reflow soldering. In general, the electronic components need not all be directly coupled to the capacitive touch switch, but may, for instance and in some embodiments, be disposed or connected to other electronic components that may be directly coupled to the capacitive switch. Such indirect connections through one or more other electronic components (such as electrical connectors) may also be considered as being "disposed' on the capacitive touch switch, as used in this context. Electrical connections could be established in any suitable manner, including using traditional soldering or through the use of a reflow soldering process.

**[0118]** The term "providing" is generally used in this context to be an inclusive term and encompass any manner of obtaining or making available a capacitive touch switch for use in such methods. For instance, in some embodiments, the capacitive touch switch and/or components thereof may be acquired, such as by purchase from a third party. In some embodiments, the capacitive touch switch could be manufactured or assembled, or the

components could be provided to a third party that may then assemble the capacitive touch switch.

**[0119]** In general, by disposing the electronic components on the capacitive touch switch, some embodiments may enable the electronic components to be disposed, arranged, and electrically coupled before being inserted into a confined space (such as the partial enclosure - *e.g.* an electronics module or the outer casing thereof). As explained above, this process may reduce the costs and complexities associated with manufacture (*e.g.* the coupling of the components and establishing of the electrical connections) because this fabrication process can be done in a less restrictive environment, which provides easier access to the electronic components and electrical connections there between. That is, as noted above, typically when fabricating and electrically coupling electronic components when the components are already disposed within an enclosure (such as an electronics module), the space restrictions may make it difficult to accurately and efficiently form the electrical connections, particularly when attempting to use traditional soldering techniques. This can result in shorts forming across electrical connections and/or otherwise result in damage to the electrical connections. Moreover, this process is typically done by hand because of the space restrictions, which greatly reduces manufacturing speed and increases human error in the process.

**[0120]** In contrast, some embodiments provided herein may, but need not, enable the use of a more efficient manufacturing process where the electrical components are fabricated and electrically connected outside of the confines of an enclosure. The partial enclosure, rather than potentially serving as the foundational structural component for disposing the electronic components, may more or less serve to protectively encapsulate a complete (or substantially complete) circuit assembly that includes a capacitive touch switch, control components, and in some embodiments, a power source. This may enable a more automated manufacturing process (*i.e.* the components may no longer need to be electrically coupled manually), or otherwise increase the fabrication yield and efficiency.

**[0121]** In some embodiments, in the first method as described above, the first method may further include the step of electrically coupling one or more of the plurality of electronic components to the capacitive touch switch. This may comprise any suitable technique for electrically coupling the components. The inventors have found, however, that in some embodiments, it may be preferred that the step of electrically coupling one or more of the

plurality of electronic components to the capacitive touch switch may comprise reflow soldering. "Reflow soldering" may refer to a process in which a solder paste (*e.g.* a sticky mixture of powdered solder and flux) is used to temporarily attach one or several electrical components to their contact pads (*e.g.* electrical contacts), after which the entire assembly may be subjected to controlled heat, which melts the solder, permanently connecting the joint. Thus, for instance, the solder paste may be disposed so as to temporarily couple one or electronic components (*e.g.* electrical connectors or flex circuits) to the capacitive touch switch and the entire assembly may then be heated so as to permanently couple the components. This process may be more efficient than attempting to hand solder each component, and may also provide an efficient manner of coupling the components. However, as noted above embodiments are not so limited, and any suitable process may be used to electrically and physically couple the components.

**[0122]** In some embodiments, in the first method as described above, the first method may further include the step of electrically coupling one of the plurality of electronic components to another of the plurality of electronic components. That is, the electronic components that are disposed on the capacitive touch switch may also be electrically coupled to one another. For instance, two electronic components that are each coupled to the capacitive touch switch may also be electrically connected. For example, a controller that may be coupled the capacitive touch switch may also be electrically connected to a power source or an electrical connector. In addition, electronic components may be both directly and indirectly coupled to the capacitive touch switch. For example, an electrical connecter or flexible circuit may be directly coupled to the capacitive touch switch, and then an additional electronic component may be coupled to the electrical connector of flexible circuit (but not directly to the capacitive touch switch). This may enable stacking of the electronic components.

**[0123]** In some embodiments, in the first method as described above, the first method may further include the step of coupling the enclosure to a temple of an eyeglass (*i.e.* eyewear) frame. In some embodiments, the step of coupling the enclosure to the temple of the eyeglass frame may comprise disposing the enclosure substantially within the temple of the eyeglass frame. The enclosure may be maintained with the temple by any suitable means, such as through the use of adhesives, fasteners, or electrical conductors, such as the exemplary embodiments described above and illustrated in FIGS. 1-18. In some embodiments, the electronic eyeglass frame may comprise an electro-active eyeglass frame (i.e. it may comprise an electro-active lens, such a dynamic or electro-chromic lens).

**[0124]** In some embodiments, the electronic eyeglass frame may comprise a first conductive path, and the first method may further comprise the step of electrically coupling at least one of the electronic components to the first conductive path. Examples of such connections were described above, particularly with reference to FIGS. 11 and 15-16. In some embodiments, the first conductive path may be electrically coupled to an electro-active lens. In some embodiments, the first conductive path may comprise anyone of, or some combination of: a slip ring or a pogo pin. A slip ring or a pogo ping may generally be used to maintain a conductive path through the temple and the lens housing, even as the temple is moved relative to the lens housing. In some embodiments, where the first conductive path includes a slip ring, the first conductive path may further comprise a lug coupled to the slip ring. In some embodiments, the lug may be integrally coupled to the temple. Examples of such embodiments are described in detail above, particularly with reference to the electronic eyewear shown in FIGS. 1-18. In some embodiments, the first method may further include the step of insert molding the lug into the eye glass frame.

**[0125]** In some embodiments, the lug may be disposed on the capacitive touch switch. That is, in some embodiments, unlike the exemplary embodiments shown in FIGS. 1-18, the lugs that comprise a part of the first conductive path may be disposed on the capacitive touch switch (which may be coupled to the electronics module). The lugs thereby may not be integrally coupled to the temple.

**[0126]** In some embodiments, in the first method as described above, the enclosure may comprise an electronics module. In some embodiments, the enclosure may comprise a temple of an eyeglass frame. That is, for instance, in some embodiments a separate electronics module may not be utilized to enclose the electronic components. Instead, the capacitive touch switch and the electronic components disposed thereon may be directly inserted and coupled to the temple. In this manner, the temple of the frames may provide structural support and protection for the components, without requiring the extra step of enclosing the components in a module.

**[0127]** In some embodiments, in the first method as described above, the first method may further comprise the step of applying a conformal coating to the plurality of electronic components. As used in this context, a "conformal coating" may refer to any coating that is designed to substantially protect or enclose the electrical connections of the plurality of electronic components (and/or the components themselves) that are disposed on the capacitive

touch switch. The conformal coating may also protect portions of the capacitive touch switch as well. The conformal coating may be configured to prevent short circuits, foreign materials, atmospheric conditions (such as moisture) or any other external forces from affecting the electrical connections or damaging the electronic components. In this regard, the coating may generally be moisture proof or resistant. The conformal coating may have any suitable thickness, but is typically less than 1 mm thick, and more preferably less than .5 mm thick. The coating may comprise any suitable material, such as a brushed, spray or dip applied acrylic, urethane, silicone, or epoxy. It should be noted that components that are intended to form one or more electrical connections with an external component(s) may be masked during the deposition/application process of the conformal coating (or the coating may be later removed) so as to expose the electrical contacts of these components.

**[0128]** In some embodiments, the first method may further include the step of masking a portion of the electronic components such that an electrical contact is exposed through the conformal coating. In some embodiments, the first method may further include the step of removing a portion of the conformal coating to expose an electrical contact of one or more of the plurality of electronic components.

**[0129]** In some embodiments, in the first method as described above, the plurality of electronic components may comprise any one of, or some combination of: a flexible circuit, a printed circuit board, or an electrical connector. In some embodiments, the plurality of electronic components may include a power source.

**[0130]** In some embodiments, in the first method as described above, the capacitive touch switch and the enclosure may be configured to be pressure fitted. As noted above, the capacitive touch switch may be coupled to the enclosure in any suitable manner. However, the inventors have found that pressure fitting the capacitive touch switch to the enclosure may provide for more efficient assembly, as well as easier access to the components disposed on the capacitive touch switch after the capacitive touch switch has been initially coupled to the enclosure. For instance, if an adhesive were used, the capacitive touch switch may be damaged if it was decoupled from the enclosure. However embodiments are not so limited, and in some instances, in the first method as described above, the capacitive touch switch may be coupled to the enclosure using any one of, or some combination of: a fastener or an adhesive.

**[0131]** In some embodiments, in the first method as described above, the capacitive touch switch may comprise a stiff material. As used in this context, "stiff" may refer to a material that substantially maintains its shape when the plurality of electronic components is disposed thereon. In some embodiments, in the first method as described above, the capacitive touch switch may comprise a rigid, molded plastic such as a liquid crystal polymer or other plastic engineered for ablation and plating.

**[0132]** In some embodiments, a method may be provided. The method may include the steps of providing a substrate (such as a surface of touch switch), disposing a plurality of electronic components on the substrate, electrically coupling one of the plurality of electronic components to another of the plurality of electronic components, coupling the substrate to a partial enclosure, and coupling the enclosure to a temple of an eyeglass frame. That is, as noted above, although it may be preferred that a capacitive touch switch is used in some embodiments, embodiments are not so limited. Indeed, disposing the electronic components on a substrate and forming one or more electrical connections prior to coupling the substrate to a partial enclosure may provide similar manufacturing advantages (*e.g.* allow for automatic pick and place of the electronic components) when using different types of substrates. In some embodiments, the step of coupling the enclosure to the temple of the eyeglass frame may comprise disposing the enclosure substantially within the temple of the eyeglass frame.

**[0133]** With reference to FIGS. 19-29, exemplary embodiments of electronic assemblies comprising a capacitive touch switch and methods for manufacturing the same are provided. These exemplary devices and methods are provided for illustration purposes and are not intended to be limiting.

**[0134]** With reference to FIG. 19, the components of a current design of an electronics module are shown. As illustrated, this device may comprise a capacitive touch switch **201**, a flexible circuit **202** that may be electrically coupled to the capacitive touch switch **201**, a printed circuit board (PCB) **203**, a power source **204** (*e.g.* a battery assembly), a partial enclosure **205** (*e.g.* outer casing of an electronics module), electrical conductors **206** (*e.g.* pogo pins) that may form one or more connections between the electronic components disposed inside the electronics module to electronic components that may be disposed outside the module, and electrical component **207** coupled to the PCB **203**. The device shown in FIG. 19 corresponds to embodiments where the electronic components are first disposed in the electronics module,

electrical connections are then formed, and then capacitive touch switch **201** is coupled to the electronics module (e.g. via super glue) and functions as a seal for a potting that is used to fill the vacant space in the module after the electrical connections are formed. The components are hand soldered, including the electrical connections of the pogo pins **206** to the electronic components inside the electronics module, which as described above, increases manufacture time and reduces the reliability of the device (*e.g.* by increasing manufacturing error). Indeed, many of the electronic components are subject to short faults during and after the fabrication process.

**[0135]** FIG. 20(a) shows a top view and FIG. 20(b) shows a cross-sectional view of the device of FIG. 19. As illustrated, this device comprises a capacitive touch switch **201** (not shown in the top-view of FIG. 20(a) for illustration purposes), a flexible circuit **202** that may be electrically coupled to the capacitive touch switch **201**, a printed circuit board (PCB) **203**, a power source **204** (*e.g.* a battery assembly), a partial enclosure **205** (*e.g.* outer casing of an electronics module), electrical conductors **206** (*e.g.* pogo pins) that may form one or more connections between the electronic components disposed inside the electronics module to electronic components that may be disposed outside the module, and electronic component **207** coupled to the PCB **203**. As can be seen in FIG. 20(b), the components are disposed along the bottom surface of the enclosure **205**, creating a separation from some of the components and the capacitive touch switch **201** that is functioning as the seal for the electronics module. That is, for example, the components are first disposed in the partial enclosure **205**, electrically connections may be formed between some of the components, and then the capacitive touch switch **201** may be super glued to the top surface of the enclosure **205**. As described above, this results in numerous deficiencies in the manufacturing process, and increases the risk of defects in the device (particularly because of the need to manually solder the electrical connections).

**[0136]** With reference to FIG. 21, the components of an exemplary design of an electronics module in accordance with some embodiments are shown. As illustrated, this device may comprise a capacitive touch switch **201** (such as a molded capacitive touch switch **201** that may be fitted so as to be coupled to the enclosure **205**), a flexible circuit **202** that may be electrically coupled to the capacitive touch switch **201**, a printed circuit board (PCB) **203** having an electrical contact or connector **208**, a power source **204** (*e.g.* a battery assembly), a partial enclosure **205** (*e.g.* an outer casing of an electronics module), and electrical connectors **214** that may be configured to electrically couple the flex **202** to the PCB **203**. The molded capacitive touch switch **201** shown in this example may be formed in any suitable manner, such as by using

Laser Direct Structuring (LDS) to create a switch curvature that can "snap" into an enclosure **205** (as opposed to being glued or welded); however, embodiments are not so limited and any suitable method of coupling the capacitive touch switch **201** to an enclosure **205** may be used. The enclosure **205** may include an opening **209** through which one or more electrical conductors may be disposed and that may form a conductive path to the electrical contact **208** that is electrically coupled to the PCB **203**.

**[0137]** As noted above, electrical connections may be made between the capacitive touch switch and one or more of the electronic components using any suitable method, including re-low soldering. Thus, with reference to FIG. 22, the exemplary capacitive touch switch **201** is shown as having reflow solder pads **210** disposed on its underside (*i.e.* the side opposite the surface that may interact with the wearer's finger). The reflow solder pads **210** may correspond to the electrical contacts of the touch switch **201**, and may be used by a controller or other electronic component to receive signals from the touch switch **201** and determine an action to be performed. The inventors have found that reflow soldering may provide advantages over other methods of forming electrical connections, including that the process may be performed automatically (rather than manual soldering) and the reflow soldering processes may also be used to physically couple the components together. Thus, in this manner, electronic components may be both electrically coupled to the touch switch **201**, as well as physically disposed and coupled thereto. In addition, embodiments may provide a molded capacitive touch switch design that may comprise a "snap feature" **215** that may be configured to couple the capacitive touch switch **201** to the enclosure **205**.

**[0138]** With reference to FIG. 23, in some embodiments, an intermediate flexible circuit **202** may be utilized, which may be soldered to the capacitive touch switch **201** so as to provide a ground plane and electrical connectors (*e.g.* connectors **214**, such as 1 mm stack-height connectors) to other electronic components. In addition, the flex **202** may be electrically connected to a power source and comprise additional electronic components (such as controllers) to provide additional layout options and otherwise provide flexibility in design and footprint of the electronic assembly.

**[0139]** With reference to FIG. 24, the partial enclosure **205** that may be utilized in some embodiments may be in the form of a traditional outer casing of an electronics module; however, embodiments are not so limited. For instance, the utilization of fabrication methods such as

those described herein may allow for an enclosure **205** that has, for instance, a smaller geometry (based on the reduction of unused spaced within the module because of the increased design flexibility provided by constructing the electronic assembly outside the enclosure on the capacitive touch switch); a snap feature deposed around the perimeter (corresponding to the snap feature **215** of the capacitive touch switch **201**), which may eliminate the need to use an adhesive in some embodiments; and, in some instances, the enclosure **205** could comprise electrical traces disposed on the bottom surface to allow for a battery assembly circuit leg across the enclosure (or to certain components), which may not be practical in some embodiments where the electronic components are disposed on the bottom surface of the enclosure **205** (rather than disposed on the capacitive touch switch **201**).

**[0140]** With reference to FIG. 25, an exemplary capacitive touch switch **201** is shown as having electrical traces **212**. The electrical traces **212** may be electrically coupled to one or electronic components (not shown), and may thereby send signals from the capacitive touch switch **201** (such as indications of when a wearer interacts with the capacitive touch switch **201**) to one or more devices that may be utilized to active or deactivate an electronic function of the eyewear. FIG. 26 shows the same capacitive touch switch **201** as in FIG. 25, but with electrical connectors **214** disposed on the surface of the capacitive touch switch **201**. In some embodiments, the electrical connectors **214** may be reflow soldered to the surface of the capacitive touch switch **201**, which may also be used to form one or more electrical connections with the electrical traces **212**.

**[0141]** FIG. 27 shows an exemplary printed circuit board (PCB) **203** having a plurality of electrical connectors **214** and electronic components **207** disposed thereon. The electrical components **207** may provide any functionality required, such as current or voltage control for the device, or may function as a controller (*i.e.* the components may control the electronic functionality provided by electronic devices disposed on the electronic eyewear based on signals received from the capacitive touch switch **201**). The electrical connectors **214** may couple to the corresponding electrical connectors **214** that may be reflow soldered to the surface of the capacitive touch switch **201** as shown in FIG. 26 (and thereby couple the PCB **203** to the capacitive touch switch **201**).

**[0142]** FIG. 28 shows a plurality of electronic components disposed on the capacitive touch switch **201**. As shown in this exemplary embodiment, the components have been disposed on

the capacitive touch switch **201** prior to the assembly being inserted into an enclosure **205**, such as the outer casing of an electronics module. The PCB **203** may have been coupled to the capacitive touch switch **201** through the electrical connectors **214** (not shown). In some embodiments, and as shown in FIG. 28, a power source **204** may also be coupled to the capacitive touch switch **201** prior to the assembly being disposed within a partial enclosure **205**; however, embodiments are not so limited, and in some instances, the power source **204** may be disposed in the enclosure **205** separately or may be located in a different portion of the electronic eyewear. The PCB **203** may comprise any number of electronic components **213**, which may be disposed on the PCB **203** before or after the PCB **203** is disposed on the capacitive touch switch **201**. In the example embodiment shown in FIG. 28, the PCB **203** also has coupled thereto an electrical connector **208** comprising a structure that may be utilized to both electrically and physically couple the PCB **203** (and thereby the other electronics components and the electronics assembly in general) to one or more conductors that may be disposed in, or otherwise coupled to, the electronic eyewear frames. FIG. 29 shows the exemplary device and components illustrated in FIG. 30 disposed within a partial enclosure **205**. The opposite side of the enclosure may comprise an opening such that the surface of the capacitive touch switch **201** may be exposed and interacted with by a wearer of the electronic eyewear.

**[0143]** FIG. 30 is a flow chart that illustrates exemplary steps that may be performed in accordance with some methods provided herein. For example, at step **301** a capacitive touch switch may be provided. The capacitive touch switch may serve as the platform or "back bone" on which some of the electronic components of an electronics module or electronic eyewear may be disposed. Next, at step **302**, one or more electronic components may be disposed on a surface of the capacitive touch switch. For instance, as shown in FIG. 26, electrical connectors may be disposed on the surface (*e.g.* using reflow soldering). However, embodiments are not so limited, and the components may be coupled to the surface of the capacitive touch switch in any suitable manner. In step **303**, one or more electrical connections may be formed between the capacitive touch switch and the electronic components that were coupled to the capacitive touch switch in step **302**. In some embodiments, the electrical connections may be formed simultaneously with step **302**, such as when reflow soldering is used; however, embodiments are not so limited.

**[0144]** Continuing with reference to FIG. 30, at step **304** one or more electronic components may be coupled to the one or more of the electronic components that were previously disposed on the capacitive touch switch in step **302**. For instance, electrical connectors coupled to a PCB

may be coupled to one or more electrical connectors that may have been reflow soldered to the capacitive touch switch. In this manner, an electronic assembly may be created, wherein each additional electronic component may connect to another electronic component or components. Each of these additional electronic components may be considered to be disposed on the capacitive touch switch, as used in this context. At step **305**, one or more electrical connections may be formed, to the extent that this was not performed during step **304**.

**[0145]** In some embodiments, at step **306**, a conformal layer (*e.g.* an encasing or encapsulating layer) may be deposited over some or all of the electronic assembly that is now disposed on the capacitive touch switch. The conformal layer may be used to seal and protect the electrical connections that were formed in steps **303** and/or **305**, as well as to protect the electronic components themselves (such as from moisture, which could damage or affect device performance). As described above, to the extent electrical contacts may be required so as to form electrical connections with other components that are not part of the electronic assembly disposed on the capacitive touch switch, these electrical contacts may be masked during the deposition process of the conformal layer, or the conformal (*i.e.* encapsulation) material may be subsequently removed to expose the electrical contacts. It should be noted that while it may be preferred in some embodiments to include a conformal layer, embodiments are not so limited. In some embodiments, the conformal layer may have a thickness that is less than 1 mm in thickness (preferably less than .5 mm).

**[0146]** At step **307**, the capacitive touch switch (which comprises the assembly of electronic components that were disposed thereon in steps **302** and **304**) may be coupled to an enclosure. As described above, the enclosure may comprise the outer casing of an electronics module or the cavity of a temple of electronic eyewear. The step of coupling the capacitive touch switch to the enclosure may comprise any suitable method, including pressure fitting the two components (if they are designed and configured to have the structural interface to do so). The enclosure may provide protection for the electronic components from external forces, but need not necessarily support the components because they may be supported by the capacitive touch switch. As noted above, the capacitive touch switch, or at least a portion thereof, may comprise a material that may be firm enough to substantially maintain its shape and structure, even with the electronic components disposed thereon. Finally, at step **309**, one or more electrical connections may be formed between the components disposed on the capacitive touch switch (*e.g.* that may now be disposed within an electronics module) and one or more electronic components disposed on the

electronic eyewear. Examples of such connections were described above with reference to the exemplary embodiments shown in FIGS. 1-18; however, embodiments are not so limited.

**[0147]** The exemplary methods were described above for illustration purposes. One or more of the steps may not be performed in some embodiments, or additional steps may be included as would be understood by one of ordinary skill in the art after reading this disclosure.

**Conclusion**

**[0148]** It is understood that the various embodiments described herein are by way of example only, and are not intended to limit the scope of the invention. For example, many of the materials and structures described herein may be substituted with other materials and structures without deviating from the spirit of the invention. The present invention as claimed may therefore includes variations from the particular examples and preferred embodiments described herein, as will be apparent to one of skill in the art. It is understood that various theories as to why the invention works are not intended to be limiting.

**[0149]** 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.

**[0150]** 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. That is, one or more features from any embodiment can be combined with one or more features of any other embodiment without departing from the scope of the invention.

**[0151]** As noted previously, all measurements, dimensions, and materials provided herein within the specification or within the figures are by way of example only.

**[0152]** A recitation of "a," "an," or "the" is intended to mean "one or more" unless specifically indicated to the contrary.

**[0153]** 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 lens housing adapted to support a first lens and a second lens;

a first temple movably coupled to the lens housing;

a second temple movably coupled to the lens housing;

an electronics module disposed at least partially within the first temple; and

a first electrical conductor coupled to the first temple;

wherein a first conductive path is provided from the first temple to the lens housing at least in part by the first electrical conductor; and

wherein the first electrical conductor is configured to couple the electronics module to the first temple.

2. The first device of claim 1, wherein the first electrical conductor is configured to constrain the electronics module.

3. The first device of claim 1, wherein the first electrical conductor is integrally coupled to the first temple.

4. The first device of claim 3, wherein the first electrical conductor is insert molded with the first temple.

5. The first device of claim 1, wherein the first electrical conductor comprises a lug.

6. The first device of claim 1, further comprising:

a second electrical conductor coupled to the first temple;

wherein a second conductive path is provided from the first temple to the lens housing at least in part by the second electrical conductor; and

wherein the second electrical conductor is configured to constrain the electronics module.

7. The first device of claim 1, wherein the electronics module comprises any two of: a power source, a controller, and a sensor.

8. The first device of claim 7, wherein the sensor comprises a touch switch.

9. The first device of claim 1, wherein the first electrical conductor is electrically coupled to a slip ring.

10. The first device of claim 9, further comprising a hinge, wherein the slip ring is disposed substantially within the hinge.

11. The first device of claim 1, wherein the electronics module is configured to be removably coupled to the first temple.

12. The first device of claim 1, wherein the electronics module comprises an opening;

wherein the first electrical conductor has a first portion that extends a first distance of at least approximately 1 cm into the electronic module through the opening, and

wherein the first electrical conductor has a second portion that extends a second distance of at least approximately 1 cm outside of the electronics module away from the opening.

13. The first device of claim 12,

wherein the first distance that the first portion of the first electrical conductor extends into the electronics module is at least approximately 2 cm, and

wherein the second distance that the second portion of the first electrical conductor extends away from the opening is at least approximately 2 cm.

14. The first device of claim 1, wherein the first electrical conductor comprises a single structural element.

15. The first device of claim 1, wherein the first electrical conductor is configured to maintain the first conductive path as the first temple is moved relative to the lens housing.

16. The first device of claim 1, further comprising a first lens and a second lens coupled to the lens housing;

wherein the first lens has a first electrical contact; and

wherein the first conductive path is electrically coupled to the first electrical contact.

17. A first method, comprising:

providing a capacitive touch switch;

disposing a plurality of electronic components on the capacitive switch; and

coupling the capacitive touch switch to a partial enclosure.

18. The first method of claim 17, further comprising the step of electrically coupling one or more of the plurality of electronic components to the capacitive touch switch.

19. The first method of claim 18, wherein the step of electrically coupling one or more of the plurality of electronic components to the capacitive touch switch comprises reflow soldering.

20. The first method of claim 17, further comprising the step of electrically coupling one of the plurality of electronic components to another of the plurality of electronic components.

21. The first method of claim 17, further comprising the step of disposing the enclosure substantially within a temple of an eyeglass frame.

22. The first method of claim 21, wherein the eye glass frame comprises electro-active eyeglass frames.

23. The first method of claim 21,

wherein the eyeglass frame comprises a first conductive path; and

wherein the first method further comprises the step of electrically coupling at least one of the electronic components to the first conductive path.

24. The first method of claim 23, wherein the first conductive path is electrically coupled to an electro-active lens.

25. The first method of claim 23, wherein the first conductive path comprises anyone of, or some combination of: a slip ring and a pogo pin.

26. The first method of claim 25, wherein the first conductive path further comprises a lug coupled to the slip ring.

27. The first method of claim 26, wherein the lug is integrally coupled to the temple.

28. The first method of claim 26, wherein the lug is disposed on the capacitive touch switch.

29. The first method of claim 17, wherein the enclosure comprises a temple of an eyeglass frame.

30. The first method of claim 17, wherein the enclosure comprises an electronics module.

31. The first method of claim 17, further comprising the step of applying a conformal coating to the plurality of electronic components.

32. The first method of claim 31, wherein the conformal coating comprises anyone of, or some combination of: an acrylic, urethane, silicone, or epoxy.

33. The first method of claim 31, further comprising the step of masking a portion of the electronic components such that an electrical contact is exposed through the conformal coating.

34. The first method of claim 31, further comprising the step of removing a portion of the conformal coating to expose an electrical contact of one or more of the plurality of electronic components.

35. The first method of claim 17, wherein the plurality of electronic components comprises any one of, or some combination of: a flexible circuit, a printed circuit board, and one or more electrical connectors.

36. The first method of claim 17, wherein the plurality of electronic components comprises a power source.

37. The first method of claim 17, wherein the capacitive touch switch and the enclosure are configured to be pressure fitted.

38. The first method of claim 17, wherein the capacitive touch switch is coupled to the enclosure using any one of, or some combination of: a fastener or an adhesive.

39. The first method of claim 17, wherein the capacitive touch switch comprises a stiff material.

40. The first method of claim 17, wherein the capacitive touch switch comprises a liquid crystal polymer or other plastic engineered for ablation and plating.

## ABSTRACT OF THE DISCLOSURE

In some embodiments, a first device may be provided. The first device may comprise a lens housing adapted to support a first lens and a second lens, a first temple movably coupled to the lens housing, a second temple movably coupled to the lens housing, an electronics module disposed at least partially within the first temple, and a first electrical conductor coupled to the first temple. A first conductive path may be provided from the first temple to the lens housing at least in part by the first electrical conductor. The first electrical conductor may be configured to couple the electronics module to the first temple.

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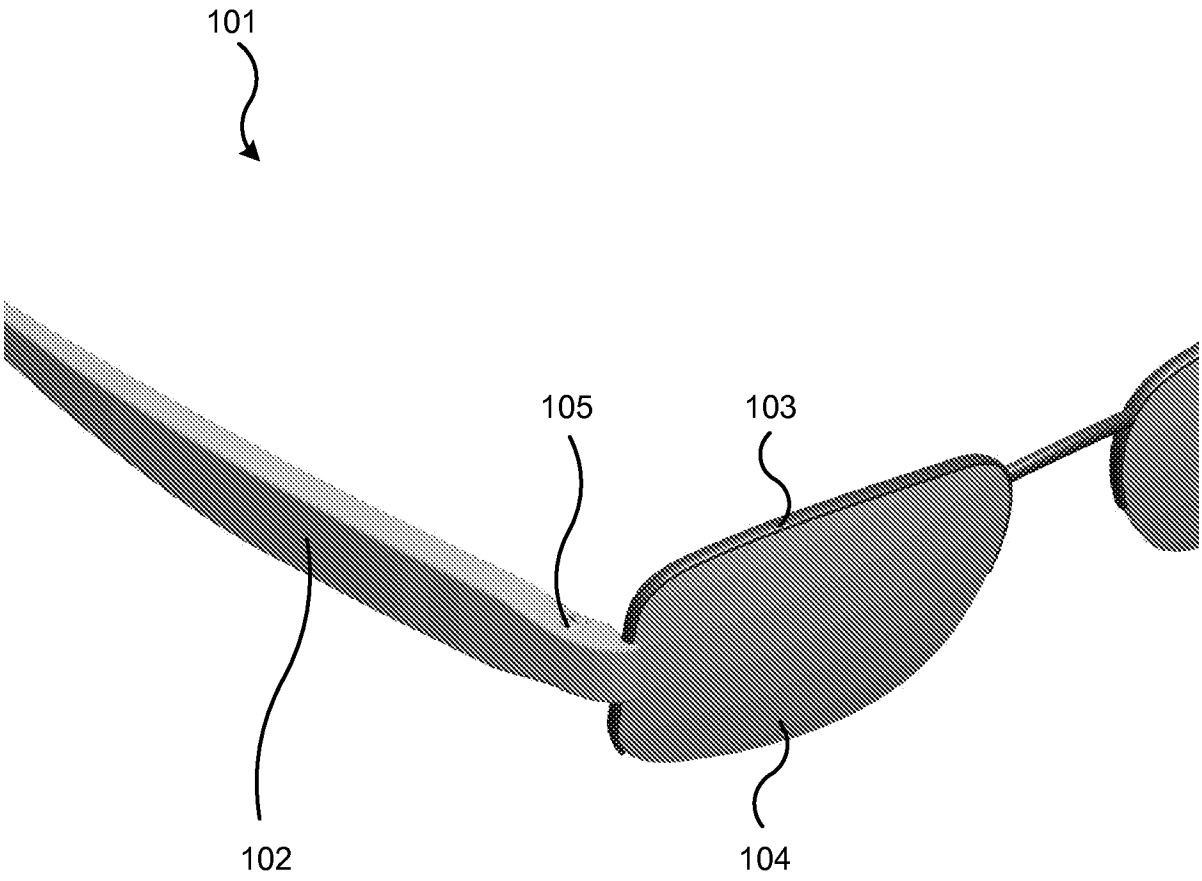


*FIG. 1*

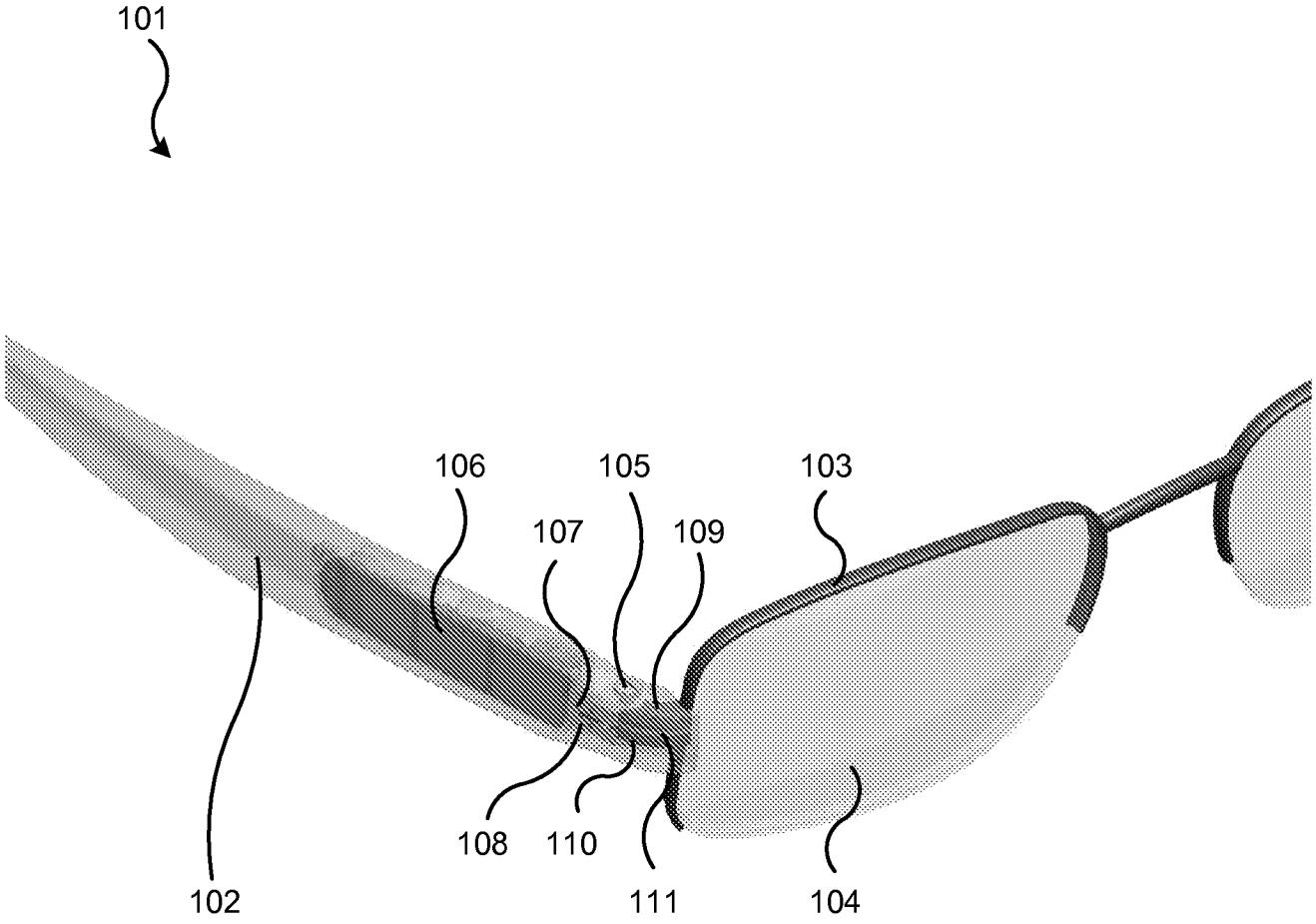


*FIG. 2*

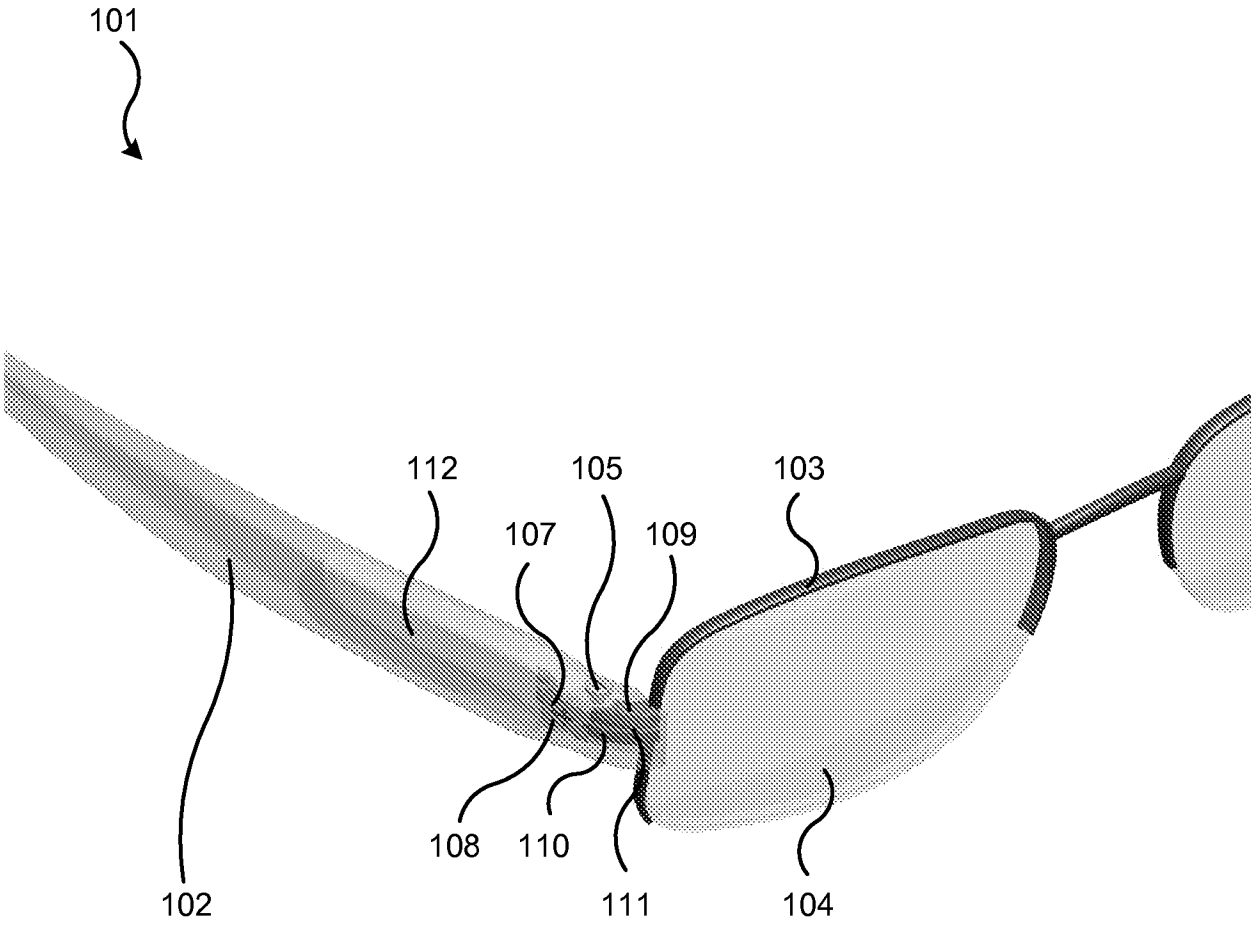


*FIG. 3*

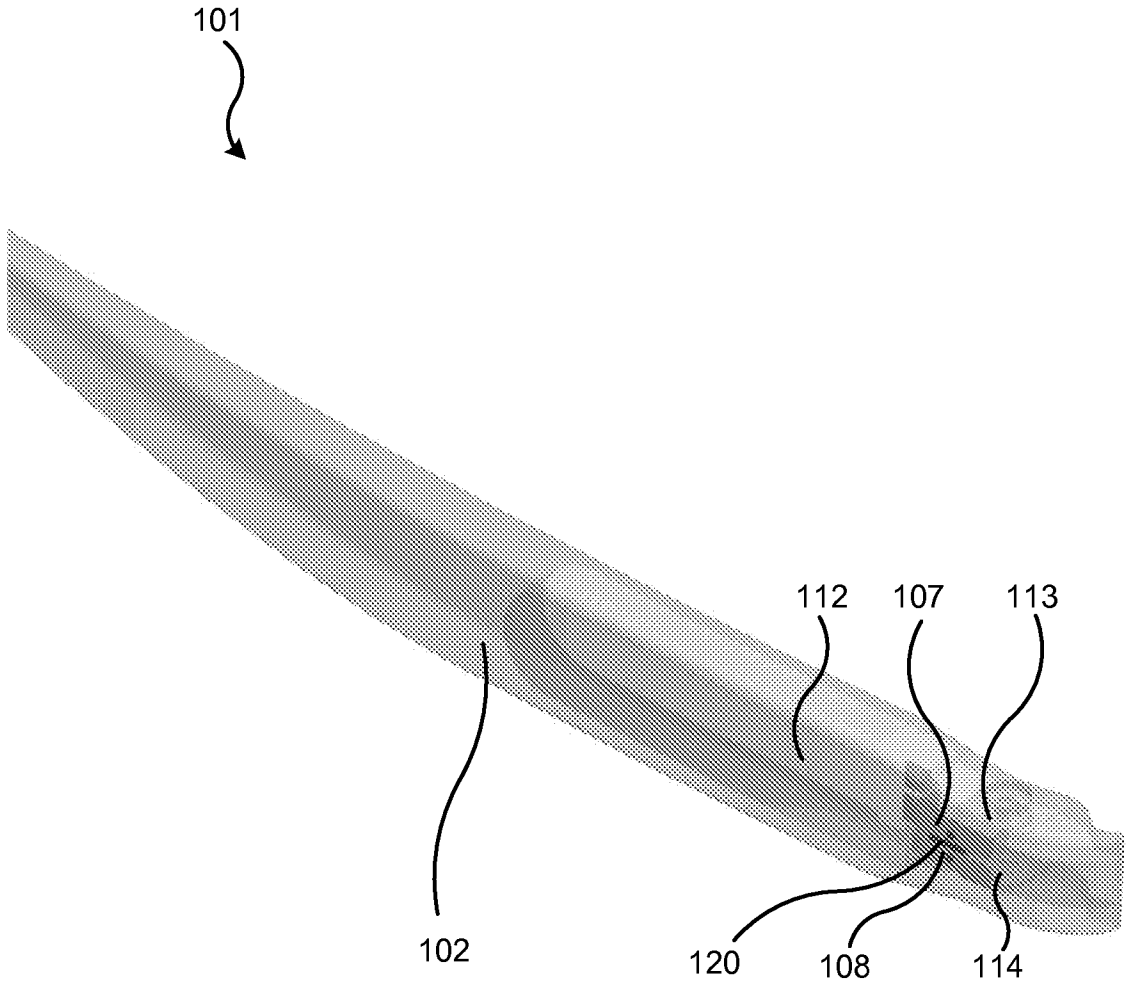


*FIG. 4*

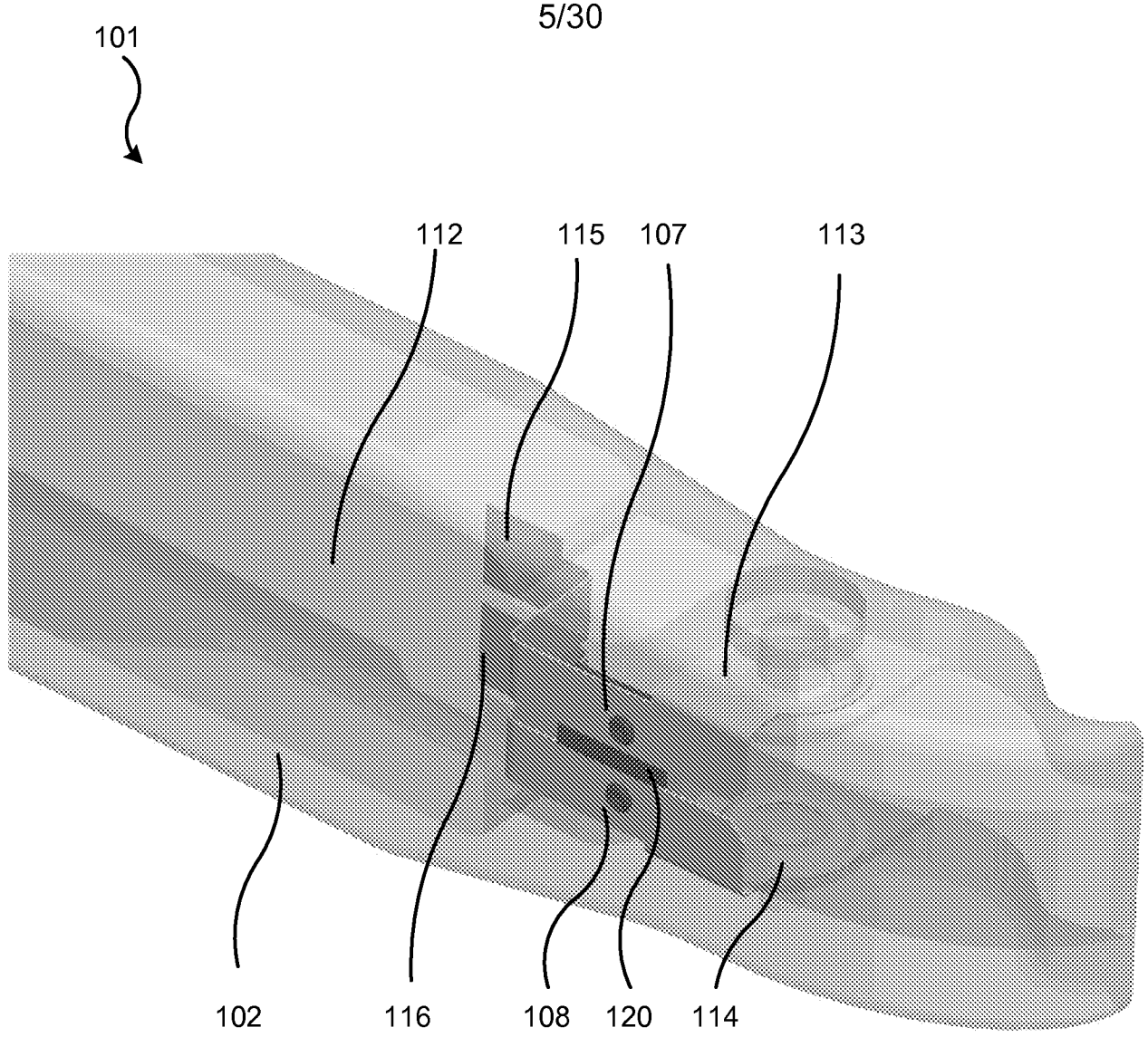


*FIG. 5*

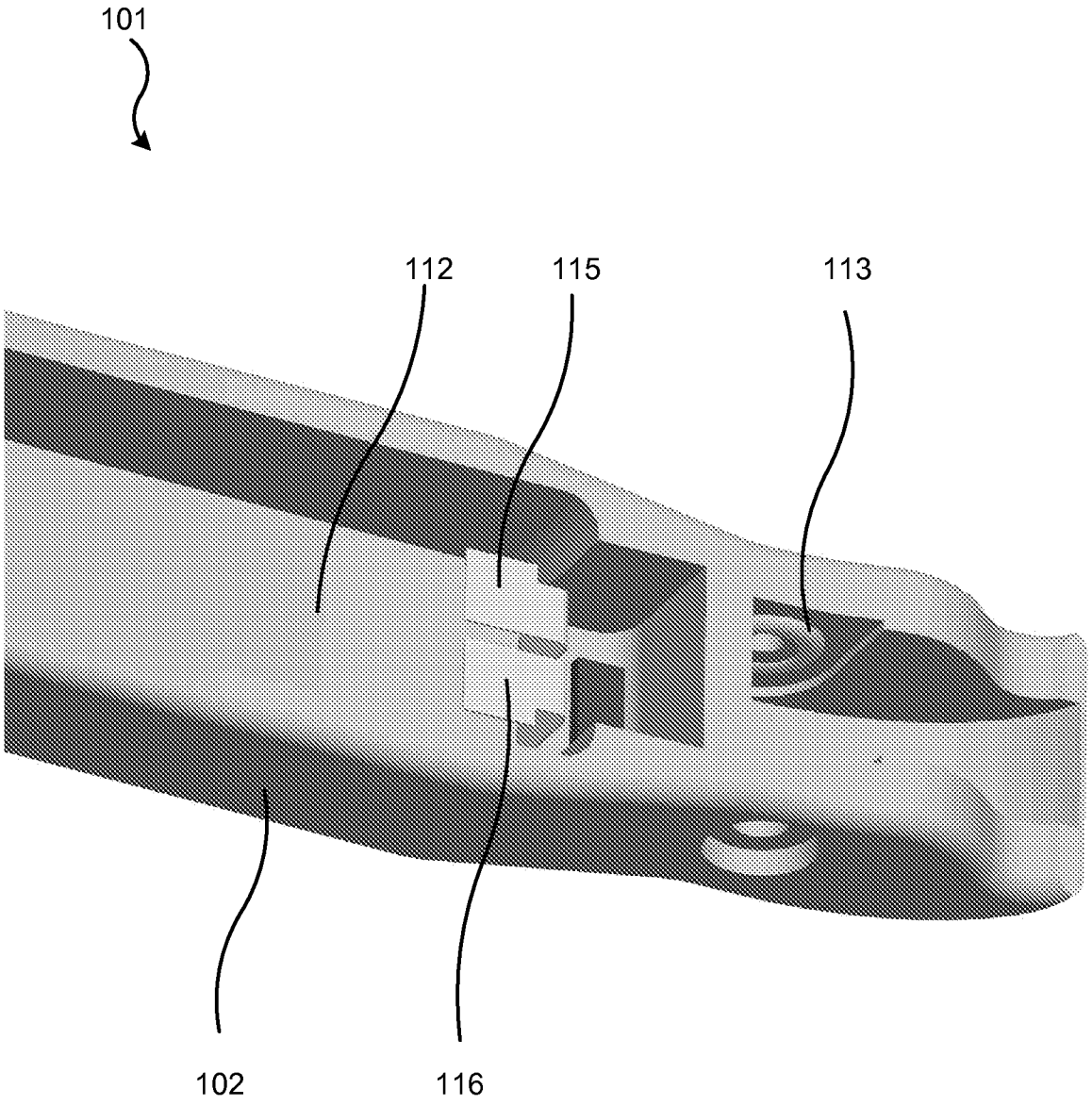


***FIG. 6***

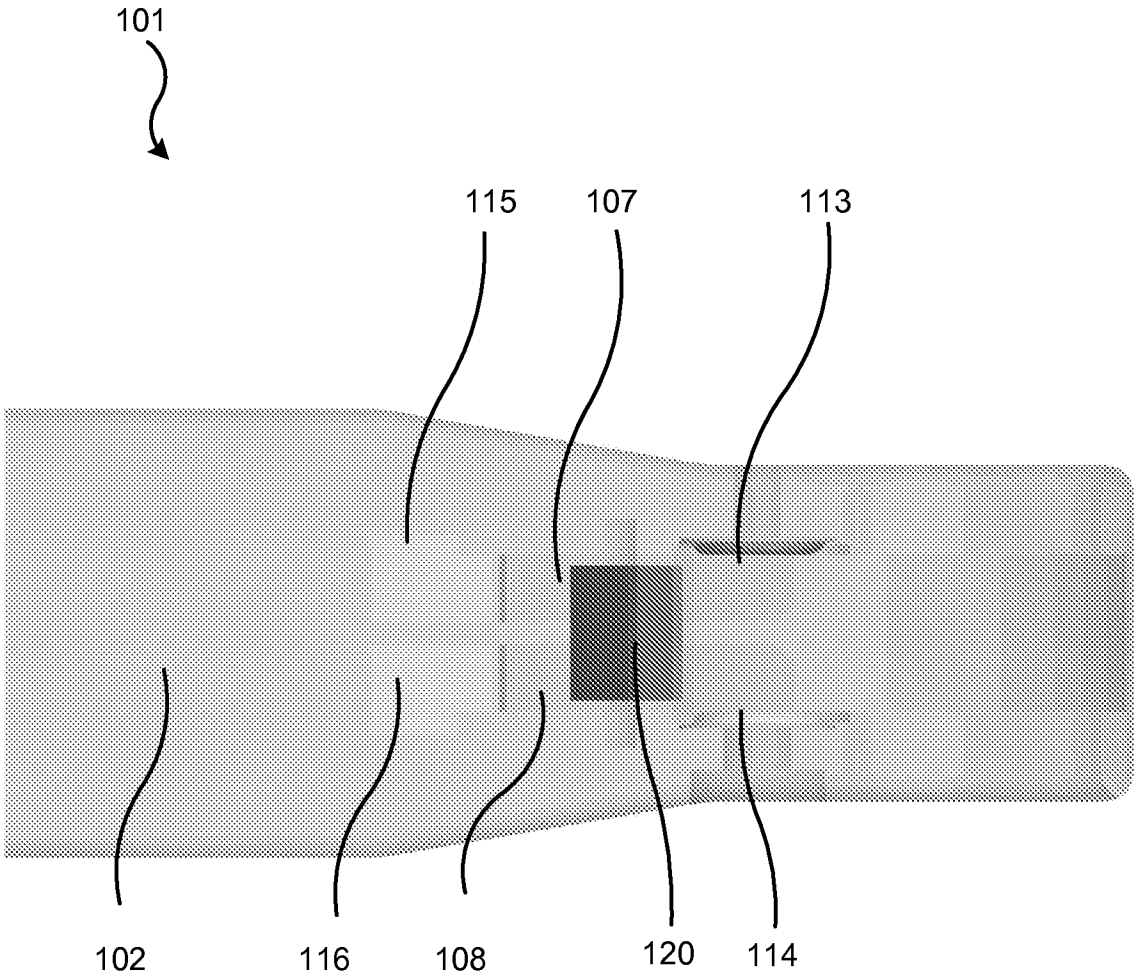


*FIG. 7*

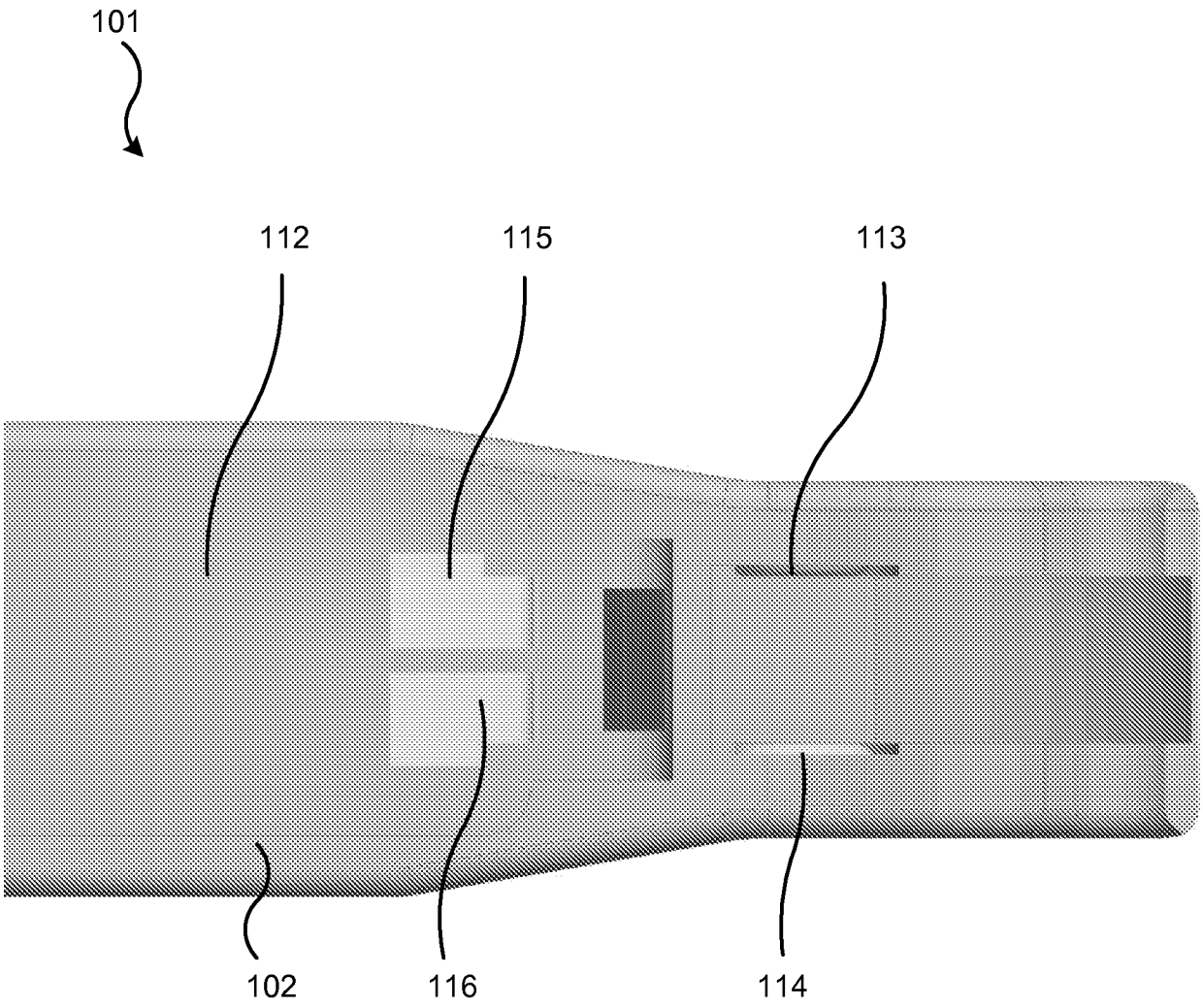


*FIG. 8*

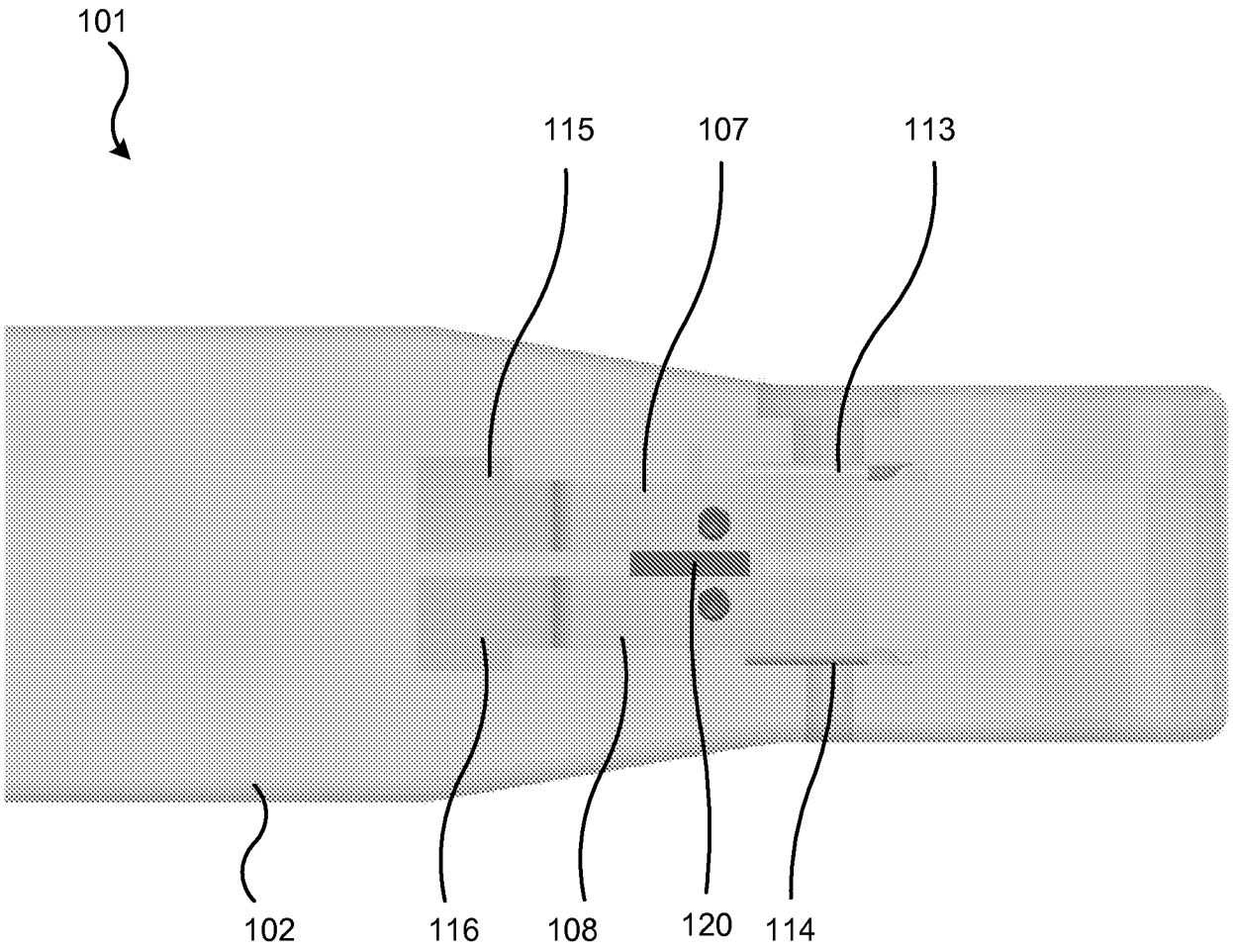


***FIG. 9***

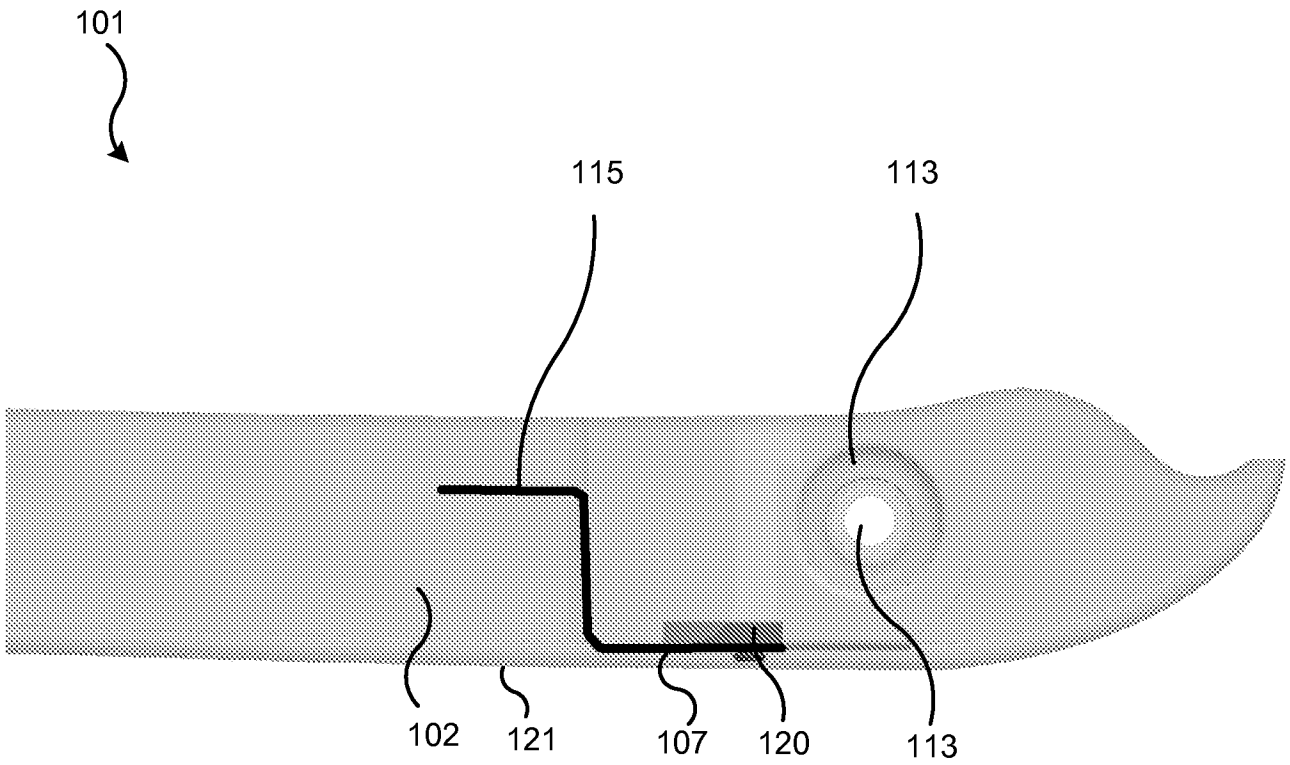


***FIG. 10***

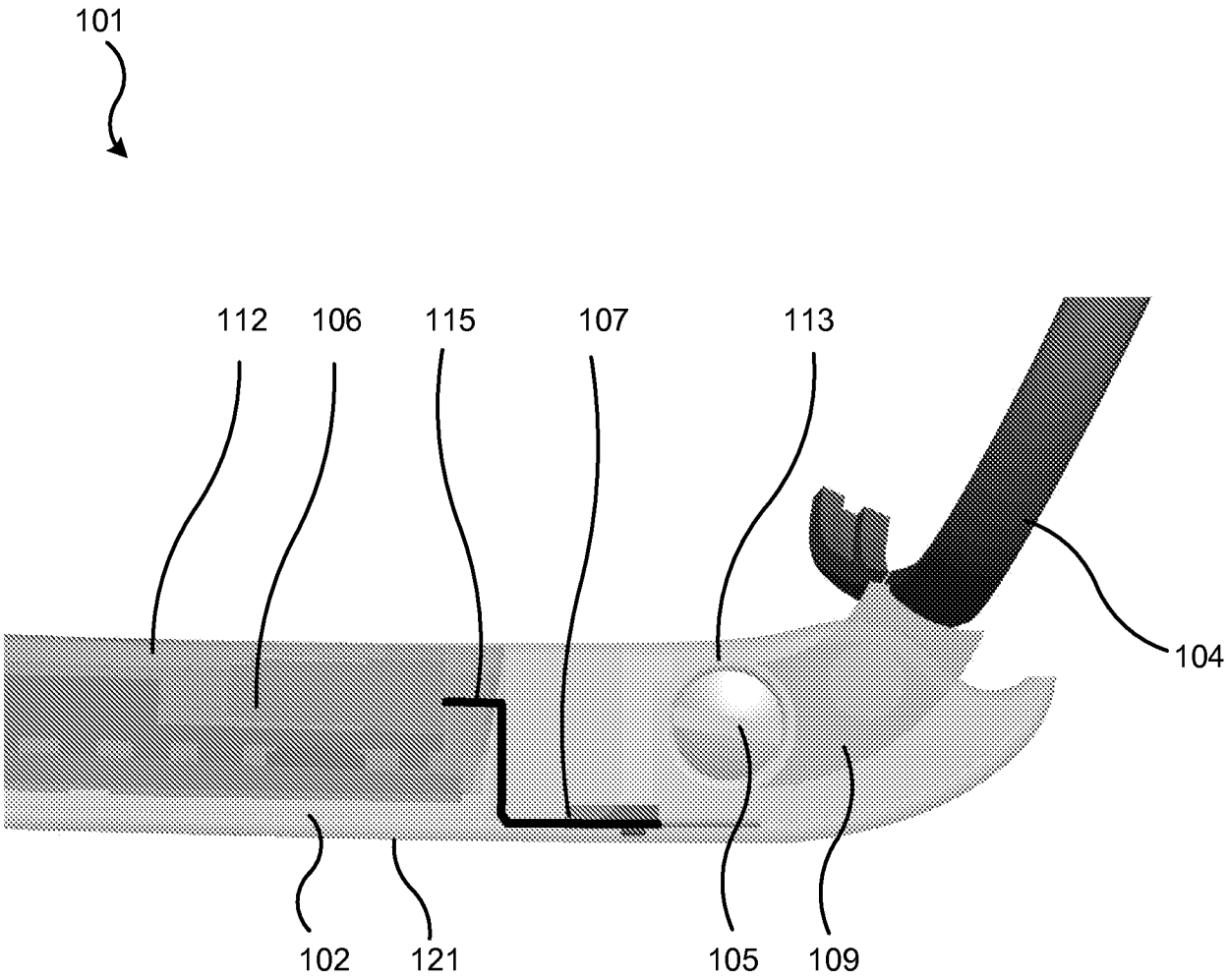


***FIG. 11***

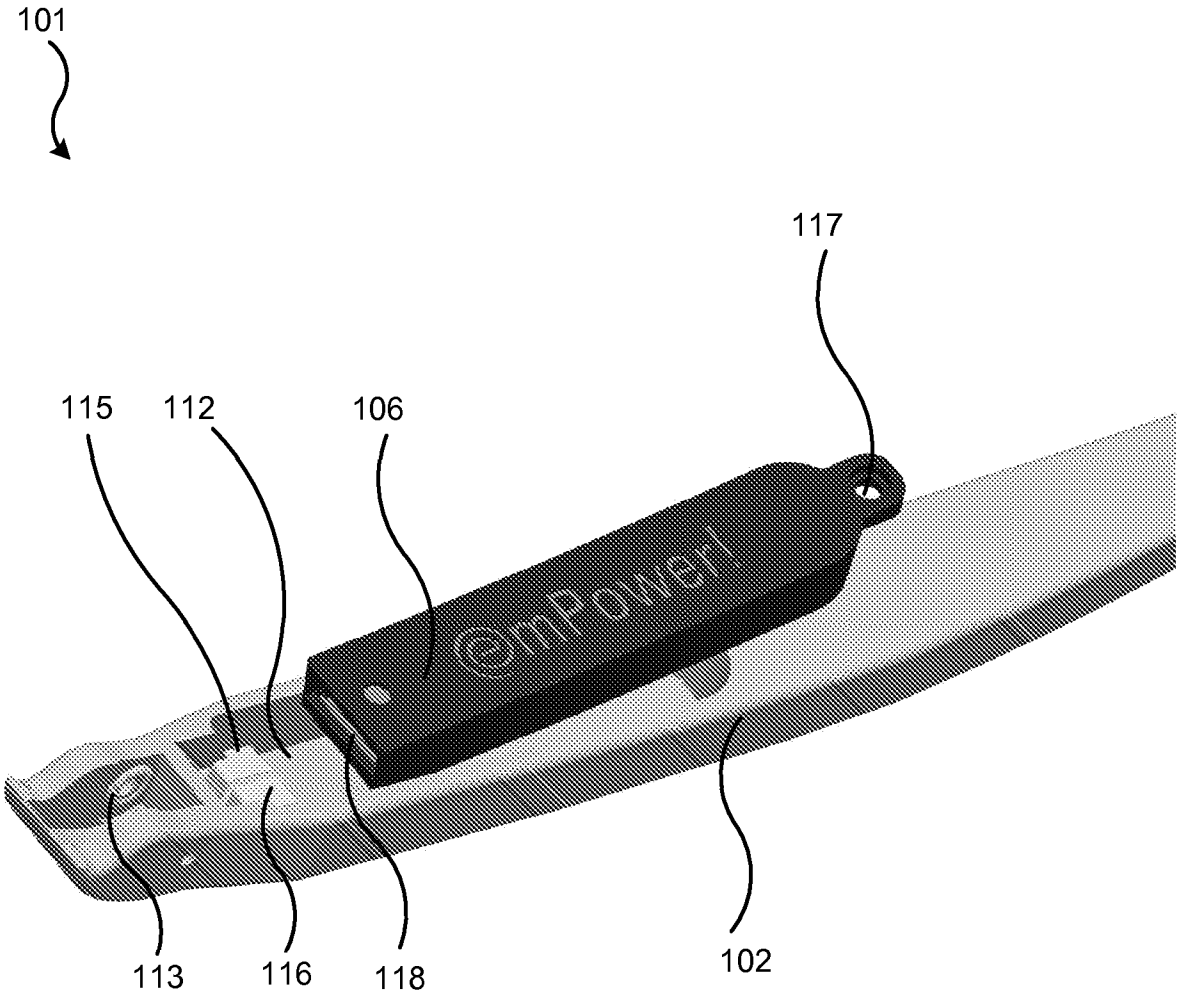


*FIG. 12*

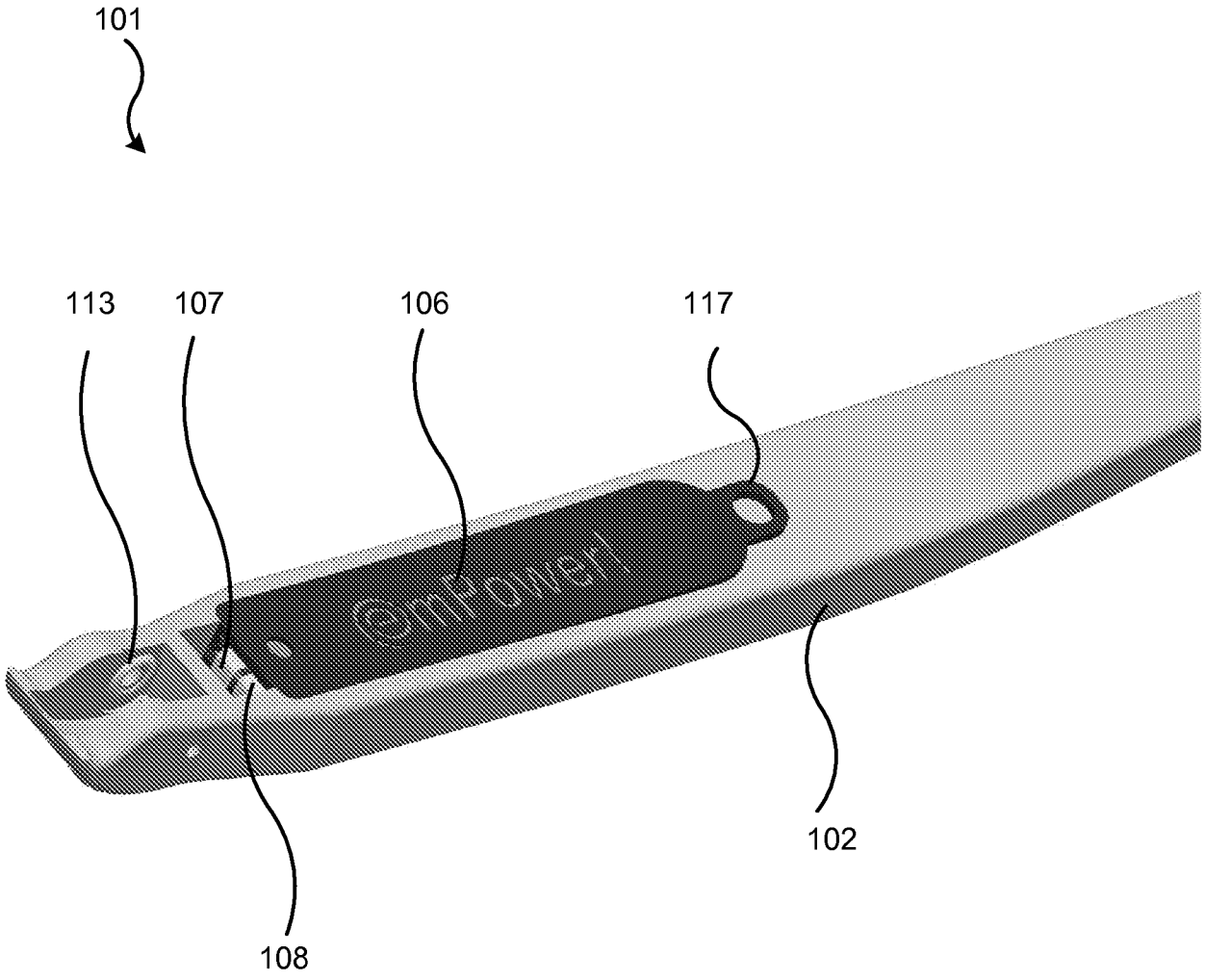


*FIG. 13*

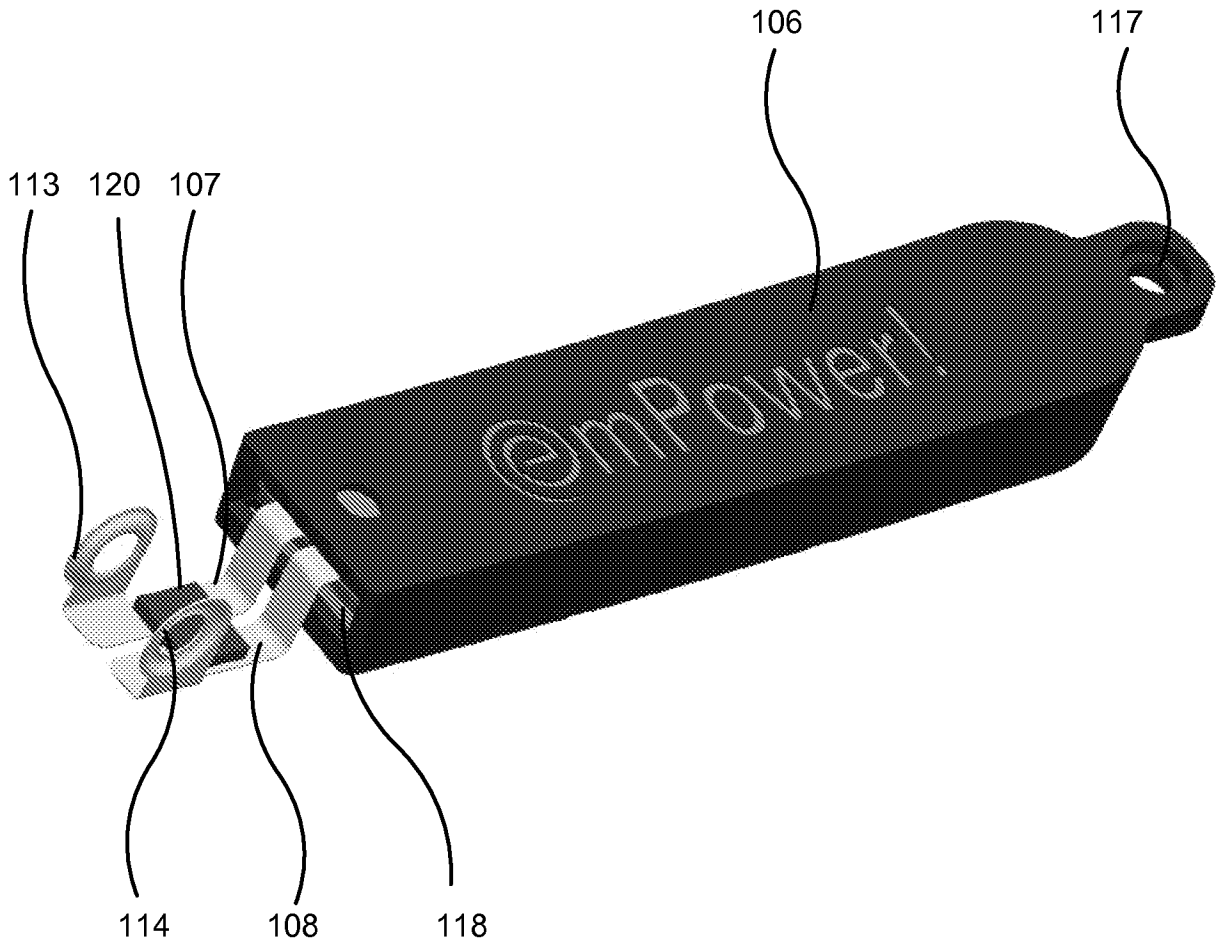


***FIG. 14***

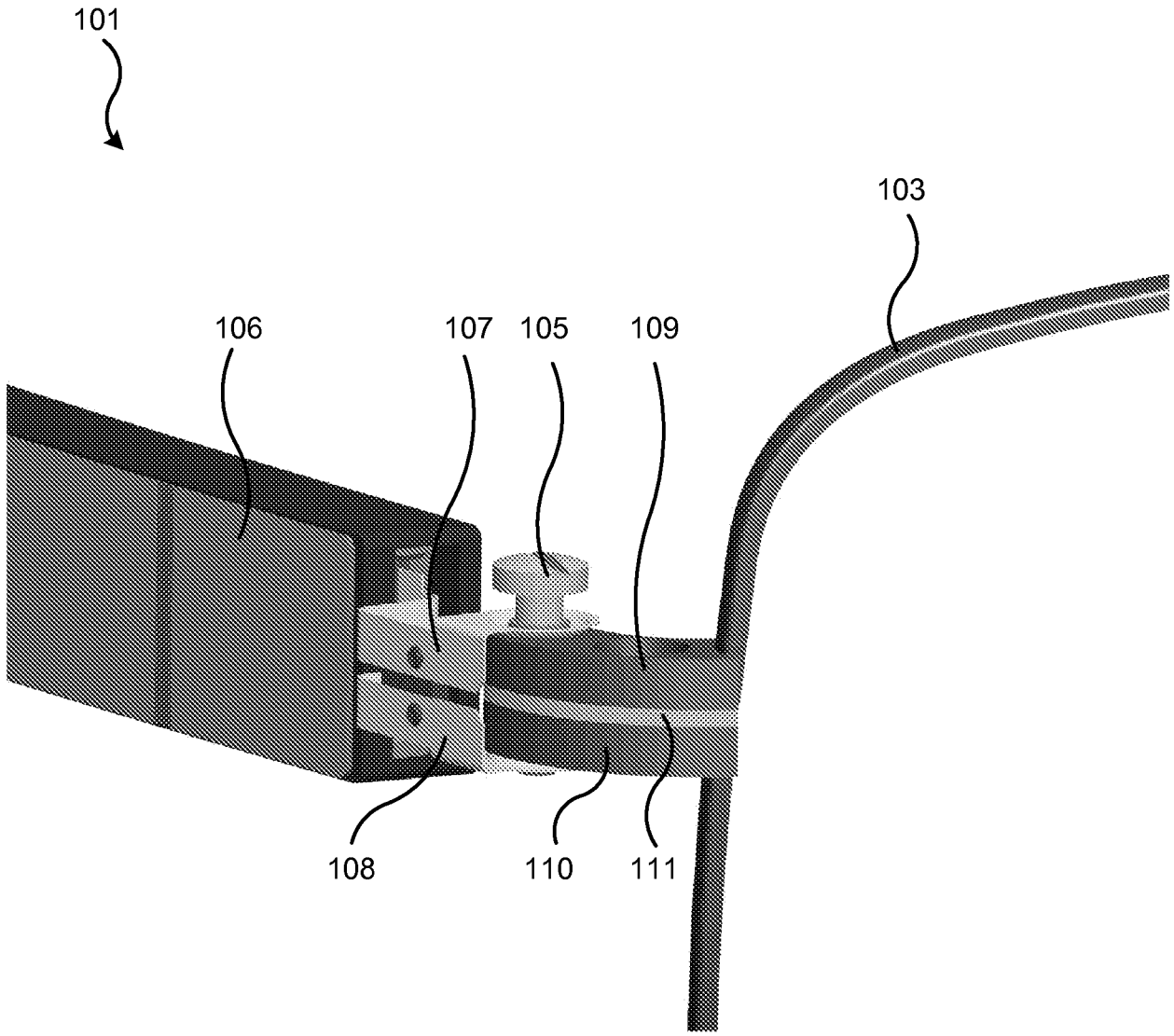


***FIG. 15***

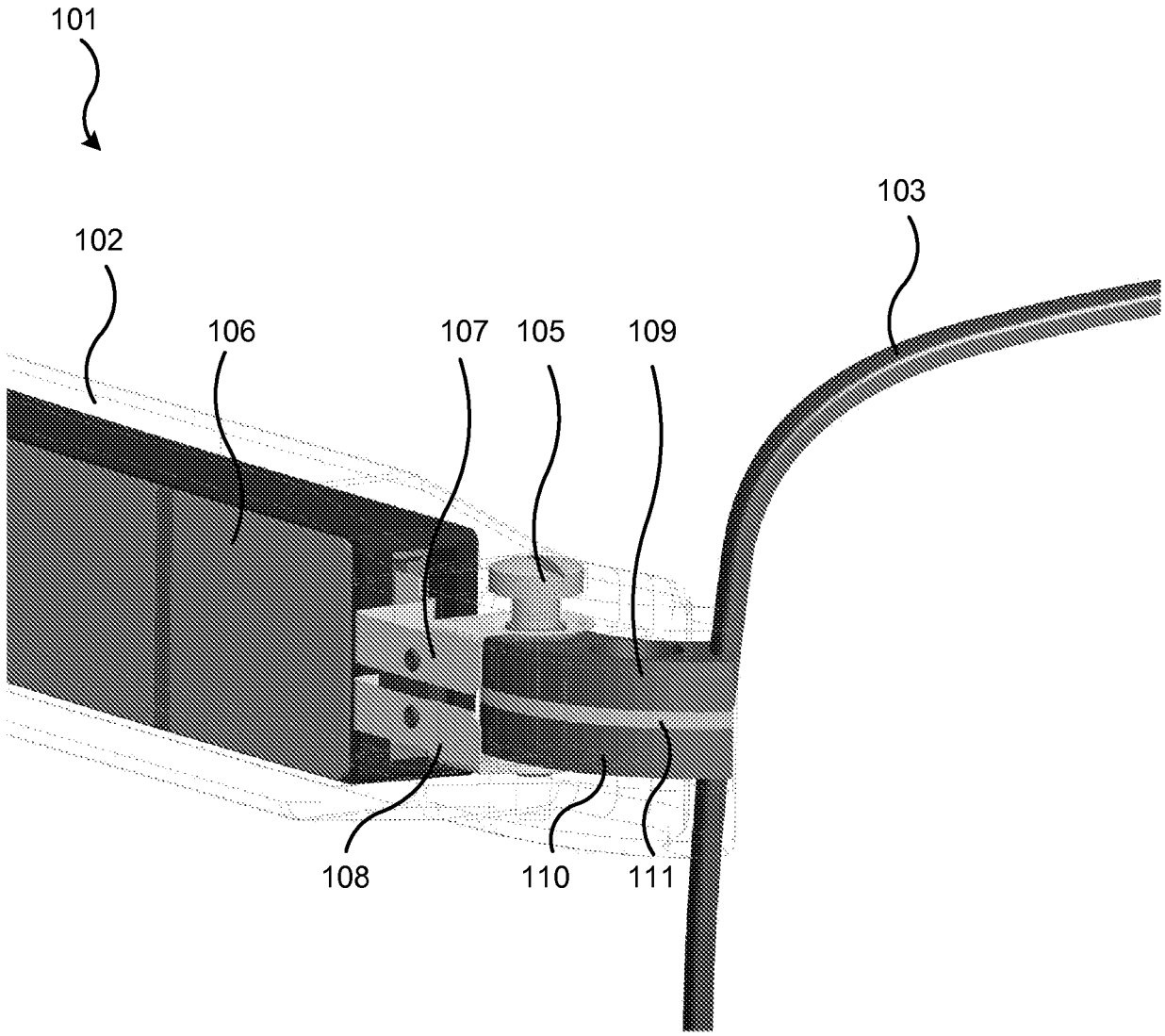


***FIG. 16***

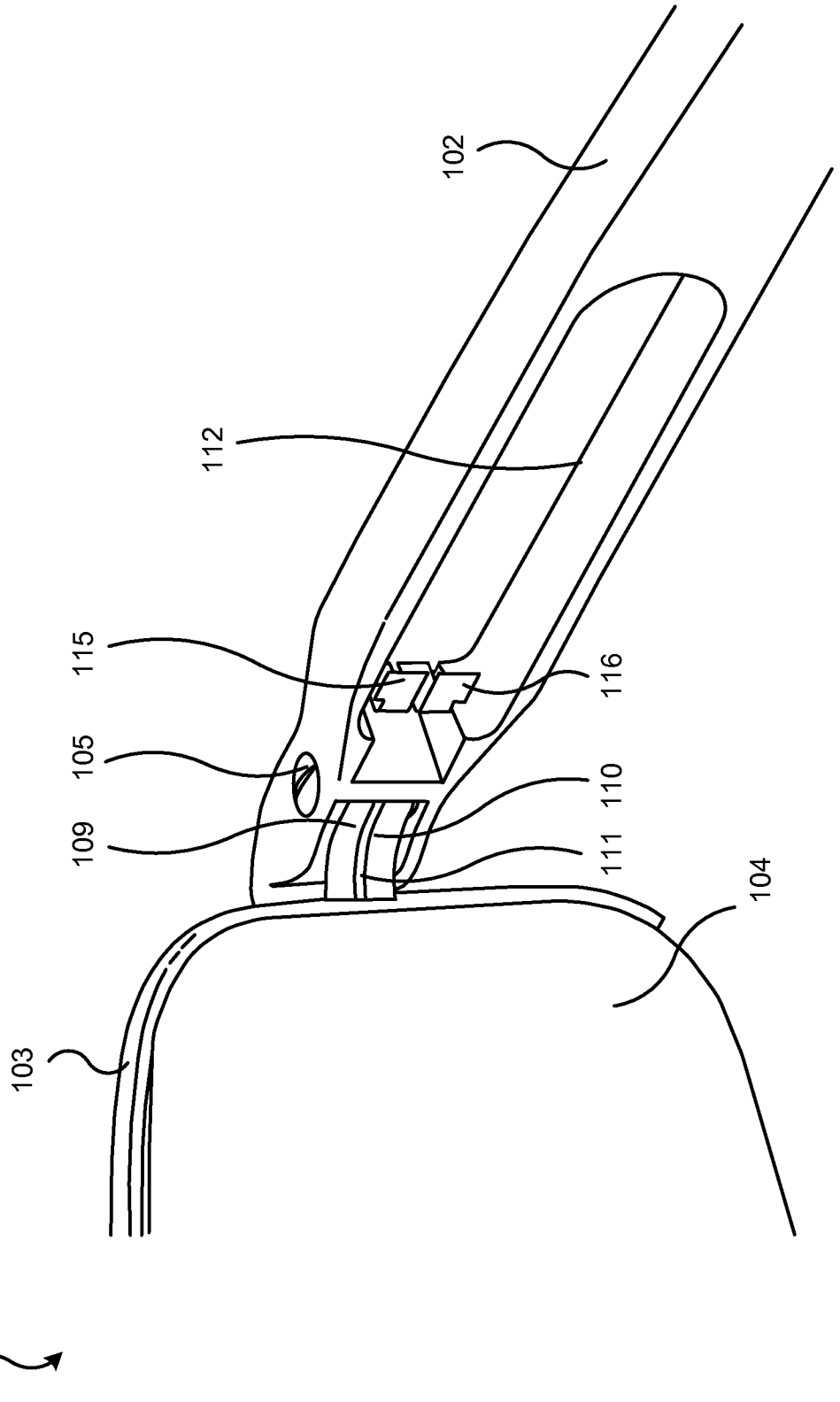


FIG. 17

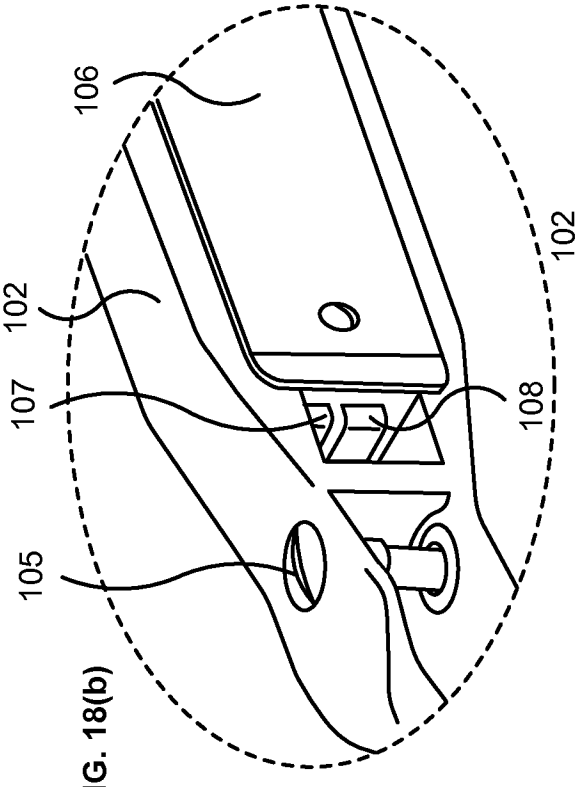


FIG. 18(b)

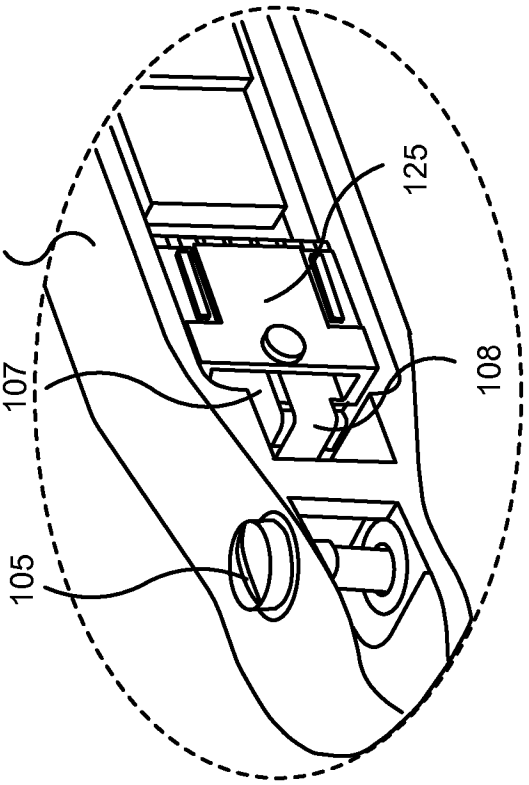


FIG. 18(c)

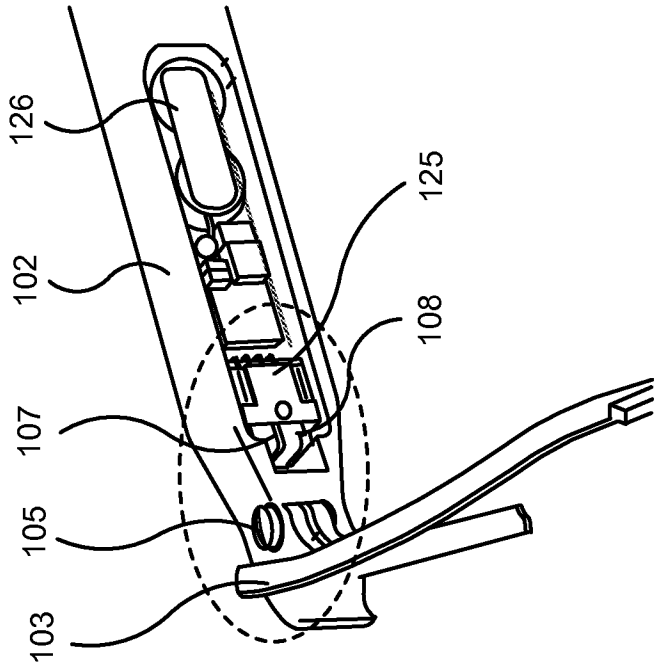


FIG. 18(a)

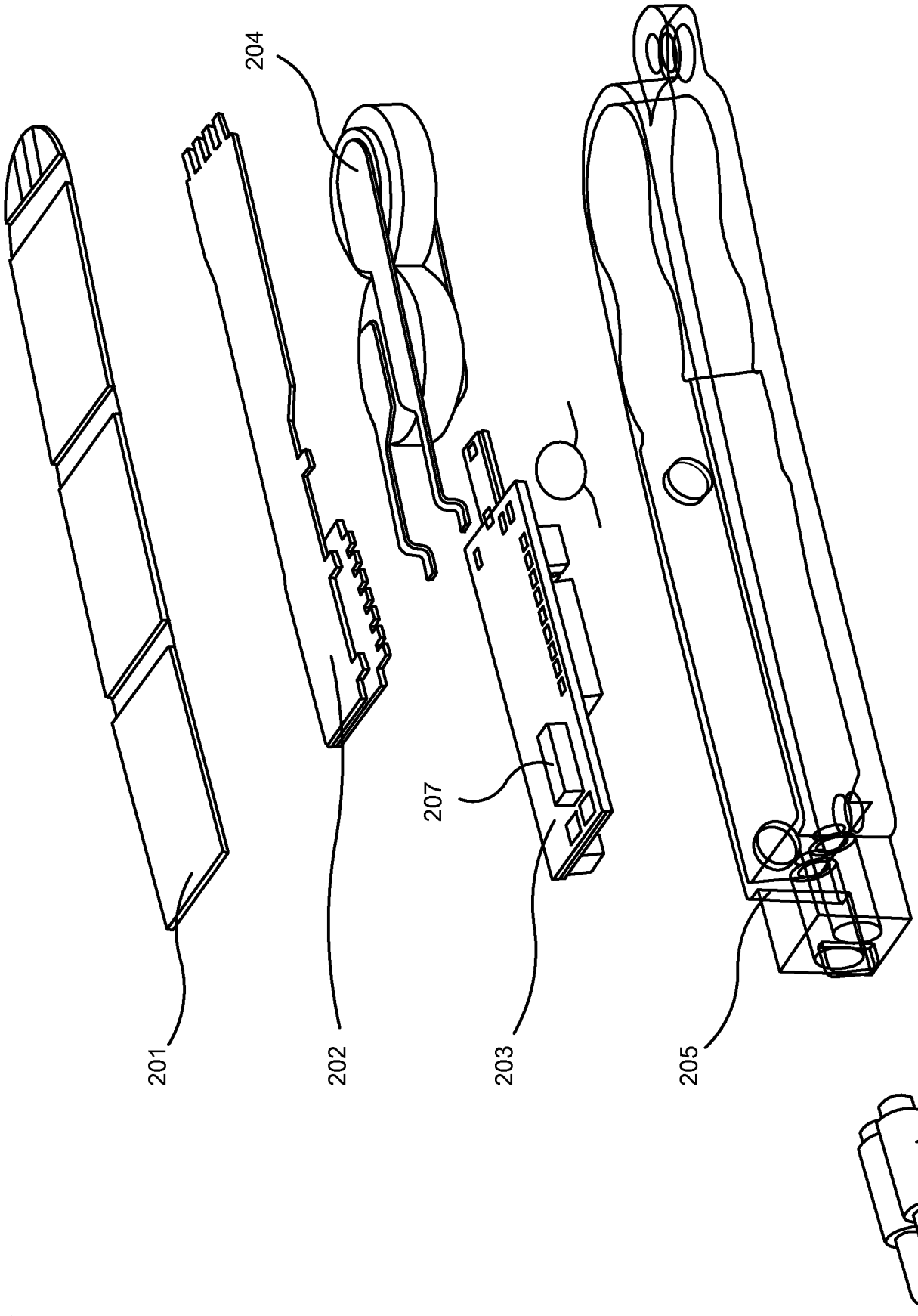


FIG. 19

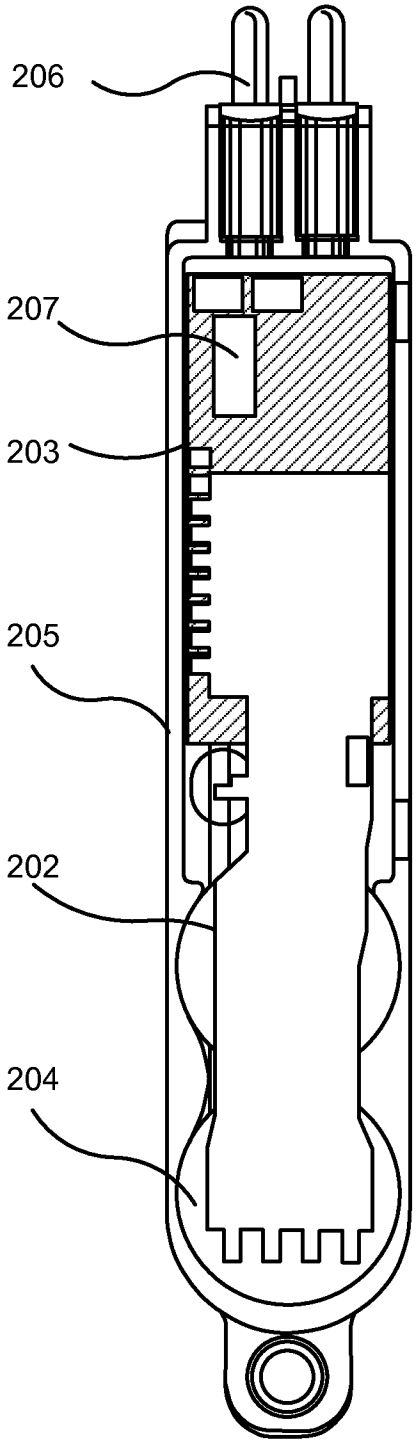


FIG. 20(a)

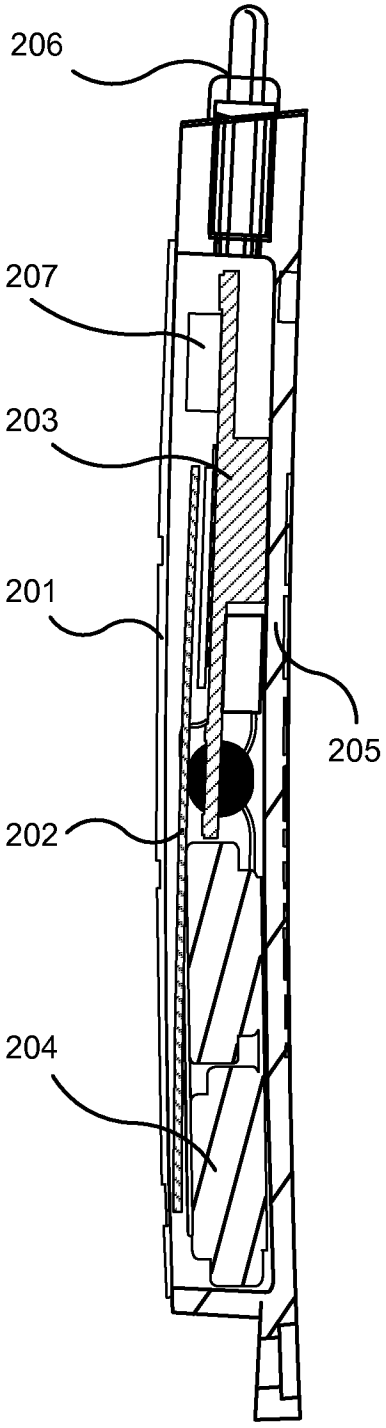


FIG. 20(b)

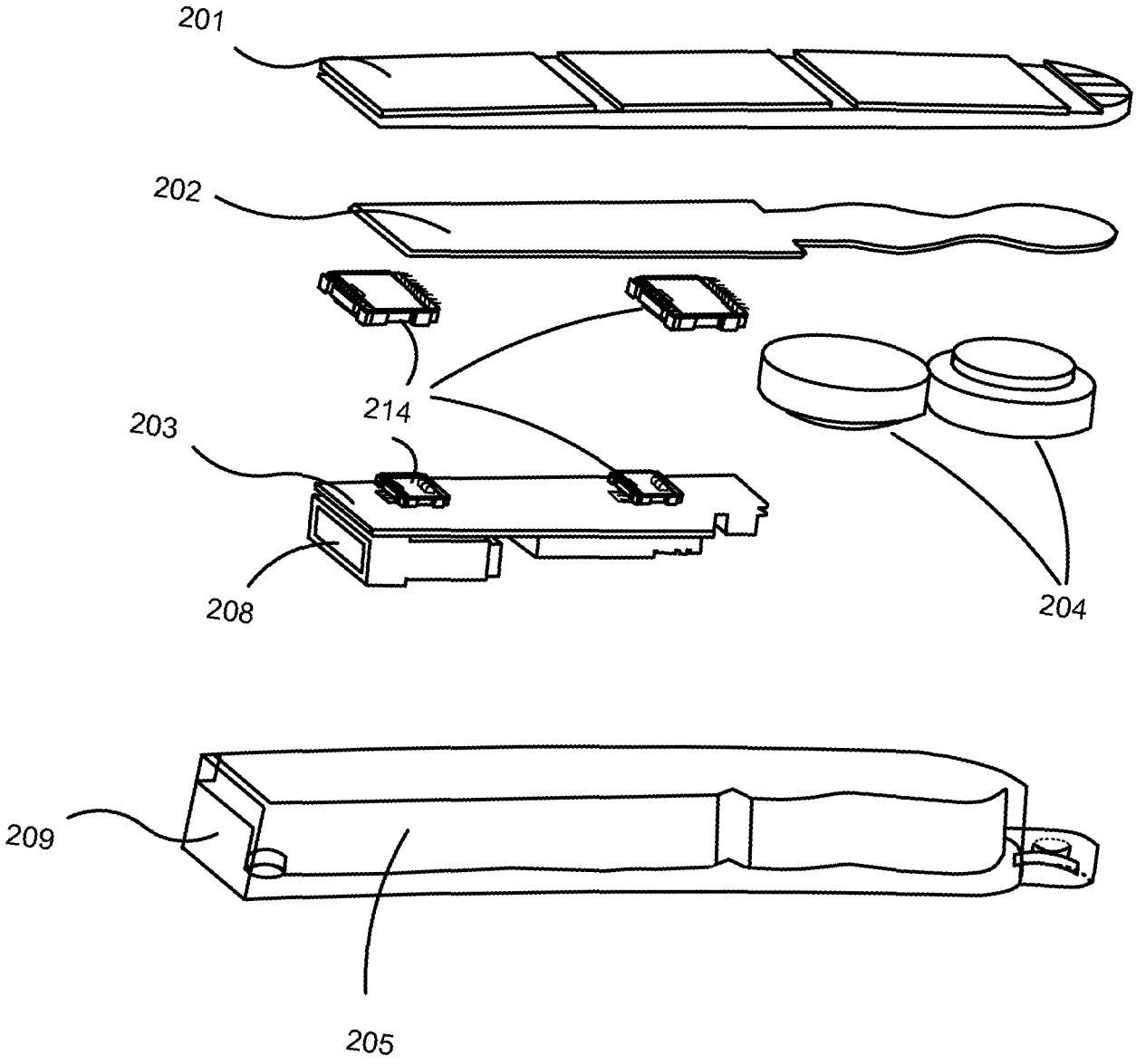


FIG. 21

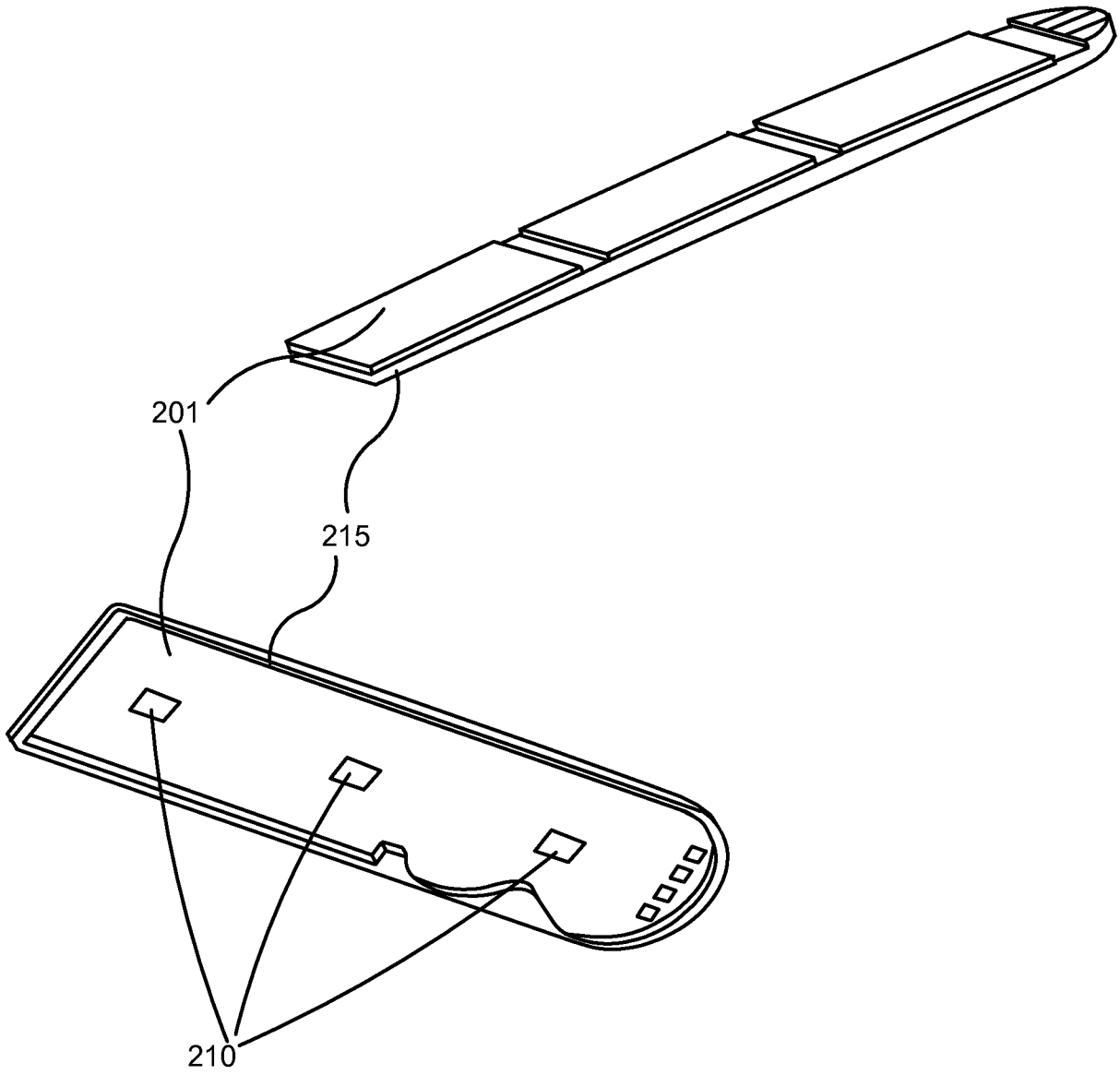


***FIG. 22***

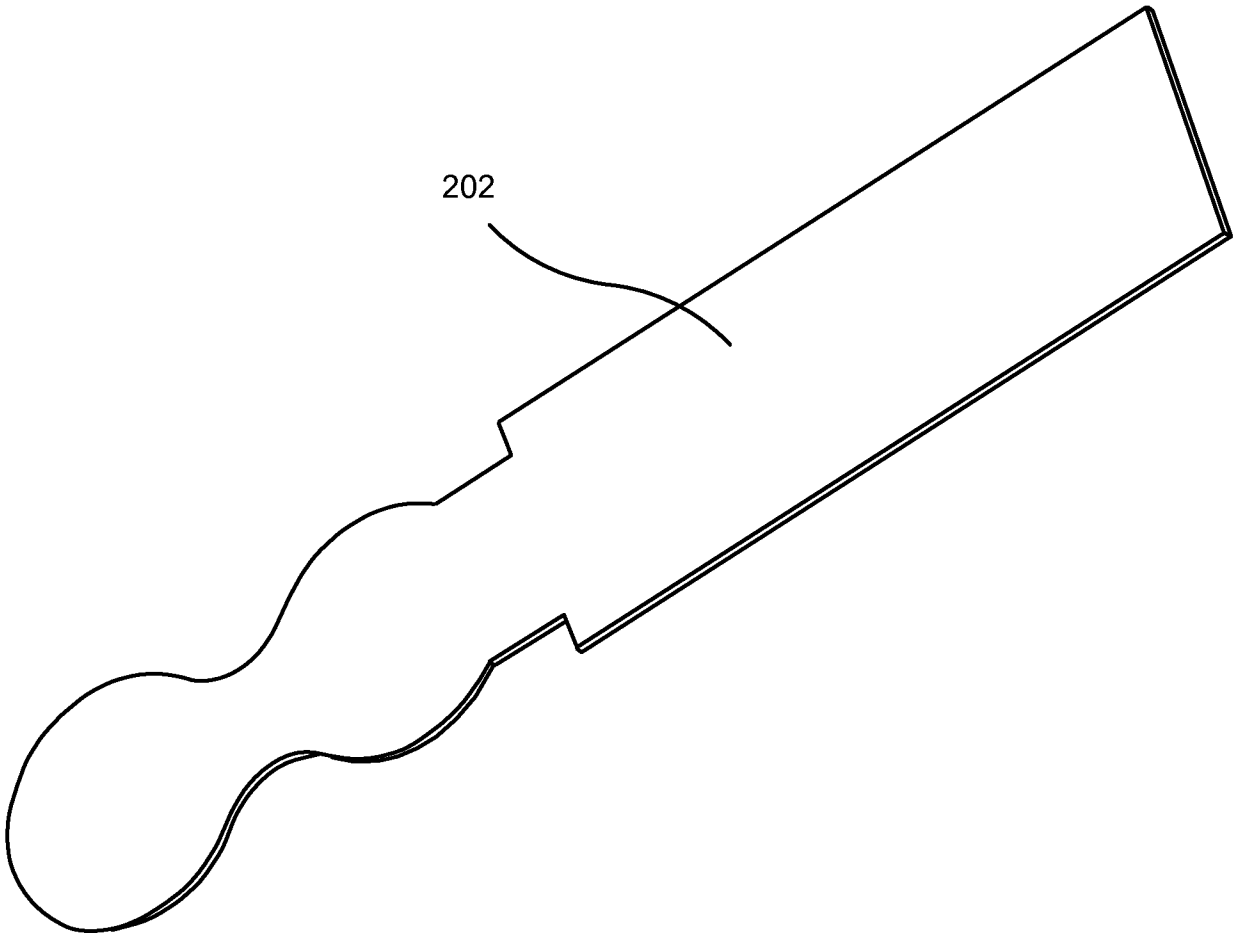


*FIG. 23*

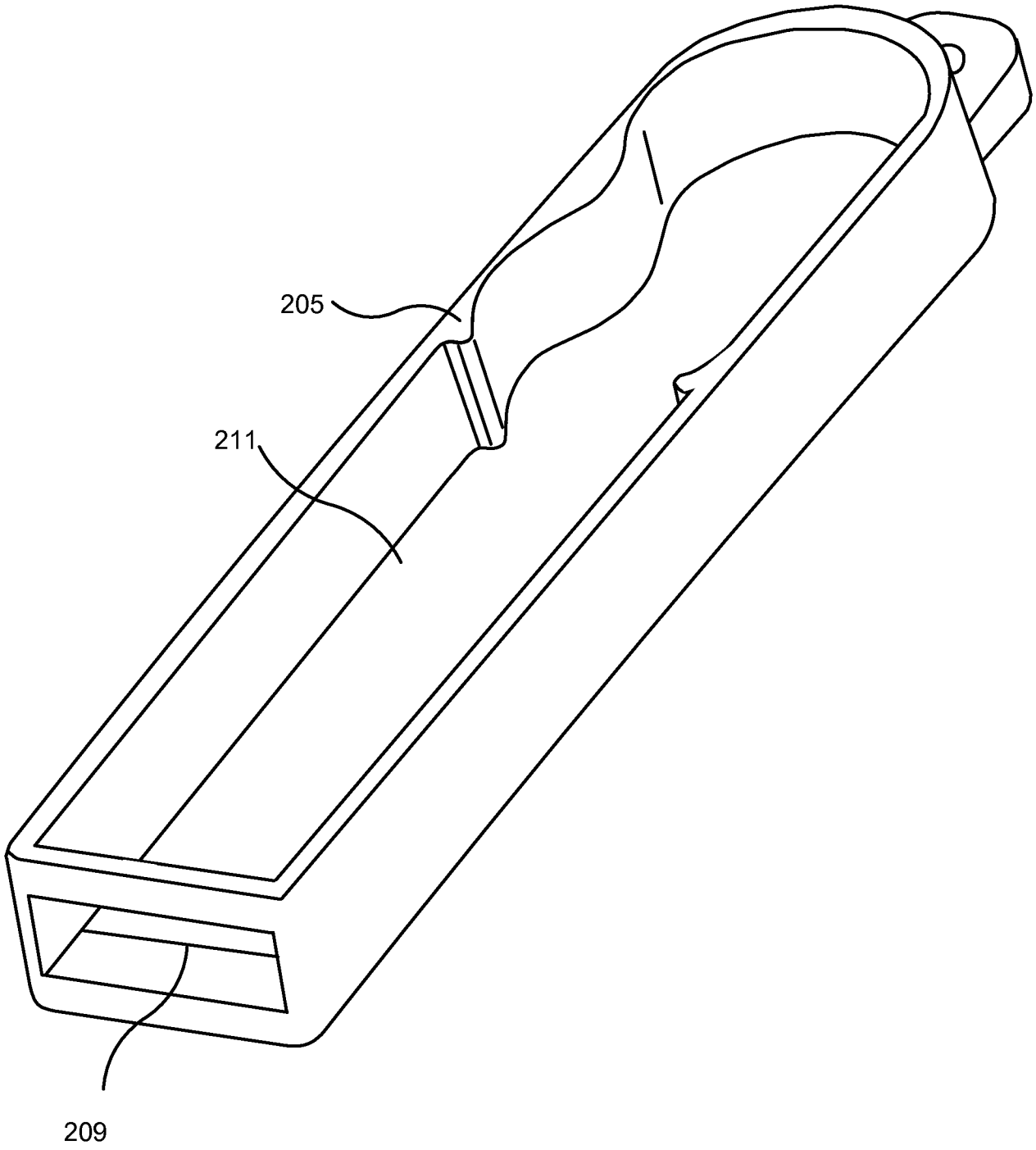


***FIG. 24***

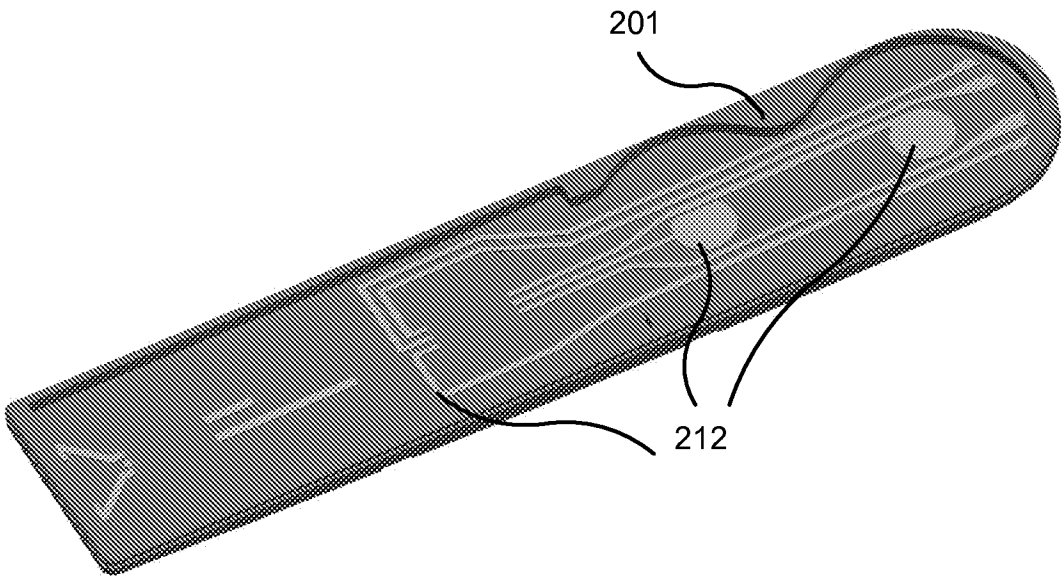


***FIG. 25***

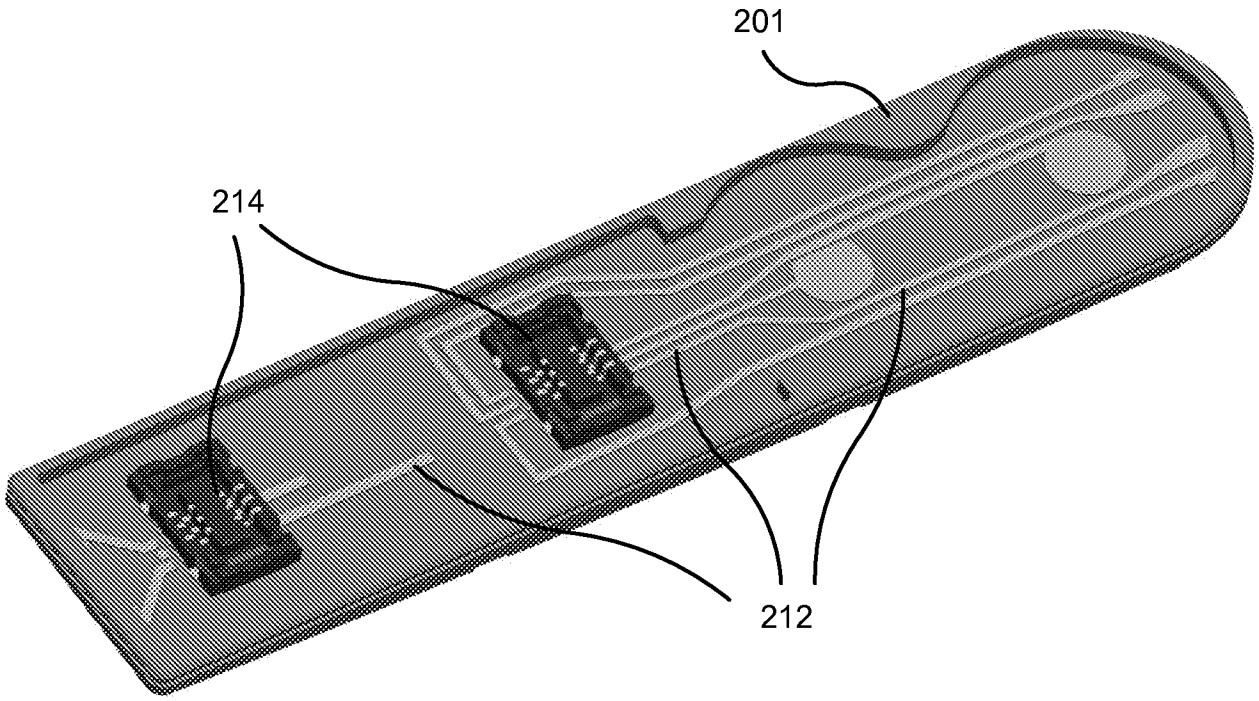


***FIG. 26***

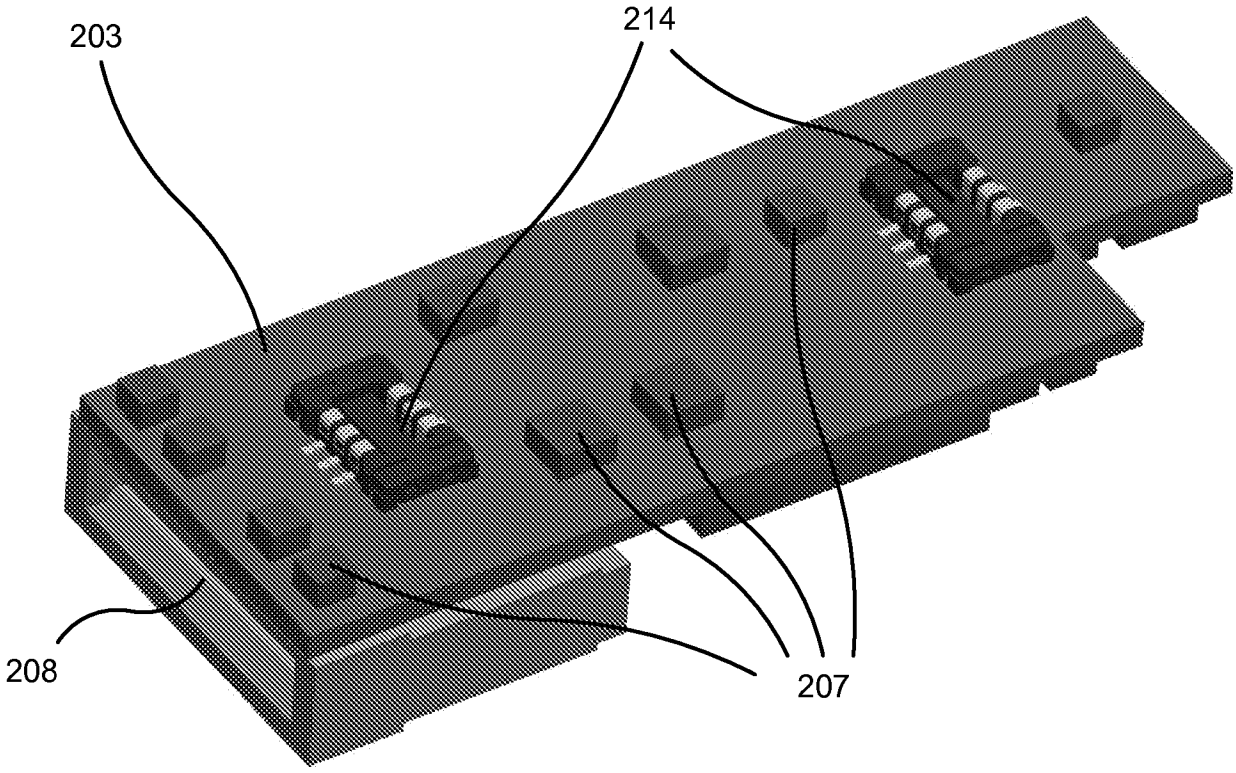


***FIG. 27***

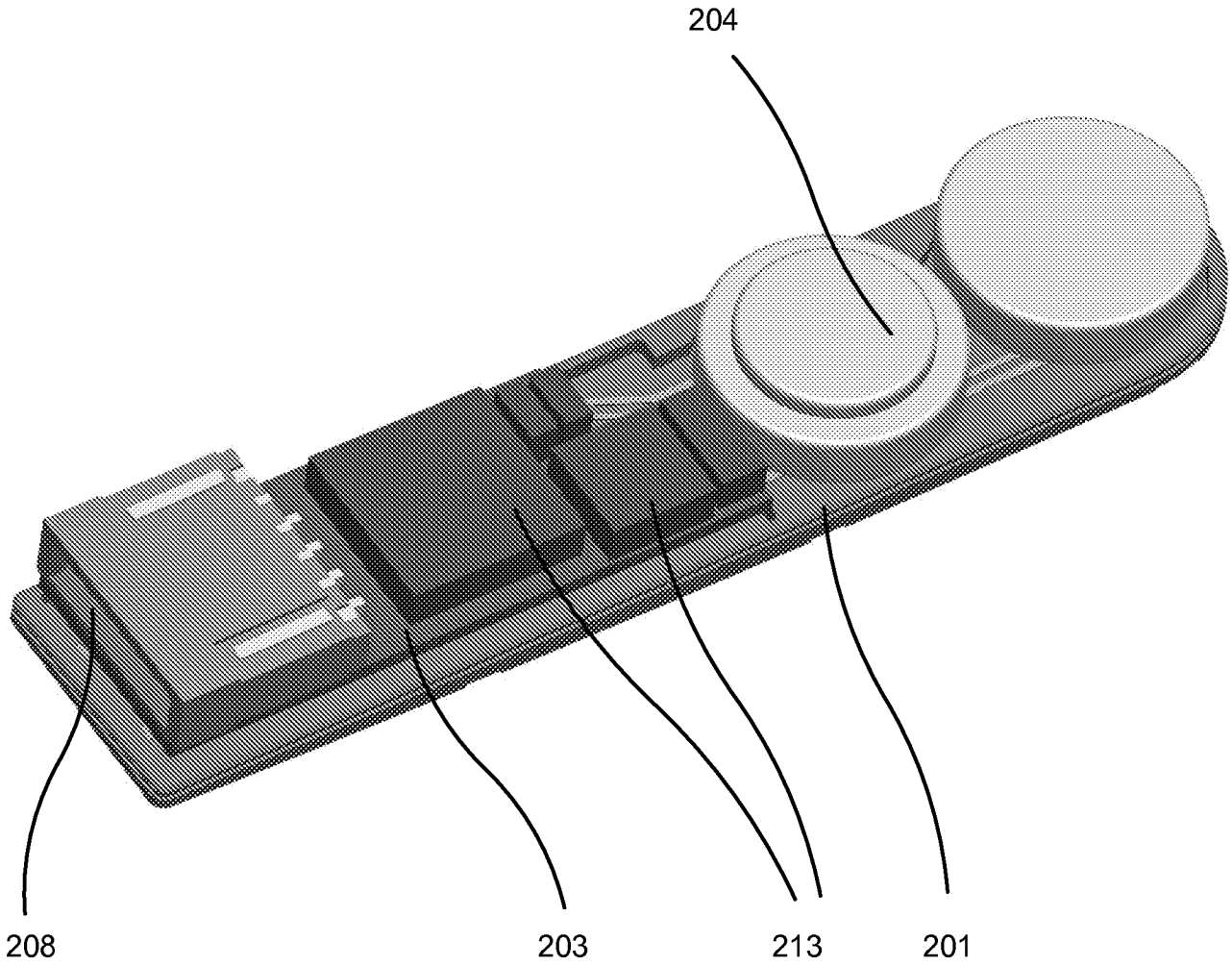


***FIG. 28***

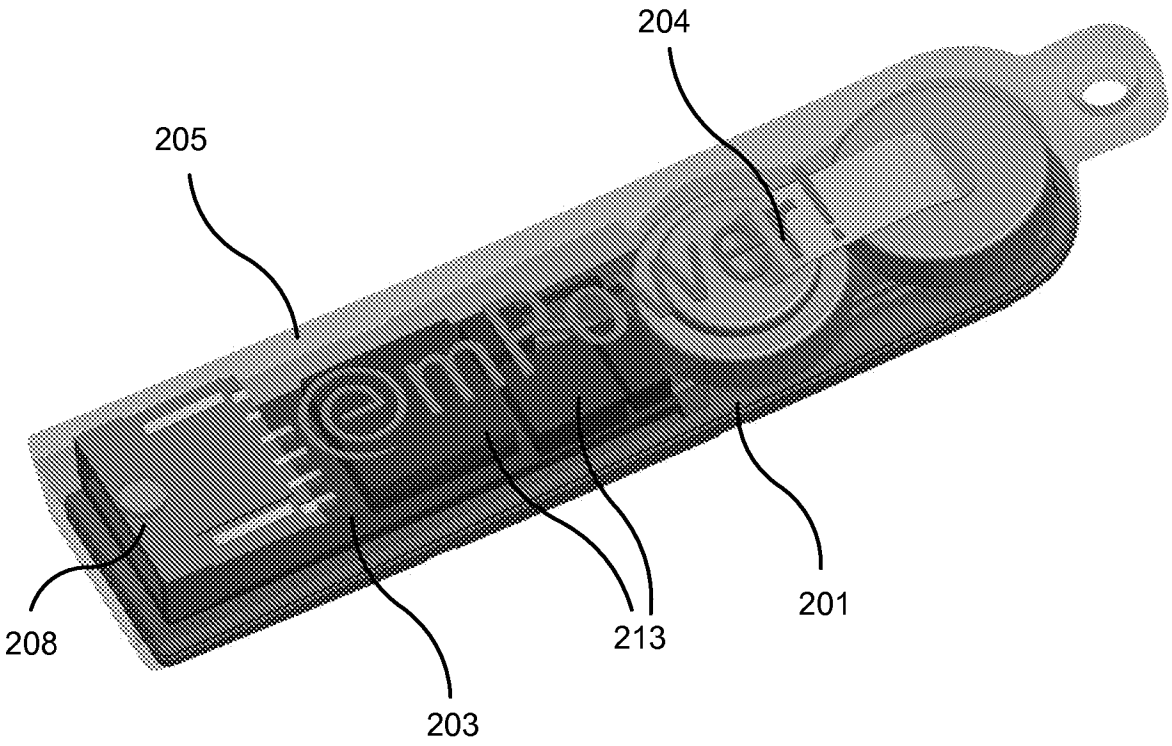


***FIG. 29***

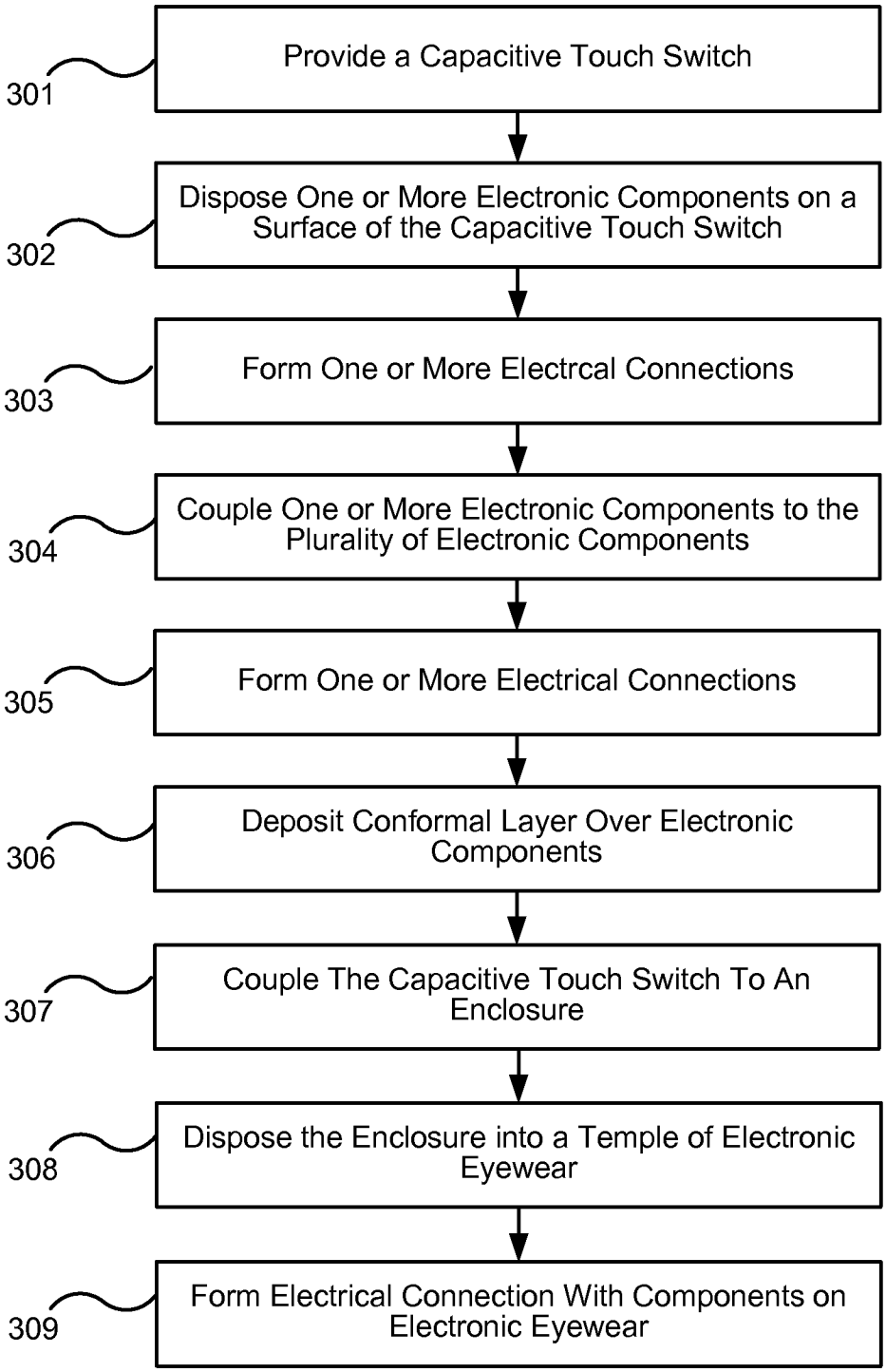
Provide a Capacitive Touch Switch
301
Dispose One or More Electronic Components on a Surface of the Capacitive Touch Switch
302
Form One or More Electrcal Connections
303
Couple One or More Electronic Components to the Plurality of Electronic Components
304
Form One or More Electrical Connections
305
Deposit Conformal Layer Over Electronic Components
306
Couple The Capacitive Touch Switch To An Enclosure
307
Dispose the Enclosure into a Temple of Electronic Eyewear
308
Form Electrical Connection With Components on Electronic Eyewear
309

***FIG. 30***

**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:: | |
| Title:: | ELECTRONIC FRAMES COMPRISING ELECTRICAL CONDUCTORS |
| Attorney Docket Number:: | 91904-831532 |
| Request for Early Publication:: | No |
| Request for Non-Publication:: | No |
| Suggested Drawing Figure:: | |
| Total Drawing Sheets:: | 30 |
| Small Entity?:: | No |
| Latin name:: | |
| Variety denomination name:: | |
| Petition included?:: | No |
| Petition Type:: | |
| Licensed US Govt. Agency:: | |
| Contract or Grant Numbers One:: | |
| Secrecy Order in Parent Appl.:: | No |

**Applicant Information**

| | |
|---|---|
| Applicant Authority Type:: | Inventor |
| Primary Citizenship Country:: | US |
| Status:: | Full Capacity |
| Given Name:: | Charles |
| Middle Name:: | |
| Family Name:: | Willey |
| Name Suffix:: | |
| City of Residence:: | Roanoke |
| State or Province of Residence:: | VA |
| Country of Residence:: | US |
| Street of Mailing Address:: | 1801 Windsor Avenue |
| City of Mailing Address:: | Roanoke |
| State or Province of mailing address:: | VA |
| Country of mailing address:: | US |
| Postal or Zip Code of mailing address:: | 24015 |

**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 | Non-provisional | 61/441,817 | February 11, 2011 |

**Foreign Priority Information**

| Country:: | Application number:: | Filing Date:: |
|---|---|---|

**Assignee Information**

| | |
|---|---|
| Assignee Name:: | PixelOptics, Inc. |
| Street of mailing address:: | 5241 Valleypark Drive |
| City of mailing address:: | Roanoke |
| State or Province of mailing address:: | VA |
| Country of mailing address:: | US |
| Postal or Zip Code of mailing address:: | 24019 |

Submitted by:

Signature /Patrick M. Lafferty/ Date February 13, 2012

Printed Name Patrick M. Lafferty Registration Number 63,000

This sheet is not to be filed with the USPTO, but retained in the prosecution file as a record of the iManage number. Fields having no information may be deleted from the ADS. For example, if there is no foreign priority claim, the foreign priority text may be deleted from the ADS.

63974921 v1

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 12065096 |
| **Application Number:** | 13372240 |
| **International Application Number:** | |
| **Confirmation Number:** | 8374 |
| **Title of Invention:** | ELECTRONIC FRAMES COMPRISING ELECTRICAL CONDUCTORS |
| **First Named Inventor/Applicant Name:** | Charles Willey |
| **Customer Number:** | 72162 |
| **Filer:** | Patrick M. Lafferty/Joan Soll |
| **Filer Authorized By:** | Patrick M. Lafferty |
| **Attorney Docket Number:** | 91904-831532 |
| **Receipt Date:** | 13-FEB-2012 |
| **Filing Date:** | |
| **Time Stamp:** | 18:10:43 |
| **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 | | APPLN.pdf | 205418<br>cac44f80a0f75987f4c1916e4932667e58b287e5 | yes | 51 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Specification | 1 | 45 |
| | Claims | 46 | 50 |
| | Abstract | 51 | 51 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Drawings-only black and white line drawings | 2012_02_13_DRWGS_91904-831532.pdf | 2679995<br>c8360d7696cb3fa94e73ae30f590925ccdc279ac | no | 30 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Application Data Sheet | 2012_02_13_ADS_91904-831532.pdf | 53339<br>ff730e77538f095a05b528c0925b361e2ec6bcb2 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied ADS fillable form | | | | | |
| | | **Total Files Size (in bytes):** | 2938752 | | |

**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.**

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Application Number: 13372240 Document Date: 2/13/2012

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

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- Examiners may access SCORE content via the eDAN interface.
- Other USPTO employees can bookmark the current SCORE URL (http://es/ScoreAccessWeb/).
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Form Revision Date: February 8, 2006