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- 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))

[Continued on next page]

(54) Title: FLUID-FILLED LENSES AND ACTUATION SYSTEMS THEREOF

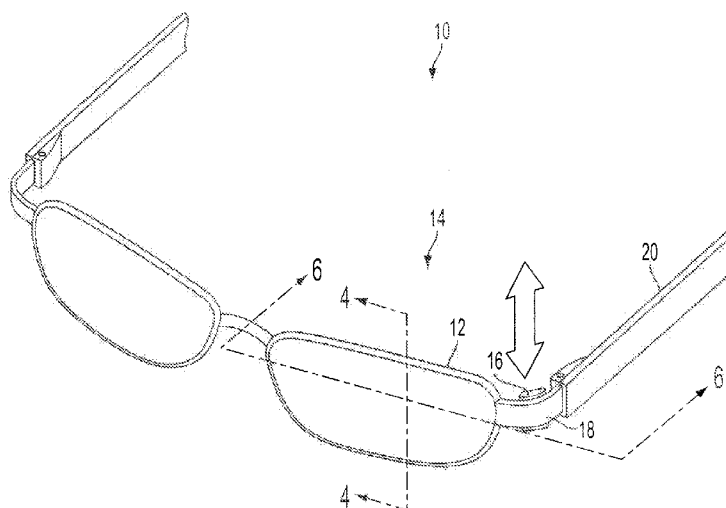


FIG. 1

(57) Abstract: An actuator assembly for an adjustable fluid-filled lens is provided. In some embodiments, the actuator assembly includes a clamp configured to adjust the optical power of the fluid lens module when the clamp is compressed. In some embodiments, a magnetic element is configured to adjust the optical power of the fluid-filled lens. In some embodiments, a plunger changes the optical power of the fluid lens module. In some embodiments, a reservoir is configured such that deformation of the reservoir changes the optical power of the fluid-filled lens. In some embodiments, a balloon is configured to deform the reservoir. In some embodiments, an adjustable fluid-filled lens includes a septum configured to be pierceable by a needle and automatically and fluidly seal a fluid chamber after withdrawal of the needle. In some embodiments, a thermal element can heat fluid within a fluid chamber to change an optical power of the lens module.





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**(88) Date of publication of the international search report:**

5 July 2012

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/60186

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G02C 5/22 (2012.01)

USPC - 351/153

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 5/22 (2012.01)

USPC: 351/153

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

IPC(8): G02C 5/22 (2012.01)

USPC: 359/642, 643, 665, 666; 351/41, 121, 140, 153, 158

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

PubWEST; PGPB, USPT, EPAB, JPAB; Google Scholar; Google Patent; Search Terms: fluid liquid lens optic frame clamp band worm corrective glasses spectacle arm nose ear lever actuator membrane hinge flex deform membrane

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 2006/0164731 A1 (Wu et al.) 27 July 2006 (27.07.2006) para. [0040] through [0064], Fig. 1-9B	1, 2 and 6 ----- 3-5
Y	US 2009/0052049 A1 (Batchko et al.) 26 February 2009 (26.02.2009) para. [0155], Fig. 12F	3-5
A	US 2010/0208194 A1 (Gupta et al.) 19 August 2010 (19.08.2010) entire document	1-6
A	US 2010/0208195 A1 (Gupta et al.) 19 August 2010 (19.08.2010) entire document	1-6
A	US 7,438,723 B2 (Esch) 21 October 2008 (21.10.2008) entire document	1-6

☐ 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

"&amp;" document member of the same patent family

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/60186

## 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 Extra Sheet (below).

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 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.:  
Group I: Claims 1-6, drawn to an actuator assembly for an adjustable fluid-filled lens.

### 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/US 11/60186

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-6, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group II: Claims 7-11, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group III: Claims 12-14, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group IV: Claims 15-16, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group V: Claims 17-18 and 22-24, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group VI: Claims 19-21, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group VII: Claim 25, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group VIII: Claim 26, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group IX: Claims 27-29, drawn to an actuator assembly for an adjustable fluid-filled lens.  
Group X: Claims 30-34, drawn to an actuator assembly for an adjustable fluid-filled lens.

The inventions listed as Groups I-X do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The technical feature of Group I is clamp, which is not present in Groups II-X.  
The technical feature of Group II is the magnetic slider, which is not present in Groups I and III-X.  
The technical feature of Group III is the plunger connected to a cable, which is not present in Groups I, II and IV-X.  
The technical feature of Group IV is the plunger magnetically coupled, which is not present in Groups I-III and V-X.  
The technical feature of Group V is the flexible pusher, which is not present in Groups I-IV and VI-X.  
The technical feature of Group VI is the wheel, which is not present in Groups I-V and VII-X.  
The technical feature of Group VII is the inflatable balloon, which is not present in Groups I-VI and VIII-X.  
The technical feature of Group VIII is the duckbill valve, which is not present in Groups I-VII and IX-X.  
The technical feature of Group IX is the septum, which is not present in Groups I-VIII and X.  
The technical feature of Group X is the thermal element, which is not present in Groups I-IX.

Although Groups III and IV do share the common technical feature of a plunger, said technical feature does not represent an improvement over the prior art of US 2010/0208195 A1 (Gupta et al.) that teaches a fluid filled lens assembly with a plunger (Abstract).

Although Groups V-VIII do share the common technical feature of a reservoir, said technical feature does not represent an improvement over the prior art of US 2010/0208195 A1 (Gupta et al.) that teaches a fluid filled lens assembly with a reservoir (Abstract).

Although Groups VII and VIII do share the common technical feature of a pressure relief valve, said technical feature does not represent an improvement over the prior art of US 7,438,723 B2 (Esch) that teaches a fluid filled lens assembly with a relief valve (col 11, ln 23-25).

Accordingly, unity of invention is lacking under PCT Rule 13.1.