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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))*

(88) Date of publication of the international search report:
3 September 2009

(54) Title: IMAGE STABILIZATION SYSTEM USING ONE, OR MORE, LIQUID LENS

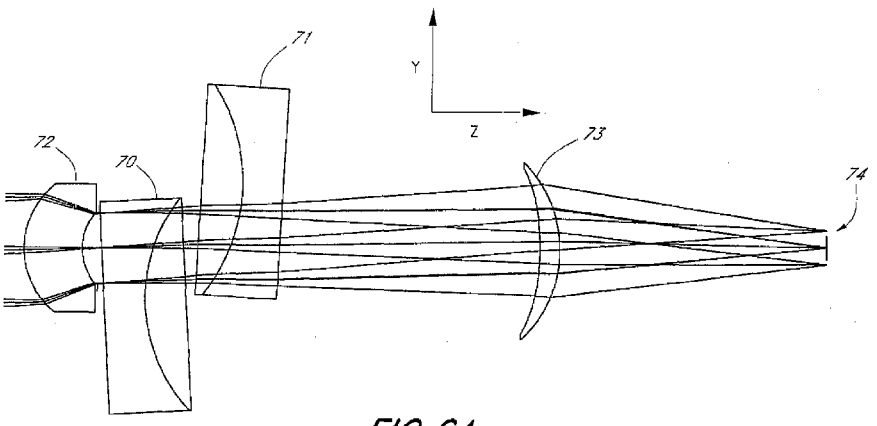

FIG. 6A

(57) Abstract: An image stabilization system, comprises a plurality of lens elements aligned along two optical axes; and one or more liquid lens cell (70, 71) comprising first and second contacting liquids, wherein the contacting optical surface between the contacting liquids has a variable shape that is substantially symmetrical to its own optical axis and is asymmetrical to at least one other optical axis; wherein the plurality of lens elements and the at least one liquid lens cell collect radiation emanating from an object side and provide stabilization of the image.

WO 2009/073388 A3

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B26/02 G02B27/64 G02B3/14

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)
G02B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 6 936 809 B2 (VIINIKANOJA JARKKO [FI]) 30 August 2005 (2005-08-30) figures 3,9	1,9-11, 16 2-4
Y	US 2007/263293 A1 (BATCHKO ROBERT G [US] ET AL) 15 November 2007 (2007-11-15) paragraphs [0089] - [0091], [0096]; figure 3B	2-4

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

☒ See patent family annex.

* Special categories of cited documents :

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

"E" earlier 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
23 March 2009	03/07/2009

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/084233

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.:

1-4, 9-18

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.

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

1. claims: 1-4,9-18

Claim 2 relates to an image stabilisation system comprising one liquid lens cell according to claim 1, the latter appearing to be known from the disclosure of publication US 6 936 809 B2 (D1) which discloses an image stabilisation system (see e.g. figure 9) comprising a plurality of lenses (L1, 100, L2) aligned along two optical axes (main axis O.A. and that O.A'. of element 100, see e.g. figure 3) and one liquid lens cell (100) having a first and a second contacting liquids (200 and 220) wherein the contacting surface in between has a variable shape being symmetrical to its own axis (O.A'.) and asymmetrical to another optical axis (O.A.); wherein the plurality of lenses and the liquid lens cell provide stabilisation of the image (see e.g. column 1 line 17).
Claims 3 and 4 are dependent there upon. Independent claim 9 and dependent claims 10-18 appear to be also either known from or obvious over the disclosure of D1.
The underlying problem to be solved is how to better stabilise the image e.g. by correcting horizontal or vertical jitter.
The special feature is the provision of a second liquid lens cell.

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2. claims: 19-21,30-34

Independent claim 19 relates to an image stabilisation system comprising two liquid lens cells. Claims 20 and 21 depend on claim 19. Independent claim 30 relates to a similar problem; Claims 31-34 depend on claim 30.
The underlying problem to be solved is how to ensure a fixed axial focus.
The special feature is the control in tandem of the two liquid lens cells, the second lens cell contributing to focusing.

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3. claims: 22-28

Independent claim 22 relates to an image stabilisation system comprising two pairs of liquid lens cells. Claims 23-26 depend on claim 22. Independent claim 27 relates to a similar problem and claim 28 depends there upon.
The underlying problem to be solved is how to provide image stabilisation in different, e.g. perpendicular, axes.
The special feature is the offset of the second pair of liquid lens cells being perpendicular to that of the first pair of liquid lens cells.

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4. claims: 1,5-8,29

Independent claim 29 relates to an image stabilisation system comprising two liquid lens cells. Claim 5 relates to a similar problem and to an image stabilisation system comprising at least one liquid lens cell according to claim 1, the latter appearing to be known from the disclosure of D1 (see above); claims 6-8 depend on claim 5.
The underlying problem to be solved is how to increase the degrees of freedom in image stabilisation and to compensate for thermal effects.
The special feature is a third liquid lens cell.

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5. claims: 35,36

Independent claim 35 relates to an image stabilisation system comprising two pairs of liquid lens cells. Claim 36 depends on claim 35.
The underlying problem to be solved is how to enable an image stabilisation range for the first pair of liquid lens cells to be greater than e.g. twice that for the second pair of liquid lens cells.
The special feature is the magnitude of the offset of the second pair of liquid lens cells that is greater than that of the first pair of liquid lens cells.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/084233

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6936809 B2	30-08-2005	US 2004227063 A1	18-11-2004
US 2007263293 A1	15-11-2007	WO 2008138010 A1	13-11-2008