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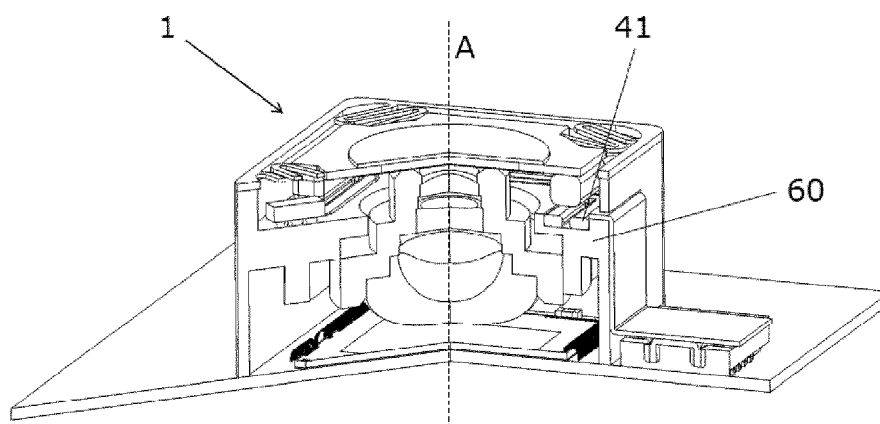
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HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR,
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PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,

(54) Title: OPTICAL DEVICE, PARTICULARLY CAMERA, PARTICULARLY COMPRISING AUTOFOCUS, IMAGE
STABILIZATION AND SUPER RESOLUTION

Fig. 23



(57) Abstract: The present invention relates to Optical device (1), comprising: a transparent and elastically expandable membrane (10), an optical element (20) facing the membrane (10), a wall member (300), wherein the optical element (20) and the membrane (10) are connected to the wall member (300) such that a container (2) with a volume (V) is formed, a fluid (F) residing in said volume (V), and a lens shaping part (11) that is in contact with the membrane (10) for defining a curvature adjustable area (10c) of the membrane (10), which area (10c) faces said optical element (20), and a circumferential lens barrel (50) that surrounds an opening (50c) in which at least one rigid lens (51) is arranged that is held by the lens barrel (50), and an actuator means (40) that is designed to move the optical element (20) in an axial direction (A) with respect to the lens shaping part (11), which axial direction (A) is oriented perpendicular to a plane along which the lens shaping part (11) extends, or to move the lens shaping part (11) in an axial direction (A) with respect to the optical element (20), which axial direction (A) is oriented perpendicular to a plane along which the rigid lens (51) extends so as to adjust the pressure of the fluid (F) residing inside the volume (V) and therewith a curvature of said area (10c).

SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
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- *as to the identity of the inventor (Rule 4.17(i))*
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/054954

A. CLASSIFICATION OF SUBJECT MATTER

INV. G02B3/14 G02B27/64 H02K41/02 H04M1/02 H05K1/00
G02B13/00
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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 H02K H04M H05K

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 860 556 A1 (OPTOTUNE AG [CH]) 15 April 2015 (2015-04-15)	1-4,7, 10,11, 13, 26-28, 31,32, 35, 47-52, 56, 63-69, 71-74, 77,78 58-62, 79-83
Y	paragraphs [0019], [0041], [0061], [0065] - [0076], [0079]; figures 12-18,23-26 ----- -/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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

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"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

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/054954

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/144186 A1 (FENG CHEN [US] ET AL) 19 June 2008 (2008-06-19)	1,29,75, 76
Y	paragraphs [0054] - [0080], [0168]; figures 13a,13b,14 -----	30
X	US 2011/089245 A1 (HAVENS WILLIAM H [US] ET AL) 21 April 2011 (2011-04-21)	1,7,8, 10,11, 31,32,84
Y	paragraphs [0026], [0027], [0038] - [0054]; figures 1-3,5-7 -----	79-82
Y	JP 2011 112757 A (KONICA MINOLTA HOLDINGS INC) 9 June 2011 (2011-06-09) abstract; figures 3,4 -----	30,83
Y	US 6 445 515 B2 (ZEISS STIFTUNG [DE]) 3 September 2002 (2002-09-03) column 1, line 34 - column 2, line 50 column 3, line 65 - column 4, line 65 column 2, lines 8-26; figure 1 -----	58-62
Y	EP 1 004 910 A2 (LUCENT TECHNOLOGIES INC [US]) 31 May 2000 (2000-05-31) paragraphs [0007] - [0011], [0015] - [0017]; figure 1 -----	58,61

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2017/054954

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.:
1, 3, 4, 7, 8, 10, 11, 13, 26-32, 35, 47-52, 56, 58-69, 71-82
84(completely); 2, 83(partially)
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, 3, 4, 7, 8, 10, 11, 13, 26-32, 35, 47-52, 56, 63-69, 71-82, 84(completely); 2, 83(partially)

An optical device comprising a lens barrel and a fluid lens having a variable curvature or tilt through axially moving actuators.

2. claims: 5, 6(completely); 2, 83(partially)

An optical device comprising a lens barrel and a fluid lens providing image stabilization through lateral shifting of an element.

3. claim: 9

A variable curvature fluid lens having plasma bonded elements.

4. claim: 12

A mold insert embedded in a recess of a lens barrel

5. claims: 14-19

A lens barrel having centering means of a lens shaping element.

6. claims: 20-25

A glue pocket

7. claims: 33, 53

A spring element applying a restoring force

8. claim: 34

A threaded barrel for adjusting lens to sensor distance.

9. claims: 36-46, 55, 57

An actuator having legs extending through a housing.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

10. claim: 54

An athermalization spacer

11. claims: 58-62

An deformable lens actuator using electropermanent magnets

12. claim: 70

An optical element designed to form a fluid cavity

13. claim: 85

A method for calibrating an optical image stabilization
function of an optical device.

14. claim: 86

A method for calibrating an autofocus function of an optical
device.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/054954

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