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- (71) **Applicant: DYNAMIC OPTICS S.R.L.** [IT/IT]; Via della Tecnica, 85, 36030 Sarcedo (VI) (IT).
- (72) **Inventor: BONORA, Stefano;** Via Sebastiano Venier, 118, 35127 Padova (PD) (IT).
- (74) **Agent: GALLO, Luca;** Gallo & Partners S.r.l., Via Carlo Rezzonico, 6, 35131 Padova (PD) (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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

(54) **Title:** ADAPTIVE OPTICAL DEVICE

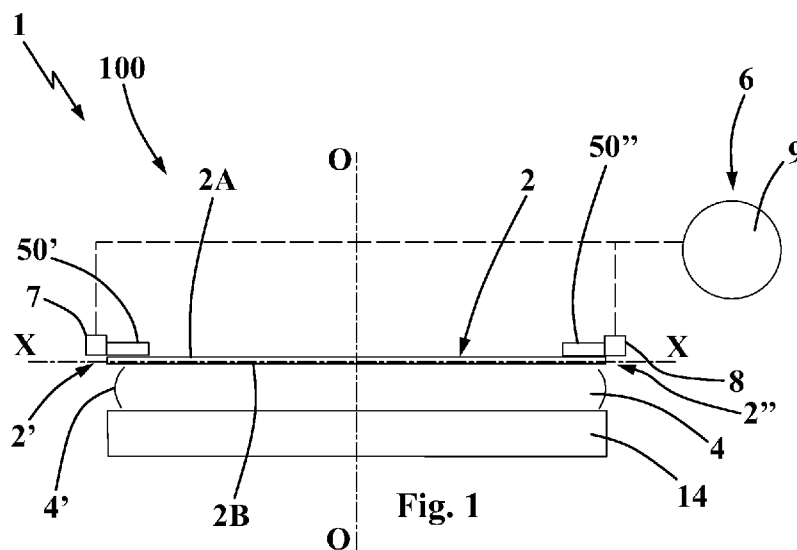


Fig. 1

(57) **Abstract:** Adaptive optical device provided with a deformable lens comprising a membrane (2) which is extended between a first end (2') and an opposite second end (2'') and is provided with an internal face (2B) placed on an optical layer (4) of deformable and transparent material. In addition, the deformable lens comprises actuator means (6) arranged for varying the curvature of the membrane (2) with respect to the optical axis (O) of the lens. Such actuator means (6) comprise a first movement member (7) and a second movement member (8) movable parallel to the optical axis (O) and connected, respectively, to the first end (2') and to the second end (2'') of the membrane (2), and a drive member (9) operatively connected to the first and to the second movement member (7, 8) and arranged in order to move them by respectively moving the first end (2') and the second end (2'') of the first membrane (2) parallel to the optical axis (O), in order to place the first membrane (2) at least in a curved configuration.



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))*

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21 October 2021 (21.10.2021)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2020/062511

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G02B3/14 G02B26/00
 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)
 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 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	WO 2015/052233 A1 (OPTOTUNE AG [CH]) 16 April 2015 (2015-04-16) cited in the application pages 13-14; figures 1-3 -----	1,6
X	WO 2018/167739 A1 (DYNAMIC OPTICS S R L [IT]) 20 September 2018 (2018-09-20) paragraphs [0059], [0069] - [0086]; figures 36,13,14 -----	1-3,5, 10,11
Y		7
A	US 7 098 871 B1 (TEGREENE CLARENCE T [US] ET AL) 29 August 2006 (2006-08-29) column 18, line 65 - column 22, line 21; figure 53 -----	1,4,9
A	US 4 890 903 A (TREISMAN MICHEL [GB] ET AL) 2 January 1990 (1990-01-02) columns 4, 5, 8 - column 9; figures 6,7 -----	4
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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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 9 August 2021	Date of mailing of the international search report 22/09/2021
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Feeney, Orla
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INTERNATIONAL SEARCH REPORT

International application No
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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 2017/017019 A1 (BOLIS SEBASTIEN [FR]) 19 January 2017 (2017-01-19) paragraph [0014]; figures 1A,1B -----	7
X	STURMER MORITZ ET AL: "Cylindrical lens with integrated piezo actuation for focal length tuning and lateral scanning", 2014 IEEE 27TH INTERNATIONAL CONFERENCE ON MICRO ELECTRO MECHANICAL SYSTEMS (MEMS), IEEE, 26 January 2014 (2014-01-26), pages 1171-1174, XP032579128, DOI: 10.1109/MEMSYS.2014.6765855 page 1171 - page 1172; figures 1-3 -----	1,9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2020/062511

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, 9-11

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: 1-7, 9-11

arrangement of membranes and optical layers in an adaptive optical device

2. claim: 8

actuating mechanism for an adaptive optical device.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2020/062511

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015052233	A1	16-04-2015	EP 2860555 A1 WO 2015052233 A1

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