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(54) Title: SUBJECTIVE WAVEFRONT REFRACTION USING CONTINUOUSLY ADJUSTABLE WAVE PLATES OF ZERNIKE FUNCTION

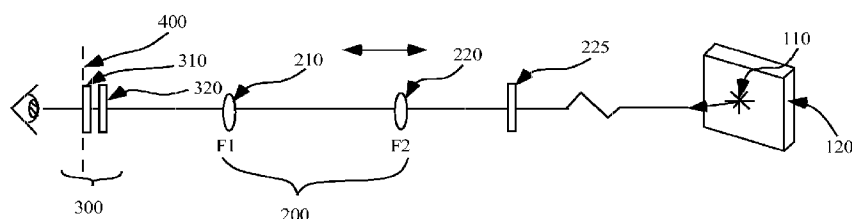


Fig. 1A

(57) Abstract: A wavefront device produces adjustable amplitudes in optical path differences and adjustable axis orientation angles, two substantially identical wave plates (225) have a wavefront profile of at least the third order Zernike polynomial function which are not circularly symmetric, as denoted by $Z(i,j)$ where $i \geq 3$ and $j \neq 0$. The wave plates are mounted in rotatable mounts (124) with their optical centers substantially aligned with each other.



WO 2008/088571 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/685 10

A. CLASSIFICATION OF SUBJECT MATTER

IPC: A61B 3/00(2006.01);A61B **3/10**(2006.01);A61 B 3/02(2006.01)

USPC: 35 1/222,237-238,241-242,246

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. : 35 1/222,237-238,241-242,246

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, JPO, Derwent, IBM technical database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,050,687 A (Bille et al) 18 April 2000 (18.4.2000) Whole Document	4-15 & 17-27
A	US 6,155,684 A (Bille et al) 5 December 2000 (5. 12.2000) Whole Document	4-15 & 17-27
A	US 2003/005303 1 A1 (Wirth) 20 March 2003 (20.3 2003) Whole Document	4-15 & 17-27



Further documents are listed in the continuation of Box C.

D

See patent family annex.

* Special categories of cited documents		"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/685 10

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:
Please See Continuation 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 additional fees, this Authority did not invite payment of any 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.: 4-15 and 17-27

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US07/685 10

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

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, claim(s) 1-3, drawn to a wavefront device including the details of circularly symmetric waveplates classified in US class/subclass 356/489.

Group II, claim(s) 4-6, drawn to a method of generating a subjective optical prescription including the details of rotating the entire assembly including two waveplates classified in US class/subclass 351/246.

Group III, claim(s) 7-15, drawn to a method of determining second order and higher order aberrations of a patient's eye including the details of minimizing a refractive error of the patient by adjusting amplitude and angle of the first adjustable waveplate classified in US class/subclass 351/246.

Group IV, claim(s) 16, drawn to a device for correcting refractive errors of second or higher order aberrations of an eye including the details of specific value adjustable Zernike wave plates classified in US class/subclass 351/200.

Group V, claim(s) 17-27, drawn to a device for determining or correcting aberrations of an eye including the details of one or more conjugally placed waveplates classified in US class/subclass 351/205.

Group VI, claim(s) 28-52, drawn to an optical instrument for generating a prescription for one or more corrective lenses or corrective procedures including the details of a defocus corrector assembly and an astigmatism corrector assembly classified in 351/222.

The inventions listed as Groups I-VI 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: Groups 1-6 recite the mutually exclusive subject matter as disclosed in the examiner's presentation of groups above. Given the above cited technical features it is clear that the groups I-VI have mutually exclusive subject matter, and therefore, lack unity of invention.