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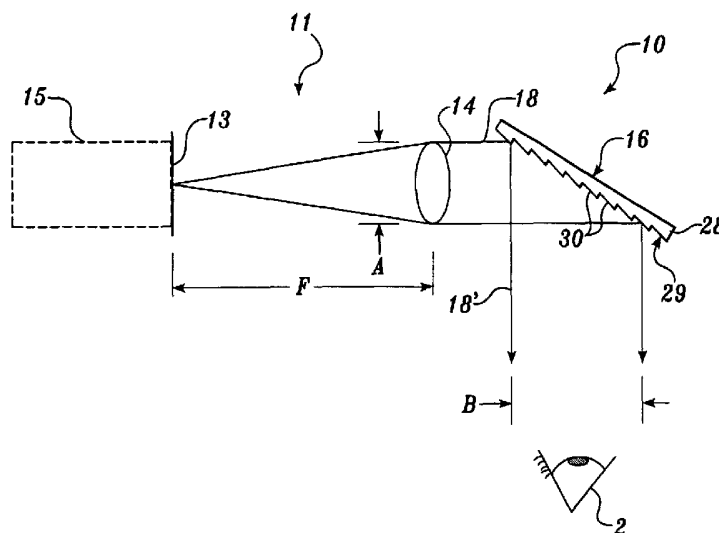
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- (88) Date of publication of the international search report:  
14 November 2002

[Continued on next page]

(54) Title: VIRTUAL IMAGING SYSTEM



(57) Abstract: A virtual imaging system (10) that allows a user to view a virtual image of an object field is provided. The system includes an imaging subsystem (11) having at least one lens (14). The imaging subsystem is arranged such that its object field (13) is at or near its focal point, thereby positioning the virtual image at or near infinity. In one embodiment, the imaging subsystem further includes an image generator (15) located in the object field. The system further includes an eyebox spreader (16) that is arranged to receive the light transmitted from the imaging subsystem and to redirect the light to a user's eye (2). The eyebox spreader is adapted to effectively increase an eyebox "A" of the imaging subsystem to "B" and thus the size of the virtual image. In one embodiment, the eyebox spreader is formed of a Fresnel surface that defines an array of parallel, optically flat facets thereon. Spreading the eyebox in this manner allows for a user to view the virtual image at ease while at the same time allowing the virtual imaging system to be compactly constructed and light in weight.



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/28411

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G02B27/01

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 7 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, 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	US 4 220 400 A (VIZENOR) 2 September 1980 (1980-09-02)  column 2, line 44 - column 4, line 18; figures 1-4 column 4, line 2 - line 5	1,2,4,7, 9,11-13, 15,17, 27,28,43
A	----	3,21,57
X	EP 0 344 881 A (REFLECTION TECHNOLOGY) 6 December 1989 (1989-12-06) column 5, line 34 - line 55; figure 1 column 6, line 17 - line 29 column 7, line 18 - line 39	27,48
A	----- -/--	22



Further documents are listed in the continuation of box C.



Patent family members are listed in 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

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International Application No  
PCT/US 00/28411

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 5 781 345 A (FERRANTE) 14 July 1998 (1998-07-14)	54
Y	column 5, line 6 - line 52; figures 1-3,7	50
A		24,26, 44,45, 47,49,52
X	US 4 269 475 A (ELLIS) 26 May 1981 (1981-05-26)	49
A	abstract column 2, line 59 -column 3, line 7; figure 1	24-26, 44,45,47
X	EP 0 850 614 A (NIDEK) 1 July 1998 (1998-07-01)	55
A	column 6, line 13 - line 48; figure 4	19,42
Y	WO 91 06031 A (COHEN) 2 May 1991 (1991-05-02)	50
A	claims 1,10,19	51
A	US 3 936 605 A (UPTON) 3 February 1976 (1976-02-03)	6,27,28
	abstract column 1, line 31 - line 45; figure 1 column 1, line 62 - line 65 column 3, line 60 -column 4, line 17; figure 5	
A	EP 0 301 801 A (REFLECTION TECHNOLOGY) 1 February 1989 (1989-02-01)	1,27
	abstract	
A	WO 93 01583 A (VPL RESEARCH) 21 January 1993 (1993-01-21)	5
	abstract page 6, line 4; figures 1,2 page 8, line 6 - line 22	
A	EP 0 922 985 A (YAMAZAKI) 16 June 1999 (1999-06-16)	14,20,56
	column 6, line 48 - line 57; figure 1	
A	H. W. UPTON: "EYEGLOSS HEADS-UP-DISPLAYS" PROCEEDINGS OF THE SID, vol. 23, no. 2, 1982, pages 77-80, XP002109673 Los Angeles abstract; figure 2	16,29-31
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## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/28411

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 827 337 A (SEIKO EPSON) 4 March 1998 (1998-03-04) column 23, line 12 - line 30; figures 20A,20B ---	18, 19, 41,55
A	US 4 280 506 A (ZURCHER) 28 July 1981 (1981-07-28) column 1, line 9 - line 63 ---	32-36
A	DE 28 15 339 A (NAEF) 18 October 1979 (1979-10-18) claim 1 ---	37
A	US 5 345 325 A (TWACHTMANN) 6 September 1994 (1994-09-06) column 1, line 23 - line 26 ---	39
A	US 3 809 462 A (BAUMGARDNER) 7 May 1974 (1974-05-07) abstract column 5, line 63 -column 7, line 19; figures 16,17 -----	54

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 00/28411

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.
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.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.