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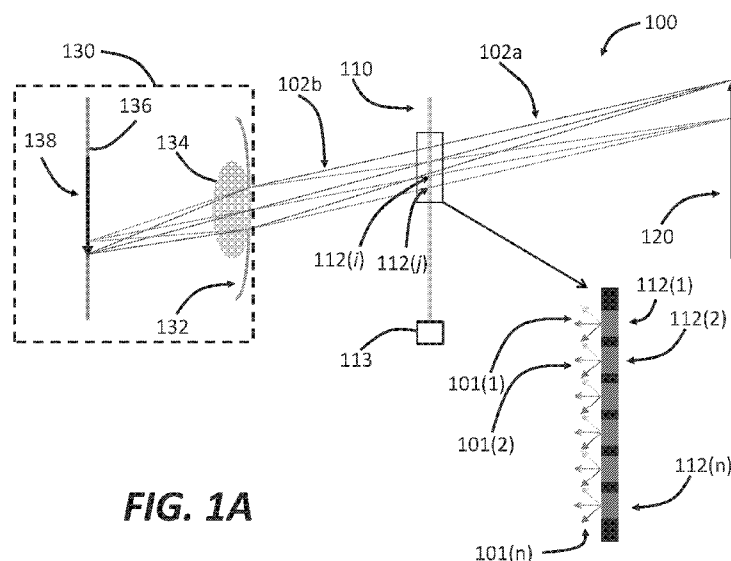
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Declarations under Rule 4.17:

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

[Continued on next page]

(54) Title: APPARATUS AND METHODS FOR AUGMENTED REALITY

**FIG. 1A**

(57) Abstract: A display for augmented reality (AR) includes an array of optical phased arrays (OPAs) integrated into a transparent substrate. The array of OPAs emit light encoded with four dimensional (4D) light field including 2D spatial coordinates and 2D directional coordinates to create an image of a virtual object on a retina of a viewer. By adjusting the emission directions of light beam emitted by individual OPAs in the display, the depth perception can be adjusted accordingly. The array of OPAs can also be encoded with holographic information, including intensity and phase distribution, of a virtual object to create the image of the virtual object on the retina. The AR display can further incorporate liquid crystal (LC) into the OPAs for modulating the amplitudes and relative phases of light emitted by the OPAs.

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INTERNATIONAL SEARCH REPORT

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PCT/US 16/40420

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G02F 1/29 (2017.01)

CPC - G02B 27/0172; G02B 27/0176; G02B 27/0075; G02B 27/0179; G02B 2027/0134; G02F 1/292

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(8): G02F 1/29 (2017.01)

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

IPC(8): G02F 1/29 (2017.01)

CPC: G02B 27/0172; G02B 27/0176; G02B 27/0075; G02B 27/0179; G02B 2027/0134; G02F 1/292; USPC: 359/279,9,10

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

Patbase, Google Scholar, Google Web Search terms used: Phased array, optical, opa, steer, angle, project, display, image, retina, eye, photonic, nanophotonic, pattern, viewer, person, observer, modulate, frequency, amplitude, phase, head mounted, hmd, hologram, augmented reality, ar, preset, encode, path, difference, subset

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y -- A	US 2014/0192394 A1 (SUN et al.) 10 July 2014 (10.07.2014), para [0007], [0040], [0077], [0090], [0101], [0104], [0108]-[0109]	1-5, 11, 12, 22 6-10, 13-21, 23-25
Y -- A	US 2006/0033995 A1 (SMITH et al.) 16 February 2006 (16.02.2006), para [0018], [0023], [0034], [0040]	1-5, 11, 12, 22 6-10, 23-25
Y -- A	US 6,522,794 B1 (BISCHEL et al.) 18 February 2003 (18.02.2003), col 111, ln 17-41; col 111, ln 59-col 112, ln 42	1-5, 11, 12, 22 6-10, 23-25
A	US 2012/0328298 A1 (YI et al.) 27 December 2012 (27.12.2012), para [0006]-[0007], [0045], [0066]	13-21
A	US 5,353,133 A (BERNKOPF) 04 October 1994 (04.10.1994), col 9, ln 48-61	13-21

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

* 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
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"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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