(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 April 2014 (17.04.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/056632 A1

(51) International Patent Classification:
G02B 5/18 (2006.01) *G02B 27/42* (2006.01)
G02B 21/36 (2006.01)

(21) International Application Number:
PCT/EP2013/057715

(22) International Filing Date:
12 April 2013 (12.04.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12250161.2 12 October 2012 (12.10.2012) EP

(71) Applicant: **VISION ENGINEERING LIMITED** [GB/GB]; Send Road, Send, Woking, Surrey GU23 7ER (GB).

(72) Inventor: **MERCER, Graham, Peter, Francis**; 1 Tarrant Gardens, Hartley Witney, Hampshire RG27 8NE (GB).

(74) Agent: **BODEN, Keith, McMurray**; Fry Heath & Spence LLP, The Gables, Massetts Road, Horley, Surrey RH6 7DQ (GB).

(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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: OPTICAL INSTRUMENTS

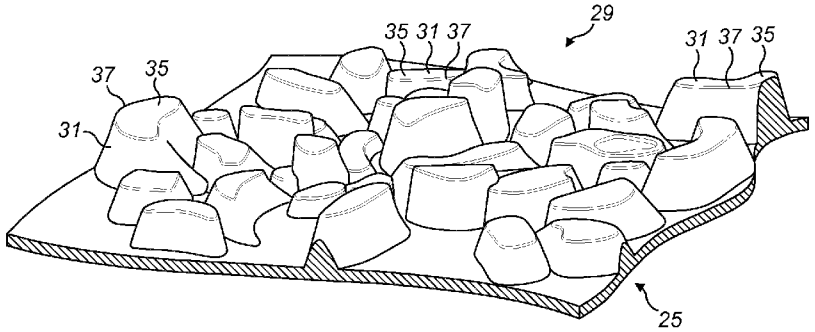

FIG. 2(b)

(57) **Abstract**: An optical instrument for producing an optical image to be viewed by an observer, the optical instrument comprising : an optical system for producing an optical image of an object which is viewable by an observer at an exit pupil; and a diffractive element located at an image plane of the optical system for producing an array of exit pupils, which are perceivable as a single, enlarged exit pupil by the observer; wherein the diffractive element comprises a surface which has an array of diffractive units, each of which generates one of the exit pupils of the array of exit pupils, the diffractive units each comprising replications of a pattern of a plurality of separated areas which are effective to produce diffractive interference of light and generate a plurality of exit pupils which are displaced relative to one another in the form of an array of exit pupils, such as to be viewable as a single, continuous enlarged exit pupil, and the areas comprise irregular features of different sizes, both in horizontal and vertical section, which have curved surfaces at lateral faces thereof; wherein the diffractive units are disposed progressively radially outwardly from the optical axis of the diffractive element and configured progressively to provide for an increasing angular offset, such that, independent of location on the aperture of the diffractive element and without any relay lens arrangement, light from the received image is relayed to a common region on a viewing plane across the aperture of the diffractive element.

WO 2014/056632 A1