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

(19) World Intellectual Property Organization

International Bureau



(43) International Publication Date 24 January 2008 (24.01,2008)

PCT

(10) International Publication Number WO 2008/011377 A3

(51) International Patent Classification: *H01L 33/00* (2006.01) *G02B 17/08* (2006.01)

(21) International Application Number:

PCT/US2007/073603

(22) International Filing Date: 16 July 2007 (16.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/807,565 17 July 2006 (17.07.2006) US

(71) Applicant (for all designated States except US): 3M INNOVATIVE PROPERTIES COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors: THIELEN, James A.; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). LEATHERDALE, Catherine A.; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). OUDERKIRK, Andrew J.; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). LU, Dong; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). BARNES, Amy S.; 3M

Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

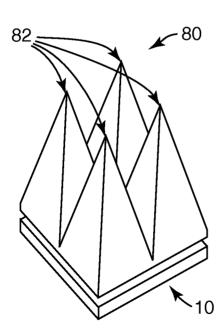
- (74) Agents: PRALLE, Jay, R. et al.; 3M Center, Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

with international search report

[Continued on next page]

(54) Title: LED PACKAGE WITH CONVERGING EXTRACTOR



(57) Abstract: In one aspect, the present application discloses a light source comprising an LED die optically coupled to an extractor comprising a plurality of optical elements each having a base, an apex smaller than the base, and a converging side extending between the base and the apex. The extractor base is no greater in size than the emitting surface of the LED die. In another aspect, methods of making light sources are disclosed, comprising the steps of providing an LED die having an emitting surface; forming a plurality of optical elements each having a base, an apex smaller than the base, and a converging side extending between the base and the apex; arranging the plurality of optical elements to form an extractor, the extractor having an extractor base no greater in size than the emitting surface; and optically coupling the extractor base to the emitting surface of the LED die.

- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- (88) Date of publication of the international search report: 13 March 2008

INTERNATIONAL SEARCH REPORT

International application No PCT/US2007/073603

A. CLASSIFICATION OF SUBJECT MATTER INV. H01L33/00 ADD. G02B17/08

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) H01L

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

Calanant	Other and designant with indication, where appropriate of the relevant passages	Relevant to claim No.
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Helevant to diaminivo.
χ .	US 2004/061120 A1 (MIZUYOSHI AKIRA [JP])	1,4-9,
: •	1 April 2004 (2004-04-01)	11-15,
•		17-19,
		26,27
	paragraphs [0009], [0010], [0012] - [0017], [0019], [0025], [0027]	
V ', ' ','	paragraphs [0065] - [0068], [0074];	20
•	figures 11,12F	
	paragraph [0087]; figure 13	
Υ	EP 1 657 758 A (LUMILEDS LIGHTING LLC	20
	[US]) 17 May 2006 (2006-05-17) abstract	
v . 1 /	paragraphs [0002], [0018]; figure 2	20-24,28
ı	paragraph [0046]; figures 19,20	23 21,23
	paragraphs [0049], [0050]; figures 21,22	
	-/	
: ,	,	

·	
X Further documents are listed in the continuation of Box C.	X 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 'E' earlier document but published on or after the international filling 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 filling 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 10 January 2008	Date of mailing of the international search report 21/01/2008
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Tinjod, Frank

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/073603

C(Continua	ition). DOCUMENTS CONSIDERED TO BE RELEVANT	101/03200//0/3603
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Х	US 2004/113167 A1 (BADER STEFAN [DE] ET AL) 17 June 2004 (2004-06-17) paragraphs [0012], [0021]	1,4,5,7, 8,10-16, 18,19, 25,26
Υ	paragraphs [0012], [0021] paragraphs [0048], [0051]; figures 2b,4 paragraphs [0052] - [0054]; figures 5a,5b	20-24,28
X A	US 2006/091411 A1 (OUDERKIRK ANDREW J [US] ET AL) 4 May 2006 (2006-05-04) cited in the application paragraphs [0004] - [0007], [0013] paragraphs [0015], [0017]	1,7-14, 16-19, 25-27
Λ 	paragraphs [0015], [0017] paragraphs [0036] - [0038], [0041]; figure 6 paragraph [0045]; figure 7 paragraphs [0047] - [0050]; figure 8	24,28
X	US 2002/141006 A1 (POCIUS DOUGLAS W [US] ET AL) 3 October 2002 (2002-10-03)	1-5,7, 11,12, 18-20, 22,23, 26,28
	paragraphs [0002], [0012] paragraph [0063]; figure 17 paragraph [0048]; figure 7A paragraph [0052]; figure 9 paragraph [0046]; figure 7C	
x	EP 1 536 487 A (MATSUSHITA ELECTRIC WORKS LTD [JP]) 1 June 2005 (2005-06-01)	1,7,11, 12,16, 18,19,25
A	paragraphs [0060], [0061]; figures 20,21 paragraph [0108]; figures 46a,47	20
4	GB 2 340 301 A (OXLEY DEV CO LTD [GB]) 16 February 2000 (2000-02-16) page 1, lines 11-21 page 3, lines 5-16; figure 2	1-5,7, 17,18,28

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2007/073603

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 20040611	20 A1	01-04-2004	JP	2004128057	A	22-04-2004
EP 1657758	A	17-05-2006	JP US US		A A1 A1	08-06-2006 18-05-2006 18-05-2006
US 20041131	67 A1	17-06-2004	DE JP US	10245628 2004128507 2007034888	Α	15-04-2004 22-04-2004 15-02-2007
US 20060914	11 A1	04-05-2006	EP KR WO	1805810 20070070241 2006049746	Α	11-07-2007 03-07-2007 11-05-2006
US 20021410	06 A1	03-10-2002	DE JP TW	10213611 2003017740 541719	Α	10-10-2002 17-01-2003 11-07-2003
EP 1536487	A	01-06-2005	AU CN WO US		A A1	12-12-2003 17-08-2005 04-12-2003 10-08-2006
GB 2340301	A	16-02-2000	NONE			