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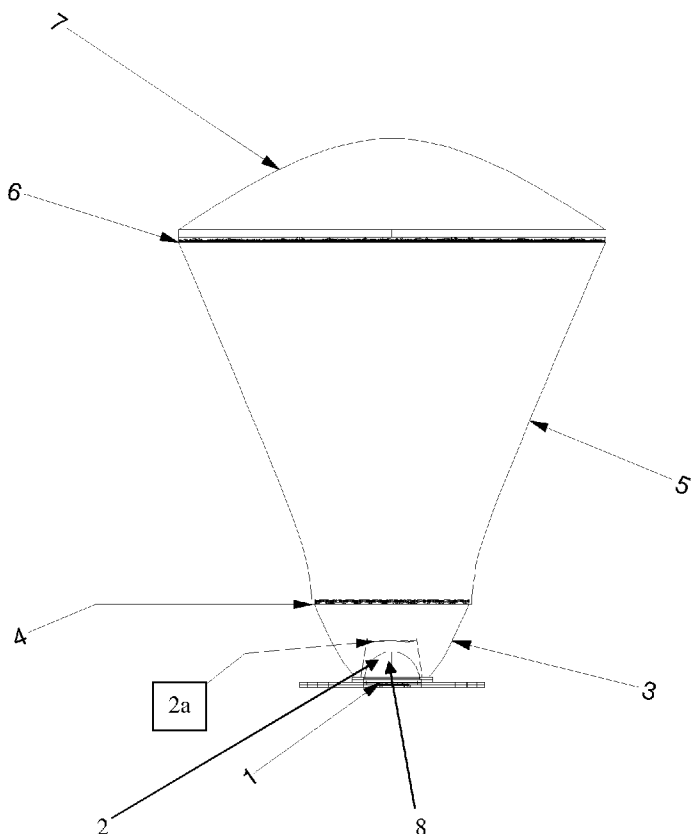
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60/871,581 22 December 2006 (22.12.2006) US
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[Continued on next page]

(54) Title: MULTI-PRIMARY LED COLLIMATION OPTIC ASSEMBLIES



(57) Abstract: The present invention relates to an optical assembly which improves color uniformity and improved collimation of light produced by multiple LED light sources in a light engine. The optical assembly is specifically tailored to match the placement of the solid-state emitters making up the light engine or light producing element. Specifically, a shaped free-form spline patch inner collimation lens having an optimized cross-sectional shape and micro-ridges is used to disperse light; multi-lobe TIR collimation lens having an optimized cross-sectional shape and micro-ridges is used to disperse and redistribute phase as well as provide collimation; primary mixing lenslet array having an optimized surface is used to disperse light from the light emitter; a spline profile reflector further mixes and collimates the light; a secondary lenslet array further mixes the light; and a secondary collimation lens further collimates the light.

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<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b>                  IPC(8) - G02B 27/30 (2008.04)                  USPC - 359/641, 800                  According to International Patent Classification (IPC) or to both national classification and IPC</p>																							
<p><b>B. FIELDS SEARCHED</b></p> <p>Minimum documentation searched (classification system followed by classification symbols)                  IPC(8) - G02B 27/30 (2008.04)                  USPC - 359/641, 800</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched                  IPC(8) - G02B 27/30 (2008.04) -see keyword below-                  USPC - 359/641, 642, 738, 800 -see keyword below-</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)                  PubWEST(USPT,PGPB,EPAB,JPAB); Google patents: DialogPRO                  Search terms - Tertiary lens, multiple, optical elements, color, uniformity, micro lens, lenslet, reflector, concentrator, total internal reflection, fly's eye, LED, light emitting diode, TIR, light engine.</p>																							
<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:10%;">Category*</th> <th style="width:70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width:20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td align="center">Y</td> <td>US 6,637,924 B2 (PELKA et al.) 28 October 2003 (28.10.2003) Figures 2, 3, and 11; col. 5, ln. 52-54; col. 5, ln. 55-63.</td> <td align="center">1-25</td> </tr> <tr> <td align="center">Y</td> <td>US 6,560,038 B1 (PARKYN, Jr., et al.) 06 May 2003 (06.05.2003) Figure 3</td> <td align="center">1-25</td> </tr> <tr> <td align="center">Y</td> <td>US 2004/0070841 A1 (BIERHUIZEN) 15 April 2004 (15.04.2004) para [0051]</td> <td align="center">1-25</td> </tr> <tr> <td align="center">Y</td> <td>US 2002/0067549 A1 (TAWA et al.) 06 June 2002 (06.06.2002) para [0070]</td> <td align="center">4, 5, 10, 11, 19, and 20</td> </tr> <tr> <td align="center">Y</td> <td>US 7,006,306 B2 (FALICOFF et al.) 28 February 2006 (28.02.2006) Figure 5</td> <td align="center">7-9</td> </tr> <tr> <td align="center">Y</td> <td>US 5,245,481 A (KANEKO et al.) 14 September 1993 (14.09.1993) Abstract</td> <td align="center">22</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	US 6,637,924 B2 (PELKA et al.) 28 October 2003 (28.10.2003) Figures 2, 3, and 11; col. 5, ln. 52-54; col. 5, ln. 55-63.	1-25	Y	US 6,560,038 B1 (PARKYN, Jr., et al.) 06 May 2003 (06.05.2003) Figure 3	1-25	Y	US 2004/0070841 A1 (BIERHUIZEN) 15 April 2004 (15.04.2004) para [0051]	1-25	Y	US 2002/0067549 A1 (TAWA et al.) 06 June 2002 (06.06.2002) para [0070]	4, 5, 10, 11, 19, and 20	Y	US 7,006,306 B2 (FALICOFF et al.) 28 February 2006 (28.02.2006) Figure 5	7-9	Y	US 5,245,481 A (KANEKO et al.) 14 September 1993 (14.09.1993) Abstract	22
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<p>Date of the actual completion of the international search 15 May 2008 (15.05.2008)</p>		<p>Date of mailing of the international search report <b>10 JUN 2008</b></p>																					
<p>Name and mailing address of the ISA/US                  Mail Stop PCT, Attn: ISA/US, Commissioner for Patents                  P.O. Box 1450, Alexandria, Virginia 22313-1450                  Facsimile No. 571-273-3201</p>		<p>Authorized officer:                  Lee W. Young                  PCT Helpdesk: 571-272-4300                  PCT OSP: 571-272-7774</p>																					