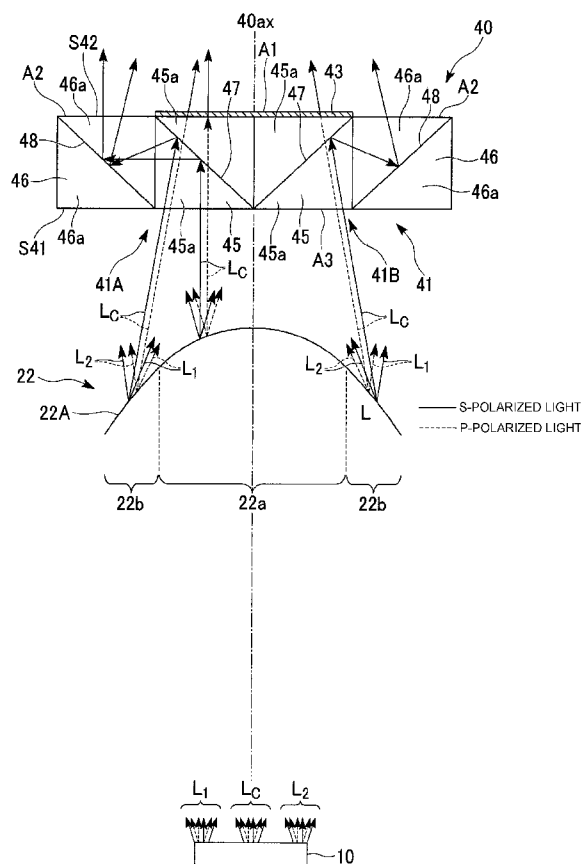




- (51) International Patent Classification:
G03B 21/00 (2006.01) *H04N 9/00* (2006.01)
- (21) International Application Number:
PCT/JP2013/000721
- (22) International Filing Date:
8 February 2013 (08.02.2013)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
2012-031849 16 February 2012 (16.02.2012) JP
- (71) Applicant: SEIKO EPSON CORPORATION [JP/JP]; 4-1, Nishi-shinjuku 2-chome, Shinjuku-ku, Tokyo, 1630811 (JP).
- (72) Inventor: AKIYAMA, Koichi; c/o SEIKO EPSON CORPORATION, 3-5, Owa 3-chome, Suwa-shi, Nagano, 3928502 (JP).
- (74) Agents: KAMIYANAGI, Masataka et al.; c/o Intellectual Property Division SEIKO EPSON CORPORATION, 80, Harashinden, Hirooka, Shiojiri-shi, Nagano, 3990785 (JP).
- (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, 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,

[Continued on next page]

(54) Title: ILLUMINATION DEVICE AND PROJECTOR



(57) Abstract: An illumination device (100) including a solid-state light source device (10), a pickup lens unit (20) on which light from the solid-state light source device is incident, and a polarization conversion element (40). A lens (22) constituting the light exit surface of the pickup lens unit (20) is an aspherical lens having a light exit surface shaped like a rotationally symmetric shape centered on a light axis (40ax) when viewed from a direction of the light axis (40ax), and having a cross-section of an aspherical shape when cut with a plane parallel to the light axis (40ax). The light exit surface of the aspherical lens has a function of collimating and then emitting the light having been emitted from the center of the solid-state light source device (10) in an area near to the light axis (40ax), and emitting the light so as to converge toward the light axis (40ax) in an area far from the light axis (40ax)



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).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

Published:

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

(88) Date of publication of the international search report:

30 January 2014

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2013/000721

A. CLASSIFICATION OF SUBJECT MATTER
INV. G03B21/00 H04N9/00
ADD.

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)
G03B

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 practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005 208571 A (SEIKO EPSON CORP) 4 August 2005 (2005-08-04) Illumination device comprising a pickup lens unit including an aspherical lens, and a polarization conversion element, and corresponding projector; abstract; figures 1-12 -----	1-7
X	US 2011/157566 A1 (AKIYAMA KOICHI [JP]) 30 June 2011 (2011-06-30) Illumination device comprising a pickup lens unit including an aspherical lens, and a polarization conversion element, and corresponding projector; paragraph [0071] - paragraph [0216]; figures 1-17C ----- -/--	1-7

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

☒ 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 application or patent 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

26 November 2013

Date of mailing of the international search report

04/12/2013

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Tomezzoli, Giancarlo

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2013/000721

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/007240 A1 (QU LUJIE [CN] ET AL) 13 January 2011 (2011-01-13) Illumination device comprising a pickup lens unit and a polarization conversion element, and corresponding projector; paragraph [0014] - paragraph [0052]; figures 1-7 -----	1-7
A	US 2004/046942 A1 (KATSUMATA MASAO [JP] ET AL) 11 March 2004 (2004-03-11) Illumination device comprising a pickup lens unit and a polarization conversion element, and corresponding projector; paragraph [0001] - paragraph [0173]; figures 1-15C -----	1-7
A	US 6 084 714 A (USHIYAMA TOMIYOSHI [JP] ET AL) 4 July 2000 (2000-07-04) Illumination device comprising a pickup lens unit and a polarization conversion element, and corresponding projector; column 1, line 5 - column 16, line 25; figures 1-10 -----	1-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2013/000721

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005208571 A	04-08-2005	JP 4661149 B2 JP 2005208571 A	30-03-2011 04-08-2005
US 2011157566 A1	30-06-2011	CN 102109142 A US 2011157566 A1	29-06-2011 30-06-2011
US 2011007240 A1	13-01-2011	CN 101943845 A US 2011007240 A1	12-01-2011 13-01-2011
US 2004046942 A1	11-03-2004	CN 1464995 A JP 3972680 B2 JP 2003075916 A US 2004046942 A1 WO 03001291 A1	31-12-2003 05-09-2007 12-03-2003 11-03-2004 03-01-2003
US 6084714 A	04-07-2000	JP 3832076 B2 JP H11231264 A US 6084714 A	11-10-2006 27-08-1999 04-07-2000