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[US/US]; 43 Archibald Avenue, Methuen, MA 01844 (US). **WONG, Jo-ey** [CN/US]; 1850 Beacon Street, #202, Brookline, MA 02445 (US).

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(74) Agent: **HOUSTON, J., Grant**; Axsun Technologies, Inc., 1 Fortune Drive, Billerica, MA 01821 (US).

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(71) Applicant (*for all designated States except US*): **AXSUN TECHNOLOGIES, INC.** [US/US]; 1 Fortune Drive, Billerica, MA 01821 (US).

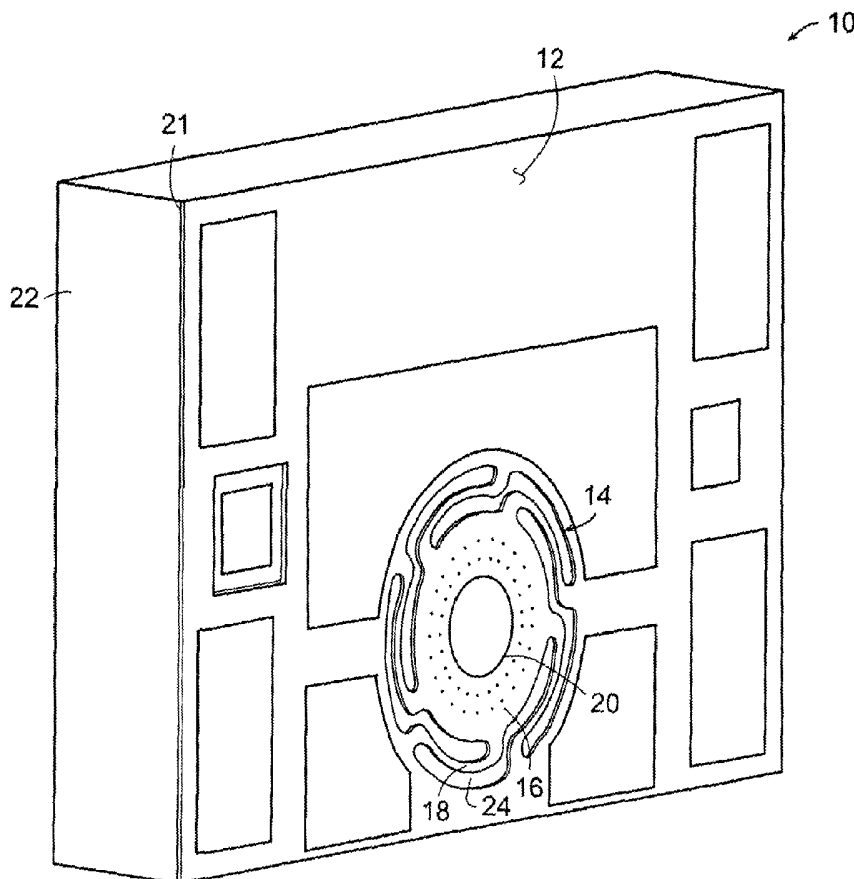
(72) Inventors; and

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(75) Inventors/Applicants (*for US only*): **LE, Minh, Van**

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(54) Title: MEMS SINGULATION PROCESS UTILIZING PROTECTIVE COATING



(57) Abstract: A process for singulating MOEMS optical devices (10) from a precursor structure (110), in which the precursor structure (110) comprises device material (12), having movable optical structures (14), and handle material (22), through which optical ports (30) are formed to provide for optical access to the movable optical structures (14). The process comprises coating a frontside and a backside of the precursor structure (110) with protection material (610). The precursor structure (110) is then attached to a substrate such as dicing tape and the precursor structure (110) separated into individual optical devices (10) by a process, including die sawing. Thereafter, the optical devices (10) are removed from the tape and the protection material (610) removed from the optical devices (10).



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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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)
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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, WPI Data, PAJ, IBM-TDB, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 44045 A (AMKOR TECHNOLOGY INC) 27 July 2000 (2000-07-27) page 2, line 18 -page 3, line 12; figures 5-7 page 6, line 8 - line 15 page 11, line 7 - line 12 page 13, line 1 - line 14 page 14, line 5 - line 20 page 15, line 6 -page 16, line 3 ---	1-3,8-14
X	US 5 832 585 A (MATHEW RANJAN ET AL) 10 November 1998 (1998-11-10) column 2, line 39 - line 65; figures 1-3 column 3, line 23 - line 53 column 4, line 24 - line 43 ---- -/--	1,3-7

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Patent family members are listed in annex.

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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

McGinley, C

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 661 737 A (TEXAS INSTRUMENTS INC) 5 July 1995 (1995-07-05) figure 4 column 7, line 24 - line 35 column 9, line 2 - line 20 ----	1-14
A	US 5 389 182 A (MIGNARDI MICHAEL A) 14 February 1995 (1995-02-14) column 1, line 62 -column 2, line 5 column 2, line 52 -column 4, line 6 ----	1-14
A	US 5 622 900 A (SMITH GREGORY C) 22 April 1997 (1997-04-22) figures 1-3 ----	1-14
A	US 5 824 177 A (KURAHASHI TAKASHI ET AL) 20 October 1998 (1998-10-20) column 2, line 2 - line 24 ----	1-14
Y	US 5 250 843 A (EICHELBERGER CHARLES W) 5 October 1993 (1993-10-05) column 17, line 67 -column 18, line 15 ----	15-19
Y	US 5 362 681 A (ROBERTS JR CARL M ET AL) 8 November 1994 (1994-11-08) column 3, line 38 -column 4, line 2; figures 6,7 ----	15-19
A	EP 0 623 955 A (MOTOROLA INC) 9 November 1994 (1994-11-09) column 2, line 22 - line 52 -----	15-19

INTERNATIONAL SEARCH REPORT

 International Application No
 PCT/US 02/02348

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0044045	A	27-07-2000	US 6465329 B1 WO 0044045 A1	15-10-2002 27-07-2000
US 5832585	A	10-11-1998	DE 19735041 A1	19-02-1998
EP 0661737	A	05-07-1995	US 5435876 A CA 2119505 A1 CN 1100563 A ,B DE 69419489 D1 DE 69419489 T2 EP 0661737 A1 JP 7099172 A	25-07-1995 30-09-1994 22-03-1995 19-08-1999 13-01-2000 05-07-1995 11-04-1995
US 5389182	A	14-02-1995	CA 2129212 A1 CN 1120733 A ,B EP 0655781 A2	03-02-1995 17-04-1996 31-05-1995
US 5622900	A	22-04-1997	CA 2115947 A1 CN 1101458 A ,B DE 69415059 D1 DE 69415059 T2 EP 0614102 A2 JP 7006983 A	04-09-1994 12-04-1995 21-01-1999 20-05-1999 07-09-1994 10-01-1995
US 5824177	A	20-10-1998	JP 9027466 A DE 19628237 A1	28-01-1997 16-01-1997
US 5250843	A	05-10-1993	AU 648417 B2 AU 1874392 A CA 2106872 A1 EP 0577779 A1 JP 6502744 T WO 9217901 A1	21-04-1994 02-11-1992 28-09-1992 12-01-1994 24-03-1994 15-10-1992
US 5362681	A	08-11-1994	DE 69329529 D1 DE 69329529 T2 EP 0651693 A1 JP 7509351 T WO 9402299 A1	09-11-2000 08-03-2001 10-05-1995 12-10-1995 03-02-1994
EP 0623955	A	09-11-1994	US 5473192 A CN 1095862 A EP 0623955 A2 JP 6333962 A	05-12-1995 30-11-1994 09-11-1994 02-12-1994