



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/965,032	02/04/2014	8642491	SP05-073B	5934

22928 7590 01/15/2014
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 511 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Adam J.G. Ellison, Painted Post, NY;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address.)

22928 7590 10/03/2013
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Susan M. Kane	(Depositor's name)
<i>Susan M. Kane</i>	(Signature)
January 2, 2014	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B	5934

TITLE OF INVENTION; FINING OF BOROALUMINO SILICATE GLASSES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	01/03/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
BOLDEN, ELIZABETH A	1731	501-066000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
 (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. Maurice M. Klee, Ph.D.
 2. Thomas R. Beall
 3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Corning Incorporated

Corning, New York

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

☐ A check is enclosed.
☐ Payment by credit card, Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number **03-3325** (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature



Date January 2, 2014

Typed or printed name

Thomas R. Beall

Registration No. 40,424

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	12965032			
Filing Date:	10-Dec-2010			
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES			
First Named Inventor/Applicant Name:	Adam J.G. Ellison			
Filer:	Thomas Russell Beall/Susan Kane			
Attorney Docket Number:	SP05-073B			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0
Petitioner Ex 1002				000004

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	17794694
Application Number:	12965032
International Application Number:	
Confirmation Number:	5934
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES
First Named Inventor/Applicant Name:	Adam J.G. Ellison
Customer Number:	22928
Filer:	Thomas Russell Beall/Susan Kane
Filer Authorized By:	Thomas Russell Beall
Attorney Docket Number:	SP05-073B
Receipt Date:	02-JAN-2014
Filing Date:	10-DEC-2010
Time Stamp:	09:58:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$960
RAM confirmation Number	10367
Deposit Account	033325
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Petitioner Ex 1002

000006

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	20140102_SP05-073B_US_Issue_Fee_Transmittal_Ltr.pdf	826870	no	2
			385d8411de0febd4f360520e9822d4a74f46b5d6		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	31982	no	2
			85b7fd8e175425bc5b4085799571d1109c6c4dd8		

Warnings:

Information:

Total Files Size (in bytes):			858852
------------------------------	--	--	--------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

22928 7590 10/03/2013
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

EXAMINER

BOLDEN, ELIZABETH A

ART UNIT

PAPER NUMBER

1731

DATE MAILED: 10/03/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/965,032

12/10/2010

Adam J.G. Ellison

SP05-073B

5934

TITLE OF INVENTION: FINING OF BOROALUMINO SILICATE GLASSES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	01/03/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

22928 7590 10/03/2013
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B	5934

TITLE OF INVENTION: FINING OF BOROALUMINO SILICATE GLASSES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	01/03/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
BOLDEN, ELIZABETH A	1731	501-066000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. <div> 1 _____ 2 _____ 3 _____ </div>
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B	5934

22928 7590 10/03/2013
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

EXAMINER

BOLDEN, ELIZABETH A

ART UNIT	PAPER NUMBER
----------	--------------

1731

DATE MAILED: 10/03/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 455 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 455 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**Notices of Allowance and Fee(s) Due mailed between October 1, 2013 and
December 31, 2013**

(Addendum to PTOL-85)

If the “Notice of Allowance and Fee(s) Due” has a mailing date on or after October 1, 2013 and before January 1, 2014, the following information is applicable to this application.

If the issue fee is being timely paid on or after January 1, 2014, the amount due is the issue fee and publication fee in effect January 1, 2014. On January 1, 2014, the issue fees set forth in 37 CFR 1.18 decrease significantly and the publication fee set forth in 37 CFR 1.18(d)(1) decreases to \$0.

If an issue fee or publication fee has been previously paid in this application, applicant is not entitled to a refund of the difference between the amount paid and the amount in effect on January 1, 2014.

<i>Examiner-Initiated Interview Summary</i>	Application No. 12/965,032	Applicant(s) ELLISON, ADAM J.G.	
	Examiner Elizabeth A. Bolden	Art Unit 1731	

All participants (applicant, applicant's representative, PTO personnel):

(1) Elizabeth A. Bolden. (3) ____.

(2) Maurice Klee. (4) ____.

Date of Interview: 19 September 2013.

Type: ☒ Telephonic ☐ Video Conference
 ☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
 If Yes, brief description: ____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 19.

Identification of prior art discussed: N/A.

Substance of Interview
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The Examiner contacted the Applicant's Representative about a possible Examiner's Amendment in order to put this case in condition for allowance. The Examiner proposed an amendment to the range of As₂O₃ and Sb₂O₃ in claim 19. The Examiner and the Applicant's representative agreed to the proposed amendment.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

Notice of Allowability	Application No. 12/965,032	Applicant(s) ELLISON, ADAM J.G.	
	Examiner Elizabeth A. Bolden	Art Unit 1731	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 8 August 2013.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-6, 19-22 and 2437. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. ☐ Notice of References Cited (PTO-892) | 5. ☒ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 6. ☒ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

Art Unit: 1731

DETAILED ACTION

The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 8 August 2013 has been considered by the examiner.

Terminal Disclaimer

The terminal disclaimer filed on 8 August 2013 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent 7,534,734 has been reviewed and is accepted. The terminal disclaimer has been recorded.

The terminal disclaimer filed on 8 August 2013 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent 7,851,394 has been reviewed and is accepted. The terminal disclaimer has been recorded.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Maurice Klee on 19 September 2013.

The application has been amended as follows:

In claim 19, line 9, the number "0.05" has been deleted and the number --0.005-- has been inserted in its place.

In claim 19, line 10, the number "0.05" has been deleted and the number --0.005-- has been inserted in its place.

Claim 23 has been cancelled.

Allowable Subject Matter

Claims 1-6, 19-22, and 24-37 are allowed.

Reason for Allowance

The following is an examiner's statement of reasons for allowance:

Art Unit: 1731

The prior art fail to disclose or suggest with sufficient specificity an alkali-free glass comprising in mole percentages the recited components, wherein the glass has the specific recited relationship of the alkaline earth metal oxides to the Al_2O_3 content, the glass has greater than or equal to 1 mole percent MgO , and the glass limits the amounts of As_2O_3 and Sb_2O_3 content present in the glass. Furthermore, the glass has a liquidus viscosity that is greater than or equal to 100,000 poise and is made for the downdraw process.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elizabeth A. Bolden whose telephone number is (571)272-1363. The examiner can normally be reached on 10 am to 6:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kaj K. Olsen can be reached on 571-272-1344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Karl E Group/
Primary Examiner, Art Unit 1731

/Elizabeth A. Bolden/
Examiner
Art Unit 1731

EAB
20 September 2013

<i>Examiner-Initiated Interview Summary</i>	Application No. 12/965,032	Applicant(s) ELLISON, ADAM J.G.	
	Examiner Elizabeth A. Bolden	Art Unit 1731	

All participants (applicant, applicant's representative, PTO personnel):

(1) Elizabeth A. Bolden. (3) ____.

(2) Maurice Klee. (4) ____.

Date of Interview: 19 September 2013.

Type: ☒ Telephonic ☐ Video Conference
 ☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
 If Yes, brief description: ____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 19.

Identification of prior art discussed: N/A.

Substance of Interview
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The Examiner contacted the Applicant's Representative about a possible Examiner's Amendment in order to put this case in condition for allowance. The Examiner proposed an amendment to the range of As₂O₃ and Sb₂O₃ in claim 19. The Examiner and the Applicant's representative agreed to the proposed amendment.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S62	1	"12965032"	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:31
S63	108	((ADAM) near2 (ELLI SON)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:31
S64	54	S63 and ((SiO2 or "SiO.sub.2" or SiO2 or "SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or Sn02 or "Sn0.sub.2" or tin or stannous or stannic))	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:32
S66	1491	501/66.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:32
S67	352	501/66.ccls. and ((SiO2 or "SiO.sub.2" or SiO2 or "SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or Sn02 or "Sn0.sub.2" or tin or stannous or stannic))	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:32
S68	19	("20020023463" "20030121288" "20060003884" "20060242996" "3338696" "3682609" "4180618" "5374595" "5785726" "5824127" "6128924" "6169047" "6319867" "6468933" "6537937" "6881692" "6992030").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:33
S69	0	ru-642265-\$.did.	EPO; JPO; DERWENT	OR	ON	2013/09/17 15:33
S70	2	EP-607865-\$.did.	EPO; JPO; DERWENT	OR	ON	2013/09/17 15:33
S71	2	JP-2001348247-\$.did.	EPO; JPO;	OR	ON	2013/09/17

			DERWENT			15:33
S72	2	JP-2004189535-\$.did.	EPO; JPO; DERWENT	OR	ON	2013/09/17 15:33
S73	2	WO-2004087597-\$.did.	EPO; JPO; DERWENT	OR	ON	2013/09/17 15:33
S74	8	S69 S70 S71 S72 S73	EPO; JPO; DERWENT	OR	ON	2013/09/17 15:33
S75	2	("5374595" "6468933").PN.	US- PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:36
S76	10	("5801109" "7696113" "7709406" "7833919" "7851394" "7935649" "7946128" "20110048074" "20110079049" "20130065747").PN.	US- PGPUB; USPAT; USOCR	OR	ON	2013/09/17 15:37

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S77	0	501/66.ccls.	UPAD	OR	ON	2013/09/17 15:37
S78	43	glass and ((SiO2 or "SiO.sub.2" or SiO2 or "SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or SnO2 or "SnO.sub.2" or tin or stannous or stannic))	UPAD	OR	ON	2013/09/17 15:37
S79	1	(glass and ((SiO2 or "SiO.sub.2" or SiO2 or "SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or SnO2 or "SnO.sub.2" or tin or stannous or stannic))).clm.	UPAD	OR	ON	2013/09/17 15:37
S80	139	501/66.ccls. and ((SiO2 or "SiO.sub.2" or SiO2 or "SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or SnO2 or "SnO.sub.2" or tin or stannous or stannic))	US- PGPUB	OR	ON	2013/09/17 15:37
S81	410	(glass and ((SiO2 or "SiO.sub.2" or SiO2 or	US-	OR	ON	2013/09/17

		"SiO.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or Sn02 or "Sn0.sub.2" or tin or stannous or stannic))).clm.	PGPUB			15:37
S82	354	S81 not S80	US-PGPUB	OR	ON	2013/09/17 15:37
S83	35	((alkali near free) and glass and ((SiO2 or "SiO.sub.2" or Si02 or "Si0.sub.2" or silica or silicon or quartz) and (Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or Al2O3 or "Al.sub.2 O.sub.3" or "Al.sub.2O.sub.3" or alumina or aluminum) and (B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or B2O3 or "B.sub.2 O.sub.3" or "B.sub.2O.sub.3" or boron or borio or boro or boron) and (MgO or Mg0 or Magnesium) and (CaO or Ca0 or calcium or calico or calcia or lime) and (SnO2 or "SnO.sub.2" or Sn02 or "Sn0.sub.2" or tin or stannous or stannic))).clm.	US-PGPUB	OR	ON	2013/09/17 15:53
S84	10	S83 not S80	US-PGPUB	OR	ON	2013/09/17 15:55

9/ 20/ 2013 10:51:06 AM
C:\ Users\ ebolden\ Documents\ EAST\ Autosave\ ~ EASTAutoSave.wsp.asv

Search Notes 	Application/Control No. 12965032	Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.
	Examiner ELIZABETH A BOLDEN	Art Unit 1731

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
501	66	5/5/2013	EAB
Updated		9/19/2013	EAB

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	5/5/2013	EAB
EAST	5/5/2013	EAB
Updated	9/19/2013	EAB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
501	66	9/19/2013	EAB
PG-PUB	Text	9/19/2013	EAB

--	--

Receipt date: 08/08/2013

12965032 - GAU: 1731

PTO/SB/08a (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet

1

of

2

Complete if Known

Application Number	12/965,032
Filing Date	December 10, 2010
First Named Inventor	Ellison
Art Unit	1731
Examiner Name	Elizabeth Bolden
Attorney Docket Number	ADP-231.2 US (SP05-073B)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
		US- 5801109	09-01-1998	Nishizawa et al.	
		US- 7696113	04-13-2010	Ellison	
		US- 7709406	05-04-2010	Cornelius et al.	
		US- 7833919	11-16-2010	Danielson et al.	
		US- 7851394	12-14-2010	Ellison	
		US- 7935649	05-03-2011	Ellison	
		US- 7946128	05-24-2011	Cornelius et al.	
		US- 2011/0048074	03-03-2011	Danielson et al.	
		US- 2011/0079049	04-07-2011	Ellison	
		US- 2013/0065747	03-14-2013	Danielson et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁸
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				

Examiner
Signature

/Elizabeth A. Bolden/

Date
Considered

09/18/2013

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /E.A.B./ 000023

Substitute for form 1449/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT***(Use as many sheets as necessary)***Complete if Known**

Application Number	12/965,032
Filing Date	December 10, 2010
First Named Inventor	Ellison
Art Unit	1731
Examiner Name	Elizabeth Bolden
Attorney Docket Number	ADP-231.2 US (SP05-073B)

Sheet 2 of 2

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
		May 20, 2013 Office Action for U.S. Application No. 12/965,004 (8 pages).	
		November 25, 2002 "Supplemental Information Disclosure Statement" in US Application No. 09/990,750, now U.S. Patent No. 6,831,029 (with attached Tables 1-3; 5 pages).	
		Professional English translation of JP 2004-189535.	

Examiner Signature	/Elizabeth A. Bolden/	Date Considered	09/18/2013
--------------------	-----------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO:**

Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /E. A. 00024

Issue Classification 	Application/Control No. 12965032	Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.	
	Examiner ELIZABETH A BOLDEN	Art Unit 1731	

CPC						
Symbol					Type	Version

CPC Combination Sets									
Symbol					Type	Set	Ranking	Version	

/ELIZABETH A BOLDEN/ Examiner.Art Unit 1731	9/20/2013	Total Claims Allowed: 24	
(Assistant Examiner)	(Date)		
/KARL GROUP/ Primary Examiner.Art Unit 1731	09/24/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	N/A

Issue Classification 	Application/Control No. 12965032	Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.
	Examiner ELIZABETH A BOLDEN	Art Unit 1731

☐ Claims renumbered in the same order as presented by applicant								☐ CPA		☒ T.D.		☐ R.1.47			
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	23	30												
2	2	24	31												
3	3	7	32												
4	4	8	33												
5	5	9	34												
6	6	10	35												
13	19	11	36												
14	20	12	37												
15	21														
16	22														
17	24														
18	25														
19	26														
20	27														
21	28														
22	29														

/ELIZABETH A BOLDEN/ Examiner.Art Unit 1731 (Assistant Examiner)	9/20/2013 (Date)	Total Claims Allowed: 24	
/KARL GROUP/ Primary Examiner.Art Unit 1731 (Primary Examiner)	09/24/2013 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure N/A

Application Number 	Application/Control No. 12/965,032	Applicant(s)/Patent under Reexamination ELLISON, ADAM J.G.	
Document Code - DISQ		Internal Document – DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : August 8, 2013	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

Henry D. Jefferson

U.S. Patent and Trademark Office

**TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING
REJECTION OVER A "PRIOR" PATENT**Docket Number (Optional)
ADP-231.2 US (SP05-073B)

In re Application of: Adam J. G. Ellison

Application No.: 12/965,032

Filed: December 10, 2010

For: FINING OF BOROALUMINO SILICATE GLASSES

The owner*, CORNING INCORPORATED, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 7534734 & 7851394 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

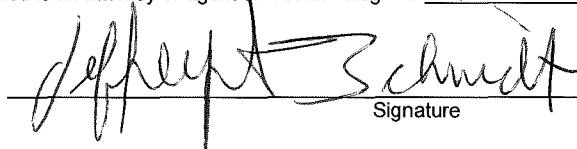
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 41,574


Signature

August 5, 2013
Date

Jeffrey A. Schmidt
Typed or printed name

(607) 974-2155
Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	12965032			
Filing Date:	10-Dec-2010			
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES			
First Named Inventor/Applicant Name:	Adam J.G. Ellison			
Filer:	Maurice M. Klee/Any Klee			
Attorney Docket Number:	SP05-073B			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Claims in Excess of 20	1202	5	80	400
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:	Petitioner Ex 1002			000030

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Statutory or Terminal Disclaimer	1814	1	160	160
Total in USD (\$)				740

Electronic Acknowledgement Receipt

EFS ID:	16539734
Application Number:	12965032
International Application Number:	
Confirmation Number:	5934
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES
First Named Inventor/Applicant Name:	Adam J.G. Ellison
Customer Number:	22928
Filer:	Maurice M. Klee/Anya Klee
Filer Authorized By:	Maurice M. Klee
Attorney Docket Number:	SP05-073B
Receipt Date:	08-AUG-2013
Filing Date:	10-DEC-2010
Time Stamp:	16:09:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$740
RAM confirmation Number	2962
Deposit Account	111158
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Rate of application and reexamination processing fees)

Petitioner Ex 1002

000032

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	NPL_JP2004189535A_Professional_translation.pdf	582194	no	20
			6e1494bb753ea78f878c4644ff1e7846ff23bc54		
Warnings:					
Information:					
2	Amendment/Req. Reconsideration-After Non-Final Reject	adp2312_US_a_Amendment_w_ExhA.pdf	679545	no	18
			7edef26a0814e51efe56b7eeaa9098ce7693e741		
Warnings:					
Information:					
3	Miscellaneous Incoming Letter	adp2312_US_a_Fee_Transmittal_sb0017.pdf	552462	no	1
			10e33d0ff3996b419425f4c76587e3bf7950eb3f		
Warnings:					
Information:					
4	Information Disclosure Statement (IDS) Form (SB08)	adp2312_US_a_IDS_sb0008.pdf	954596	no	2
			8099c04f605a8f2a1370766590fdb43c1b706491		
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
5	Transmittal Letter	adp2312_US_a_Supp_IDS_Letter_w_ExhA-B.pdf	583166	no	17
			82cda8d074e5196a1696ca82b213d58433c6a989		
Warnings:					
Information:					
6	Terminal Disclaimer Filed	adp2312_US_a_US_Terminal_Disclaimer.pdf	267600	no	1
			1bc57678a606a40cbd6eda4571323d9f8303de9d		
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	33473	no	2
			3943db9084c21f4eb0f31a8a65f7b2513fb2f999		
Warnings:					
Information:					
Total Files Size (in bytes):			3653036		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet

1

of

2

Complete if Known

Application Number	12/965,032
Filing Date	December 10, 2010
First Named Inventor	Ellison
Art Unit	1731
Examiner Name	Elizabeth Bolden
Attorney Docket Number	ADP-231.2 US (SP05-073B)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
		US- 5801109	09-01-1998	Nishizawa et al.	
		US- 7696113	04-13-2010	Ellison	
		US- 7709406	05-04-2010	Cornelius et al.	
		US- 7833919	11-16-2010	Danielson et al.	
		US- 7851394	12-14-2010	Ellison	
		US- 7935649	05-03-2011	Ellison	
		US- 7946128	05-24-2011	Cornelius et al.	
		US- 2011/0048074	03-03-2011	Danielson et al.	
		US- 2011/0079049	04-07-2011	Ellison	
		US- 2013/0065747	03-14-2013	Danielson et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ²
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				

Examiner
SignatureDate
Considered

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Complete if Known

Application Number	12/965,032
Filing Date	December 10, 2010
First Named Inventor	Ellison
Art Unit	1731
Examiner Name	Elizabeth Bolden
Attorney Docket Number	ADP-231.2 US (SP05-073B)

Sheet	2	of	2
-------	---	----	---

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
		May 20, 2013 Office Action for U.S. Application No. 12/965,004 (8 pages).	
		November 25, 2002 "Supplemental Information Disclosure Statement" in US Application No. 09/990,750, now U.S. Patent No. 6,831,029 (with attached Tables 1-3; 5 pages).	
		Professional English translation of JP 2004-189535.	

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Adam J. G. Ellison
Serial No. : 12/965,032
Filed : December 10, 2010
For : FINING OF BOROALUMINO SILICATE GLASSES
Examiner : Elizabeth Bolden
Group : 1731

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

In accordance with 37 CFR §1.56 and 37 CFR §1.97(c), applicant wishes to call the Examiner's attention to the references listed on the Information Disclosure Statement by Applicant (PTO Form SB08) submitted herewith. Copies of the references listed therein are submitted herewith, with the exception of the references which are U.S. patent documents (37 CFR §1.98(a)(2)(ii)).

As the Examiner is aware, this application and co-pending application US 12/965,004 (the '004 application) both claim priority from US 60/694,478 and US 11/478,493, and both applications had first Office Actions issued in May 2013. Each of those Office Actions included obviousness-type double patenting (ODP) rejections, but the patents/applications relied on in those rejections were not the same. By this Supplemental Information Disclosure Statement, applicant is making of record in this application the patents/applications relied on in the ODP rejections of the '004 application. Also being made of record are issued patents and pending applications which share a common priority with any of the patents/applications cited in the ODP rejections of this application or the '004 application. A copy of the May 20, 2013 Office Action from the '004 application which contains its ODP rejections is attached hereto as Exhibit A.

In the December 10, 2010 Information Disclosure Statement for this application, applicant made of record U.S. Patent No 6,169,047 (the '047 patent). That patent is a continuation-in-part of U.S. Patent No. 5,801,109 (the '109 patent). In 1996, Corning Incorporated, the assignee of this application, prepared and tested three examples from the '109 patent (Examples 4, 14, and 31), which also appear in the '047 patent (Examples 3, 12, and 41). Attached hereto as Exhibit B is a November 25, 2002 Supplemental Information Disclosure Statement from U.S. Application No. 09/990,750, now U.S. Patent No. 6,831,029, which contains the data for these examples (see Table 2).

Submitted herewith is a PTO form SB08 which lists the issued patents and pending patent applications relating to the ODP rejections, the '109 patent, and Exhibits A and B hereto. Consideration of these materials in connection with the prosecution of this application is respectfully requested.

Respectfully submitted,

Date: August 8, 2013

/Maurice M. Klee/
Maurice M. Klee, Ph.D.
Reg. No. 30,399
Attorney for Applicant
1951 Burr Street
Fairfield, CT 06824
(203) 255-1400

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Adam J. G. Ellison
Appl. No. : 12/965,032
Filed : December 10, 2010
For : FINING OF BOROALUMINO SILICATE GLASSES
Examiner : Elizabeth Bolden
Group : 1731

AMENDMENT

This Amendment is submitted in response to the Office Action dated May 10, 2013. Its contents are:

- (1) a listing of the claims of the application which includes the
Amendments to the Claims being made by this Amendment -- page 2;
and
- (2) applicant's **Remarks** -- page 7.

No extension of time is believed to be necessary for the filing of this Amendment, but if an extension of time is required, applicant requests that this be considered a petition therefor. The Director is hereby authorized to charge any fees which may be required for such an extension to Deposit Account No. 11-1158.

Amendments to the Claims:

This listing of claims will replace all prior versions of the claims in this application:

Listing of Claims:

Claim 1 (currently amended): An alkali-free glass for a downdraw process comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1
SnO ₂ :	0.01 0-0.15

wherein:

- (a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]_2 \leq 1.25$, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;
- (b) the glass has the following compositional characteristics:
- (i) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;
 - (ii) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃; and
 - (iii) on an oxide basis, the glass comprises at least 0.01 mole percent SnO₂; and
- (c) the glass has a liquidus viscosity that is greater than or equal to 100,000 poise.

Claim 2 (currently amended): The glass of Claim 1 wherein:

$$\frac{\Sigma[\text{RO}]}{[\text{Al}_2\text{O}_3]} \leq 1.25.$$

~~the glass has at least one of the following compositional characteristics:~~

- ~~(a) — on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;~~
- ~~(b) — on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 ;~~

Claim 3 (currently amended): The glass of Claim 1 [[2]] wherein, on an oxide basis, SrO is at most 1.0 mole percent. ~~the glass has compositional characteristics (a) and (b).~~

Claim 4 (currently amended): The glass of Claim 1 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
- (b) a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:

$$28 \times 10^{-7}/^\circ\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^\circ\text{C};$$

- (c) a liquidus temperature less than or equal to 1170°C.;
- ~~(d) — a liquidus viscosity that is greater than or equal to 100,000 poise;~~
- ~~[[e]]~~d) a strain point that is greater than or equal to 650°C.

Claim 5 (original): The glass of Claim 4 wherein the glass has at least properties (a) through (c).

Claim 6 (currently amended): The glass of Claim 4 wherein the glass has properties (a) through ~~[[e]]~~ (d).

Claims 7-18 (canceled)

Claim 19 (currently amended): An alkali-free glass sheet produced by a downdraw process comprising a glass that comprises SiO_2 , Al_2O_3 , B_2O_3 , MgO , and CaO , and, on an oxide basis, has:

- (i) a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ is the sum of the mole percents of MgO , CaO , SrO , and BaO ; and
- (ii) a MgO content greater than or equal to 1.0 mole percent;

wherein:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 ;
- (c) on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 ;

and

(d) the glass has a liquidus viscosity that is greater than or equal to 100,000 poise, ~~;~~ and

~~(e) — the glass sheet has a volume of at least 500 cubic centimeters and is produced by a downdraw process for which a population of 50 of the glass sheets sequentially produced by the process has an average gaseous inclusion level of less than 0.05 gaseous inclusions/cubic centimeter.~~

Claim 20 (previously presented): The glass sheet of Claim 19 wherein on an oxide basis, the glass comprises at most 0.15 mole percent SnO_2 .

Claim 21 (new): The glass sheet of Claim 19 wherein the glass has a MgO content between 1.2 and 2.8 mole percent.

Claim 22 (new): The glass sheet of Claim 19 wherein the glass is substantially free of BaO .

Claim 23 (new): The glass sheet of Claim 19 wherein the glass comprises at most 0.005 mole percent As_2O_3 and at most 0.005 mole percent Sb_2O_3 .

Claim 24 (new): The glass sheet of Claim 19 wherein the glass has a density that is less than or equal to 2.41 grams/cm³.

Claim 25 (new): The glass sheet of Claim 19 wherein the glass has a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:

$$28 \times 10^{-7}/^{\circ}\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^{\circ}\text{C}.$$

Claim 26 (new): The glass sheet of Claim 19 wherein the glass has a liquidus temperature less than or equal to 1170°C.

Claim 27 (new): The glass sheet of Claim 19 wherein the glass has a strain point that is greater than or equal to 650°C.

Claim 28 (new): The glass sheet of Claim 19 wherein the downdraw process is a fusion process.

Claim 29 (new): The glass sheet of Claim 19 wherein:

- (i) the glass sheet has a volume of at least 500 cubic centimeters; and
- (ii) a population of 50 of the glass sheets sequentially produced by the downdraw process has an average gaseous inclusion level of less than 0.05 gaseous inclusions/cubic centimeter.

Claim 30 (new): The glass sheet of Claim 19 wherein the glass has a liquidus viscosity greater than or equal to 200,000 poise.

Claim 31 (new): The glass of Claim 1 wherein the glass has a density that is less than or equal to 2.41 grams/cm³.

Claim 32 (new): The glass of Claim 1 wherein the glass has a liquidus viscosity greater than or equal to 200,000 poise.

Claim 33 (new): The glass of Claim 1 wherein, on an oxide basis, the glass comprises at most 0.15 mole percent SnO₂.

Claim 34 (new): The glass of Claim 1 wherein the glass has a MgO content between 1.2 and 2.8 mole percent.

Claim 35 (new): The glass of Claim 1 wherein the glass is substantially free of BaO.

Claim 36 (new): The glass of Claim 1 wherein the glass comprises at most 0.005 mole percent As₂O₃ and at most 0.005 mole percent Sb₂O₃.

Claim 37 (new): The glass of Claim 1 wherein the downdraw process is a fusion process.

REMARKS

This response to the Office Action dated May 10, 2013, is organized as follows:

- I. Claim Amendments
- II. Rejections Under 35 U.S.C. §112, ¶1, and 35 U.S.C. §102
- III. Rejection Under 35 U.S.C. §103
- IV. Double Patenting
- V. Conclusion

I. Claim Amendments

By the above amendments, this application now contains two independent claims, i.e., Claim 1 directed to an alkali-free glass for a downdraw process and Claim 19 directed to an alkali-free glass sheet produced by a downdraw process. Each of these independent claims requires:

- (1) a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0;
- (2) a MgO content greater than or equal to 1.0 mole percent;
- (3) at least 0.01 mole percent SnO_2 ;
- (4) at most 0.05 mole percent As_2O_3 ;
- (5) at most 0.05 mole percent Sb_2O_3 ; and
- (6) a liquidus viscosity that is greater than or equal to 100,000 poise.

As discussed in Section III below, these limitations fully distinguish the Miwa reference (Japanese Patent Publication No. JP 2004-189535) cited against applicant's claims in the May 10th Office Action.

II. Rejections Under 35 U.S.C. §112, ¶1, and 35 U.S.C. §102

The "Examiner Comment" on page 2 of the Office Action, as well as the rejections under 35 U.S.C. §112, ¶1, and 35 U.S.C. §102, are based on the statement that "none of the parent documents preceding [the present application] disclose the glass composition wherein the glass has a liquidus temperature less than or equal to 1170°C."

In fact, this subject matter was part of applicant's provisional application No. 60/694,478, as well as applicant's parent application No. 11/478,493. Each of those applications contained the following disclosure (see page 21, lines 16-20, of the provisional application and page 21, line 30, to page 22, line 2, of the parent application):

The glasses of Examples 1-43 can also be formed using downdraw techniques, such as the fusion technique. Thus, they **have liquidus temperatures less than or equal to 1170°C** and liquidus viscosities equal to or greater than 100,000, and in most cases, equal to or greater than 150,000. (emphasis added)

This disclosure also appears in the present application at page 21, lines 3-7, as well as in paragraph [0109] of the published version of the parent application, i.e., U.S. Patent Application Publication No. US 2006/0293162.

At page 3 of the Office Action, the Examiner stated that:

While the specification shows examples of specific glass compositions having a specific liquidus temperatures from 1105-1220°C, the specification is not enabled for the limitation of the liquidus temperature being less than or equal to 1170°C, since that range includes values not encompassed by the specific examples.

As discussed at page 21, lines 12-27, of the present application (see page 21, line 25, to page 22, line 8, of the provisional application and page 22, lines 7-22, of the parent application), Examples 44-52 are comparative examples. The 1220°C value recited in the above quotation from the Office Action comes from the comparative examples, specifically, from Example 46. The examples of the invention, on the other hand, i.e., Examples 1-43, all have liquidus temperatures that are less than or equal to 1170°C, as stated in the above-quoted portion of the specification.

In view of these considerations, applicant respectfully submits that his claims that call for a liquidus temperature that is less than or equal to 1170°C are fully supported by the present application, the parent application, and the provisional application. Accordingly, withdrawal of the §112 and the §102 rejections is respectfully requested.

III. Rejection Under 35 U.S.C. §103

The present invention is directed to glasses that are fined using tin oxide instead of arsenic or antimony and to glass sheets comprising those glasses that are suitable for use as substrates for displays, such as liquid crystal displays. In addition, the glasses have liquidus viscosities suitable for production of the glass sheets by a downdraw process, e.g., the fusion process. Specifically, the liquidus viscosities of the glasses are greater than or equal to 100,000 poise.

In accordance with the invention, it was discovered that to achieve these goals, the glass has to have both a MgO content greater than or equal to 1.0 mole percent and an RO/Al₂O₃ ratio greater than or equal to 1.00. The criticality of the MgO content and the RO/Al₂O₃ ratio to low gaseous inclusion levels for tin fining and high liquidus viscosities for downdraw forming is discussed at, for example, page 10, line 19, to page 15, line 26, of applicant's specification. Figure 3 further illustrates the criticality of the RO/Al₂O₃ ratio to gaseous inclusion levels for a MgO content greater than or equal to 1.0 mole percent.

As we will now show, the Miwa reference cited in the May 10th Office Action does not disclose or suggest the criticality of having both a RO/Al₂O₃ ratio ≥ 1.0 and a MgO content ≥ 1.0 mole%.

The Miwa reference has 22 examples, 16 of which (i.e., 72%) have no MgO. Consequently, a person of ordinary skill in the art would never realize the importance of having a MgO content ≥ 1.0 mole % from a reference such as Miwa which, most of time, does not use any MgO. Moreover, the remaining 6 examples of Miwa that use some MgO do not disclose or suggest the present invention.

Attached hereto as Exhibit A are weight to mole conversions for the six examples of Miwa that have MgO, i.e., Examples 12, 15, 18, and 20-22. Five of these six purposely use Sb₂O₃ (Examples 12, 15, and 20-22) and two of those five use both Sb₂O₃ and As₂O₃ (Examples 12 and 22). The only example that uses MgO and does not purposely use Sb₂O₃ or As₂O₃ is Example 18, but that example is clearly distinguished

by applicant's claims because the example has less than half of applicant's lower limit of 1.0 mole % MgO, i.e., this example has just 0.487 mole % MgO.

With regard to Sb_2O_3 and As_2O_3 , in addition to Examples 12, 15, and 20-22, fourteen additional examples of Miwa purposely contain Sb_2O_3 or $\text{Sb}_2\text{O}_3 + \text{As}_2\text{O}_3$. Thus, in total, 19 of Miwa's 22 examples or more than 85% contain Sb_2O_3 or $\text{Sb}_2\text{O}_3 + \text{As}_2\text{O}_3$. When combined with the fact that more than 70% of Miwa's examples do not contain MgO, it is evident that Miwa does not render applicant's claims obvious since each of those claims require: (i) a MgO content greater than or equal to 1.0 mole percent, (ii) at most 0.05 mole percent As_2O_3 , and (iii) at most 0.05 mole percent Sb_2O_3 . Accordingly, for at least these reasons, withdrawal of the §103 rejection is respectfully requested.

IV. Double Patenting

Submitted herewith is a terminal disclaimer with respect to U.S. Patents Nos. 7,851,394 and 7,534,734 cited for obviousness-type double patenting in the May 10th Office Action.

This terminal disclaimer is being made without prejudice and its sole purpose is to obviate the double patent rejection made by the Examiner. See MPEP §804.02. Pursuant to the holding in, for example, Quad Environmental Technologies Corp. v. Union Sanitary District, 946 F.2d 870, 20 USPQ2d 1392 (Fed. Cir. 1991), this terminal disclaimer is not to be construed in any way as an obviousness admission with regard to any of the claims of this application or the '394 or '734 patents.

With regard to the provisional obviousness-type double patenting rejection based on co-pending application No. 12/470,968, because that application is a later-filed application and has not been allowed, applicant believes that under the provisions of Section 804(I)(B)(1) of the MPEP, a terminal disclaimer is not needed for this application.

The foregoing response to the obviousness-type double patenting rejections, including the filing of a terminal disclaimer directed to the '394 and '734 patents, should

not be taken as agreement with or acquiescence in any of the arguments put forth in the Office Action in connection with those rejections.

V. Conclusion

In view of the foregoing, applicant believes that this application is now in condition for allowance. Accordingly, reconsideration and the issuance of a notice of allowance for the application are respectfully requested.

Respectfully submitted,

Date: August 8, 2013

/Maurice M. Klee/

Maurice M. Klee, Ph.D.

Reg. No. 30,399

Attorney for Applicant

1951 Burr Street

Fairfield, CT 06824

(203) 255-1400

Appl: US 12/965,032
Atty Dkt: ADP-231.2 US (SP05-073B)

Exhibit A

**Weight-to-Mole Conversion for
Examples 12, 15, 18, 20, 21 and 22 of
Miwa JP 2004-189535
(6 pages)**

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole% (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	62.0	1.0319	68.478
4	Al ₂ O ₃	101.961276	15.0	0.1471	9.762
5	B ₂ O ₃	69.620200	9.4	0.1350	8.959
6	MgO	40.304400	0.5	0.0124	0.823
7	CaO	56.077400	7.0	0.1248	8.282
8	SrO	103.619400	4.0	0.0386	2.562
9	BaO	153.326400	0.05	0.0003	0.020
10	As ₂ O ₃	197.841400	0.1	0.0005	0.033
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	0.5	0.0061	0.405
13	Sb ₂ O ₃	291.518200	0.7	0.0024	0.159
14	SnO ₂	150.708800	0.25	0.0017	0.113
15	Cl	35.4527	0.1	0.0028	0.186
16	ZrO ₂	123.222800	0.4	0.0032	0.212
17	Fe ₂ O ₃	159.688200	0.015	0.0001	0.007
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.5069	

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole% (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	62.0	1.0319	67.185
4	Al ₂ O ₃	101.961276	16.0	0.1569	10.216
5	B ₂ O ₃	69.620200	11.0	0.1580	10.287
6	MgO	40.304400	1.3	0.0323	2.103
7	CaO	56.077400	8.0	0.1427	9.291
8	SrO	103.619400	1.0	0.0097	0.632
9	BaO	153.326400	0.5	0.0033	0.215
10	As ₂ O ₃	197.841400	0	0.0000	0.000
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	0	0.0000	0.000
13	Sb ₂ O ₃	291.518200	0.1	0.0003	0.020
14	SnO ₂	150.708800	0.1	0.0007	0.046
15	Cl	35.4527	0	0.0000	0.000
16	ZrO ₂	123.222800	0	0.0000	0.000
17	Fe ₂ O ₃	159.688200	0.01	0.0001	0.007
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.5359	

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole% (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	62.0	1.0319	67.964
4	Al ₂ O ₃	101.961276	17.0	0.1667	10.979
5	B ₂ O ₃	69.620200	10.0	0.1436	9.458
6	MgO	40.304400	0.3	0.0074	0.487
7	CaO	56.077400	8.5	0.1516	9.985
8	SrO	103.619400	0.5	0.0048	0.316
9	BaO	153.326400	1.5	0.0098	0.645
10	As ₂ O ₃	197.841400	0	0.0000	0.000
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	0	0.0000	0.000
13	Sb ₂ O ₃	291.518200	0	0.0000	0.000
14	SnO ₂	150.708800	0.15	0.0010	0.066
15	Cl	35.4527	0.05	0.0014	0.092
16	ZrO ₂	123.222800	0	0.0000	0.000
17	Fe ₂ O ₃	159.688200	0.01	0.0001	0.007
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.5183	

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole % (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	64.0	1.0652	69.794
4	Al ₂ O ₃	101.961276	15.5	0.1520	9.959
5	B ₂ O ₃	69.620200	9.0	0.1293	8.472
6	MgO	40.304400	0.7	0.0174	1.140
7	CaO	56.077400	6.5	0.1159	7.594
8	SrO	103.619400	2.0	0.0193	1.265
9	BaO	153.326400	0	0.0000	0.000
10	As ₂ O ₃	197.841400	0	0.0000	0.000
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	1.0	0.0123	0.806
13	Sb ₂ O ₃	291.518200	0.4	0.0014	0.092
14	SnO ₂	150.708800	0.1	0.0007	0.046
15	Cl	35.4527	0.3	0.0085	0.557
16	ZrO ₂	123.222800	0.5	0.0041	0.269
17	Fe ₂ O ₃	159.688200	0.015	0.0001	0.007
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.5262	

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole% (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	62.0	1.0319	67.269
4	Al ₂ O ₃	101.961276	16.0	0.1569	10.228
5	B ₂ O ₃	69.620200	11.0	0.1580	10.300
6	MgO	40.304400	4.0	0.0992	6.467
7	CaO	56.077400	4.0	0.0713	4.648
8	SrO	103.619400	1.0	0.0097	0.632
9	BaO	153.326400	0	0.0000	0.000
10	As ₂ O ₃	197.841400	0	0.0000	0.000
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	0	0.0000	0.000
13	Sb ₂ O ₃	291.518200	2.0	0.0069	0.450
14	SnO ₂	150.708800	0	0.0000	0.000
15	Cl	35.4527	0	0.0000	0.000
16	ZrO ₂	123.222800	0	0.0000	0.000
17	Fe ₂ O ₃	159.688200	0.02	0.0001	0.007
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.5340	

1 A	B	C	D	E	F
2	Compound	Molecular Weight	Wt. %	# of Moles (Wt. %/MW)	Mole % (# of Moles/TotalMoles)*100
3	SiO ₂	60.084000	58.5	0.9736	66.403
4	Al ₂ O ₃	101.961276	15.0	0.1471	10.033
5	B ₂ O ₃	69.620200	10.0	0.1436	9.794
6	MgO	40.304400	1.0	0.0248	1.691
7	CaO	56.077400	5.0	0.0892	6.084
8	SrO	103.619400	6.0	0.0579	3.949
9	BaO	153.326400	1.4	0.0091	0.621
10	As ₂ O ₃	197.841400	1.0	0.0051	0.348
11	PbO	223.199400	0	0.0000	0.000
12	ZnO	81.389400	0	0.0000	0.000
13	Sb ₂ O ₃	291.518200	0.5	0.0017	0.116
14	SnO ₂	150.708800	0.05	0.0003	0.020
15	Cl	35.4527	0.05	0.0014	0.095
16	ZrO ₂	123.222800	1.5	0.0122	0.832
17	Fe ₂ O ₃	159.688200	0.03	0.0002	0.014
18	TiO ₂	79.865800	0	0.0000	0.000
19	HfO ₂	210.488800	0	0.0000	0.000
20	Y ₂ O ₃	225.809900	0	0.0000	0.000
21	P ₂ O ₅	141.944522	0	0.0000	0.000
			totalmoles =	1.4662	

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

FEE TRANSMITTAL		Complete if known	
		Application Number	12/965,032
		Filing Date	December 10, 2010
☐ Applicant asserts small entity status. See 37 CFR 1.27.		First Named Inventor	Ellison
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.		Examiner Name	Elizabeth Bolden
		Art Unit	1731
TOTAL AMOUNT OF PAYMENT	(\$ 740)	Practitioner Docket No.	ADP-231.2 US (SP05-073B)

METHOD OF PAYMENT (check all that apply)
☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 111158 Deposit Account Name: Maurice M. Klee

For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**
☒ Charge any additional fee(s) or underpayment of fee(s) ☒ Credit any overpayment of fee(s) under 37 CFR 1.16 and 1.17

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION**1. BASIC FILING, SEARCH, AND EXAMINATION FEES** (U = undiscounted fee; S = small entity fee; M = micro entity fee)

Application Type	FILING FEES			SEARCH FEES			EXAMINATION FEES			Fees Paid (\$)
	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	
Utility	280	140*	70	600	300	150	720	360	180	
Design	180	90	45	120	60	30	460	230	115	
Plant	180	90	45	380	190	95	580	290	145	
Reissue	280	140	70	600	300	150	2,160	1,080	540	
Provisional	260	130	65	0	0	0	0	0	0	

* The \$140 small entity status filing fee for a utility application is further reduced to \$70 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	Undiscounted Fee (\$)	Small Entity Fee (\$)	Micro Entity Fee (\$)
Each claim over 20 (including Reissues)	80	40	20
Each independent claim over 3 (including Reissues)	420	210	105
Multiple dependent claims	780	390	195
Total Claims			
25 - 20 or HP = 5 x 80 = 400			
HP = highest number of total claims paid for, if greater than 20.			
Indep. Claims			
2 - 3 or HP = 0 x =			
HP = highest number of independent claims paid for, if greater than 3.			

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$400 (\$200 for small entity) (\$100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fees Paid (\$)
- 100 =	/ 50 =	(round up to a whole number) x	=	

4. OTHER FEE(S)

Non-English specification, \$130 fee (no small or micro entity discount)

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small or micro entity)

Other (e.g., late filing surcharge): Fees under 37 CFR 1.17(p) & 1.20(d) for submission of IDS and Statutory Disclaimer 340

SUBMITTED BY			
Signature	/Maurice M. Klee/	Registration No. (Attorney/Agent)	30399
Name (Print/Type)	Maurice M. Klee	Telephone	(203) 255-1400
		Date	August 8, 2013

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/965,032	Filing Date 12/10/2010	☐ To be Mailed
---	---	----------------------------------	---------------------------------------

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

(Column 1)

(Column 2)

FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		X \$ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
				TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

(Column 1)

(Column 2)

(Column 3)

	08/08/2013	CLAIMS REMAINING AFTER AMENDMENT	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	* 25	Minus	** 20	= 5		X \$80 =	400
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 4	= 0		X \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
	TOTAL ADD'L FEE							400

(Column 1)

(Column 2)

(Column 3)

		CLAIMS REMAINING AFTER AMENDMENT	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=		X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
	TOTAL ADD'L FEE							

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/BRENDA HARRISON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B	5934
22928	7590	05/10/2013		
CORNING INCORPORATED			EXAMINER	
SP-TI-3-1			BOLDEN, ELIZABETH A	
CORNING, NY 14831			ART UNIT	PAPER NUMBER
			1731	
			NOTIFICATION DATE	DELIVERY MODE
			05/10/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usdocket@corning.com

Office Action Summary	Application No. 12/965,032	Applicant(s) ELLISON, ADAM J.G.	
	Examiner Elizabeth A. Bolden	Art Unit 1731	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 October 2012.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-20 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Interim copies:

- a) ☐ All b) ☐ Some c) ☐ None of the: Interim copies of the priority documents have been received.

Attachment(s)

- | | |
|---|---|
| 1) ☒ Notice of References Cited (PTO-892) | 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____. | 4) ☐ Other: ____. |

Art Unit: 1731

DETAILED ACTION
Information Disclosure Statement

The Information Disclosure Statement (IDS) submitted 10 December 2010 has been considered by the Examiner.

Examiner Comment

The instant application is a continuation of 11/478,493. However, the instant claims contain subject matter broader than the scope of the 11/478,493 application. This subject matter does not appear to have been disclosed in any of the parent or priority applications preceding application 12/965,032. Therefore, 12/965,032 is a continuation-in-part of 11/478,493. MPEP 201.11 (I)(B) states “if a claim in a continuation-in-part application recites a feature which was not disclosed or adequately supported by a proper disclosure under 35 U.S.C. 112 in the parent nonprovisional application,...such a claim is entitled only to the filing date of the continuation-in-part application”. Hence because none of the parent documents preceding application 12/965,032 disclose the glass composition where in the glass has a liquidus temperature of less than or equal to 1170°C as set forth in the claims of the instant invention, applicant only has priority for claims 1-20 back to the filing date of application 12/965,032 (filed December 10, 2010). See *Ex parte DesOrmeaux*, 25 USPQ2d 2040 and *In re Chu*, 36, USPQ2d 1089 where parent patents were deemed to be prior art against examined applications despite a claim of priority to those parent patents.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(a):

(a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), first paragraph:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Art Unit: 1731

Claims 4-6, 10-12, and 16-18 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation in the claims that the glass has a liquidus temperature of less than or equal to 1170°C is not disclosed in the body of the specification. While the specification shows examples of specific glass compositions having a specific liquidus temperatures from 1105-1220 °C, the specification is not enabled for the limitation of the liquidus temperature being less than or equal to 1170°C, since that range includes values not encompassed by the specific examples. Furthermore the specification does not point to the criticality of the liquidus temperature.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as anticipated by Ellison, U.S. Patent Application Publication U.S. 2006/0293162 A1.

The examiner notes that U.S. 2006/0293162 A1 is in the same family as U.S. Application 11/478,493, which the instant invention claims priority back to via a continuation. However, the instant claims contain subject matter broader than the scope of the 11/478,493 application. This subject matter does not appear to have been disclosed in any of the parent or priority applications preceding application 12/965,032. MPEP 201.11 (I)(B) states “if a claim in a continuation-in-part application recites a feature which was not disclosed or adequately supported by a proper disclosure under 35 U.S.C. 112 in the parent nonprovisional application,...such a claim is entitled only to the filing date of the continuation-in-part application”. Hence because none of the parent documents preceding application 12/965,032 disclose a glass composition as set forth in the claims of the instant invention, applicant only has priority for claims 1-20 back to the filing date of application 12/965,032 (filed December 10, 2010) and U.S. 2006/0293162 A1 qualifies as

Art Unit: 1731

prior art under 35 U.S.C. 102(b) against the claims. See *Ex parte DesOrmeaux*, 25 USPQ2d 2040 and *In re Chu*, 36, USPQ2d 1089 where parent patents were deemed to be prior art against examined applications despite a claim of priority to those parent patents.

Ellison discloses an alkali free glass having the following composition in terms of molar percentages: SiO₂ 64-71, Al₂O₃ 9-12, B₂O₃ 7-12, MgO 1-3, CaO 6-11.5, SrO 0-2, BaO 0-0.1, Sb₂O₃ 0-0.05, SnO₂ ≥0.01, and As₂O₃ 0-0.05 wherein RO/Al₂O₃ is 1-1.25. See Abstract and the entire specification, specifically, paragraphs [0019]-[0031]. Ellison discloses that the glass has a density of ≤ 2.41, liquidus viscosity of ≥100,000 poise, a strain point of ≥650°C, and a coefficient of thermal expansion of 28-34x10⁻⁷/°C. See paragraphs [0051]-[0056]. Ellison discloses that the glass sheets are made by the drawdown process in a population of 50 sheets having a volume of 500 cubic centimeters or more and has an average gaseous inclusion of less than 0.05 inclusions/cubic centimeters. See paragraph [0049]. The compositional and property ranges of Ellison are sufficiently specific to anticipate the glass as recited in claims 1-20. See MPEP 2131.03. Furthermore, Ellison discloses Examples 1-52 which read on 1 or more of claims 1-20. See Table 1.

Claim Rejections - 35 USC § 103

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miwa, Japanese Patent Publication JP 2004-189535 A.

A machine-generated translation of JP 2004-189535 A accompanies this action. In reciting this rejection, the examiner will cite this translation.

Miwa teaches a glass having the following alkali-free composition in terms of weight percentages: SiO₂ 55-70, Al₂O₃ 12-20, B₂O₃ 5-15, MgO 0-5, CaO 0-12, SrO 0-10, BaO 0-10, ZnO 0-5, ZrO₂ 0-5, Cl 0-0.5, SnO₂ 0.01-0.3, Sb₂O₃ 0-1, and As₂O₃ 0-0.1. See Abstract and the entire specification, specifically, paragraphs [0013]-[0014] and [0022]. Miwa teaches that the glass has a coefficient of thermal expansion of 30-34x10⁻⁷/°C, strain point of >665°C, and a liquidus temperature of ≤1120°C. See paragraph [0047].

Miwa fails to teach any examples or compositional ranges in terms of molar percentages that are sufficiently specific to anticipate the compositional limitations of claims 1-20. However, it is believed that the weight percent ranges taught by Miwa if converted to molar percentages

Art Unit: 1731

would have overlapping compositional ranges with instant claims 1-20. See Abstract and the entire specification, specifically, paragraphs [0013]-[0014], [0022], and [0047]. Overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

One of ordinary skill in the art would expect that a glass with overlapping compositional ranges would have the properties as recited in claims 4-6, 10-12, and 16-19.

Products of identical composition may not have mutually exclusive properties. In re Spada 15 USPQ2d 1655,1658 (Fed. Circ. 1990).

As to claims 19, the claim would have been obvious because a particular known technique was recognized as part of the ordinary capabilities of one skilled in the art the downdraw process is a known technique that is capable of producing the glass sheet as recited in claim 19.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Art Unit: 1731

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-20 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-3, 5-9, 12, 14, 15, 18, and 22-24 of copending Application No. 12/470,968. Although the conflicting claims are not identical, they are not patentably distinct from each other because overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claims 1-20 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 7,851,394. Although the conflicting claims are not identical, they are not patentably distinct from each other because overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

Claims 1-20 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-13 of U.S. Patent No. 7,534,734. Although the conflicting claims are not identical, they are not patentably distinct from each other because overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to /Elizabeth A. Bolden/ whose telephone number is (571)272-1363. The examiner can normally be reached on 10 am to 6:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kaj Olsen can be reached on 571-272-1344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1731

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Karl E Group/
Primary Examiner, Art Unit 1731

Elizabeth A. Bolden
/Elizabeth A. Bolden/
Examiner
Art Unit 1731

EAB
5 May 2013

Notice of References Cited	Application/Control No. 12/965,032		Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.	
	Examiner Elizabeth A. Bolden		Art Unit 1731	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,534,734	05-2009	Ellison, Adam James Gillmar	501/66
*	B	US-2009/0294773	12-2009	Ellison, Adam James	257/72
*	C	US-2006/0293162	12-2006	Ellison, Adam J.G.	501/066
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Machine Translation of JP 2004-189535 A, July 8, 2004.
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

FORM PTO-1449 (MODIFIED) LIST OF PATENTS AND PUBLICATIONS FOR APPLICANTS INFORMATION DISCLOSURE STATEMENT	ATTORNEY DOCKET NO.	SERIAL NO.
	SP05-073B	
	APPLICANT Adam James Ellison	
	FILING DATE	GROUP: 1793

REFERENCE DESIGNATION			U.S. PATENT DOCUMENTS				
Examiner Initial		Document Number	Date	Name	Class	Sub-Class	Filing Date if Approp.
	AA	3,338,696	08-29-67	Stuart M. Dockerty	65	145	
	AB	3,682,609	08-08-72	Stuart M. Dockerty	65	83	
	AC	4,180,618	12-25-79	Alpha et al.	428	428	
	AD	5,374,595	12-20-94	W.H. Dumbaugh et al.	501	66	
	AE	5,785,726	07-28-98	W.G. Dorfled et al.	65	134.1	
	AF	5,824,127	10-20-98	James C. Bange et al.	65	90	
	AG	6,128,924	10-10-00	James C. Bange et al.	65	90	
	AH	6,169,047	01-2001	Nishizawa et al.	501	66	
	AI	6,319,867	11-20-01	Lisa C. Chacon et al.	501	66	
	AJ	6,468,933	10-2002	Narita et al.	501	56	
	AK	2002/0023463	02-2002	Siebers et al.	65	99.5	
	AL	6,537,937	03-2003	Nishizawa et al.	501	66	
	AM	2003/0121288	07-03-03	Jun Naka et al.	65	134.3	
	AN	6,881,692	04-19-05	Murata et al.	501	66	
	AO	2006/0003884	01-05-06	Nishizawa et al.	501	72	
	AP	2006/0242996	11-02-06	G. DeAngelis et al.	65	134.1	
	AQ	6,992,030	01-31-06	Paulson	501	66	

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Sub-Class	Translation Yes No	
	AR	RU642265	01-15-79	Russia				X
	AS	EP 0 607 865	07-27-94	Europe			X	
	AT	2001-348247	12/2001	Japan				X
	AU	2004-189535	07/2004	Japan				X
	AV	2004/087597	10/2004	PCT				X

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)

AW	
----	--

EXAMINER: /Elizabeth A. Bolden/ DATE CONSIDERED: 05/02/2013

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609: draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /E.A.B./

Search Notes 	Application/Control No. 12965032	Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.
	Examiner ELIZABETH A BOLDEN	Art Unit 1731

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
501	66	5/5/2013	EAB

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	5/5/2013	EAB
EAST	5/5/2013	EAB

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

--	--

<i>Index of Claims</i> 	Application/Control No. 12965032	Applicant(s)/Patent Under Reexamination ELLISON, ADAM J.G.
	Examiner ELIZABETH A BOLDEN	Art Unit 1731

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	05/05/2013							
	1	✓							
	2	✓							
	3	✓							
	4	✓							
	5	✓							
	6	✓							
	7	✓							
	8	✓							
	9	✓							
	10	✓							
	11	✓							
	12	✓							
	13	✓							
	14	✓							
	15	✓							
	16	✓							
	17	✓							
	18	✓							
	19	✓							
	20	✓							



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
 United States Patent and Trademark Office
 Address: COMMISSIONER FOR PATENTS
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 5934

SERIAL NUMBER 12/965,032	FILING or 371(c) DATE 12/10/2010 RULE	CLASS 501	GROUP ART UNIT 1731	ATTORNEY DOCKET NO. SP05-073B		
APPLICANTS Adam J.G. Ellison, Painted Post, NY; ** CONTINUING DATA ***** This application is a CON of 11/478,493 06/28/2006 PAT 7851394 which claims benefit of 60/694,478 06/28/2005 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 12/21/2010						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /ELIZABETH A BOLDEN/ Acknowledged Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY NY	SHEETS DRAWINGS 3	TOTAL CLAIMS 18	INDEPENDENT CLAIMS 3	
ADDRESS CORNING INCORPORATED SP-TI-3-1 CORNING, NY 14831						
TITLE FINING OF BOROALUMINO SILICATE GLASSES						
FILING FEE RECEIVED 1340	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Adam J. G. Ellison
Appl. No. : 12/965,032
Filed : December 10, 2010
For : FINING OF BOROALUMINO SILICATE GLASSES
Examiner : Elizabeth Bolden
Group : 1731

PRELIMINARY AMENDMENT

Prior to its initial examination, please amend the above-identified application as set forth below.

The contents of this amendment are as follows:

- (1) a listing of the claims of the application which includes the
Amendments to the Claims being made by this Preliminary
Amendment -- page 2; and
- (2) applicants' **Remarks** -- page 7.

Amendments to the Claims:

This listing of claims will replace all prior versions of the claims in this application:

Listing of Claims:

Claim 1 (original): An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1
SnO ₂ :	0.01-0.15

wherein:

$$1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25,$$

where [Al₂O₃] is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO.

Claim 2 (original): The glass of Claim 1 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃.

Claim 3 (original): The glass of Claim 2 wherein the glass has compositional characteristics (a) and (b).

Claim 4 (original): The glass of Claim 1 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
- (b) a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:
$$28 \times 10^{-7}/^{\circ}\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^{\circ}\text{C};$$
- (c) a liquidus temperature less than or equal to 1170°C.
- (d) a liquidus viscosity that is greater than or equal to 100,000 poise;
- (e) a strain point that is greater than or equal to 650°C.

Claim 5 (original): The glass of Claim 4 wherein the glass has at least properties (a) through (c).

Claim 6 (original): The glass of Claim 4 wherein the glass has properties (a) through (e).

Claim 7 (original): An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1

wherein:

- (a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$,

where [Al₂O₃] is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the compositional characteristic that on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 ; and

(c) the glass has a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:

$$28 \times 10^{-7}/^{\circ}\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^{\circ}\text{C}.$$

Claim 8 (original): The glass of Claim 7 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 .

Claim 9 (original): The glass of Claim 8 wherein the glass has compositional characteristics (a) and (b).

Claim 10 (original): The glass of Claim 7 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
- (b) a liquidus temperature less than or equal to 1170°C.
- (c) a liquidus viscosity that is greater than or equal to 100,000 poise;
- (d) a strain point that is greater than or equal to 650°C.

Claim 11 (original): The glass of Claim 10 wherein the glass has at least properties (a) and (b).

Claim 12 (original): The glass of Claim 10 wherein the glass has properties (a) through (d).

Claim 13 (original): An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1

wherein:

(a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$,

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the compositional characteristic that on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 ; and

(c) the glass has a liquidus temperature less than or equal to 1170°C.

Claim 14 (original): The glass of Claim 13 wherein the glass has at least one of the following compositional characteristics:

(a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;

(b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 .

Claim 15 (original): The glass of Claim 14 wherein the glass has compositional characteristics (a) and (b).

Claim 16 (original): The glass of Claim 13 wherein the glass has at least one of the following properties:

(a) a density that is less than or equal to 2.41 grams/cm³;

(b) a liquidus viscosity that is greater than or equal to 100,000 poise;

(c) a strain point that is greater than or equal to 650°C.

Claim 17 (original): The glass of Claim 16 wherein the glass has at least property (a).

Claim 18 (original): The glass of Claim 16 wherein the glass has properties (a) through (c).

Claim 19 (new): An alkali-free glass sheet comprising a glass that comprises SiO_2 , Al_2O_3 , B_2O_3 , MgO , and CaO , and, on an oxide basis, has:

- (i) a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ is the sum of the mole percents of MgO , CaO , SrO , and BaO ; and
- (ii) a MgO content greater than or equal to 1.0 mole percent;

wherein:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 ;
- (c) on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 ;
- (d) the glass has a liquidus viscosity that is greater than or equal to 100,000 poise; and
- (e) the glass sheet has a volume of at least 500 cubic centimeters and is produced by a downdraw process for which a population of 50 of the glass sheets sequentially produced by the process has an average gaseous inclusion level of less than 0.05 gaseous inclusions/cubic centimeter.

Claim 20 (new): The glass sheet of Claim 19 wherein on an oxide basis, the glass comprises at most 0.15 mole percent SnO_2 .

REMARKS

The foregoing amendment adds two more claims (one independent and one dependent) to this application so as to provide additional protection for applicant's invention.

These claims highlight applicant's important discovery regarding the refining (fining) of glass sheets manufactured using a commercial downdraw process. As set forth in applicant's specification, in order to use tin oxide as the refining (fining) agent instead of arsenic or antimony, the glass has to have both a MgO content greater than or equal to 1.0 mole percent and an RO/Al₂O₃ ratio greater than or equal to 1.00. The added claims recite these requirements. In addition, they require that the glass (1) has a liquidus viscosity of at least 100,000 poise so that it can be manufactured by a downdraw process and (2) includes tin for fining instead of arsenic or antimony.

Examination of these further claims along with the originally-filed claims is respectfully requested.

Respectfully submitted,

Date: October 26, 2012

/Maurice M. Klee/

Maurice M. Klee, Ph.D.

Reg. No. 30,399

Attorney for Applicant

1951 Burr Street

Fairfield, CT 06824

(203) 255-1400

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

FEE TRANSMITTAL

Complete if known

Application Number	12/965,032
Filing Date	December 10, 2010
First Named Inventor	Ellison
Examiner Name	Bolden
Art Unit	1731
Practitioner Docket No.	ADP-231.2 US (SP05-073B)

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$ 250

METHOD OF PAYMENT (check all that apply)☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____☒ Deposit Account Deposit Account Number: 111158 Deposit Account Name: Maurice M. Klee

For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**☒ Charge any additional fee(s) or underpayment of fee(s) ☐ Credit any overpayment of fee(s)
under 37 CFR 1.16 and 1.17**WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	390	195	620	310	250	125	
Design	250	125	120	60	160	80	
Plant	250	125	380	190	200	100	
Reissue	390	195	620	310	760	380	
Provisional	250	125	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 (including Reissues)	62	31
Each independent claim over 3 (including Reissues)	250	125
Multiple dependent claims	460	230

Total Claims	Extra Claims	Fee (\$)	Fee Paid (\$)
20	-20 or HP = 0 x	62	0

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims	Extra Claims	Fee (\$)	Fee Paid (\$)
4	-3 or HP = 1 x	250	250

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$320 (\$160 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fee Paid (\$)
- 100 =	/ 50 =	(round up to a whole number) x		

4. OTHER FEE(S)

Fees Paid (\$)

Non-English specification, \$130 fee (no small entity discount)

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small entity)

Other (e.g., late filing surcharge):

SUBMITTED BY

Signature	/Maurice M. Klee/	Registration No. (Attorney/Agent)	30399	Telephone	(203) 255-1400
Name (Print/Type)	Maurice M. Klee	Date	October 26, 2012		

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	12965032			
Filing Date:	10-Dec-2010			
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES			
First Named Inventor/Applicant Name:	Adam J.G. Ellison			
Filer:	Maurice M. Klee/Any Klee			
Attorney Docket Number:	SP05-073B			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	250	250
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:	Petitioner Ex 1002			000080

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				250

Electronic Acknowledgement Receipt

EFS ID:	14085403
Application Number:	12965032
International Application Number:	
Confirmation Number:	5934
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES
First Named Inventor/Applicant Name:	Adam J.G. Ellison
Customer Number:	22928
Filer:	Maurice M. Klee/Any Klee
Filer Authorized By:	Maurice M. Klee
Attorney Docket Number:	SP05-073B
Receipt Date:	26-OCT-2012
Filing Date:	10-DEC-2010
Time Stamp:	14:13:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 250
RAM confirmation Number	451
Deposit Account	111158
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Rate of application and reexamination processing fees)

Petitioner Ex 1002

000082

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Preliminary Amendment	adp2312_US_a_Preliminary_Amdt.pdf	40716 77683e62c20fa61bcf4baad04ffc00001d00fa5b	no	7
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	adp2312_US_a_Fee_Transmittal_sb0017.pdf	493877 9a8e90fc8c0265040c70161f00ddc80c06697142	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30188 f331a31963d11cbdd35aa797e1590c4047056981	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			564781		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/965,032		Filing Date 12/10/2010		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
			TOTAL			TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	10/26/2012	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	=	0		X \$62=	0	
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 3	=	1		X \$250=	250	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	250	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=		X \$	=		
	Independent (37 CFR 1.16(h))	*	Minus	***	=		X \$	=		
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B

CONFIRMATION NO. 5934

PUBLICATION NOTICE



OC000000047008497

22928
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

Title: FINING OF BOROALUMINO SILICATE GLASSES

Publication No. US-2011-0082022-A1

Publication Date: 04/07/2011

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/965,032	12/10/2010	Adam J.G. Ellison	SP05-073B

22928
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

CONFIRMATION NO. 5934
POA ACCEPTANCE LETTER



Date Mailed: 12/29/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/10/2010.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/bto/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 12/965,032	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	330
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	220
TOTAL CLAIMS (37 CFR 1.16(j))	18	minus 20 = *			OR	x 52 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 220 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s)) If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1090
* If the difference in column 1 is less than zero, enter "0" in column 2.							
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	OR	x =
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	OR	x =
	Application Size Fee (37 CFR 1.16(s))					OR	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR	
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/965,032	12/10/2010	2871	1090	SP05-073B	18	3

CONFIRMATION NO. 5934

22928
CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

FILING RECEIPT



OC000000045089892

Date Mailed: 12/29/2010

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Adam J.G. Ellison, Painted Post, NY;

Power of Attorney: The patent practitioners associated with Customer Number 22928

Domestic Priority data as claimed by applicant

This application is a CON of 11/478,493 06/28/2006 PAT 7,851,394
which claims benefit of 60/694,478 06/28/2005

Foreign Applications

If Required, Foreign Filing License Granted: 12/21/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/965,032**

Projected Publication Date: 04/07/2011

Non-Publication Request: No

Early Publication Request: No

Title

FINING OF BOROALUMINO SILICATE GLASSES

Preliminary Class

349

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Adam J.G. Ellison

Serial No.:

Filed:

For: FINING OF BOROALUMINO
SILICATE GLASSES

COMBINED
CERTIFICATE UNDER
37 C.F.R. § 3.73(b)
and
POWER OF ATTORNEY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE UNDER 37 C.F.R. § 3.73(b)

CORNING INCORPORATED, a New York corporation, certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of an assignment from the inventor(s) of the patent application identified above. A true copy of the unrecorded Assignment is attached hereto.

The undersigned has reviewed the above referenced assignment of the patent application identified above and, to the best of the undersigned's knowledge and belief, title is in the assignee identified above.

The undersigned is empowered to sign this certificate on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

(U.S.)

Attorney Docket No.: ADP-231 (SP05-073)

POWER OF ATTORNEY BY ASSIGNEE

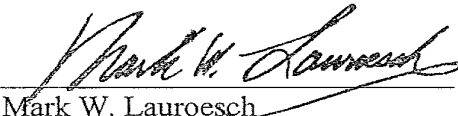
CORNING INCORPORATED, the assignee of the full and exclusive right, title and interest in and to the accompanying application for United States Letters Patent entitled **FINING OF BOROALUMINO SILICATE GLASSES** and executed by Adam J.G. Ellison on 06-22-2006, respectively, appoints the practitioners associated with the Customer Number provided below (i.e., the practitioners associated with the Intellectual Property Department, Corning Incorporated) to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith. Please direct all correspondence to **Thomas R. Beall** at the address associated with that Customer Number.

Customer Number: 22928

CORNING INCORPORATED

Date: June 28, 2006

By


Mark W. Lauroesch
Assistant Secretary

ASSIGNMENT

FOR VALUE RECEIVED, I, as a below named inventor, hereby sell, assign and transfer unto Corning Incorporated, a corporation organized and existing under the laws of the State of New York, having its principal place of business at Corning, New York, (hereinafter CORNING), as assignee, and unto its successors, assigns and legal representatives, the entire right, title and interest, for all countries, in and to certain inventions relating to a **FINING OF BOROALUMINO SILICATE GLASSES**, such inventions being generally described in an application for Letters Patent of the United States executed on

DATE June 22, 2006

and in any future patent applications claiming the benefit of the filing date of that application, and all the rights and privileges under any and all Letters Patents that may be granted therefore.

I request that any and all patents for said inventions be issued to CORNING, its successors, assigns and legal representatives, or to such nominees as CORNING may designate.

I agree that, when requested, I will, without charge to CORNING and at CORNING's expense, sign all papers, take all rightful oaths, and do all acts which may be necessary, desirable or convenient for securing and maintaining patents for said inventions in any and all countries and for vesting title thereto in CORNING, its successors, assigns and legal representatives or nominees.

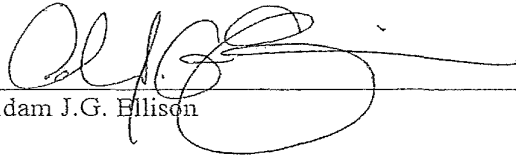
I authorize and empower CORNING, its successors, assigns and legal representatives or nominees, to invoke and claim for any application for patent or other form of protection for said inventions filed by it or them, the benefit of the right of priority provided by the International Convention for the Protection of Industrial Property, as amended, or by any convention which may henceforth be substituted for said Convention or entered as a supplement to, and to invoke and claim such right of priority without further written or oral authorization.

I hereby consent that a copy of this assignment shall be deemed a full legal and formal equivalent of any assignment, consent to file or like document which may be required in any country for any purpose and more particularly in proof of the right of CORNING, or its successors, assigns and legal representatives or nominees to claim the aforesaid benefit of the right of priority provided by the International Convention for the Protection of Industrial Property, as amended, or by any convention which may henceforth be substituted for it or entered as a supplement to it.

I covenant with CORNING, its successors, assigns and legal representatives or nominees, that the rights and property herein conveyed are free and clear of any encumbrance, and that I have full right to convey the same as herein expressed.

Signed at Corning, NY, this

6/22/06
Date

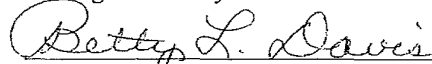

Adam J.G. Ellison

State of New York)

: ss.

County of Steuben)

On the 22 day of June 2006, before me personally came Adam J.G. Ellison known to be the person described in and who executed the foregoing instrument, and acknowledged that they executed the same.


Notary Public

Betty L. Davis
Notary Public, State of New York
Qualified in Steuben County No. 01DA6146735
My Commission Expires May 22, 2010

Electronic Patent Application Fee Transmittal

Application Number:

Filing Date:

Title of Invention:

FINING OF BOROALUMINO SILICATE GLASSES

First Named Inventor/Applicant Name:

Adam James Ellison

Filer:

Thomas Russell Beall/Susan Kane

Attorney Docket Number:

SP05-073B

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220

Pages:

Claims:

Miscellaneous-Filing:

Petition:

Patent-Appeals-and-Interference:

Petitioner Ex 1002

000095

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1090

Electronic Acknowledgement Receipt

EFS ID:	9009583
Application Number:	12965032
International Application Number:	
Confirmation Number:	5934
Title of Invention:	FINING OF BOROALUMINO SILICATE GLASSES
First Named Inventor/Applicant Name:	Adam James Ellison
Customer Number:	22928
Filer:	Thomas Russell Beall/Susan Kane
Filer Authorized By:	Thomas Russell Beall
Attorney Docket Number:	SP05-073B
Receipt Date:	10-DEC-2010
Filing Date:	
Time Stamp:	13:41:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1090
RAM confirmation Number	9558
Deposit Account	033325
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Petitioner Ex 1002

000097

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		20101210_SP05-073B_US_Transmittal_Ltr.pdf	983180 81f5ab22822a406a9f0b8613900a02b9f69fd1de	yes	2
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	1	
	Fee Worksheet (PTO-875)		2	2	
Warnings:					
Information:					
2		20101210_SP05-073B_US_Application_final.pdf	1630359 96a6afa290dd83ddb2da98e3a43694395da8a128	yes	31
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	27	
	Claims		28	30	
	Abstract		31	31	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	20101210_SP05-073B_US_Drawings.pdf	34992 3e09247d499f4606ef56425ba5179ed97115e6b4	no	3
Warnings:					
Information:					
4	Oath or Declaration filed	20101210_SP05-073B_US_Declaration.pdf	311664 0a7a46fdb7e1d3feb7355e3402abd6f9935d0a7f	no	2
Warnings:					
Information:					
5		20101210_SP05-073B_US_Information_Disclosure_Statement_C.pdf	683830 fd0f780d9a82788cff772913b0d8eebbe0f80ade	yes	2

	Multipart Description/PDF files in .zip description								
	Document Description		Start	End					
	Transmittal Letter		1	1					
	Information Disclosure Statement (IDS) Filed (SB/08)		2	2					
Warnings:									
Information:									
6	Miscellaneous Incoming Letter	20101210_SP05-073B_US_Notice_of_Recording_of_Assignment.pdf	615994 3d0bbc161ae2c9a9c83c15d906cdf9f5cd9207a9	no	3				
Warnings:									
Information:									
7	Power of Attorney	20101210_SP05-073B_US_Power_of_Attorney.pdf	156320 4010e82404932038c173086f28c2b079de431192	no	4				
Warnings:									
Information:									
8	Fee Worksheet (PTO-875)	fee-info.pdf	32716 0f48b1e7ca64592087bb25cbdc9b7046f67dde8	no	2				
Warnings:									
Information:									
Total Files Size (in bytes):			4449055						
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>									

FORM PTO-1449 (MODIFIED) LIST OF PATENTS AND PUBLICATIONS FOR APPLICANTS INFORMATION DISCLOSURE STATEMENT	ATTORNEY DOCKET NO.	SERIAL NO.
	SP05-073B	
	APPLICANT Adam James Ellison	
	FILING DATE	GROUP: 1793

REFERENCE DESIGNATION			U.S. PATENT DOCUMENTS				
Examiner Initial		Document Number	Date	Name	Class	Sub-Class	Filing Date if Approp.
	AA	3,338,696	08-29-67	Stuart M. Dockerty	65	145	
	AB	3,682,609	08-08-72	Stuart M. Dockerty	65	83	
	AC	4,180,618	12-25-79	Alpha et al.	428	428	
	AD	5,374,595	12-20-94	W.H. Dumbaugh et al.	501	66	
	AE	5,785,726	07-28-98	W.G. Dorfled et al.	65	134.1	
	AF	5,824,127	10-20-98	James C. Bange et al.	65	90	
	AG	6,128,924	10-10-00	James C. Bange et al.	65	90	
	AH	6,169,047	01-2001	Nishizawa et al.	501	66	
	AI	6,319,867	11-20-01	Lisa C. Chacon et al.	501	66	
	AJ	6,468,933	10-2002	Narita et al.	501	56	
	AK	2002/0023463	02-2002	Siebers et al.	65	99.5	
	AL	6,537,937	03-2003	Nishizawa et al.	501	66	
	AM	2003/0121288	07-03-03	Jun Naka et al.	65	134.3	
	AN	6,881,692	04-19-05	Murata et al.	501	66	
	AO	2006/0003884	01-05-06	Nishizawa et al.	501	72	
	AP	2006/0242996	11-02-06	G. DeAngelis et al.	65	134.1	
	AQ	6,992,030	01-31-06	Paulson	501	66	

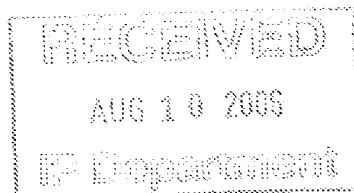
FOREIGN PATENT DOCUMENTS								
		Document Number	Date	Country	Class	Sub-Class	Translation	
							Yes	No
	AR	RU642265	01-15-79	Russia				X
	AS	EP 0 607 865	07-27-94	Europe			X	
	AT	2001-348247	12/2001	Japan				X
	AU	2004-189535	07/2004	Japan				X
	AV	2004/087597	10/2004	PCT				X

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	
AW	

EXAMINER:	DATE CONSIDERED:
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609: draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	



SP05-073



UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND
DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

AUGUST 01, 2006

PTAS



103270982A

TRB
THOMAS R. BEALL
CORNING INCORPORATED
PATENT DEPARTMENT
SP-TI-03-1
CORNING, NY 14831UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT DIVISION OF THE U.S. PATENT AND TRADEMARK OFFICE. A COMPLETE MICROFILM COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW.

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE. THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM. IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE, YOU MAY CONTACT THE EMPLOYEE WHOSE NAME APPEARS ON THIS NOTICE AT 571-272-3350. PLEASE SEND REQUEST FOR CORRECTION TO: U.S. PATENT AND TRADEMARK OFFICE, MAIL STOP: ASSIGNMENT SERVICES BRANCH, P.O. BOX 1450, ALEXANDRIA, VA 22313.

RECORDATION DATE: 06/28/2006

REEL/FRAME: 018028/0949
NUMBER OF PAGES: 3BRIEF: ASSIGNMENT OF ASSIGNOR'S INTEREST (SEE DOCUMENT FOR DETAILS).
DOCKET NUMBER: ADP-231(SP05-073)

ASSIGNOR:

ELLISON, ADAM J.G.

DOC DATE: 06/22/2006

ASSIGNEE:

CORNING INCORPORATED
PATENT DEPT.; SP-TI-03-1
CORNING, NEW YORK 14831

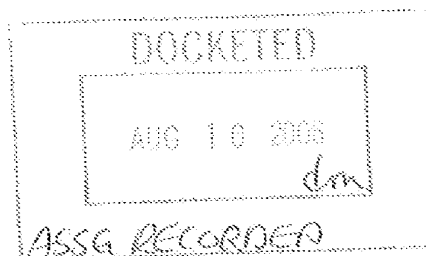
SERIAL NUMBER: 11478493

FILING DATE: 06/28/2006

PATENT NUMBER:

ISSUE DATE:

TITLE: FINING OF BOROALUMINO SILICATE GLASSES



018028/0949 PAGE 2

ASSIGNMENT SERVICES BRANCH
PUBLIC RECORDS DIVISION

07-10-2006

ne: ADP-231 (SP05-073)

PATENT

To the Honorable Commissioner of Patents and Trademarks

103270982

uments or copy thereof.

(1) Conveying Party(ies): Adam J.G. Ellison

Title: FINING OF BOROALUMINO SILICATE GLASSES

Additional name(s) of conveying party(ies) attached? Yes ☐ No ☒

(2) Receiving Party: Corning Incorporated
Patent Dept.; SP-TI-03-1
Corning, NY 14831

(3) Nature of conveyance: Assignment executed: 06-22-2006.

(4) Application number(s) and/or patent number(s) against which this assignment is to be recorded:

A. Patent Application No.(s):
Filing date:

B. Patent No.(s):
Filing date:

If this document is being filed together with a new application, this assignment is also to be recorded against said application, executed on ____.

(5) Name and address of party to whom correspondence concerning document should be mailed:

Name: Thomas R. Beall
Reg. No. 40,424
Corning Incorporated
Patent Department
SP-TI-03-1
Corning, NY 14831
Phone No.: 607-974-3921

(6) Total Number of applications and/or patents involved: one

(7) Total Fee = \$40.00

- ☐ Enclosed (Check No.)
☐ Included with filing fee. Check No. ____.
☒ Authorization given by Corning Incorporated to charge deposit account number 03-3325

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Thomas R. Beall
Thomas R. Beall

June 28, 2006
Date

Total number of pages comprising cover sheet: three (3)

07/07/2006 NJAMA1 00000083 033325 11478493

01 FC:8021

40.00 DA

UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))</i>		Attorney Docket No. SP05-073B		Total Pages 2	
First Named Inventor or Application Identifier: Adam James Ellison					
Title: FINING OF BOROALUMINO SILICATE GLASSES					
Express Mail Label No.					

CERTIFICATE OF MAILING OR TRANSMISSION I hereby certify that this paper and/or fee or charge authorization is being transmitted to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on December 10, 2010 , via: ☐ Express Mail Post Office to Addressee service of the United States Postal Service under 37 CFR §1.10 (Express Mail Label No.); ☐ depositing with the United States Postal Service with sufficient postage as first class mail under 37 CFR §1.8 (Mail Stop _____); ☐ Facsimile Transmission under 37 CFR §1.6(d) (Facsimile No. _____); ☒ the Electronic Filing System of the U.S. Patent and Trademark Office under 37 CFR §1.6(a)(4)	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
Signature <u><i>Susan M. Kane</i></u> Susan M. Kane	

1. ☒ * Fee Transmittal Form <i>(Submit an original and a duplicate for fee processing)</i> 2. ☒ Specification [Total Pages 31] <i>(preferred arrangement set forth below)</i> - Descriptive title of the Invention - Cross References to Related Applications - Statement Regarding Fed sponsored R&D - Reference to Microfiche Appendix - Background of the Invention - Brief Summary of the Invention - Brief Description of the Drawings (if filed) - Detailed Description - Claim(s) - Abstract of the Disclosure 3. ☒ Drawing(s) (35 U.S.C. § 113) [Total Sheets 3] 4. Oath or Declaration [Total Pages 2] a. ☐ Executed (original or copy) b. ☒ Copy from a prior application (37 C.F.R. § 1.63(d)) <i>(for continuation/divisional with Box 16 completed)</i> i. ☐ DELETION OF INVENTOR(S) <i>Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).</i>	5. ☐ Microfiche Computer Program (Appendix) 6. Nucleotide and/or Amino Acid Sequence Submission <i>(if applicable, all necessary)</i> a. ☐ Computer Readable Copy b. ☐ Paper Copy (identical to computer copy) c. ☐ Statement verifying identity of above copies
---	---

ACCOMPANYING APPLICATION PARTS	
7. ☐ Assignment Papers (cover sheet & document(s)) 8. ☒ 37 C.F.R. § 3.73(b) Statement ☒ Power of Attorney <i>(when there is an assignee)</i> 9. ☐ English Translation Document (if applicable) 10. ☒ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations 11. ☐ Preliminary Amendment 12. ☐ Return Receipt Postcard (MPEP 503) <i>(should be specifically itemized)</i> 14. ☐ Certified Copy of Priority Document(s) ☒ Other: Copy of Notice of Recordation of Assignment <i>(if foreign priority is claimed)</i>	

16. If a CONTINUING APPLICATION , check appropriate box, and supply the requisite information below and in a preliminary amendment: ☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. 11/478,493, Filed June 28, 2006 Prior application information: Examiner: Matthew E. Hoban Group / Art Unit: 1793 For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation <u>can only</u> be relied upon when a portion has been inadvertently omitted from the submitted application parts.	
---	--

17. CORRESPONDENCE ADDRESS	
☒ Customer Number or Bar Code Label 22928 or ☐ Correspondence address below	
NAME	Thomas R. Beall
ADDRESS	CORNING INCORPORATED, SP-TI-3-1
CITY	Corning
STATE	NY
ZIP CODE	14831
COUNTRY	USA
TELEPHONE	(607) 974-3921
FAX	(607) 974-3848
Name (Print/Type)	Thomas R. Beall
Registration No. (Attorney/Agent)	40,424
Signature	<u><i>Thomas R. Beall</i></u>
Date	December 10, 2010

FEE TRANSMITTAL for FY 2010

Complete if Known

Application Number	To Be Assigned
Filing Date	Herewith
First Named Inventor	Adam James Ellison
Examiner Name	To Be Assigned
Group / Art Unit	To Be Assigned
Attorney Docket Number	SP05-073B

TOTAL AMOUNT OF PAYMENT (\$)**1,090.00**

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number **03-3325**

Deposit Account Name **Corning Incorporated**

- ☒ Charge Any Additional Fees Required Under 37 C.F.R. §§ 1.16 and 1.17

2. ☐ Payment Enclosed:

☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEE

Application Type	Filing Fee	Search Fee	Exam Fee	Fee
Utility	330	540	220	1,090.00
Design	210	100	130	
Plant	210	310	160	
Reissue	310	510	620	
Provisional	210	0	0	
SUBTOTAL (1)				(\$)1,090.00

2. EXCESS CLAIM FEES

		Extra Claims	Fee from below	Fee Paid
Total Claims	18 - 20** =	x	52 =	00.00
Independent Claims	3 - 3** =	x	220 =	00.00
Multiple Dependent			390 =	0.00

**or number previously paid, if greater; For Reissues, see below

Large Entity

Fee Code	Fee (\$)	Fee Description
1202	52	Claims in excess of 20
1201	220	Independent claims in excess of 3
1203	390	Multiple dependent claim, if not paid 0
1204	220	** Reissue independent claims over original patent
1205	52	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$)**00.00**

FEE CALCULATION (continued)

3. APPLICATION SIZE FEE

1081	250	Utility application size fee (for each additional 50 sheets that exceeds 100 pages)
1082	250	Design application size fee (for each additional 50 sheets that exceeds 100 pages)
1083	250	Plant application size fee (for each additional 50 sheets that exceeds 100 pages)
1084	250	Reissue application size fee (for each additional 50 sheets that exceeds 100 pages)
1085	250	Provisional application size fee (for each additional 50 sheets that exceeds 100 pages)

4. OTHER FEES

Fee Fee Fee Description Large Entity Fee Paid

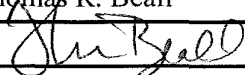
Code (\$)

1051	130	Surcharge - late filing fee or oath
1052	50	Surcharge - late provisional filing fee or cover sheet
1053	130	Non-English specification
1812	2,520	For filing a request for reexamination
1804	920*	Requesting publication of SIR prior to Examiner action
1805	1,840*	Requesting publication of SIR after Examiner action
1251	120	Extension for reply within first month
1252	450	Extension for reply within second month
1253	1,020	Extension for reply within third month
1254	1,590	Extension for reply within fourth month
1255	2,160	Extension for reply within fifth month
1401	500	Notice of Appeal
1402	500	Filing a brief in support of an appeal
1403	1,000	Request for oral hearing
1451	1,510	Petition to institute a public use proceeding
1452	500	Petition to revive - unavoidable
1453	1,500	Petition to revive - unintentional
1501	1,400	Utility issue fee (or reissue)
1502	800	Design issue fee
1503	1,000	Plant issue fee
1462	400	Petitions to the Director not specifically provided for (Group I) 1.17(f)
1463	200	Petitions to the Director not specifically provided for (Group II) 1.17(g)
1464	130	Petitions to the Director not specifically provided for (Group III) 1.17(h)
1807	50	Petitions related to provisional applications
1806	180	Submission of Information Disclosure Stmt
8021	40	Recording each patent assignment per property (times number of properties)
1809	790	Filing a submission after final rejection (37 C.F.R. § 1.129(a))
1810	790	For each additional invention to be examined (37 C.F.R. § 1.129(b))
1801	790	Request for Continued Examination (RCE)
1802	900	Request for expedited examination of a design application

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY

Name (Print/Type)	Thomas R. Beall	Registration No. (Attorney/Agent)	40,424
Signature		Date	December 10, 2010

Completed (if applicable)

FINING OF BOROALUMINO SILICATE GLASSES**I. CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation of U.S. Application Serial No. 11/478,493, filed June 28, 2006, now U.S. Patent No. 7,851,394, which claims the benefit of U.S. Application Serial No. 60/694,478 filed on June 28, 2005 and entitled "Fining of Boroalumino Silicate Glasses" which is incorporated by reference herein in.

II. FIELD OF THE INVENTION

The present invention relates to alkali-free, boroalumino silicate glasses exhibiting desirable physical and chemical properties for use as substrates in flat panel display devices, such as, active matrix liquid crystal displays (AMLCDs). In accordance with certain of its aspects, the invention relates to the fining of such glasses (also referred to in the art as "refining").

III. BACKGROUND OF THE INVENTION

Displays may be broadly classified into one of two types: emissive (e.g., CRTs and plasma display panels (PDPs)) or non-emissive. This latter family, to which liquid crystal displays (LCDs) belong, relies upon an external light source, with the display only serving as a light modulator. In the case of liquid crystal displays, this external light source may be either ambient light (used in reflective displays) or a dedicated light source (such as found in direct view displays).

Liquid crystal displays rely upon three inherent features of liquid crystal (LC) materials to modulate light. The first is the ability of LC materials to cause optical rotation of polarized light. Second is the dependence of such rotation on the mechanical orientation of the liquid crystal. And third is the ability of the liquid crystal to undergo mechanical orientation by the application of an external electric field.

In the construction of a simple, twisted nematic (TN) liquid crystal display, two substrates surround a layer of liquid crystal material. In a display type known as Normally White, the application of alignment layers on the inner surfaces of the substrates creates a 90° spiral of the liquid crystal director. This means that the

polarization of linearly polarized light entering one face of the liquid crystal cell will be rotated 90° by the liquid crystal material. Polarization films, oriented 90° to each other, are placed on the outer surfaces of the substrates.

Light, upon entering the first polarization film becomes linearly polarized.

5 Traversing the liquid crystal cell, the polarization of this light is rotated 90° and is allowed to exit through the second polarization film. Application of an electric field across the liquid crystal layer aligns the liquid crystal directors with the field, interrupting its ability to rotate light. Linearly polarized light passing through this cell does not have its polarization rotated and hence is blocked by the second polarization
10 film. Thus, in the simplest sense, the liquid crystal material becomes a light valve, whose ability to allow or block light transmission is controlled by the application of an electric field.

The above description pertains to the operation of a single pixel in a liquid crystal display. High information type displays require the assembly of several million
15 of these pixels, which are referred to in the art as sub pixels, into a matrix format. Addressing all of these sub pixels, i.e., applying an electric field to all of these sub pixels, while maximizing addressing speed and minimizing cross-talk presents several challenges. One of the preferred ways to address sub pixels is by controlling the electric field with a thin film transistor located at each sub pixel, which forms the basis
20 of active matrix liquid crystal display devices (AMLCDs).

The manufacturing of these displays is extremely complex, and the properties of the substrate glass are extremely important. First and foremost, the glass substrates used in the production of AMLCD devices need to have their physical dimensions tightly controlled. The downdraw sheet drawing processes and, in particular, the fusion
25 process described in U.S. Patents Nos. 3,338,696 (Dockerty) and 3,682,609 (Dockerty), is one of the few processes capable of delivering glass sheets which can be used as substrates without requiring costly post forming finishing operations, such as lapping and polishing. Unfortunately, the fusion process places rather severe restrictions on the glass properties, requiring relatively high liquidus viscosities, preferably greater than
30 100,000 poises, more preferably, greater than 150,000 poises.

Typically, the two plates (substrate assemblies) that comprise a flat panel display are manufactured separately. One, the color filter plate, has a series of red, blue, green, and black organic dyes deposited on it. Each of these primary colors must

correspond precisely with a sub pixel of the companion active plate. To remove the influence of differences between the ambient thermal conditions encountered during the manufacture of the two plates, it is desirable to use glass substrates whose dimensions are independent of thermal condition (i.e., glasses with lower coefficients of thermal expansion). However, this property needs to be balanced by the generation of stresses between deposited films (e.g., silicon films) and the substrates that arise due to expansion mismatch. It is estimated that an optimal coefficient of thermal expansion (CTE) is in the range of $28\text{--}34 \times 10^{-7}/^{\circ}\text{C}$ ($0\text{--}300^{\circ}\text{C}$), more preferably, $28\text{--}33 \times 10^{-7}/^{\circ}\text{C}$ ($0\text{--}300^{\circ}\text{C}$).

The active plate, so called because it contains the active, thin film transistors, is manufactured using typical semiconductor type processes. These include sputtering, CVD, photolithography, and etching. It is highly desirable that the glass be unchanged during these processes. Thus, the glass needs to demonstrate both thermal stability and chemical durability.

Thermal stability (also known as thermal compaction or shrinkage) is dependent upon both the inherent viscous nature of a particular glass composition (as indicated by its strain point) and the thermal history of the glass sheet as determined by the manufacturing process. U.S. Patents Nos. 5,374,595 (Dumbaugh et al.) and 6,319,867 (Chacon et al.) disclose glasses with strain points in excess of 650°C which, when subjected to the thermal history of the fusion process, have acceptable thermal stability for active plates based both on a-Si thin film transistors (TFTs) and super low temperature p-Si TFTs. Higher temperature processing (such as required by low temperature p-Si TFTs) may require the addition of an annealing step to the glass substrate to ensure thermal stability.

Chemical durability implies a resistance to attack by the various etchant solutions used in the manufacture processes. Of particular interest is a resistance to attack from the dry etching conditions used to etch the silicon layer. To benchmark the dry etch conditions, a substrate sample is exposed to an etchant solution known as 110BHF. This test consists of immersing a sample of glass in a solution of 1 volume of 50 wt.% HF and 10 volumes 40 wt.% NH_4F at 30°C for 5 minutes. The sample is graded on weight loss and appearance. In addition to the 110BHF test, glass substrates are also tested for their resistance to acid conditions. In this case, the etchant solution is 5% HCl and the glass sample is immersed in the test solution for 24 hours at 95°C .

In addition to these requirements, AMLCD manufacturers are finding that both demand for larger display sizes and the economics of scale are driving them to process larger sized pieces of glass. Current industry standards are Gen VI (1500mm x 1850mm) and Gen VII (1870mm x 2200mm), but future efforts are geared toward even larger sizes in excess of 2 meters on each side. This raises several concerns.

First is simply the weight of the glass. The increase in glass weight in going from one generation to the next has significant implications for the robotic handlers used to ferry the glass into and through process stations. In addition, elastic sag, which is dependent upon glass density and Young's modulus, becomes a particularly critical issue with larger sheet sizes, impacting the ability to load, retrieve, and space the glass in the cassettes used to transport the glass between process stations.

In addition to the weight and sag problems, the increasing sizes of substrates leads to greater challenges in terms of manufacturing defect-free glass sheets. Because of the small sizes of sub pixels, substrates used for display applications must be essentially completely defect free.

One of the primary sources of defects is gaseous inclusions (also known as "seeds") resulting from entrapment of air in the molten glass as batch materials are melted. Historically, such gaseous inclusions have been removed through the use of arsenic as a fining agent. However, arsenic raises environmental and health issues, and thus there has been a continuing effort in the art to produce glasses with lower arsenic levels and, preferably, glasses which are substantially arsenic free. U.S. Patent Nos. 5,785,726 (Dorfeld et al.) 6,128,924 (Bange et al.) 5,824,127 (Bange et al.) and co-pending patent application Serial No. 11/116,669 disclose processes for manufacturing arsenic free glasses.

Efforts have been made to replace arsenic fining with antimony fining. However, antimony has its own environmental and health issues. Also, compared to arsenic, antimony is a less effective fining agent.

In quantitative terms, the gaseous inclusion level in commercially produced glass sheets needs to be less than or equal to 0.10 gaseous inclusions/cm³ of glass and preferably less than or equal to 0.05 inclusions/cm³ for sheets having a volume of at least 500 cm³. Moreover, it is not sufficient to achieve a low level of gaseous inclusions in one or just a few glass sheets, but in order to be cost effective, glass manufacturers need to achieve the above low inclusion levels consistently. A measure

of such consistency is to examine the gaseous defect level in a population of sequentially produced glass sheets, e.g., 50 sequential glass sheets. Thus, to have commercial viability, a glass intended for use as a substrate in display applications needs to achieve the above (or better) gaseous inclusion levels on average for at least 50 sequential sheets.

In view of the foregoing, it would be desirable to provide a glass composition for display devices having a low density to alleviate difficulties associated with larger sheet size, preferably less than or equal to 2.45 grams/cm³ and a liquidus viscosity greater than or equal to 100,000 poises to allow manufacture by, for example, the fusion process. In addition, it would be desirable for the glass to have a thermal expansion coefficient (CTE) in the range of $28-34 \times 10^{-7}/^{\circ}\text{C}$, and preferably between about $28-33 \times 10^{-7}/^{\circ}\text{C}$, over the temperature range of 0-300°C. Furthermore, it would be advantageous for the glass to have a strain point greater than 650°C, and for the glass to be resistant to attack from etchant solutions. It would also be desirable for the glass to have a low gaseous inclusion level when commercially manufactured without the use of arsenic and/or antimony as fining agents.

IV. SUMMARY OF THE INVENTION

In accordance with a first aspect, the invention provides an alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0 (preferably 0-1.0)
BaO:	0-0.1

wherein:

$$(a) \quad 1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25 \text{ (preferably, } 1.03 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.12),$$

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO; and

(b) the glass has at least one (and preferably both) of the following compositional characteristics:

- (i) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 ;
- (ii) on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 .

Preferably, the glass has the further compositional characteristic that on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 .

In accordance with a second aspect, the invention provides an alkali-free glass comprising in mole percent on an oxide basis:

SiO_2 : 64.0-71.0

Al_2O_3 : 9.0-12.0

B_2O_3 : 7.0-12.0

MgO : 1.0-3.0

CaO : 6.0-11.5

SrO : 0-1.0

BaO : 0-0.1

wherein:

$$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \geq 1.00 \text{ (preferably, } \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \geq 1.03).$$

Preferably, the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio is less than or equal to 1.25 (more preferably, less than or equal to 1.12). Also, the glass preferably has at least one (more preferably, all) of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 ;
- (c) on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 .

In accordance with a third aspect, the invention provides a method for producing alkali-free glass sheets by a downdraw process (e.g., a fusion process) comprising selecting, melting, and fining batch materials so that the glass making up the sheets comprises SiO_2 , Al_2O_3 , B_2O_3 , MgO , and CaO , and, on an oxide basis, has:

- (i) a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0; and
- (ii) a MgO content greater than or equal to 1.0 mole percent (and preferably less than or equal to 3.0 mole percent);

wherein:

(a) the fining is performed without the use of substantial amounts of either arsenic or antimony (i.e., the concentrations of As_2O_3 and Sb_2O_3 are each less than or equal to 0.05 mole percent); and

5 (b) a population of 50 sequential glass sheets produced by the downdraw process from the melted and fined batch materials has an average gaseous inclusion level of less than 0.05 gaseous inclusions/cubic centimeter, where each sheet in the population has a volume of at least 500 cubic centimeters.

10 Preferably, the glass making up the sheet is also substantially free of BaO (i.e., the concentration of BaO is less than or equal to 0.05 mole percent). Also, SnO_2 is preferably used in the fining.

In accordance with each of the foregoing aspects of the invention, the glass preferably has some and most preferably all of the following properties:

- 15 (a) a density that is less than or equal to 2.41 grams/cm^3 ;
(b) a liquidus viscosity that is greater than or equal to 100,000 poise;
(c) a strain point that is greater than or equal to 650°C ;
(d) a linear coefficient of thermal expansion (CTE) over the temperature range $0\text{-}300^\circ\text{C}$ which satisfies the relationship:

$$28 \times 10^{-7}/^\circ\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^\circ\text{C}.$$

20 It should be noted that the ranges specified above include the end points of the range. For example, when SiO_2 is specified to have a concentration of 64.0-71.0 mole percent on an oxide basis, the 64.0 and 71.0 values are included in the permissible values for the SiO_2 concentration. Similarly, when a concentration or other parameter is described as "being between X and Y," the X and Y values are included as part of the range.

25 Additional features and advantages of the invention are set forth in the detailed description which follows and, in part, will be readily apparent to those skilled in the art from that description or recognized by practicing the invention as described herein. The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitutes a part of this specification.

30 It is to be understood that the various features of the invention disclosed in this specification and in the drawings can be used in any and all combinations. More generally, both the above summary and the following detailed description are merely

exemplary of the invention and are intended to provide an overview or framework for understanding the nature and character of the invention.

V. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a liquidus phase diagram of the CaO-Al₂O₃-SiO₂ system.

5 Figure 2 is a liquidus phase diagram of the MgO-Al₂O₃-SiO₂ system.

Figure 3 shows the effect of the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio on inclusions (blisters) per pound values for a multi-day experiment.

VI. DETAILED DESCRIPTION OF THE INVENTION

10 As discussed above, the present invention is concerned with improved glasses for use as substrates in flat panel displays, e.g., AMLCDs. In particular, the glasses meet the various property requirements of such substrates. The major components of the glass are SiO₂, Al₂O₃, B₂O₃, and at least two alkaline earth oxides, i.e., at least MgO and CaO.

15 SiO₂ serves as the basic glass former of the glasses of the invention. Its concentration should be greater than 64 mole percent in order to provide the glass with a density and chemical durability suitable for a flat panel display glass, e.g., an AMLCD glass, and a liquidus temperature (liquidus viscosity) which allows the glass to be formed by a downdraw process (e.g., a fusion process).

20 In particular, to be suitable for use in flat panel display applications, in particular, AMLCDs, the glasses of the invention preferably have a density less than or equal to 2.45 grams/cm³ (more preferably, less than or equal to 2.43 grams/cm³, most preferably, less than or equal to 2.41 grams/cm³), a weight loss which is less than or equal to 0.8 milligrams/cm² when a polished sample is exposed to a 5% HCl solution for 24 hours at 95°C, and a weight loss of less than 1.5 milligrams/cm² when exposed
25 to a solution of 1 volume of 50 wt.% HF and 10 volumes 40 wt.% NH₄F at 30°C for 5 minutes.

To be formed by a downdraw process, the glasses preferably have a liquidus viscosity which is greater than or equal to 100,000 poises, more preferably greater than or equal to 150,000 poises, and most preferably greater than or equal to 200,000 poises.

30 In terms of an upper limit, the SiO₂ concentration should be less than or equal to 71 mole percent to allow batch materials to be melted using conventional, high volume, melting techniques, e.g., Joule melting in a refractory melter. When the concentration of SiO₂ goes above 71 mole percent, the 200 poise temperature (melting temperature)

generally rises above 1650°C, which is typically the upper limit for conventional melting processes.

Preferably, the SiO₂ concentration is between 66.0 and 70.5 mole percent, more preferably between 66.5 and 70.0 mole percent, and most preferably, between 67.0 and 69.5 mole percent. As a result of their SiO₂ content, the glasses of the invention typically have melting temperatures greater than or equal to 1600°C and less than or equal to 1650°C.

Al₂O₃ is another glass former of the glasses of the invention. An Al₂O₃ concentration greater than or equal to 9.0 mole percent provides the glass with a low liquidus temperature and a corresponding high liquidus viscosity. The use of at least 9.0 mole percent Al₂O₃ also improves the glass' strain point and modulus. In order to achieve an $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.00 (see below), the Al₂O₃ concentration needs to be kept below 12.0 mole percent. Preferably, the Al₂O₃ concentration is between 9.5 and 11.5 mole percent.

B₂O₃ is both a glass former and a flux that aids melting and lowers the melting temperature. To achieve these effects, the glasses of the invention have B₂O₃ concentrations that are equal to or greater than 7.0 mole percent. Large amounts of B₂O₃, however, lead to reductions in strain point (approximately 10°C for each mole percent increase in B₂O₃ above 7.0 mole percent), modulus, and chemical durability.

For use in flat panel (e.g., AMLCD) applications, the glasses of the invention preferably have a strain point equal to or greater than 650°C (more preferably, equal to or greater than 655°C, most preferably, equal to or greater than 660°C), a Young's modulus equal to or greater than 10.0×10^6 psi (more preferably, equal to or greater than 10.3×10^6 psi; most preferably, equal to or greater than 10.6×10^6 psi), and a chemical durability as described above in connection with the discussion of the SiO₂ content of the glass. A high strain point is desirable to help prevent panel distortion due to compaction/shrinkage during thermal processing subsequent to manufacturing of the glass. A high Young's modulus is desirable since it reduces the amount of sag exhibited by large glass sheets during shipping and handling.

To achieve the above properties, the glasses of the invention have B₂O₃ concentrations that are less than or equal to 12.0 mole percent. Preferably, the B₂O₃ concentration is between 8.0 and 12.0 mole percent, more preferably between 8.5 and 11.5 mole percent, and most preferably, between 9.0 and 11.0 mole percent.

The Al_2O_3 and B_2O_3 concentrations are preferably selected as a pair to increase strain point, increase modulus, improve durability, reduce density, and reduce CTE, while maintaining the melting and forming properties of the glass. For example, an increase in B_2O_3 and a corresponding decrease in Al_2O_3 can be helpful in obtaining a lower density and CTE, while an increase in Al_2O_3 and a corresponding decrease in B_2O_3 can be helpful in increasing strain point, modulus, and durability, provided that the increase in Al_2O_3 does not reduce the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio below 1.00. For reference, as discussed above, glasses for use in AMLCD applications preferably have CTE's (0-300°C) in the range of $28\text{-}34 \times 10^{-7}/^\circ\text{C}$.

In addition to the glass formers (SiO_2 , Al_2O_3 , and B_2O_3), the glasses of the invention also include at least two alkaline earth oxides, i.e., at least MgO and CaO , and, optionally, SrO and/or BaO . The alkaline earth oxides provide the glass with various properties important to melting, fining, forming, and ultimate use.

In accordance with the invention, it has been found that the MgO concentration in the glass and the glass' $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO , CaO , SrO , and BaO , are critical to the glass' performance and, in particular, are critical with regard to meltability and fining.

Although not wishing to be bound by any particular theory of operation, it is believed that following aspects of glass chemistry are involved in the roles of MgO and the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio in the glasses of the invention.

As is known in the art, in aluminosilicate glasses, Al^{3+} ions seek to be surrounded by four oxygen ions (O^{2-}). One means by which this occurs is traditionally called a charge-balance interaction. A silicon ion (Si^{4+}) bonded to four O^{2-} can be thought of as contributing $\frac{1}{4} \times (+4)$ or an incremental charge of +1 towards the bonding requirements of each O^{2-} . If one of these oxygen ions is bonded in turn to a 4-fold coordinated Al^{3+} , then there is an additional contribution of $\frac{1}{4} \times (+3) = +\frac{3}{4}$ towards the bonding requirements of the O^{2-} ion, for a total of $+1\frac{3}{4}$. The remaining $+\frac{1}{4}$ can be obtained by a nearby +2 cation such as an alkaline earth, e.g., $\frac{1}{8} \times (+2) = +\frac{1}{4}$. The total charge contributed by positively charged ions exactly balances the negative charge of the oxygen ions, and aluminum can remain in 4-fold coordination. The +2 cations that serve in this role are referred to as charge-balancing cations. Provided that the

$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio is 1 or more, it then follows that nearly all aluminum in calcium aluminosilicate glasses is 4-fold coordinated by oxygen. See M Taylor, GE Brown, Structure of mineral glasses: I. The feldspar glasses $\text{NaAlSi}_3\text{O}_8$, KAlSi_3O_8 , $\text{CaAl}_2\text{Si}_2\text{O}_8$. *Geochim. Cosmochim Acta* **43**:61-75 (1979); P. McMillan, B. Piriou, A Navrotsky, A Raman spectroscopic study of glasses along the joins silica-calcium aluminate, silica-sodium aluminate, and silica-potassium aluminate. *Geochim Cosmochim Acta* **46**:2021-2037 (1982); and A Navrotsky, G Peraudeau, P McMillan, JP Coutures, A thermochemical study of glasses and crystals along the joins silica-calcium aluminate and silica-sodium aluminate. *Geochim Cosmochim Acta* **46**:2039-2047 (1982). As is also known in the art, the efficacy of charge-balance by +2 cations varies inversely with their size. The usual explanation for this is that small +2 cations polarize oxygen ions and destabilize their bonds with other cations. See KL Geisinger, GV Gibbs, A Navrotsky, A molecular orbital study of bond length and angle variations in framework silicates. *Phys Chem Minerals* **11**: 266-285 (1985); and A Navrotsky, KL Geisinger, P McMillan, GV Gibbs, The tetrahedral framework in glasses and melts-inferences from molecular orbital calculations and physical properties. *Phys Chem Minerals* **11**:284-298 (1985). The preferred +2 cations in the invention are CaO, MgO and SrO, in order of maximum concentration. The Ca^{2+} ion is better at stabilizing aluminum in 4-fold coordination than the Mg^{2+} ion, but not as effective as the Sr^{2+} ion. In the glasses of the present invention, Sr^{2+} will be completely consumed in charge-balancing interactions, followed by Ca^{2+} up to the limit that virtually all Al^{3+} ions are stabilized in 4-fold coordination by Ca^{2+} or Sr^{2+} . If Al^{3+} ions remain that still require charge-balance, Mg^{2+} ions will be used for this purpose until the remaining Al^{3+} ions are stabilized in 4-fold coordination.

The alkaline earth ions that are not used to stabilize aluminum in 4-fold coordination will tend to share oxygen ions with adjacent silicon ions. In this role, the alkaline earths are termed network modifying cations, because they break up the tetrahedral network of Si-O-Si and Si-O-Al bonds. Given the compositional constraints outlined below, the only alkaline earth ions that can be available as network modifying cations are Ca^{2+} and Mg^{2+} . In breaking up the network structure of the glass, the modifying cations contribute to reduced viscosity at elevated temperature, thereby facilitating the basic melting process. They also reduce the solubility of gases in the glass, thereby reducing the possibility of bubble nucleation and growth at high

temperature. Further, they attack silica particles in the batch materials, causing them to be rapidly incorporated into a homogeneous melt. Finally, and most important for the present invention, they can reduce the stability of crystalline silica (e.g., cristobalite), stabilizing the liquid and thereby increasing the viscosity at which a crystal first appears on cooling. This is one of the key reasons why the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio must be ≥ 1 .

To understand this last role, i.e., the role of reducing the stability of crystalline silica, it is useful to consider the liquidus phase diagram of the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ system as depicted in Figure 1 (data used to prepare this figure are from EM Levin, CR Robbins, HF McMurdie, Phase Diagrams for Ceramists. The American Ceramic Society, Inc., Columbus, OH (1964), p. 219, converted to mole percent). The curves running through the middle of the diagram denote boundaries in composition space across which the crystal in equilibrium with a liquid changes its identity. At the top of the figure is cristobalite, a crystalline polymorph of SiO_2 . To the lower right is mullite, approximately $3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$, an aluminosilicate containing aluminum in 4-, 5- and 6-fold coordination. In the lower middle of the diagram is the calcium aluminosilicate anorthite, $\text{CaAl}_2\text{Si}_2\text{O}_8$, in which the $\text{CaO}/\text{Al}_2\text{O}_3$ ratio is 1.0 and all Al^{3+} ions are 4-fold coordinated by oxygen. The phase in the lower left is wollastonite, $\text{Ca}_2\text{Si}_2\text{O}_6$, in which all Si^{4+} ions are 4-fold coordinated by oxygen, all Ca^{2+} ions are 6-fold coordinated by oxygen, and at least some of the oxygen ions are shared between Ca^{2+} and Si^{4+} ions. The vertical line running through the middle of the triangle denotes compositions for which the $\text{CaO}/\text{Al}_2\text{O}_3$ ratio is exactly 1.0. In each of these regions, the crystal in question is in equilibrium with a molten glass, and the region of equilibrium between liquid and a particular crystal is referred to as the liquidus phase field of the crystal.

Where two liquidus phase fields intersect, the curve indicating the intersection is called a cotectic, and where three phase fields intersect, the point at which the fields converge is referred to as a eutectic. Eutectics are locations where three crystalline phases simultaneously coexist with a liquid. They are, by definition, local minima in the melting temperatures of the particular crystalline assemblage, and therefore are the compositions for which the liquid is most stable relative to any one or combination of the three crystalline phases. Two eutectics are seen in Figure 1. The first, between cristobalite, anorthite and mullite (right-hand side) is a single melt down to 1345°C , at which point the three crystalline phases simultaneously come into equilibrium with the

liquid. The second, between wollastonite, anorthite and cristobalite, is a single melt down to 1170°C, at which point those three phases simultaneously come into equilibrium with the liquid.

Were a crystalline assemblage of wollastonite, cristobalite and anorthite heated up from room temperature, the first appearance of a liquid would be at 1170°C, and the composition of the liquid would be equivalent to that of the corresponding eutectic composition. Likewise, were a crystalline assemblage of anorthite, mullite and cristobalite heated up from room temperature, the first appearance of a liquid would be at 1345°C and the composition of the liquid would be that of the corresponding eutectic between these phases. Between these two eutectics, temperatures increase monotonically to the line denoting $\text{CaO}/\text{Al}_2\text{O}_3 = 1.0$. This line denotes a thermal maximum in $\text{RO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ systems, for $\text{R} = \text{Ca}, \text{Sr}$ and Ba . In other words, $(\text{Ca}, \text{Sr}, \text{Ba})\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$ compositions to the Al_2O_3 -rich side of the $(\text{Ca}, \text{Sr}, \text{Ba})\text{O}/\text{Al}_2\text{O}_3 = 1$ line will melt at the [alkaline earth aluminosilicate]-mullite-cristobalite eutectic composition, and are thermodynamically hindered from melting at the [alkaline earth silicate]-[alkaline earth aluminosilicate]-cristobalite side of the phase diagram.

Figure 2 shows the liquidus phase diagram of the $\text{MgO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ system (data used to prepare this figure are from EM Levin, CR Robbins, HF McMurdie, Phase Diagrams for Ceramists. The American Ceramic Society, Inc., Columbus, OH (1964), p. 246, converted to mole percent). This system is unique among $\text{RO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ systems in that the magnesium aluminosilicate (cordierite)-mullite-cristobalite eutectic composition has an $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio slightly greater than 1. Unlike the other $\text{RO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ systems, initial melting of high-silica compositions in the magnesium-based system will thus tend to occur at eutectics with $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] > 1.00$. Another point of considerable importance is that the eutectics in question are at much lower silica concentrations than any of the other $\text{RO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ systems. Therefore, the lowest liquidus temperatures will be found at comparatively low silica concentrations in the $\text{MgO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ system compared to the other $\text{RO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ systems.

For the purposes of this invention, the most important consequences of the compositions of early-stage melts pertain to gas solubilities and the appearance of gaseous inclusions in the glass. The solubility of gases is comparatively high in

aluminum-rich glasses and falls steeply as the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio increases beyond 1.00. Furthermore, silica is the last component to dissolve during melting, and as it does so the solubility of gas decreases considerably. In RO-rich systems, silica dissolution occurs at a comparatively low temperature, thus further inhibiting initial gas solubility. The net impact of this is that RO-rich glasses have low initial gas solubility, and the solubility actually increases as melting proceeds, whereas Al_2O_3 -rich glasses have very high initial solubility, but it decreases as melting proceeds. As solubility decreases, gas is forced out of the glass and into bubbles. The surfaces of partially-reacted silica particles serve as effective nucleation sites for these bubbles, and help keep them in the body of the glass.

Another key component of the invention is boric oxide, B_2O_3 . It does not participate significantly in any of the binary or ternary aluminosilicate crystals nor in SiO_2 , and as a consequence its main impact is to decrease liquidus temperature through simple dilution. The main result is that for a given point on the liquidus surface of, for example, the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ system, the liquidus temperatures will decrease with addition of B_2O_3 . It is found empirically in high silica liquids that the impact of B_2O_3 on liquidus temperatures is about twenty (20) degrees Centigrade per mol%. As an example, the temperature of the anorthite-cristobalite-mullite eutectic (on the Al_2O_3 -rich side of Figure 1) decreases from 1345°C to about 1145°C when it is diluted by 10 mol% B_2O_3 . The impact of dilution on liquidus temperatures is commonly referred to as freezing point depression.

A surprising result of composition investigations in AMLCD-type glass compositions is that the substitution of 1-3 mol% MgO for CaO in the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ system causes an abrupt shift in the position of the anorthite-mullite-cristobalite liquidus to approximately the same position as the cordierite-mullite-cristobalite liquidus in the $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$ system. As a consequence, the addition of MgO not only forces all initial melting to the RO-rich side of the phase diagram, but also produces local minima in liquidus temperatures below those that might be expected from either the MgO - or CaO -based systems alone. The former follows from the discussion above concerning the $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$ system. The latter arises because the addition of a suitably small amount of any oxide will initially reduce liquidus temperatures via freezing point depression. Therefore, while intuitively one would anticipate an increase in liquidus temperatures because of the high temperatures in the ternary systems, i.e., systems

having only MgO or CaO, one in fact obtains a decrease from about 1-3 mol%, followed by increasing liquidus temperatures thereafter. Since viscosity is not significantly impacted by the substitution of MgO for CaO, the net result of the decreasing liquidus temperature is an increase in liquidus viscosity. High liquidus viscosities are a prerequisite for precision sheet downdraw processes used to convert molten glass into sheet suitable for AMLCD applications.

Prior to the present invention, it was believed that MgO concentrations equal to or greater than 1 mole percent raised liquidus temperatures (lowered liquidus viscosities), thereby compromising high viscosity forming processes, such as, downdraw processes, e.g., fusion processes. However, as discussed above and illustrated by the examples presented below, it has been found that higher levels of MgO can be used, provided that simultaneously, the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio and SiO_2 concentration are carefully controlled as described above.

Thus, in sum, the foregoing considerations show that of the alkaline earth oxides, MgO is particularly important with regard to melting and fining. In addition, relative to the other alkaline earth oxides, the presence of MgO results in lower density and CTE, and a higher chemical durability, strain point, and modulus.

In terms of concentrations, MgO should be greater than or equal to 1.0 mole percent in order to achieve the various benefits associated with MgO described above. At concentrations greater than 3.0 mole percent, even with control of the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio and the SiO_2 concentration, the liquidus temperature rises and liquidus viscosity falls such that forming the glass using a high viscosity forming process (e.g., a fusion process) is compromised. Preferably, the MgO concentration is between 1.2 and 2.8 mole percent, more preferably between 1.4 and 2.6 mole percent, and most preferably, between 1.6 and 2.4 mole percent.

Of the alkaline earth oxides, the CaO concentration in the glasses of the invention is the largest. CaO is essential to producing low liquidus temperatures (high liquidus viscosities), high strain points and moduli, and CTE's in the most desired ranges for flat panel applications, specifically, AMLCD applications. It also contributes favorably to chemical durability, and compared to other alkaline earth oxides it is relatively inexpensive as a batch material. Accordingly, the CaO concentration needs to be greater than or equal to 6.0 mole percent. However, at high concentrations, CaO increases density and CTE. Accordingly, the CaO concentration

of the glasses of the invention is less than or equal to 11.5 mole percent. Preferably, the CaO concentration is between 6.5 and 10.5 mole percent.

The remaining alkaline earth oxides -- SrO and BaO -- can both contribute to low liquidus temperatures (high liquidus viscosities) and thus the glasses of the invention will typically contain at least one of these oxides. However, both oxides increase CTE and density and lower modulus and strain point compared to MgO and CaO. Between SrO and BaO, BaO generally has more adverse effects on glass properties than SrO. Accordingly, the BaO concentration in the glasses of the invention is less than or equal to 0.1 mole percent (preferably, less than 0.05 mole percent), while the SrO concentration is allowed to be greater, i.e., less than or equal to 2.0 mole percent, preferably, less than or equal to 1.0 mole percent. Typically, the sum of the SrO and BaO concentrations will be greater than or equal to 0.4 mole percent, primarily to provide a sufficiently high liquidus viscosity so that the glass can be formed by a downdraw process.

In addition to the above components, the glasses of the invention can include various other oxides to adjust various physical, melting, fining, and forming attributes of the glasses. Examples of such other oxides include, but are not limited to, TiO_2 , MnO , ZnO , Nb_2O_5 , MoO_3 , Ta_2O_5 , WO_3 , Y_2O_3 , La_2O_3 , and CeO_2 . The amount of each of these oxides should be less than or equal to 2.0 mole percent, and their total combined concentration should be less than or equal to 5.0 mole percent. The glasses of the invention will also include various contaminants associated with batch materials and/or introduced into the glass by the melting, fining, and/or forming equipment used to produce the glass, such as, Fe_2O_3 and ZrO_2 . The glasses can also contain SnO_2 either as a result of Joule melting using tin-oxide electrodes and/or through the batching of tin containing materials, e.g., SnO_2 , SnO , SnCO_3 , SnC_2O_4 , etc.

The glasses of the invention will also normally contain some alkali as contaminants. However, for AMLCD applications, the alkali levels need to be kept below 0.1 mole percent to avoid having a negative impact on thin film transistor (TFT) performance through diffusion of alkali ions from the glass into the silicon of the TFT. As used herein, an "alkali-free glass" is a glass having a total alkali concentration which is less than or equal to 0.1 mole percent, where the total alkali concentration is the sum of the Na_2O , K_2O , and Li_2O concentrations. Preferably, the total alkali concentration is less than or equal to 0.07 mole percent.

As discussed above, in accordance with the invention, it has been found that having an $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.00 improves fining, i.e., the removal of gaseous inclusions from the melted batch materials. This improvement allows for the use of more environmentally friendly fining packages. For example, on an oxide basis, the glasses of the invention, can have one or more of the following compositional characteristics:

- (i) an As_2O_3 concentration of at most 0.05 mole percent;
- (ii) an Sb_2O_3 concentration of at most 0.05 mole percent;
- (iii) a SnO_2 concentration of at least 0.01 mole percent.

As is well-known, As_2O_3 is the most effective high temperature fining agent for AMLCD glasses, and in some embodiments of the present invention, As_2O_3 is used for fining because of its superior fining properties. However, As_2O_3 is poisonous and thus requires special handling during the glass manufacturing process. Accordingly, in certain preferred embodiments, fining is performed without the use of substantial amounts of As_2O_3 , i.e., the finished glass has at most 0.05 mole percent As_2O_3 . Most preferably, no As_2O_3 is purposely used in the fining of the glass. In such cases, the finished glass will typically have at most 0.005 mole percent As_2O_3 as a result of contaminants present in the batch materials and/or the equipment used to melt the batch materials.

Although not as toxic as As_2O_3 , Sb_2O_3 is also poisonous and requires special handling. In addition, Sb_2O_3 raises the density, raises the CTE, and lowers the strain point in comparison to glasses which use As_2O_3 or SnO_2 as a fining agent. Accordingly, in certain preferred embodiments, fining is performed without the use of substantial amounts of Sb_2O_3 , i.e., the finished glass has at most 0.05 mole percent Sb_2O_3 . Most preferably, no Sb_2O_3 is purposely used in the fining of the glass. In such cases, the finished glass will typically have at most 0.005 mole percent Sb_2O_3 as a result of contaminants present in the batch materials and/or the equipment used to melt the batch materials.

Compared to As_2O_3 and Sb_2O_3 fining, tin fining (i.e., SnO_2 fining) is less effective, but SnO_2 is a ubiquitous material which has no known hazardous properties. Also, for many years, SnO_2 has been a component of AMLCD glasses through the use of tin oxide electrodes in the Joule melting of the batch materials for such glasses (e.g., the melting of Corning Incorporated Code 7059, 1737, and EAGLE 2000 glasses). The

presence of SnO_2 in AMLCD glasses has not resulted in any known adverse effects in the use of these glasses in the manufacture of liquid crystal displays. SnO_2 , however, can form crystalline defects in AMLCD glasses when used at high concentrations. Accordingly, the concentration of SnO_2 in the finished glass is preferably less than or equal to 0.15 mole percent.

Tin fining can be used alone or in combination with other fining techniques if desired. For example, tin fining can be combined with halide fining, e.g., bromine fining. Other possible combinations include, but are not limited to, tin fining plus sulfate, sulfide, cerium oxide, mechanical bubbling, and/or vacuum fining. Also, these other fining techniques can be used by themselves (or in combinations) without the use of tin fining. In all of these cases, maintaining an $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio and MgO concentration in the ranges discussed above makes the fining process easier to perform and more effective.

The glasses of the invention can be manufactured using various techniques known in the art. Preferably, the glasses are made using a downdraw process and, most preferably, by a fusion downdraw process. Compared to other forming processes, such as the float process, the fusion process is preferred for several reasons. First, glass substrates made from the fusion process do not require polishing. Current glass substrate polishing is capable of producing glass substrates having an average surface roughness greater than about 0.5 nm (Ra), as measured by atomic force microscopy. Glass substrates produced according to the present invention and using the fusion process have an average surface roughness as measured by atomic force microscopy of less than 0.5 nm. The substrates also have an average internal stress as measured by optical retardation which is less than or equal to 150 psi.

The invention is further illustrated by the following examples, which are meant to be illustrative, and not in any way limiting, to the claimed invention.

In particular, Table 1 lists examples of the glasses of the invention and comparative glasses in terms of mole percents which are either calculated on an oxide basis from the glass batches in the case of the crucible melts or determined from measurements on the finished glass for the compositions prepared using the continuous melter (see below). Table 1 also lists various physical properties for these glasses, the units for these properties being as follows:

Density	grams/centimeter ³
CTE	$\times 10^{-7}/^{\circ}\text{C}$ (0-300 $^{\circ}\text{C}$)
Strain Point	$^{\circ}\text{C}$
Young's Modulus	$\times 10^{+6}$ psi
Melting Temp.	$^{\circ}\text{C}$
Liquidus Temp.	$^{\circ}\text{C}$
Liquidus Viscosity	poises

Inasmuch as the sum of the individual constituents totals or very closely approximates 100, for all practical purposes the reported values may be deemed to represent mole percent. The actual batch ingredients may comprise any materials, either oxides, or other compounds, which, when melted together with the other batch components, will be converted into the desired oxide in the proper proportions. For example, SrCO_3 and CaCO_3 can provide the source of SrO and CaO , respectively.

The specific batch ingredients used to prepare the glasses of Table 1 were fine sand, alumina, boric acid, magnesium oxide, limestone, strontium carbonate or strontium nitrate, and tin oxide.

The glasses of Examples 1-6, 9-11, 29-31, 33-34, 36-42, and 46-52 were prepared by melting 3,000 gram batches of each glass composition at a temperature and time to result in a relatively homogeneous glass composition, e.g., at a temperature of about 1600 $^{\circ}\text{C}$ for a period of about 16 hours in platinum crucibles. In particular, the batch materials were ball-milled for one hour using ceramic media in a ceramic mill. The batch was transferred to an 1800 cc platinum crucible and loaded into a furnace at 1600 $^{\circ}\text{C}$. After 16 hours, the crucible was removed from the furnace and the glass was poured onto a cold steel plate. When viscous enough to handle, the glass was transferred to an annealing oven at 725 $^{\circ}\text{C}$, held for one hour at this temperature, then cooled at 0.5 $^{\circ}\text{C}/\text{minute}$ to room temperature.

In Examples 7-8, 12-28, 32, 35, and 43-45, the melting was done in a laboratory scale, continuous, Joule-heated melter. Batches of the raw materials massing 45.4 kg were weighed into a mechanical mixer and combined together for five minutes. An amount of water corresponding to about 0.25 kg was added to the mixture during the last 60 seconds of mixing to reduce dust generation. The mixture was loaded using a screw feeder into a ceramic-lined furnace with tin oxide electrodes and opposing burners firing over the melt surface. The power supplied by the electrodes was

controlled by keeping the glass at a near-constant resistivity, corresponding to temperatures between 1590°C and 1610°C. The glass moved from the melter into a platinum-based conditioning system consisting of a high-temperature finer followed by a stir chamber. The finer and stir chamber temperatures were kept constant throughout the experiment, whereas the melt temperature of the ceramic-lined melter was allowed to vary with composition. The glass drained out of the stir chamber through a heated orifice and was rolled into a ribbon approximately 5 mm thick and 30 mm wide. The glass from the ribbon was analyzed periodically for defects, which were identified, counted, and converted to defects per pound. Compositions were obtained from the ribbon via standard chemical methods, and physical properties were obtained as described below.

The glass properties set forth in Table 1 were determined in accordance with techniques conventional in the glass art. Thus, the linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C is expressed in terms of $\times 10^{-7}/^{\circ}\text{C}$ and the strain point is expressed in terms of °C. These were determined from fiber elongation techniques (ASTM references E228-85 and C336, respectively). The density in terms of grams/cm³ was measured via the Archimedes method (ASTM C693). The melting temperature in terms of °C (defined as the temperature at which the glass melt demonstrates a viscosity of 200 poises) was calculated employing a Fulcher equation fit to high temperature viscosity data measured via rotating cylinders viscometry (ASTM C965-81). The liquidus temperature of the glass in terms of °C was measured using the standard gradient boat liquidus method of ASTM C829-81. This involves placing crushed glass particles in a platinum boat, placing the boat in a furnace having a region of gradient temperatures, heating the boat in an appropriate temperature region for 24 hours, and determining by means of microscopic examination the highest temperature at which crystals appear in the interior of the glass. The liquidus viscosity in poises was determined from the liquidus temperature and the coefficients of the Fulcher equation. Young's modulus values in terms of Mpsi were determined using a resonant ultrasonic spectroscopy technique of the general type set forth in ASTM E1875-00e1.

As can be seen in Table 1, Examples 1-43 have densities, CTE's, strain points, and Young's modulus values that make the glasses suitable for use in display applications, such as AMLCD applications. Although not shown in Table 1, the glasses

also have chemical durabilities suitable for these applications. In particular, Examples 12, 13, 23 and 28 were each found to have 110BHF values of between 1.25 and 1.35 milligrams/cm² and HCl durabilities of between 0.5 and 0.8 milligrams/cm². The glasses of Examples 1-43 can also be formed using downdraw techniques, such as the fusion technique. Thus, they have liquidus temperatures less than or equal to 1170°C and liquidus viscosities equal to or greater than 100,000, and in most cases, equal to or greater than 150,000.

Glasses having the compositions and properties shown in Examples 23 and 28 are currently regarded as representing the most preferred embodiments of the invention, that is, as providing the best combination of properties for the purposes of the invention at this time.

Examples 44 and 45 illustrate glasses which have liquidus viscosities less than 100,000 poises. Example 44 was found to produce mullite upon crystallization, which is an undesirable liquidus phase for downdraw processes. The presence of this phase can be eliminated by a small increase in the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio. More generally, in the compositional space of the present invention, localized regions exist where the liquidus phase is mullite. These regions can be easily recognized by persons skilled in the art from the present disclosure and avoided by small changes in the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio.

Example 45 has a MgO concentration close to the upper limit of 3.0 mole percent. As noted above, as MgO increases, the liquidus temperatures initially go down but then increase. Example 45 illustrates this later effect.

Examples 46-48 have $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratios of less than 1.00 and thus have either a low liquidus viscosity (Example 46) or high melting temperatures (Examples 47 and 48). Examples 48-52 have MgO concentrations less than 1.0 mole percent and thus have high or marginal melting temperatures (Examples 48-50) or high CTE's (Examples 51 and 52).

Figure 3 illustrates the dramatic improvement in defect levels that can be achieved by switching the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio of a glass from below 1.00 to above 1.00. This graph shows the results of an experimental study done over a 30 day period in which the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio was adjusted by increasing CaO and/or MgO at the expense of Al₂O₃ and/or SiO₂. The triangular data points show the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$

ratios on the various days of the experiment, and the solid circles show the number of inclusions per pound. As can be seen, as soon as the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio broke through the 1.00 level, the inclusion level dropped by essentially two orders of magnitude and remained at low levels even with changes in CaO and/or MgO.

5 Throughout the experiment, the MgO concentration was greater than 1.0 mole percent and the SiO_2 concentration was less than 71 mole percent.

The glass of Example 23 was produced using a downdraw process, specifically, a full-scale fusion process, and was found to produce a population of 50 sequential glass sheets which had an average inclusion level of less than 0.05 gaseous
10 inclusions/cubic centimeter, each sheet in the population having a volume of at least 500 cubic centimeters.

Although the invention has been described in detail for the purpose of illustration, it is understood that such detail is solely for that purpose and variations can be made therein by those skilled in the art without departing from the spirit and scope
15 of the invention which is defined by the following claims.

TABLE 1

Composition (mol%)	1	2	3	4	5	6
SiO ₂	68.80	68.64	68.95	68.95	68.98	68.98
Al ₂ O ₃	10.55	10.60	10.49	10.49	10.45	10.45
B ₂ O ₃	9.94	9.99	9.90	9.90	9.90	9.90
MgO	2.01	2.02	1.00	2.00	1.00	2.00
CaO	8.13	8.18	9.09	8.09	9.10	8.10
SrO	0.50	0.50	0.50	0.50	0.50	0.50
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.01	1.01	1.01	1.01	1.01	1.01
Properties						
Density	2.378	2.378	2.385	2.381	--	--
CTE	31.3	31.5	32.0	30.5	--	--
Strain Point	677	670	691	688	--	--
Young's Modulus	10.6	10.6	--	--	--	--
Melting Temp.	1629	1641	1649	1645	1640	--
Liquidus Temp.	1165	1150	1165	1140	1145	1150
Liquidus Viscosity	158000	235000	214000	370000	262000	--

Composition (mol%)	7	8	9	10	11	12
SiO ₂	69.41	68.91	68.44	68.59	68.75	69.25
Al ₂ O ₃	10.19	10.40	10.60	10.55	10.49	10.21
B ₂ O ₃	9.96	9.94	9.99	9.94	9.90	9.96
MgO	1.87	1.98	1.21	1.21	1.20	2.04
CaO	7.98	7.45	9.19	9.14	9.09	7.96
SrO	0.52	1.25	0.50	0.50	0.50	0.51
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.02	1.03	1.03	1.03	1.03	1.03
Properties						
Density	2.365	2.390	2.384	2.383	2.386	2.366
CTE	30.7	31.8	32.9	32.0	31.1	31.4
Strain Point	664	665	680	674	689	664
Young's Modulus	--	--	10.5	10.6	--	--
Melting Temp.	1641	1631	1628	1632	1646	1640
Liquidus Temp.	1145	1120	1135	1140	1150	1150
Liquidus Viscosity	263000	371000	294000	279000	273000	225000

TABLE 1 (continued)

Composition (mol%)	13	14	15	16	17	18
SiO ₂	68.84	68.18	69.16	67.59	67.65	69.32
Al ₂ O ₃	10.42	10.69	10.28	11.06	11.06	10.17
B ₂ O ₃	9.94	10.04	9.88	9.84	9.74	9.86
MgO	1.98	1.49	1.80	2.25	2.26	2.33
CaO	7.42	8.84	8.30	8.65	8.67	7.74
SrO	1.33	0.69	0.51	0.54	0.55	0.51
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.03	1.03	1.03	1.03	1.04	1.04
Properties						
Density	2.391	2.379	2.368	2.384	2.385	2.365
CTE	32.3	32.5	31.1	31.5	31.6	30.4
Strain Point	664	663	665	665	665	666
Young's Modulus	--	--	--	--	--	--
Melting Temp.	1622	1621	1632	1612	1606	1635
Liquidus Temp.	1105	1125	1125	1140	1135	1150
Liquidus Viscosity	530000	305000	376000	195000	224000	217000

Composition (mol%)	19	20	21	22	23	24
SiO ₂	69.06	68.64	68.01	68.46	69.28	69.08
Al ₂ O ₃	10.23	10.46	10.66	10.49	10.18	10.23
B ₂ O ₃	9.97	9.90	10.11	9.99	9.79	9.88
MgO	1.87	1.82	1.84	1.84	1.85	1.88
CaO	8.31	8.62	8.71	8.66	8.34	8.37
SrO	0.49	0.49	0.60	0.49	0.49	0.49
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.04	1.04	1.05	1.05	1.05	1.05
Properties						
Density	2.369	2.374	2.378	2.375	2.369	2.371
CTE	31.2	31.5	32.3	31.5	31.1	31.2
Strain Point	665	664	667	666	666	665
Young's Modulus	--	--	--	--	--	--
Melting Temp.	1637	1624	1616	1619	1644	1621
Liquidus Temp.	1130	1115	1130	1120	1145	1135
Liquidus Viscosity	360000	408000	275000	363000	233000	243000

TABLE 1 (continued)

Composition (mol%)	25	26	27	28	29	30
SiO ₂	68.88	69.11	68.52	67.80	68.29	68.45
Al ₂ O ₃	10.37	10.17	10.43	10.83	10.55	10.49
B ₂ O ₃	9.79	9.96	10.01	9.90	9.95	9.90
MgO	1.96	2.22	1.21	2.18	2.51	2.50
CaO	8.45	7.96	9.25	8.74	8.13	8.09
SrO	0.48	0.51	0.51	0.48	0.50	0.50
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.05	1.05	1.05	1.05	1.06	1.06
Properties						
Density	2.375	2.367	2.371	2.384	2.380	2.379
CTE	31.8	31.1	32.2	32.1	31.8	30.8
Strain Point	668	664	665	667	671	669
Young's Modulus	--	--	--	--	10.7	10.6
Melting Temp.	1630	1634	1627	1612	1633	1632
Liquidus Temp.	1120	1115	1115	1120	1150	1165
Liquidus Viscosity	408000	481000	448000	330000	219000	148000

Composition (mol%)	31	32	33	34	35	36
SiO ₂	69.75	67.45	68.09	68.25	68.51	68.11
Al ₂ O ₃	10.70	10.88	10.55	10.49	10.30	10.44
B ₂ O ₃	8.16	10.02	9.94	9.90	10.03	9.85
MgO	1.28	2.04	1.71	1.70	1.65	2.98
CaO	9.58	9.00	9.14	9.09	8.93	8.05
SrO	0.46	0.54	0.50	0.50	0.51	0.50
SnO ₂	0.07	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.06	1.06	1.08	1.08	1.08	1.10
Properties						
Density	2.405	2.384	2.388	2.386	2.373	2.382
CTE	32.9	32.7	31.4	32.6	32.6	31.0
Strain Point	684	661	673	674	664	668
Young's Modulus	--	--	10.6	10.6	--	10.7
Melting Temp.	--	1610	1619	1622	1640	1626
Liquidus Temp.	1155	1135	1155	1150	1130	1170
Liquidus Viscosity	--	200000	156000	177000	311000	122000

TABLE 1 (continued)

Composition (mol%)	37	38	39	40
SiO ₂	67.95	68.73	68.73	68.65
Al ₂ O ₃	10.49	10.10	10.10	10.09
B ₂ O ₃	9.90	9.90	9.90	9.90
MgO	3.00	1.00	2.00	1.10
CaO	8.09	9.70	8.70	9.69
SrO	0.50	0.50	0.50	0.50
SnO ₂	0.07	0.07	0.07	0.07
Σ[RO]/[Al ₂ O ₃]	1.10	1.11	1.11	1.12
Properties				
Density	2.385	--	--	2.390
CTE	30.7	--	--	33.3
Strain Point	671	--	--	685
Young's Modulus	10.7	--	--	--
Melting Temp.	1616	1637	1631	1644
Liquidus Temp.	1155	1150	1150	1145
Liquidus Viscosity	155000	201000	177000	269000

Composition (mol%)	41	42	43
SiO ₂	67.75	67.91	68.53
Al ₂ O ₃	10.49	10.44	10.04
B ₂ O ₃	9.90	9.84	10.04
MgO	2.20	2.19	1.94
CaO	9.09	9.05	8.90
SrO	0.50	0.50	0.48
SnO ₂	0.07	0.07	0.07
Σ[RO]/[Al ₂ O ₃]	1.12	1.12	1.13
Properties			
Density	2.390	2.393	2.373
CTE	33.3	33.1	32.6
Strain Point	670	668	661
Young's Modulus	10.7	10.7	□
Melting Temp.	1611	1615	1620
Liquidus Temp.	1145	1140	1115
Liquidus Viscosity	173000	204000	362000

TABLE 1 (continued)

Composition (mol%)	44	45	46	47	48
SiO ₂	68.79	68.09	69.25	69.25	69.25
Al ₂ O ₃	10.41	10.86	10.79	10.79	10.79
B ₂ O ₃	9.92	9.80	9.90	9.90	9.90
MgO	1.97	2.88	2.00	1.00	0.00
CaO	7.81	7.77	7.49	8.49	9.49
SrO	1.03	0.53	0.50	0.50	0.50
SnO ₂	0.07	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.04	1.03	0.93	0.93	0.93
Properties					
Density	2.385	2.380	--	2.364	2.385
CTE	31.9	30.4	--	29.6	31.3
Strain Point	666	669	--	--	--
Young's Modulus	--	--	--	--	--
Melting Temp.	1622	1615	1645	1688	1671
Liquidus Temp.	1210	1200	1220	1200	1160
Liquidus Viscosity	52000	59000	58000	137000	294000

Composition (mol%)	49	50	51	52
SiO ₂	68.98	68.73	68.45	68.45
Al ₂ O ₃	10.45	10.10	10.19	10.09
B ₂ O ₃	9.90	9.90	9.90	9.90
MgO	0.00	0.00	0.30	0.30
CaO	10.10	10.70	10.59	10.69
SrO	0.50	0.50	0.50	0.50
SnO ₂	0.07	0.07	0.07	0.07
$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$	1.01	1.11	1.12	1.14
Properties				
Density	2.394	2.375	2.397	2.395
CTE	33.4	33.4	35.6	34.7
Strain Point	--	--	686	685
Young's Modulus	--	--	--	--
Melting Temp.	1674	1650	1637	1638
Liquidus Temp.	1160	1160	1170	1160
Liquidus Viscosity	246000	173000	143000	172000

What is claimed is:

1. An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1
SnO ₂ :	0.01-0.15

wherein:

$$1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25,$$

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO.

2. The glass of Claim 1 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 ;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 .

3. The glass of Claim 2 wherein the glass has compositional characteristics (a) and (b).

4. The glass of Claim 1 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
- (b) a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:

$$28 \times 10^{-7}/^\circ\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^\circ\text{C};$$

- (c) a liquidus temperature less than or equal to 1170°C.
- (d) a liquidus viscosity that is greater than or equal to 100,000 poise;
- (e) a strain point that is greater than or equal to 650°C.

5. The glass of Claim 4 wherein the glass has at least properties (a) through (c).

6. The glass of Claim 4 wherein the glass has properties (a) through (e).

7. An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1

wherein:

- (a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$,

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the compositional characteristic that on an oxide basis, the glass comprises at least 0.01 mole percent SnO₂; and

(c) the glass has a linear coefficient of thermal expansion (CTE) over the temperature range 0-300°C which satisfies the relationship:

$$28 \times 10^{-7}/^\circ\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^\circ\text{C}.$$

8. The glass of Claim 7 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;
 (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃.

9. The glass of Claim 8 wherein the glass has compositional characteristics (a) and (b).

10. The glass of Claim 7 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
 (b) a liquidus temperature less than or equal to 1170°C.
 (c) a liquidus viscosity that is greater than or equal to 100,000 poise;
 (d) a strain point that is greater than or equal to 650°C.

11. The glass of Claim 10 wherein the glass has at least properties (a) and (b).

12. The glass of Claim 10 wherein the glass has properties (a) through (d).

13. An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1

wherein:

- (a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$,

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the compositional characteristic that on an oxide basis, the glass comprises at least 0.01 mole percent SnO₂; and

- (c) the glass has a liquidus temperature less than or equal to 1170°C.

14. The glass of Claim 13 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;
 (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃.

15. The glass of Claim 14 wherein the glass has compositional characteristics (a) and (b).

16. The glass of Claim 13 wherein the glass has at least one of the following properties:

- (a) a density that is less than or equal to 2.41 grams/cm³;
 (b) a liquidus viscosity that is greater than or equal to 100,000 poise;
 (c) a strain point that is greater than or equal to 650°C.

17. The glass of Claim 16 wherein the glass has at least property (a).

18. The glass of Claim 16 wherein the glass has properties (a) through (c).

ABSTRACT OF THE DISCLOSURE

Glasses are disclosed which can be used to produce substrates for flat panel display devices, e.g., active matrix liquid crystal displays (AMLCDs). The glasses have MgO concentrations in the range from 1.0 mole percent to 3.0 mole percent and $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratios greater than or equal to 1.00, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO. These compositional characteristics have been found to improve the melting properties of batch materials used to produce the glass, which, in turn, allows the glasses to be fined (refined) with more environmentally friendly fining agents, e.g., tin as opposed to arsenic and/or antimony.

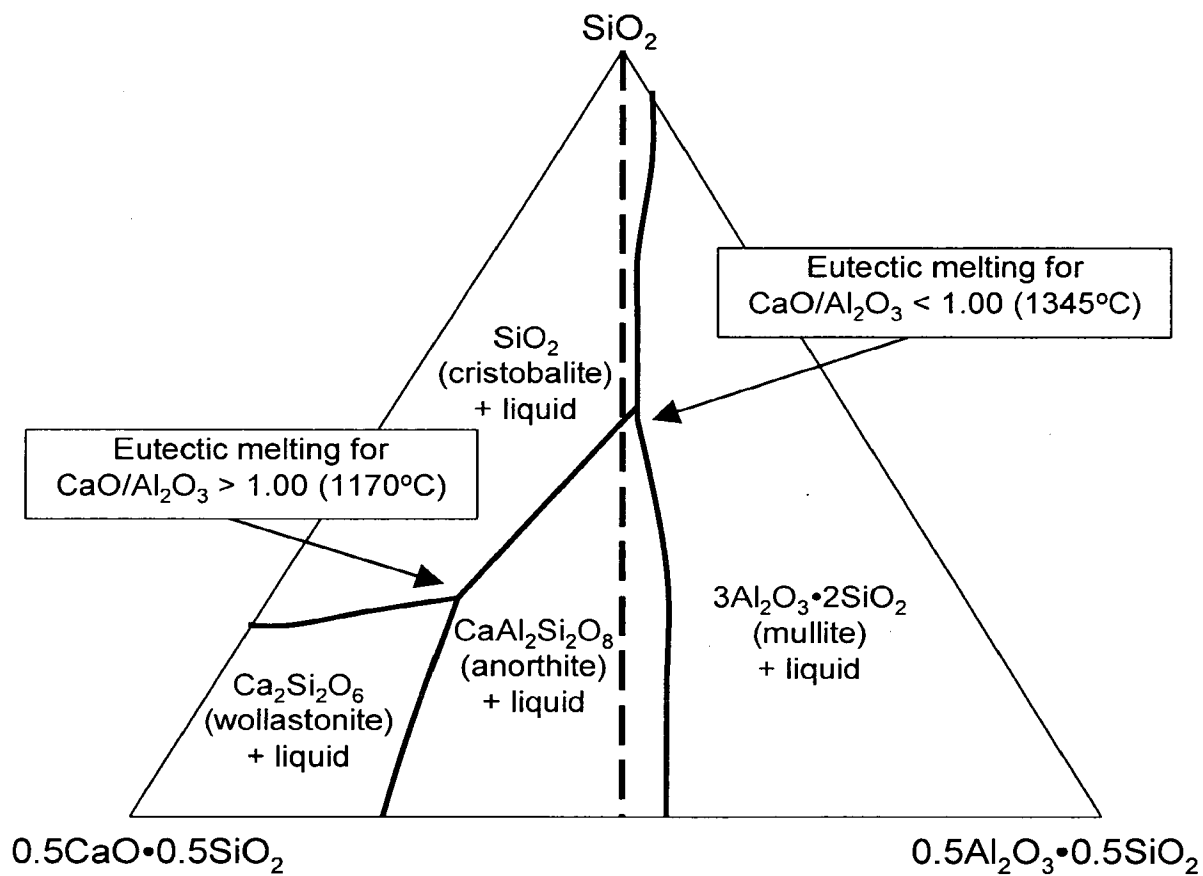


FIG. 1

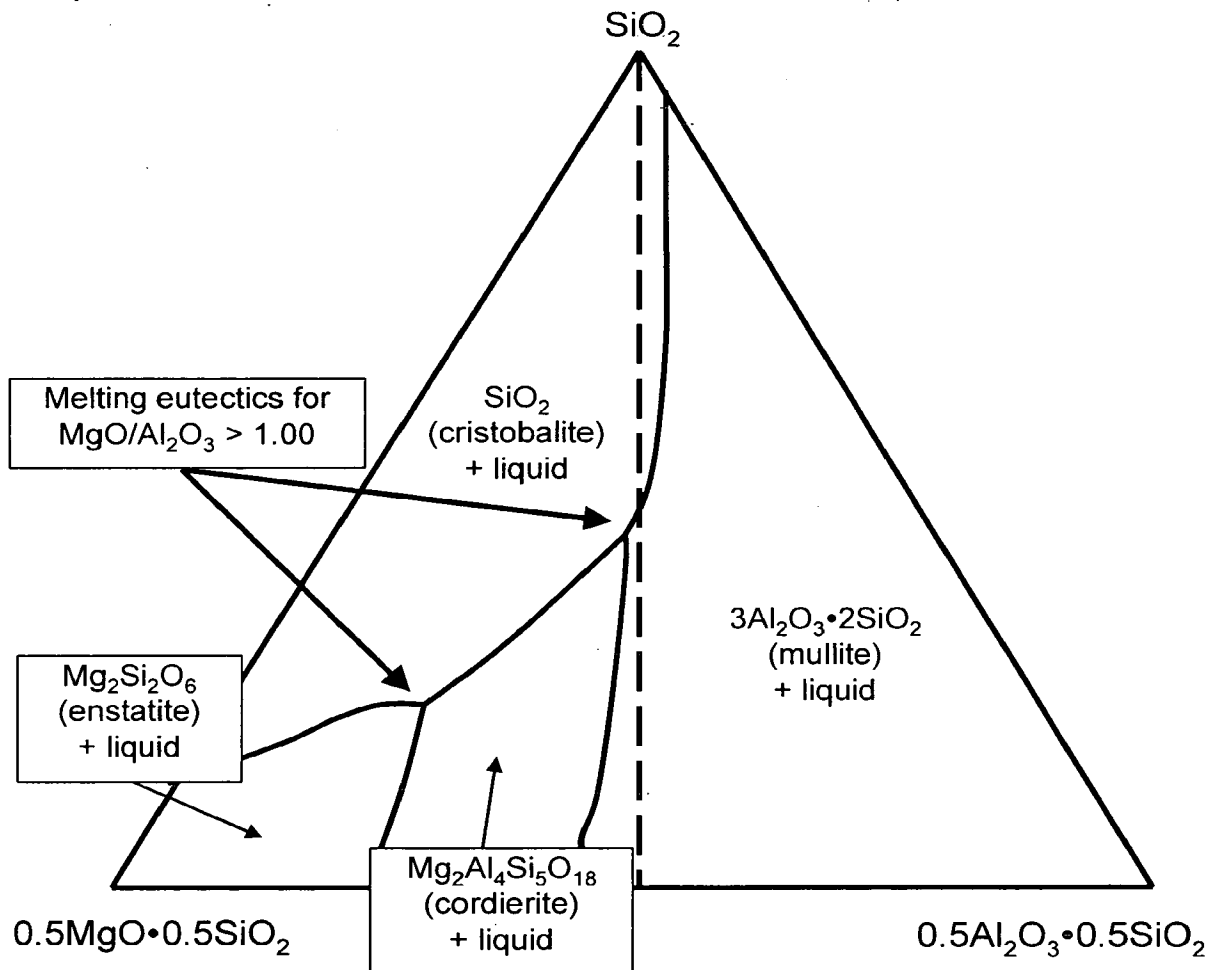


FIG. 2

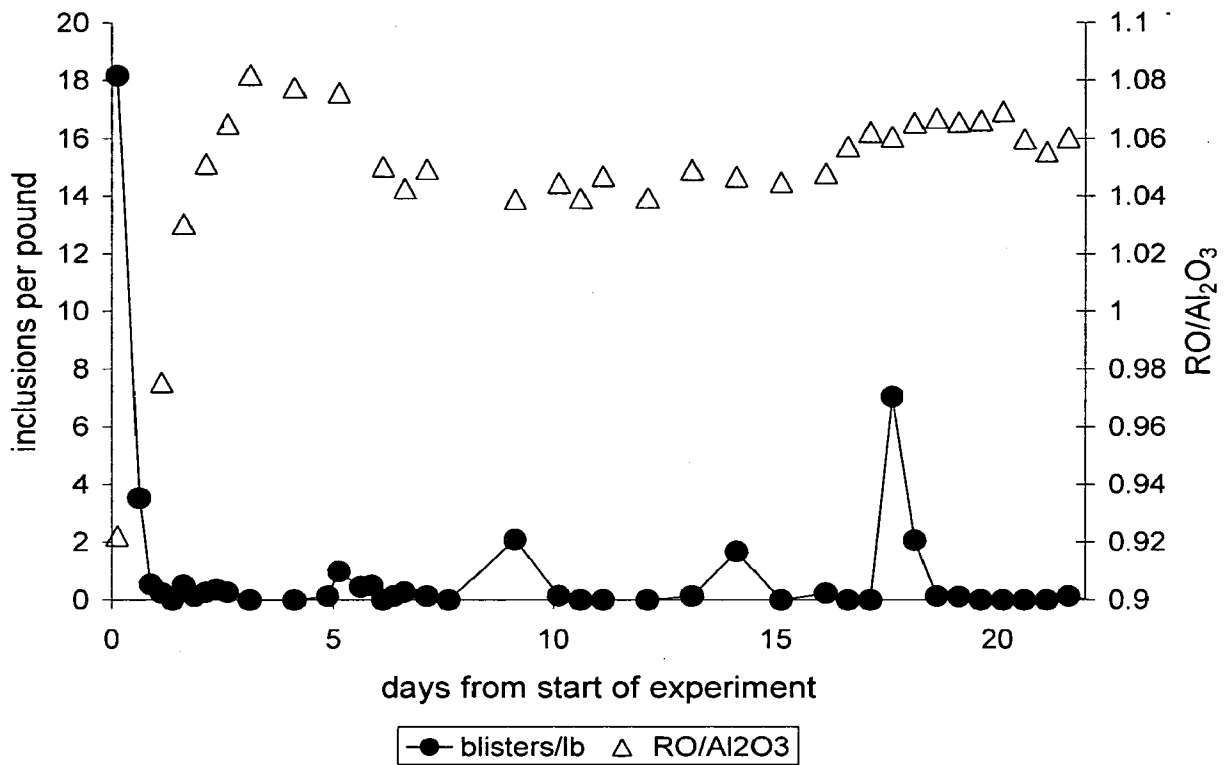


FIG. 3

DECLARATION IN ORIGINAL APPLICATIONU.S. Attorney Docket No.: **ADP-231 (SP05-073)**

As a below named inventor, I declare that:

My residence, Post Office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **FINING OF BOROALUMINO SILICATE GLASSES**.

The specification of which (check only one item below):

☒ is attached hereto

☐ was filed as United States Application Serial No. 60/694478 on June 28, 2005 and was amended on (if applicable)

☐ was filed as PCT international application number , on , and was amended under PCT Article 19 on (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate or 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, on the same subject matter, having a filing date before that of the application on which priority is claimed:

☐ **Country:** **Application No.:** **Filing Date:**

☒ **NONE**

I hereby claim the benefit under Title 35 United States Code § 119(e) and § 120 of any United States application(s) or 365(c) of any PCT international application designating the United States listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37 Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

☐ **Provisional No.:** 60/694,478 **Filed:** 06-28-2005 **Status:** Pending

☐ **Application No.:** **Filed:** **Status:**

☐ **PCT Application No:** **Filed:** **Status:**

☒ **NONE**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Inventor:

Adam J.G. Ellison

Resident Address:

453 Beartown Road, Painted Post, New York 14870

Post Office Address:

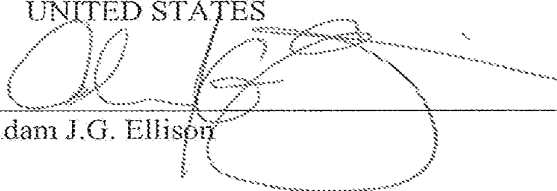
same

Citizenship:

UNITED STATES

DATE:

6/27/06


Adam J.G. Ellison

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Adam James Ellison

Serial No:

Examiner: Matthew E.
Hoban

Filed:

Group Art Unit: 1793

For: FINING OF BOROALUMINO SILICATE
GLASSESINFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.56, 1.97 – 1.98Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The Examiner's attention is hereby directed to the following reference(s) listed on the attached Form PTO-1449 for consideration in connection with the examination of the above-identified patent application. A copy of each of the reference(s) is enclosed unless it was previously submitted in related U.S. Application No. 11/478,493 or were cited in an International Search Report in a corresponding application.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the enclosed documents constitute "prior art." If it should be determined that any of the submitted documents do not constitute "prior art" under United States law, applicant(s) reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicant(s) further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the enclosed references, should one or more of the references be applied against the claims of the present application.

Date: December 10, 2010

CERTIFICATE OF MAILING OR TRANSMISSION

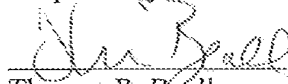
I hereby certify that this paper and/or fee or charge authorization is being transmitted to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on December 10, 2010, via:

- ☐ depositing with the United States Postal Service with sufficient postage as first class mail under 37 CFR §1.8;
- ☐ Facsimile Transmission under 37 CFR §1.6(d) (Facsimile No. _);
- ☒ the Electronic Filing System of the U.S. Patent and Trademark Office under 37 CFR §1.6(a)(4).

Signature

Susan M. Kane

Respectfully submitted,



Thomas R. Beall

Attorney/Agent for Applicant
Registration No. 40,424
Corning Incorporated
Intellectual Property Department
Mail Stop: SP-TI-03-1
Corning, NY 14831

FEE TRANSMITTAL for FY 2010

Complete if Known

Application Number	To Be Assigned
Filing Date	Herewith
First Named Inventor	Adam James Ellison
Examiner Name	To Be Assigned
Group / Art Unit	To Be Assigned
Attorney Docket Number	SP05-073B

TOTAL AMOUNT OF PAYMENT (\$)**1,090.00**

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number **03-3325**

Deposit Account Name **Corning Incorporated**

- ☒ Charge Any Additional Fees Required Under 37 C.F.R. §§ 1.16 and 1.17

2. ☐ Payment Enclosed:

☐ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEE

Application Type	Filing Fee	Search Fee	Exam Fee	Fee
Utility	330	540	220	1,090.00
Design	210	100	130	
Plant	210	310	160	
Reissue	310	510	620	
Provisional	210	0	0	
SUBTOTAL (1)				(\$)1,090.00

2. EXCESS CLAIM FEES

		Extra Claims	Fee from below	Fee Paid
Total Claims	18 - 20** =	x	52 =	00.00
Independent Claims	3 - 3** =	x	220 =	00.00
Multiple Dependent			390 =	0.00

**or number previously paid, if greater; For Reissues, see below

Large Entity

Fee Code	Fee (\$)	Fee Description
1202	52	Claims in excess of 20
1201	220	Independent claims in excess of 3
1203	390	Multiple dependent claim, if not paid 0
1204	220	** Reissue independent claims over original patent
1205	52	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$)**00.00**

FEE CALCULATION (continued)

3. APPLICATION SIZE FEE

1081	250	Utility application size fee (for each additional 50 sheets that exceeds 100 pages)
1082	250	Design application size fee (for each additional 50 sheets that exceeds 100 pages)
1083	250	Plant application size fee (for each additional 50 sheets that exceeds 100 pages)
1084	250	Reissue application size fee (for each additional 50 sheets that exceeds 100 pages)
1085	250	Provisional application size fee (for each additional 50 sheets that exceeds 100 pages)

4. OTHER FEES

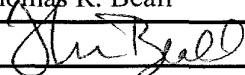
Fee Fee Fee Description Large Entity Fee Paid

1051	130	Surcharge - late filing fee or oath
1052	50	Surcharge - late provisional filing fee or cover sheet
1053	130	Non-English specification
1812	2,520	For filing a request for reexamination
1804	920*	Requesting publication of SIR prior to Examiner action
1805	1,840*	Requesting publication of SIR after Examiner action
1251	120	Extension for reply within first month
1252	450	Extension for reply within second month
1253	1,020	Extension for reply within third month
1254	1,590	Extension for reply within fourth month
1255	2,160	Extension for reply within fifth month
1401	500	Notice of Appeal
1402	500	Filing a brief in support of an appeal
1403	1,000	Request for oral hearing
1451	1,510	Petition to institute a public use proceeding
1452	500	Petition to revive - unavoidable
1453	1,500	Petition to revive - unintentional
1501	1,400	Utility issue fee (or reissue)
1502	800	Design issue fee
1503	1,000	Plant issue fee
1462	400	Petitions to the Director not specifically provided for (Group I) 1.17(f)
1463	200	Petitions to the Director not specifically provided for (Group II) 1.17(g)
1464	130	Petitions to the Director not specifically provided for (Group III) 1.17(h)
1807	50	Petitions related to provisional applications
1806	180	Submission of Information Disclosure Stmt
8021	40	Recording each patent assignment per property (times number of properties)
1809	790	Filing a submission after final rejection (37 C.F.R. § 1.129(a))
1810	790	For each additional invention to be examined (37 C.F.R. § 1.129(b))
1801	790	Request for Continued Examination (RCE)
1802	900	Request for expedited examination of a design application

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY

Name (Print/Type)	Thomas R. Beall	Registration No. (Attorney/Agent)	40,424
Signature		Date	December 10, 2010

Completed (if applicable)