

	Espacio reservado para el adhesivo de radicación
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DIRECCIÓN DE NUEVAS CREACIONES
Procedimiento acelerado de exámenes de patente (PPH)

1	NÚMERO DE SOLICITUD ANTE LA SIC NC2021/0010272		
2	GLOBAL - PPH ☐ PAÍS	3	PCT – PPH ☒ PAÍS US
4	PROSUR ☐ PAÍS	5	Alianza del Pacífico (AdP) ☐ PAÍS
6	OFICINA DE PRIMERA PRESENTACIÓN (OPP) ☐	7	OFICINA DE EXAMEN ANTERIOR (OEA) ☒
8	NÚMERO DE SOLICITUD O PUBLICACIÓN DE LA SOLICITUD (OPP) ☐ NÚMERO DE SOLICITUD EN OFICINA DE EXAMEN ANTERIOR (OEA): ☒ NÚMERO DE SOLICITUD PCT: ☐		1. 16,269,351
9	☐ REPRESENTANTE LEGAL ☒ APODERADO		
APELLIDOS DAZA MONTALVO		NOMBRES CAROLINA MERCEDES	IDENTIFICACIÓN C.C .66783790 T.P .141563 CSJ
DIRECCIÓN	Carrera 11 No. 86-53 Piso 3		No. TELÉFONO 6181088
CIUDAD	Bogotá		CORREO ELECTRÓNICO notificaciones@clarke modet.com.co
PAÍS	COLOMBIA		No. RADICACIÓN O PROTOCOLO DE PODER GENERAL
10	CONDICIONES PARA ACCEDER A ESTE PROCESO:		
10.1. DATOS DE PRIORIDAD ☒ SI ☐ NO			
(33) PAÍS DE ORIGEN		CÓDIGO PAÍS	(31) NÚMERO (32) FECHA (AAAA/MM/DD)
1. ESTADOS UNIDOS DE AMÉRICA		US	16/269,351 2019/02/06
10.2. DATOS SOLICITUD INTERNACIONAL PCT ☒ SI ☐ NO			
Solicitud Internacional No. PCT/US2020/016696		Fecha 2020/02/05	
Publicación Internacional No. WO/2020/163417		Fecha 2020/08/13	
*El solicitante presenta una copia de la(s) reivindicación(es) patentable(s) u otorgable(s) de la solicitud de la Oficina de Primera Presentación que profirió el examen de patentabilidad, junto con una traducción al castellano. ☒ SI ☐ NO			
*El solicitante presenta los resultados de búsqueda de la Oficina de Examen Anterior, junto con una traducción al castellano ☒ SI ☐ NO			
REQUISITOS PARA EL RECONOCIMIENTO DE LOS RESULTADOS DE EXÁMENES DE PATENTABILIDAD EFECTUADOS A SOLICITUDES EXTRANJERAS			
Para que la Superintendencia de Industria y Comercio pueda reconocer los resultados de exámenes de patentabilidad producidos por otras Oficinas de Propiedad Industrial se debe cumplir con las siguientes condiciones:			
(a) Al momento de solicitar el examen de patentabilidad, si el solicitante pide que se reconozcan exámenes de patentabilidad de otras oficinas extranjeras, deberá aportar junto con el pago de la tasa correspondiente, los siguientes anexos:			
(i) Copia de las resoluciones, fallos o decisiones que han sido relevantes para la determinación de la patentabilidad de la(s) solicitud(es) en la Oficina que haya proferido el examen de patentabilidad que contienen reivindicaciones patentables u otorgables que son la base de la petición, y si es del caso, su traducción al castellano. ☒ SI ☐ NO			
(ii) Copia de todas las reivindicaciones determinadas como patentables u otorgables en la Oficina que profirió el examen de patentabilidad y, si es del caso, su traducción al castellano. ☒ SI ☐ NO			
(iii) Copia de los antecedentes, información o documentos citados por el examinador de la Oficina de Primera Presentación del examen de patentabilidad, en las resoluciones, fallos o decisiones correspondientes, incluyendo la literatura no patente. Los documentos de patente deberán presentarse siempre y cuando no estén disponibles para la Superintendencia de Industria y Comercio mediante el simple acceso a bases de datos gratuitas. ☒ SI ☐ NO			
(iv) Una tabla de correspondencias de las reivindicaciones que han sido determinadas como patentables u otorgables en la solicitud de la Oficina que haya proferido el examen de patentabilidad. ☒ SI ☐ NO			
11	FIRMA DEL SOLICITANTE, DEL APODERADO O DEL REPRESENTANTE LEGAL Junto a cada firma, indicar el nombre del firmante y su calidad (si tal calidad no es obvia al leer el petitorio)		
 CAROLINA DAZA MONTALVO			



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

27081 7590 11/12/2020
O-I Glass, Inc.
Attn: Stephen L. Scharf
One Michael Owens Way
Plaza One - Legal Department
Perrysburg, OH 43551-2999

EXAMINER

JIA, XIN

ART UNIT

PAPER NUMBER

2667

DATE MAILED: 11/12/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/269,351	02/06/2019	Brian J. Chisholm	19453	6967

TITLE OF INVENTION: SEAL INTEGRITY INSPECTION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	02/12/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
 Commissioner for Patents
 P.O. Box 1450
 Alexandria, Virginia 22313-1450

By fax, send to: (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.

27081 7590 11/12/2020
O-I Glass, Inc.
Attn: Stephen L. Scharf
One Michael Owens Way
Plaza One - Legal Department
Perrysburg, OH 43551-2999

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

	(Typed or printed name)
	(Signature)
	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/269,351	02/06/2019	Brian J. Chisholm	19453	6967

TITLE OF INVENTION: SEAL INTEGRITY INSPECTION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	02/12/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
JIA, XIN	2667	382-143000

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 03-09 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,

1 _____

(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.

2 _____

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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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 forms 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: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/269,351	02/06/2019	Brian J. Chisholm	19453	6967
27081	7590	11/12/2020	EXAMINER	
O-I Glass, Inc. Attn: Stephen L. Scharf One Michael Owens Way Plaza One - Legal Department Perrysburg, OH 43551-2999			JIA, XIN	
			ART UNIT	PAPER NUMBER
			2667	
DATE MAILED: 11/12/2020				

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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 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, 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.

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.

Notice of Allowability	Application No. 16/269,351	Applicant(s) Chisholm et al.	
	Examiner XIN JIA	Art Unit 2667	AIA (FITF) Status Yes

-- 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 11/2/2020.
☐ 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 1-21. 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. _____.	

/XIN JIA/
Primary Examiner, Art Unit 2667

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Examiner's Statement of Reason for Allowance

Claims 1-21 are allowed.

The main reason for allowance of these claims are applicant's remarks filed on 11/2/2020.

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 XIN JIA whose telephone number is (571)270-5536.

The examiner can normally be reached on M-F, 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on 571-272-7778. 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.

/XIN JIA/
Primary Examiner, Art Unit 2667

Aviso de Permisibilidad	No. Solicitud 16/269,351	Solicitante(s) Chisholm et al.	
	Examinador XIN JIA	Unidad Técnica 2667	Estado AIA (FITF) Sí

-La FECHA DE ENVÍO de esta comunicación aparece en la portada con la dirección de correspondencia-
Siendo admisibles todas las reclamaciones, EL PROCESO DE FONDO ESTÁ (O PERMANECE) CERRADO en esta solicitud. Si no se incluye aquí (o se envió por correo anteriormente), se enviará por correo un Aviso de Otorgamiento (PTOL-85) u otra comunicación apropiada a su debido tiempo. **ESTE AVISO DE PERMISIBILIDAD NO ES UNA CONCESIÓN DE DERECHOS DE PATENTE.** Esta solicitud está sujeta a desistimiento por iniciativa de la Oficina o a petición del solicitante. Ver 37 CFR 1.313 y MPEP 1308.

1. ☒ Esta comunicación responde al 2/11/2020.
☐ Una(s) declaración(es)/declaración(es) juradas conforme a **37 CFR 1.130(b)** se presentaron el ____.
2. ☐ El solicitante hizo una elección en respuesta a un requisito de restricción establecido durante la entrevista el ____; el requisito de restricción y la elección se han incorporado a esta acción.
3. ☒ Los reclamos permitidos son 1-21. Como resultado de los reclamos permitidos, usted puede ser elegible para beneficiarse del programa **Patent Prosecution Highway** en una oficina de propiedad intelectual participante para la solicitud correspondiente. Para obtener más información, consulte http://www.uspto.gov/patents/init_events/pph/index.jsp o envíe una consulta a **PPHfeedback@uspto.gov**.
4. ☐ Se reconoce un reclamo de prioridad extranjera bajo 35 U.S.C. § 119(a)-(d) o (f).
Copias certificadas:
a) ☐ Todas b) ☐ Algunas *c) ☐ Ninguno de los:
1. ☐ Se han recibido copias certificadas de los documentos de prioridad.
2. ☐ Se han recibido copias certificadas de los documentos de prioridad en la Solicitud No. ____.
3. ☐ Se han recibido copias de las copias certificadas de los documentos de prioridad en esta solicitud de etapa nacional de la Oficina internacional (Regla 17.2(a) del PCT).
* Copias certificadas no recibidas: ____.

El solicitante tiene TRES MESES A PARTIR DE LA "FECHA DE ENVÍO" de esta comunicación para presentar una respuesta que cumpla con los requisitos que se indican a continuación. El incumplimiento oportuno dará lugar al ABANDONO de esta solicitud.
ESTE PLAZO DE TRES MESES NO ES PRORROGABLE.

5. ☐ Se deben enviar DIBUJOS CORREGIDOS (como "hojas de reemplazo").
☐ Incluidos los cambios requeridos por la Enmienda/Comentario del examinador adjunto o en la acción de la Oficina de número de papel/fecha de correo ____.

Los signos de identificación, como el número de solicitud (consulte 37 CFR 1.84 (c)) deben escribirse en los dibujos en el anverso (no en el reverso) de cada hoja. Las hojas de reemplazo deben etiquetarse como tales en el encabezado de acuerdo con 37 CFR 1.121(d).

6. ☐ Se debe presentar DEPOSITO DE y/o INFORMACIÓN sobre el depósito de MATERIAL BIOLÓGICO. Nótese el comentario del Examinador adjunto sobre REQUISITO PARA EL DEPÓSITO DE MATERIAL BIOLÓGICO.

Archivo(s) adjunto(s)

1. ☐ Aviso de referencias citadas (PTO-892) 2. ☐ Declaraciones de divulgación de información (PTO/SB/08), número de papel/fecha de correo ____. 3. ☐ Comentario del examinador sobre el requisito de depósito ____. 4. ☐ Resumen de la entrevista (PTO-413), número de artículo/fecha de correo ____.	5. ☐ Enmienda/comentario del examinador 6. ☒ Declaración del examinador de las razones de otorgamiento 7. ☐ Otras ____.
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/XIN JIA/ Examinador primario, Unidad técnica 2667	
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ACCIÓN DETALLADA

Aviso de estado Pre-AIA o AIA

La presente solicitud, presentada a partir del 16 de marzo de 2013, está siendo examinada por el primer inventor que presentó las disposiciones de la AIA.

Declaración del examinador de la razón de la concesión

Se permiten las reclamaciones 1-21.

La razón principal para la concesión de estas reclamaciones son los comentarios del solicitante presentados el 2/11/2020.

Los comentarios que el solicitante considere necesarios deberán presentarse antes del pago de la tasa de emisión y, para evitar retrasos en la tramitación, deberán acompañar preferentemente a la tasa de emisión. Dichos envíos deben estar claramente etiquetados como "Comentarios sobre la Declaración de Razones para la Otorgamiento".

Conclusión

Cualquier consulta relacionada con esta comunicación o comunicaciones anteriores del examinador debe dirigirse a XIN JIA, cuyo número de teléfono es (571) 270-5536. Normalmente se puede contactar al examinador de lunes a viernes, de 8:30 a. m. a 5:00 p. m.

Si los intentos de comunicarse con el examinador por teléfono no tienen éxito, se puede comunicar con el supervisor del examinador, Matthew Bella, al 571-272-7778. El número de teléfono de fax de la organización donde se asigna esta solicitud o procedimiento es 571-273-8300.

La información sobre el estado de una solicitud puede obtenerse del sistema de recuperación de información de solicitud de patente (PAIR). La información de estado de las solicitudes publicadas se puede obtener de PAIR Privado o PAIR Público. La información de estado de las solicitudes no publicadas está disponible solo a través de PAIR Privado. Para obtener más información sobre el sistema PAIR, consulte <http://pair-direct.uspto.gov>. Si tiene preguntas sobre el acceso al sistema PAIR Privado, comuníquese con el Electronic Business Center (EBC) al 866-217-9197 (llamada gratuita). Si desea recibir asistencia de un Representante de Servicio al Cliente de la USPTO o acceso al sistema de información automatizado, llame al 800-786-9199 (EN EE. UU. O CANADÁ) o al 571-272-1000.

/XIN JIA/

Examinador primario, Unidad técnica 2667

GRANTED CLAIMS IN US

1. An apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried thereby, comprising:

a conveyor configured to move said package along a path and including a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to said seal membrane of said package as said package moves through said vacuum plenum section;

an imaging sensor configured to generate one or more images of said seal membrane following the application of a sub-atmospheric pressure thereto at said vacuum plenum section; and

an electronic processing device configured to:

process said one or more images of said seal membrane generated by said sensor; and

evaluate the integrity of the seal of said package based on said one or more images.

2. The apparatus of claim 1, further comprising an inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal membrane of said package.

3. The apparatus of claim 2, further comprising an inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member of said package and prior to the generating of one or more images of said seal membrane.
4. The apparatus of claim 3, wherein said inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal member, and said inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member are the same.
5. The apparatus of claim 3, wherein said inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal member, and said inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member comprise two different inverters.
6. The apparatus of claim 1, wherein said vacuum plenum section comprises a vacuum plenum disposed beneath said conveyor.
7. The apparatus of claim 1, wherein said imaging sensor is disposed above said conveyor.
8. The apparatus of claim 1, wherein the electronic processing device is configured to evaluate the integrity of the seal of said package by determining if the seal of the package has been compromised.

9. The apparatus of claim 1, wherein said package is a hot-filled package, and said seal membrane comprises a foil seal membrane.
10. The apparatus of claim 1, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate the integrity of the seal of said package based on said determined shape of said seal membrane.
11. The apparatus of claim 1, wherein said imaging sensor is a first imaging sensor and said apparatus further comprises a second imaging sensor configured to generate one or more images of said seal membrane of said package prior to the application of a vacuum to said seal membrane, said electronic processing device configured to:
- process said one or more images generated by said second imaging sensor;
- and
- evaluate whether a vacuum was formed in said package based on said one or more images generated by said second imaging sensor.
12. The apparatus of claim 11, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate whether a vacuum was formed in said package based said determined shape of said seal membrane.

13. An apparatus for inspecting the integrity of a seal of a package that includes

a container and a seal membrane carried thereby, comprising:

a conveyor configured to move said package along a path and including a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to said seal membrane of said package as said package moves through said vacuum plenum section, wherein said vacuum plenum section comprises a vacuum plenum disposed beneath said conveyor;

a first inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal membrane at said vacuum plenum section of said conveyor;

a second inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal membrane at said vacuum plenum section of said conveyor;

an imaging sensor configured to generate one or more images of said seal membrane following the application of a sub-atmospheric pressure hereto at said vacuum plenum section and the inversion of said package by said second inverter; and

an electronic processing device configured to:

process said one or more images of said seal membrane generated by said sensor; and

evaluate the integrity of the seal of said package based on said one or more images.

- 14.The apparatus of claim 13, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate the integrity of the seal of said package based on said determined shape of said seal membrane.
- 15.The apparatus of claim 13, wherein said imaging sensor is a first imaging sensor and said apparatus further comprises a second imaging sensor configured to generate one or more images of said seal membrane of said package prior to the application of a vacuum to said seal membrane, said electronic processing device configured to:
process said one or more images generated by said second imaging sensor;
and
evaluate whether a vacuum was formed in said package based on said one or more images generated by said second imaging sensor.
- 16.The apparatus of claim 15, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate whether a vacuum was formed in said package based said determined shape of said seal membrane.
- 17.A method for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried thereby, comprising:

moving, by a conveyor, said package through a vacuum plenum section of said conveyor;

applying, by the vacuum plenum section, a sub-atmospheric pressure to said seal membrane of said package as said package passes through said vacuum plenum section;

acquiring, by an imaging sensor, one or more images of said seal membrane following said application of said sub-atmospheric pressure thereto;

processing, by an electronic processing device, said one or more images to evaluate the integrity of the seal of said package based on said one or more images of said seal membrane.

18.The method of claim 17, further comprising inverting said package prior to applying a sub-atmospheric pressure to said seal membrane of said package.

19.The method of claim 17, further comprising inverting said package following the application of a sub-atmospheric pressure to said seal membrane of said package and prior to said acquisition of said one or more images of said seal membrane.

20.The method of claim 17, wherein said processing step comprises processing said one or more images of said seal membrane to determine a shape of said seal membrane, and evaluating the integrity of the seal of said package based on said determined shape of said seal membrane.

21.The method of claim 17, further comprising:

acquiring one or more images of said seal membrane of said package prior to the application of a sub-atmospheric pressure to said seal membrane in said applying step; and

processing said one or more images to evaluate whether a vacuum was formed in said package during a sealing process performed on said package.

REIVINDICACIONES CONCEDIDAS EN USA

1. Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende:

una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío;

un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío; y

un dispositivo de procesamiento electrónico configurado para:

procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y

evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.

2. El aparato de conformidad con la reivindicación 1, caracterizado porque comprende además un inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.

3. El aparato de conformidad con la reivindicación 2, caracterizado porque comprende además un inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de la generación de una o más imágenes de dicha membrana de sellado.
4. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado son el mismo.
5. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado, y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado comprende dos inversores diferentes.
6. El aparato de conformidad con la reivindicación 1, caracterizado porque dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicha transportadora.
7. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen está colocado encima de dicha transportadora.
8. El aparato de conformidad con la reivindicación 1, caracterizado porque el dispositivo de procesamiento electrónico está configurado para evaluar la

integridad del sello de dicho empaque determinando si el sello del empaque está comprometido.

9. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho empaque es un empaque llenado en caliente y dicha membrana de sellado comprende una membrana de sellado de aluminio.

10. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.

11. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para:

procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y

evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.

12. El aparato de conformidad con la reivindicación 11, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en

dicho empaque con base en dicha forma determinada de dicha membrana de sellado.

13. Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende:

una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío; en donde dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicho transportador;

un primer inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador;

un segundo inversor configurado para invertir dicho empaque después la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador;

un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío y la inversión de dicho empaque por dicho segundo inversor; y

un dispositivo de procesamiento electrónico configurado para:

procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y

evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.

14. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.
15. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para:

procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y

evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.
16. El aparato de conformidad con la reivindicación 15, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en dicho empaque con base en dicha forma determinada de dicha membrana de sellado.
17. Un método para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende:

el desplazamiento, mediante una transportadora de dicho empaque a través de una sección de la cámara de vacío de dicha transportadora;

la aplicación, mediante la sección de la cámara de vacío, de una presión subatmosférica a dicha membrana de sellado de dicho empaque conforme dicho empaque pasa a través de dicha sección de la cámara de vacío;

la adquisición, mediante un sensor de imagen, de una o más imágenes de dicha membrana de sellado después de dicha aplicación de dicha presión subatmosférica a esta;

el procesamiento, mediante un dispositivo de procesamiento electrónico, de dicha una o más imágenes para evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes de la membrana de sellado.

18. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.
19. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de dicha adquisición de dicha una o más imágenes de dicha membrana de sellado.
20. El método de conformidad con la reivindicación 17, caracterizado porque dicho paso de procesamiento comprende el procesamiento de dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.

21. El método de conformidad con la reivindicación 17, caracterizado porque comprende, además:

la adquisición de una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicho paso de aplicación; y

el procesamiento de dicha una o más imágenes para evaluar si se formó un vacío en dicho empaque durante un proceso de sellado llevado a cabo en dicho empaque.

<i>Notice of References Cited</i>	Application/Control No. 16/269,351		Applicant(s)/Patent Under Reexamination Chisholm et al.	
	Examiner XIN JIA		Art Unit 2667	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20130141571-A1	06-2013	Yasooka; Takeshi	G01M3/36	348/135
*	B	US-10669054-B1	06-2020	Hoffman; Brian	B65B47/00	1/1
	C					
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FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	X	

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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

10 (iv)	TABLA DE CORRESPONDENCIA DE REIVINDICACIONES		
	Reivindicaciones en la solicitud en Colombia (NOTA. LAS REIVINDICACIONES ACÁ INDICADAS CORRESPONDEN A AQUELLAS MODIFICADAS EN MODIFICACIÓN VOLUNTARIA EL 25 DE ABRIL DE 2022)	Reivindicaciones otorgables en la solicitud internacional	Explicación sobre la suficiente correspondencia ó Comentarios que explican la correspondencia
	1. <i>Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende:</i> <i>una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío;</i> <i>un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío; y</i> <i>un dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y</i> <i>evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.</i>	1. <i>Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende:</i> <i>una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío;</i> <i>un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío; y</i> <i>un dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y</i> <i>evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.</i>	Corresponde a la reivindicación 1 de la solicitud colombiana
	2. <i>El aparato de conformidad con la reivindicación 1, caracterizado porque comprende además un inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.</i>	2. <i>El aparato de conformidad con la reivindicación 1, caracterizado porque comprende además un inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.</i>	Corresponde a la reivindicación 2 de la solicitud colombiana
	3. <i>El aparato de conformidad con la reivindicación 2, caracterizado porque comprende además un inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de la generación de una o más imágenes de dicha membrana de sellado.</i>	3. <i>El aparato de conformidad con la reivindicación 2, caracterizado porque comprende además un inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de la generación de una o más imágenes de dicha membrana de sellado.</i>	Corresponde a la reivindicación 3 de la solicitud colombiana

4. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado son el mismo.	4. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado son el mismo.	Corresponde a la reivindicación 4 de la solicitud colombiana
5. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado, y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado comprende dos inversores diferentes.	5. El aparato de conformidad con la reivindicación 3, caracterizado porque dicho inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado, y dicho inversor configurado para invertir dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado comprende dos inversores diferentes.	Corresponde a la reivindicación 5 de la solicitud colombiana
6. El aparato de conformidad con la reivindicación 1, caracterizado porque dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicha transportadora.	6. El aparato de conformidad con la reivindicación 1, caracterizado porque dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicha transportadora.	Corresponde a la reivindicación 6 de la solicitud colombiana
7. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen está colocado encima de dicha transportadora.	7. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen está colocado encima de dicha transportadora.	Corresponde a la reivindicación 7 de la solicitud colombiana
8. El aparato de conformidad con la reivindicación 1, caracterizado porque el dispositivo de procesamiento electrónico está configurado para evaluar la integridad del sello de dicho empaque determinando si el sello del empaque está comprometido.	8. El aparato de conformidad con la reivindicación 1, caracterizado porque el dispositivo de procesamiento electrónico está configurado para evaluar la integridad del sello de dicho empaque determinando si el sello del empaque está comprometido.	Corresponde a la reivindicación 8 de la solicitud colombiana
9. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho empaque es un empaque llenado en caliente y dicha membrana de sellado comprende una membrana de sellado de aluminio.	9. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho empaque es un empaque llenado en caliente y dicha membrana de sellado comprende una membrana de sellado de aluminio.	Corresponde a la reivindicación 9 de la solicitud colombiana
10. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	10. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	Corresponde a la reivindicación 10 de la solicitud colombiana
11. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.	11. El aparato de conformidad con la reivindicación 1, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.	Corresponde a la reivindicación 11 de la solicitud colombiana

12. El aparato de conformidad con la reivindicación 11, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	12. El aparato de conformidad con la reivindicación 11, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	Corresponde a la reivindicación 12 de la solicitud colombiana
13. Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende: una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío; en donde dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicho transportador; un primer inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador; un segundo inversor configurado para invertir dicho empaque después la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador; un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío y la inversión de dicho empaque por dicho segundo inversor; y un dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.	13. Un aparato para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende: una transportadora configurada para desplazar dicho empaque a lo largo de una ruta y que incluye una sección de la cámara de vacío configurada para crear una presión subatmosférica que se aplica a dicha membrana de sellado de dicho empaque conforme dicho empaque se desplaza a lo largo de dicha sección de la cámara de vacío; en donde dicha sección de la cámara de vacío comprende una cámara de vacío colocada debajo de dicho transportador; un primer inversor configurado para invertir dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador; un segundo inversor configurado para invertir dicho empaque después la aplicación de una presión subatmosférica a dicha membrana de sellado en dicha sección de la cámara de vacío de dicho transportador; un sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado después de la aplicación de una presión subatmosférica a este en dicha sección de la cámara de vacío y la inversión de dicho empaque por dicho segundo inversor; y un dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes de dicha membrana de sellado generadas por dicho sensor; y evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes.	Corresponde a la reivindicación 13 de la solicitud colombiana
14. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	14. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho dispositivo de procesamiento electrónico está configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	Corresponde a la reivindicación 14 de la solicitud colombiana
15. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y	15. El aparato de conformidad con la reivindicación 13, caracterizado porque dicho sensor de imagen es un primer sensor de imagen y dicho aparato comprende además un segundo sensor de imagen configurado para generar una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de un vacío a dicha membrana de sellado, dicho dispositivo de procesamiento electrónico configurado para: procesar dicha una o más imágenes generadas por dicho segundo sensor de imagen; y	Corresponde a la reivindicación 15 de la solicitud colombiana

evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.	evaluar si se formó un vacío en dicho empaque con base en dicha una o más imágenes generadas por dicho segundo sensor de imagen.	
16. El aparato de conformidad con la reivindicación 15, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	16. El aparato de conformidad con la reivindicación 15, caracterizado porque dicho dispositivo de procesamiento electrónico configurado para procesar dicha una o más imágenes de dicha membrana de sellado para determinar la forma de dicha membrana de sellado, y evaluar si se formó un vacío en dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	Corresponde a la reivindicación 16 de la solicitud colombiana
17. Un método para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende: el desplazamiento, mediante una transportadora de dicho empaque a través de una sección de la cámara de vacío de dicha transportadora; la aplicación, mediante la sección de la cámara de vacío, de una presión subatmosférica a dicha membrana de sellado de dicho empaque conforme dicho empaque pasa a través de dicha sección de la cámara de vacío; la adquisición, mediante un sensor de imagen, de una o más imágenes de dicha membrana de sellado después de dicha aplicación de dicha presión subatmosférica a esta; el procesamiento, mediante un dispositivo de procesamiento electrónico, de dicha una o más imágenes para evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes de la membrana de sellado.	17. Un método para la inspección de la integridad de un sello de un empaque que incluye un contenedor y una membrana de sellado llevada por este, caracterizado porque comprende: el desplazamiento, mediante una transportadora de dicho empaque a través de una sección de la cámara de vacío de dicha transportadora; la aplicación, mediante la sección de la cámara de vacío, de una presión subatmosférica a dicha membrana de sellado de dicho empaque conforme dicho empaque pasa a través de dicha sección de la cámara de vacío; la adquisición, mediante un sensor de imagen, de una o más imágenes de dicha membrana de sellado después de dicha aplicación de dicha presión subatmosférica a esta; el procesamiento, mediante un dispositivo de procesamiento electrónico, de dicha una o más imágenes para evaluar la integridad del sello de dicho empaque con base en dicha una o más imágenes de la membrana de sellado.	Corresponde a la reivindicación 17 de la solicitud colombiana
18. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.	18. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque.	Corresponde a la reivindicación 18 de la solicitud colombiana
19. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de dicha adquisición de dicha una o más imágenes de dicha membrana de sellado.	19. El método de conformidad con la reivindicación 17, caracterizado porque comprende además la inversión de dicho empaque después de la aplicación de una presión subatmosférica a dicha membrana de sellado de dicho empaque y antes de dicha adquisición de dicha una o más imágenes de dicha membrana de sellado.	Corresponde a la reivindicación 19 de la solicitud colombiana
20. El método de conformidad con la reivindicación 17, caracterizado porque dicho paso de procesamiento comprende el procesamiento de dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	20. El método de conformidad con la reivindicación 17, caracterizado porque dicho paso de procesamiento comprende el procesamiento de dicha una o más imágenes de dicha membrana de sellado para determinar una forma de dicha membrana de sellado y para evaluar la integridad del sello de dicho empaque con base en dicha forma determinada de dicha membrana de sellado.	Corresponde a la reivindicación 20 de la solicitud colombiana

21. El método de conformidad con la reivindicación 17, caracterizado porque comprende, además: la adquisición de una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicho paso de aplicación; y el procesamiento de dicha una o más imágenes para evaluar si se formó un vacío en dicho empaque durante un proceso de sellado llevado a cabo en dicho empaque.	21. El método de conformidad con la reivindicación 17, caracterizado porque comprende, además: la adquisición de una o más imágenes de dicha membrana de sellado de dicho empaque antes de la aplicación de una presión subatmosférica a dicha membrana de sellado en dicho paso de aplicación; y el procesamiento de dicha una o más imágenes para evaluar si se formó un vacío en dicho empaque durante un proceso de sellado llevado a cabo en dicho empaque.	Corresponde a la reivindicación 21 de la solicitud colombiana
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(12) **United States Patent**
Chisholm et al.

(10) **Patent No.:** **US 10,895,516 B2**
(45) **Date of Patent:** **Jan. 19, 2021**

(54) **SEAL INTEGRITY INSPECTION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 155 days.

(21) Appl. No.: **16/269,351**

(22) Filed: **Feb. 6, 2019**

(65) **Prior Publication Data**

US 2020/0249116 A1 Aug. 6, 2020

(51) **Int. Cl.**

G06K 9/00 (2006.01)
G01M 3/38 (2006.01)
G06T 7/50 (2017.01)
B65B 57/00 (2006.01)
G06T 7/00 (2017.01)

(52) **U.S. Cl.**

CPC **G01M 3/38** (2013.01); **B65B 57/00** (2013.01); **G06T 7/0004** (2013.01); **G06T 7/50** (2017.01)

(58) **Field of Classification Search**

CPC **B65B 57/00**; **G01M 3/38**; **G06T 7/0004**; **G06T 7/50**

See application file for complete search history.

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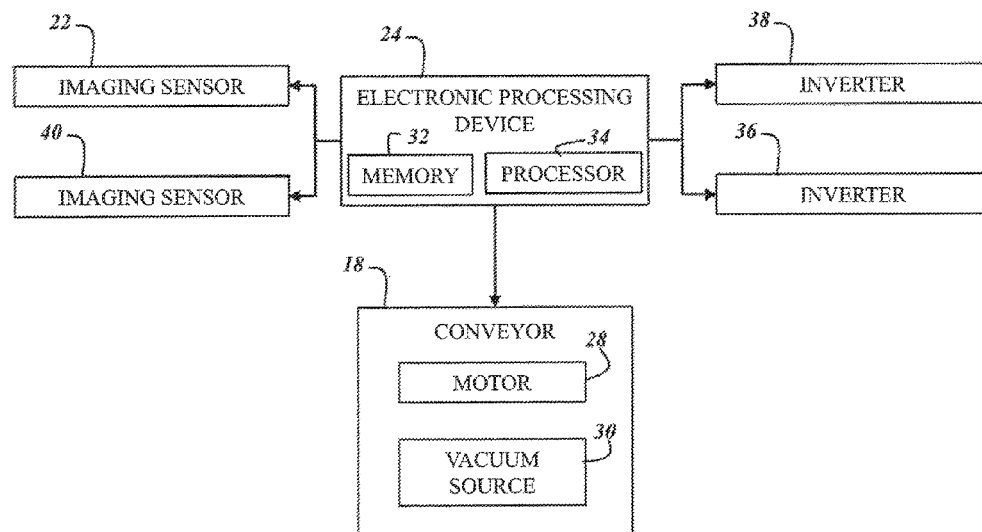
Primary Examiner — Xin Jia

(57)

ABSTRACT

An apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried by the container. The apparatus comprises a conveyor configured to move the sealed package along a path and including a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to the seal membrane of the sealed package as the package moves through the vacuum plenum section. The apparatus further comprises an imaging sensor configured to generate one or more images of the seal membrane following the application of a sub-atmospheric pressure thereto at the vacuum plenum section. The apparatus still further comprises an electronic processing device configured to process the one or more images of the seal membrane generated by the imaging sensor, and to evaluate the integrity of the seal of the package based on the one or more images.

21 Claims, 3 Drawing Sheets



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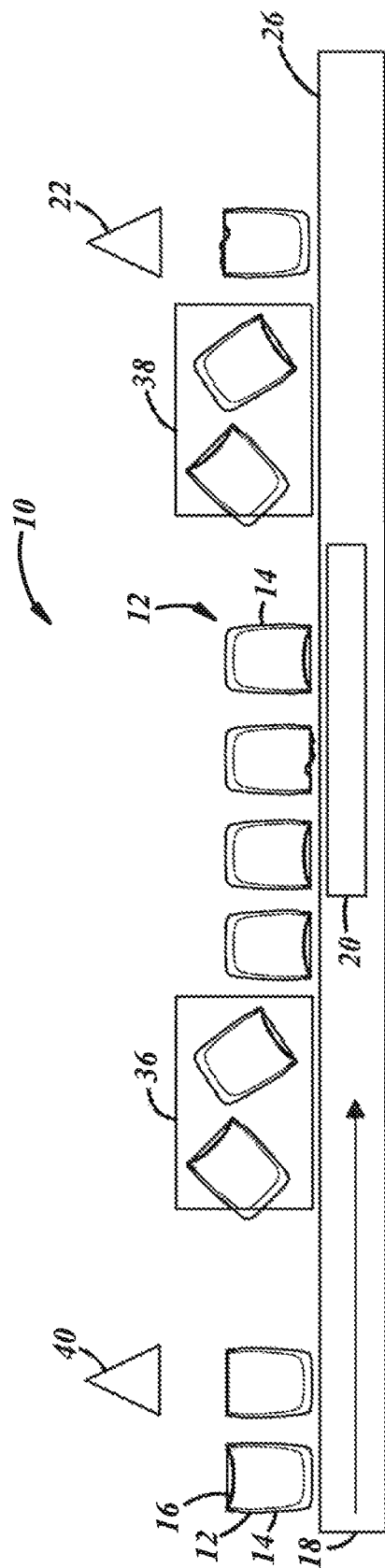


FIG. 1

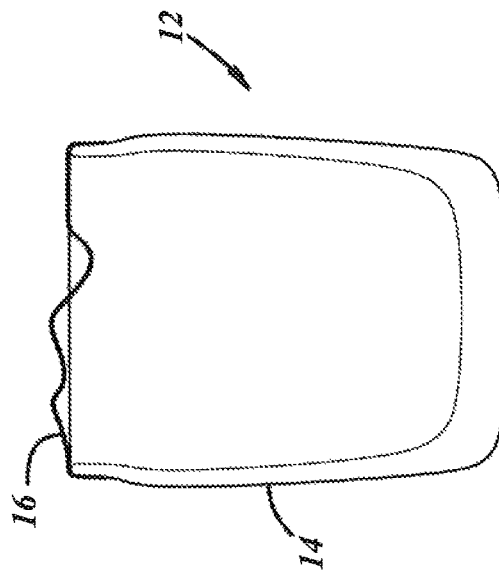


FIG. 4

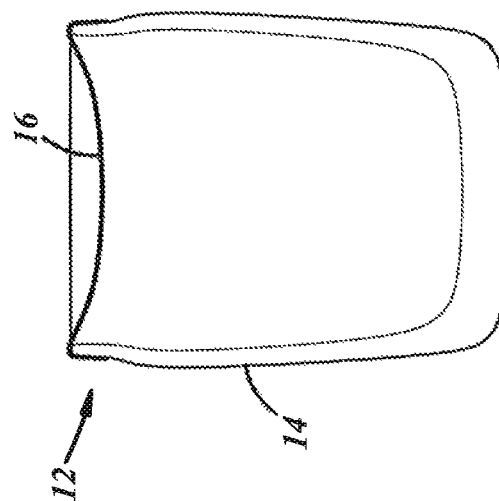


FIG. 3

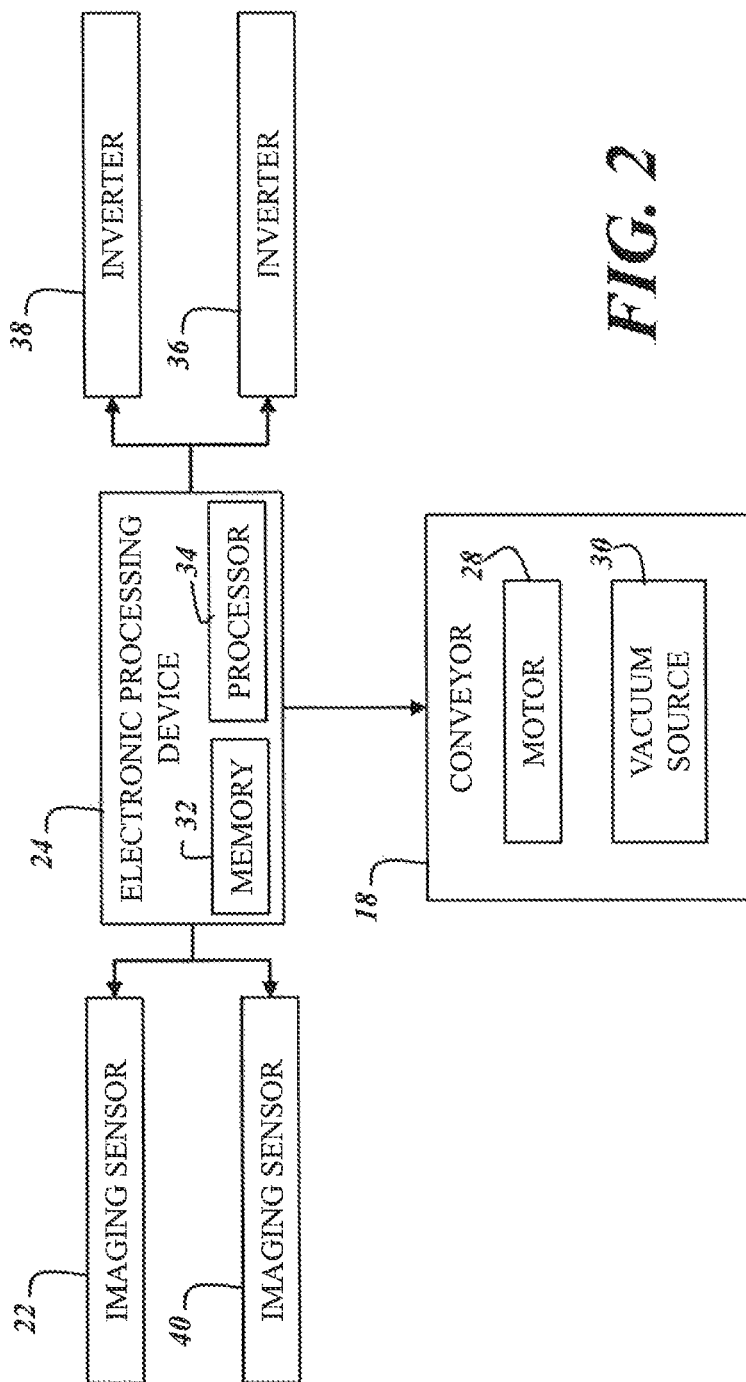
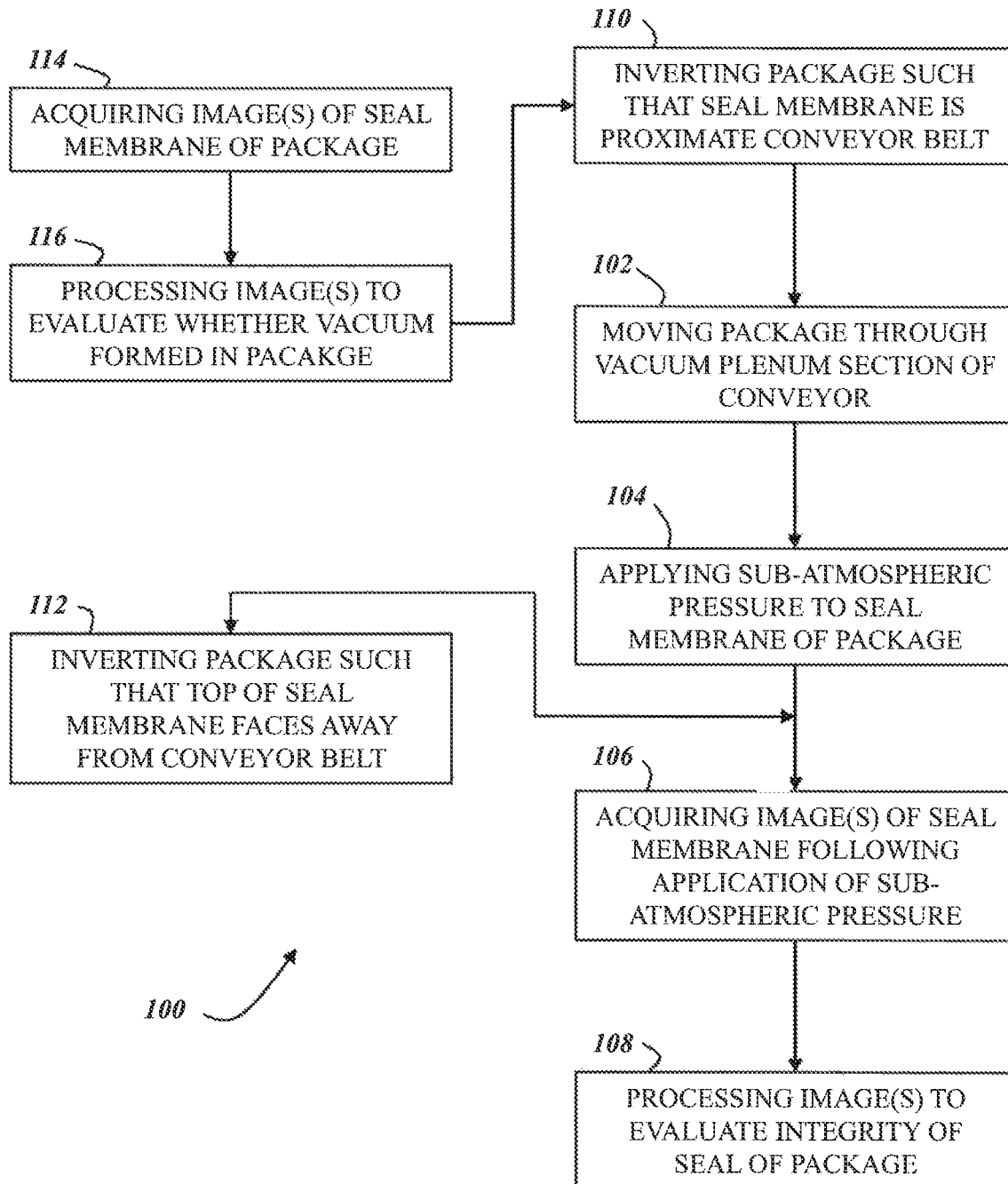


FIG. 2

**FIG. 5**

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SEAL INTEGRITY INSPECTION

The present disclosure is directed to sealed packages and, more particularly, to methods and systems for inspecting the integrity of the seals of sealed packages.

BACKGROUND AND SUMMARY OF THE DISCLOSURE

It is well known that the container of a sealed package, for example, a glass container, may be filled using what is commonly known as a “hot-fill” process. In such a process, the contents to be packaged in the container are introduced into the container at an elevated temperature. Once filled, the contents of the container may cool naturally or be subject to a cooling process.

It is also well known that hot-filled containers may be sealed with a seal membrane, for example, a foil membrane (e.g., an inelastic foil membrane), thereby forming a sealed package. In some instances, the container may be sealed immediately after the filling of the container and before the cooling of the contents of the container. For containers sealed in this way, the cooling of the contents in the container causes both hot gas and the contents in the container to condense. This, in turn, causes a vacuum to be formed in the package. The vacuum draws the foil membrane into a concave parabolic shape that is maintained so long as a vacuum is maintained within the package. However, in certain instances, the parabolic shape may also be maintained even if there is a loss of vacuum. For example, in an instance where there is, for example, a puncture in the seal membrane (e.g., foil) or a failure of the seal between the seal membrane and the sealing surface of the container, and no external forces are applied, the foil membrane may nevertheless maintain the parabolic shape even though the seal has been compromised, and thus, vacuum within the package lost. A general object of the present disclosure, in accordance with at least one aspect of the disclosure, is to provide a method and system for inspecting packages to allow for the detection of conditions where, although the membrane has a parabolic shape, the integrity of the package seal has nonetheless been compromised.

The present disclosure embodies a number of aspects that can be implemented separately from, or in combination with, each other.

In accordance with one aspect of the disclosure, an apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried by the container is provided. The apparatus comprises a conveyor configured to move the package along a path. The conveyor includes a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to the seal membrane of the package as the package moves through the vacuum plenum section. The apparatus further comprises an imaging sensor configured to generate one or more images of the seal membrane of the package following the application of the sub-atmospheric pressure thereto at the vacuum plenum section. The apparatus still further comprises an electronic processing device configured to process the one or more images of the seal membrane generated by the imaging sensor, and to evaluate the integrity of the seal of the package based on the one or more images.

In accordance with another aspect of the disclosure, there is provided an apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried by the container. The apparatus comprises a conveyor configured to move the package along a path. The

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conveyor includes a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to the seal membrane of the package as the package moves through the vacuum plenum section of the conveyor. The vacuum plenum section includes a vacuum plenum that is disposed beneath the conveyor. The apparatus further comprises a first inverter configured to invert the package prior to the application of a vacuum to the seal membrane at the vacuum plenum section of the conveyor, and a second inverter configured to invert the package following the application of a vacuum to the seal membrane at the vacuum plenum section of the conveyor. The apparatus still further comprises an imaging sensor configured to generate one or more images of the seal membrane of the package following the application of the sub-atmospheric pressure thereto at the vacuum plenum section of the conveyor, and an electronic processing device configured to process the one or more images of the seal membrane generated by the imaging sensor, and to evaluate the integrity of the seal of the package based on the one or more images.

In accordance with yet another aspect of the disclosure there is provided a method for inspecting the integrity of a seal of a package that includes a container and a sealing membrane carried thereby. The method comprises moving, by a conveyor, the package through a vacuum plenum section of the conveyor, and applying, by a vacuum plenum section of the conveyor, a sub-atmospheric pressure to the seal member of the package as the package passes through the vacuum plenum section. The method further comprises acquiring, by an imaging sensor, one or more images of the seal membrane following the application of the sub-atmospheric pressure thereto, and processing the one or more images to evaluate the integrity of the seal of the package.

BRIEF DESCRIPTION OF THE DRAWING

The disclosure, together with additional objects, features, advantages and aspects thereof, will be best understood from the following description, the appended claims, and the accompanying drawings, in which:

FIG. 1 is a diagrammatic view of an illustrative embodiment of an apparatus for inspecting the integrity of a seal of a package;

FIG. 2 is a schematic and diagrammatic view of the illustrative embodiment of the apparatus illustrated in FIG. 1;

FIG. 3 is an elevation view of a package having an uncompromised seal;

FIG. 4 is an elevation view of a package having a compromised seal; and

FIG. 5 is a flow diagram showing various steps of an illustrative embodiment of a method for inspecting the integrity of a seal of a package.

DETAILED DESCRIPTION

FIG. 1 depicts a diagrammatic illustration of one embodiment of a system 10 for inspecting the integrity of a seal of a package or sealed package 12, for example, a container 14 sealed with a seal membrane 16. The container 14 may comprise, for example, a bottle, a jar, a jug, or another suitable container in which any number of goods or products may be packaged, including, for example and without limitation, various types of food products and other liquids, gels, powders, particles, and the like. The container 14 may be formed of glass or another suitable material for packaging goods/products, for example, those goods/products identi-

fied above. The seal membrane **16** of the package **12** may also comprise any suitable material, for example, foil (e.g., inelastic foil), and may be affixed, adhered, or attached to a sealing surface of the container **14** using known processes and/or techniques.

One particular type of package that system **10** may be used to inspect is a hot-filled, foil-sealed package that is sealed immediately after filling the container with a hot product and the package is then cooled. As described elsewhere above, the cooling of the package and the product packaged therein causes both hot gas and the product in the container of the package to condense, which, in turn, causes a vacuum to be formed in the package. The vacuum draws the seal membrane (e.g., foil) into a parabolic shape that is maintained so long as a vacuum is maintained within the package. It will be appreciated, however, that the system **10** may also be used to inspect other types of sealed packages, and therefore, the present disclosure is not limited to the inspection of any particular type(s) of sealed package(s).

As shown in FIGS. **1** and **2**, in an illustrative embodiment, the system **10** includes a conveyor or conveyor system **18** having a vacuum plenum section **20**, an imaging sensor **22**, and an electronic processing device **24**.

The conveyor **18** is configured to move a sealed package **12** being inspected along a path that includes the vacuum plenum section **20**. The conveyor **18** may comprise any conveyor system known in the art that is suitable for the purposes described herein. For example, in one illustrative embodiment, the conveyor **18** comprises a motor-driven conveyor having a conveyor belt **26** on which packages being inspected are placed and that moves the package(s) along the path of the conveyor **18**. In an embodiment, and for reasons that will be apparent in view of the description below, at least one or more portions of the conveyor belt **26** has one or more perforations or holes therein. The perforations or holes allow air to be drawn through the conveyor belt **26** when a portion of the conveyor belt **26** having such perforations/holes is located within the vacuum plenum section **20** of the conveyor **18** and a sub-atmospheric pressure created by the vacuum plenum section is applied to the seal membrane **16** of a package **12** on the conveyor belt **26**. In an embodiment, the entire length of the belt has perforations or holes disposed therein, while in other embodiments, only one or more portions, but not the entirety of the belt **26**, has/have perforations/holes therein.

The vacuum plenum section **20** of conveyor **18** generally includes a vacuum plenum and a vacuum source that together are configured to create a sub-atmospheric pressure (also referred to herein as a vacuum) and to apply the sub-atmospheric pressure to the seal membrane **16** of the package **12** as the package **12** moves through the vacuum plenum section **20** of the conveyor **18**. In operation, a package **12** is moved to the vacuum plenum section **20** of the conveyor **18** and a sub-atmospheric pressure is applied to the seal membrane **16** thereof. If the seal of the package is "good" or uncompromised (i.e., there are no punctures in the seal membrane **16** or seal failures), the seal membrane **16** may or may not be drawn down to the conveyor belt **26** by the applied sub-atmospheric pressure, but in any instance, will at the very least return to its original parabolic shape under influence of the vacuum within the package **12** when the sub-atmospheric pressure is removed or its application ceased. FIG. **3** shows an illustration of a package **12** wherein the seal membrane **16** thereof has a parabolic shape that was either maintained during the application of the sub-atmo-

spheric pressure, or that the seal membrane **16** returned to when the sub-atmospheric pressure was removed or its application ceased.

If, on the other hand, there is a puncture in the seal membrane **16** or a seal failure such that the vacuum within the package **12** has leaked, the seal membrane **16** will be drawn down to or at least towards the conveyor belt **26** by the applied sub-atmospheric pressure and will remain deformed (i.e., not return to its original parabolic shape) when the sub-atmospheric pressure is removed or its application ceased, since there is not a sufficient vacuum within the package **12** to cause the seal membrane **16** to return to its original parabolic shape. FIG. **4** shows an illustration of a package **12** wherein the seal membrane **16** has a deformed shape (i.e., a non-parabolic shape).

For purposes of this disclosure, applying a sub-atmospheric pressure to the seal membrane **16** as the package **12** moves through the vacuum plenum section **20** is intended to encompass a scenario wherein the conveyor **18** stops the conveyor belt **26** when a package to be inspected reaches the vacuum plenum section **20** to allow the application of a sub-atmospheric pressure to the seal membrane of the package, as well as a scenario wherein the package moves continuously through the vacuum plenum section **20** of the conveyor **18** without stopping. Additionally, in an embodiment, the vacuum plenum (and, in an embodiment, the vacuum source of the vacuum plenum section **20**) is disposed below or beneath the conveyor belt **26** such that the sub-atmospheric pressure it creates draws the seal membrane **16** to or at least towards the conveyor belt **26**. One benefit of the vacuum plenum being below the conveyor belt is that if there is a puncture in the seal membrane, the product in the container of the package covers the puncture allowing the foil to be deformed rather than allowing the atmosphere within the container to equalize, in which case the membrane would not deform.

As briefly described above, the system **10** further includes an imaging sensor **22**. In an embodiment, the imaging sensor **22** is disposed above the conveyor **18** and is located or positioned at or downstream of the vacuum plenum section **20** of the conveyor **18**. The imaging sensor **22** is configured to generate one or more images of the seal membrane **16** of a package **12** after or following the application of a sub-atmospheric pressure thereto (i.e., after the sub-atmospheric pressure is removed or its application ceased). Accordingly, in an embodiment such as that illustrated in FIG. **1** wherein the imaging sensor **22** is positioned downstream of the vacuum plenum section **20**, once the sub-atmospheric pressure is no longer applied to the seal membrane **16** of the package **12** being inspected and the conveyor **18** moves the package **12** away from the vacuum plenum section **20**, the imaging sensor **22** generates one or more images of the seal membrane **16**. That or those images are communicated to the electronic processing device **24** of the system **10** where the image(s) may be processed as described below. In an embodiment, the imaging device **22** comprises a camera; though any other suitable imaging sensor may be used instead.

The electronic processing device **24** of the system **10** is configured to perform a number of functions. In the illustrated embodiment shown in FIG. **2**, the electronic processing device **24** is electrically connected to, and may be configured to exert at least a measure of control over, one or more components of the system **10**, for example, the conveyor system **18** (including, in an embodiment, the vacuum plenum section **20** thereof), the imaging sensor **22**, and/or one or more other components of the system **10** described

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elsewhere herein. More specifically, the electronic processing device **24** may be configured to control the operation of the motor (identified by reference numeral **28** in FIG. **2**) that drives the conveyor belt **26** to control the movement of the conveyor belt **26**. The electronic processing device **24** may also or alternatively be configured to control the vacuum source (identified by reference numeral **30** in FIG. **2**) of the vacuum plenum section **20** so as to control when and for how long a sub-atmospheric pressure is applied to the seal membrane **16** of a package **12** being inspected by the system **10**. The electronic processing device **24** may still further be configured to control the operation of the imaging sensor **22** to control when an image of a seal membrane **16** is generated. In other embodiments, the electronic processing device **24** is not configured to control the operation of some or all of the components of the system **10**, but rather one or more different electronic processing devices may be configured to do so.

The above notwithstanding, in an embodiment, the electronic processing device **24** is configured to receive one or more images generated by the imaging sensor **22**, process that or those images, and evaluate the integrity of the seal of the package **12** based on the image(s) of the seal membrane **16**. More specifically, in an embodiment, the electronic processing device **24** is configured to process the image(s) generated by the imaging sensor **22** of the seal membrane **16** of the package **12** being inspected to determine a shape of the seal membrane **16**, and to then evaluate the integrity of the seal of the package **12** purportedly formed in part by the seal membrane **16** based on that determined shape. For example, as described above, if after the application of a sub-atmospheric pressure the seal membrane **16** has a parabolic shape, it can be determined that the seal is not compromised and that the package **12** is, in fact, sealed. On the other hand, if the seal membrane **16** does not have a parabolic shape, it can be determined that the seal is compromised, and thus, that the package is not sealed. Such a package may then be discarded or removed from the conveyor **18**. Accordingly, the electronic processing device **24** is configured to use the image(s) generated by the imaging sensor **22** to determine the shape of the seal membrane **16**, and to then determine whether or not the package **12** is sealed based on that determined shape.

The electronic processing device **24** may comprise a single processing device or a plurality of processing devices that collectively perform the functionality described herein. In the latter instance, the individual processing devices may be electrically connected to each other to allow communication therebetween. The electronic processing device **24** may include or comprise any variety of electronic processors, memory devices, input/output (I/O) devices, and/or other known components, and may perform various control, inspection, and/or communication-related functions.

In an embodiment, the electronic processing device **24** includes at least one electronic memory **32** that stores information utilized to, for example, perform some or all of the functionality relating to the methodologies described herein, and, in at least some embodiments and as described above, to control the operation of one or more components of the system **10**. The electronic memory **32** may include, for example, random access memory (RAM), read only memory (ROM), hard disk(s), universal serial bus (USB) drive(s), memory card(s), or any type of suitable electronic memory means and may store a variety of data. This includes, for example, software (e.g., code or logic), firmware, programs, algorithms, scripts, and other electronic instructions that, for example, are required to perform one or more of the func-

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tions described herein; and, in an embodiment, various data structures for storing various information and data, including that required to perform some or all of the functions or method described herein.

The electronic processing device **24** may also include one or more electronic processors **34** (e.g., a microprocessor, a microcontroller, an application specific integrated circuit (ASIC), etc.) that executes instructions for software, firmware, programs, algorithms, scripts, etc. stored in the memory **32** that may govern and perform the processes and methods described herein. In an embodiment, the memory **32** is integrated in the processor **34**, while in other embodiments the memory **32** is a separate component from the electronic processor **34** but is nevertheless accessible by the electronic processor **34**.

The electronic processing device **24** may be electronically connected to other components of the system **10** (e.g., the conveyor system **18**, the imaging sensor **22**, etc.) via one or more wired or wireless connections across which that or those components and the electronic processing device **24** may communicate and interact, as required. Additionally, depending on the particular embodiment, the electronic processing device **24** may be a stand-alone unit or may be incorporated or included within another unit or module of the system **10**. Accordingly, the electronic processing device **24** is not limited to any one particular embodiment or arrangement.

In addition to the components described above, in at least certain embodiments, the system **10** may include a number of other components. For example, as shown in FIGS. **1** and **2**, the system **10** may include an inverter **36** that is configured to invert a package **12** on the conveyor belt **26** such that the seal membrane **16** rests on or is proximate or adjacent to the conveyor belt **26**. In other words, a package that is “right side up” on the conveyor belt **26** is picked up, turned “upside down,” and placed back onto the conveyor belt **26** by the inverter **36**.

In the embodiment shown in FIG. **1**, the inverter **36** is disposed upstream of the vacuum plenum section **20** of the conveyor **18** such that the package **12** to be inspected is inverted prior to or before the application of a sub-atmospheric pressure to the seal membrane **16** of the package **12** at the vacuum plenum section **20**. In another embodiment, the inverter **36** may be located or positioned at or proximate the vacuum plenum section **20** such that the package **12** is inverted when it reaches the vacuum plenum section **20** (as opposed to before it reaches the plenum section **20**), and, in an embodiment, before the application of the sub-atmospheric pressure to the seal membrane **16**. In such an embodiment, the inverter **36** may also be configured to invert (or re-invert) the package after the application of the sub-atmospheric pressure to the seal membrane **16** (i.e., when application of the sub-atmospheric pressure ceases) such that the package **12** is rotated back to its “right side up” orientation wherein the base of the container **14** of the package **12** rests on the conveyor belt **26** and the top side of the seal membrane **16** faces away from the conveyor belt **26**. This results in the seal membrane **16** being orientated such that it is in the field of view of the imaging sensor **22** positioned above the conveyor **18**, and allows the imaging sensor **22** to generate one or more images of the seal membrane **16** following the application of the sub-atmospheric pressure thereto.

In another embodiment, rather than the same inverter **36** being configured to invert a package both before and after the application of a sub-atmospheric pressure to the seal membrane of the package, the inverter **36** is configured to

invert the package before the application of the sub-atmospheric pressure, and another inverter of the system 10 is configured to invert the package after the application of a sub-atmospheric pressure to the seal membrane. For example, in the illustrative embodiment shown in FIGS. 1 and 2, the system 10 includes a second inverter 38 that is configured to invert a package after the application of a sub-atmospheric pressure to the seal membrane thereof such that the package is turned back to its "right side up" orientation wherein the base of the container rests on the conveyor belt 26 and the seal membrane of the package faces away from the conveyor belt 26. As described above, the inversion (or re-inversion) of the package results in the seal membrane 16 being orientated in such a way that it is in the field of view of the imaging sensor 22 positioned above the conveyor 18, thereby allowing the imaging sensor 22 to generate one or more images of the seal membrane 16 following the application of the sub-atmospheric pressure thereto. In such an embodiment, the inverter 38 may be disposed at or proximate the vacuum plenum section 20 of the conveyor 18. However, in other embodiments, for example, that shown in FIG. 1, the inverter 38 may be disposed downstream of the vacuum plenum section 20. The latter arrangement ensures that the sub-atmospheric pressure created at the vacuum plenum section 20 is not applied to the seal membrane when the package is being inverted by the inverter 38.

Whether the system 10 includes one or multiple inverters, each of the inverters may comprise any suitable inverter known in the art. For example, in an embodiment, each of the inverters may comprise a robotic arm having an end-of-arm tool that is suitable to grip a package. The electronic processing device 24 or another suitable processing device of the system 10 may be configured to control the operation of the robotic arm and tool to pick-up a package 12 from the conveyor belt 26, invert the package 12, and then place it back onto the conveyor belt 26. It will be appreciated, however, that any other suitable inverter may be used instead.

In at least certain embodiments, the system 10 may include further a second imaging sensor 40 that is configured for use in performing a gross inspection of a package 12 prior to the inversion of the package 12 by the inverter 36 (if applicable) and the application of a sub-atmospheric pressure to the seal membrane 16 of the package 12 at the vacuum plenum section 20 of the conveyor 18. In an embodiment, like the imaging sensor 22 described above, the imaging sensor 40 is disposed above the conveyor belt 26 and located or positioned at or upstream of the vacuum plenum section 20 of the conveyor 18. In an embodiment wherein the system 10 includes the inverter 36, the imaging sensor 40 is also located or positioned upstream of the inverter 36. The imaging sensor 40 is configured to generate one or more images of the seal membrane 16 of a package 12 being inspected prior to the application of a sub-atmospheric pressure thereto and, if applicable, prior to the inversion of the package 12. In operation, the image(s) generated by the imaging sensor 40 is/are communicated to the electronic processing device 24 of the system 10 (or to another suitable processing device of the system 10) where the image(s) may be processed and used to determine, for example, whether a vacuum was ever formed in the container of the package 12, and thus, whether there is a gross defect with the package or a malfunction of the sealing process.

More specifically, in an embodiment, the electronic processing device 24 is configured to process the image(s)

generated by the imaging sensor 40 to determine a shape of the seal membrane 16 of the package 12 being inspected, and to then evaluate, based on the determined shape, whether a vacuum was ever formed, and thus, whether there is a gross defect with the package 12 or a malfunction of the sealing process. For example, if the seal membrane 16 has a parabolic shape, it can be determined that a vacuum did, in fact, form in the package 12, and thus, there is no gross defect. On the other hand, if the seal membrane 16 does not have a parabolic shape, it can be determined that a vacuum did not form in the package 12 or has been lost, and thus, that there is a gross defect. Such a package 12 may then be discarded or removed from the conveyor 18 before it is inverted and/or a sub-atmospheric pressure is applied to the seal membrane 16 thereof at the vacuum plenum section 20 of the conveyor 18 and the sealing process can be evaluated and any problems may be corrected. Accordingly, in an embodiment, the electronic processing device 24 is configured to use the image(s) generated by the imaging sensor 40 to determine the shape of the seal membrane 16, and to then determine whether or not a vacuum was formed in the package 12, and thus, whether or not there is a gross defect with the package 12, based on that determined shape; the processing device may also alert the operator or stop the sealing process so that problems may be corrected.

As with the imaging sensor 22 described above, in an embodiment, the imaging device 40 comprises a camera; though any other suitable sensor may be used instead.

Turning now to FIG. 5, there is shown an example of a method 100 for inspecting the integrity of a seal of package that includes a container and a seal membrane. For purposes of illustration and clarity, method 100 will be described in the context of the system 10 described above and illustrated in FIGS. 1 and 2. It will be appreciated, however, that the application of the present methodology is not meant to be limited solely to such an arrangement, but rather method 100 may find application with any number of arrangements (i.e., steps of method 100 may be performed by components of the system 10 other than those described below, or arrangements of the system 10 other than that described above).

In an embodiment, method 100 comprises a step 102 of moving, by the conveyor 18, a package 12 on the conveyor belt 26 thereof that is to be inspected through the vacuum plenum section 20 of the conveyor 18. In a step 104, a sub-atmospheric pressure is applied to the seal membrane 16 of the package 12 as the package 12 passes through the vacuum plenum section 20. In an embodiment, step 104 may comprise stopping the conveyor belt 26 when the package 12 reaches the vacuum plenum section 20, and then applying the sub-atmospheric pressure. In another embodiment, step 104 may comprise continuously moving the package 12 through the vacuum plenum section 20 and applying the sub-atmospheric pressure as the package moves there-through without stopping the conveyor belt 26.

Method 100 includes further a step 106 of acquiring, by the imaging sensor 22, one or more images of the seal membrane 16 of the package 12 following the application of the sub-atmospheric pressure thereto, and a step 108 of processing, by the electronic processing device 24, that or those acquired images to evaluate the integrity of the seal of the package based on the acquired image(s). In an embodiment, step 108 comprises processing the one or more images generated by the imaging sensor 22 to determine a shape of the seal membrane 16, and then evaluating the integrity of the seal of the package 12 based on that determined shape. For example, as described above, if after the application of a sub-atmospheric pressure the seal membrane has a para-

bolic shape, it can be determined that the seal is not compromised and that the package is, in fact, sealed. On the other hand, if the seal membrane does not have a parabolic shape, it can be determined that the seal is compromised, and thus, that the package is not sealed. Such a package may then be discarded or removed from the conveyor 18. Accordingly, in an embodiment, step 108 comprises using the image(s) generated by the imaging sensor 22 to determine the shape of the seal membrane 16, and then determining, based on that determined shape, whether or not the package 12 is sealed.

In an embodiment such as that illustrated in FIG. 5, method 100 may include one or more additional steps. For example, method 100 may include a step 110 of inverting, by the inverter 36, the package 12 prior to the application of a sub-atmospheric pressure in step 104. Method 100 may include further a step 112 of inverting (or re-inverting), by the inverter 36 or the inverter 38, the package 12 following or after the application of a sub-atmospheric pressure in step 104. In an embodiment wherein method 100 includes both step 110 and step 112, step 112 is performed after step 110, as shown in FIG. 5.

Method 100 may include further a step 114 of acquiring, by the imaging device 40, one or more images of the seal membrane 16 of the package 12 prior to the application of a sub-atmospheric pressure in step 104. In an embodiment wherein method 100 includes step 114, it may further include a step 116 of processing, by the electronic processing device 24, that or those images to evaluate whether a vacuum was formed in the package 12 during a sealing process performed on the package 12, and thus, whether there is a gross defect with the package or a malfunction of the sealing process. In an embodiment, step 116 is performed prior to step 104 and, if applicable, step 110.

There thus has been disclosed a system for tracking containers that fully satisfy one or more of the objects and aims previously set forth. The disclosure has been presented in conjunction with several illustrative embodiments, and additional modifications and variations have been discussed. Other modifications and variations readily will suggest themselves to persons of ordinary skill in the art in view of the foregoing discussion. For example, the subject matter of each of the embodiments is hereby incorporated by reference into each of the other embodiments, for expedience. The disclosure is intended to embrace all such modifications and variations as fall within the spirit and broad scope of the appended claims.

The invention claimed is:

1. An apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried thereby, comprising:

a conveyor configured to move said package along a path and including a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to said seal membrane of said package as said package moves through said vacuum plenum section;

an imaging sensor configured to generate one or more images of said seal membrane following the application of a sub-atmospheric pressure thereto at said vacuum plenum section; and

an electronic processing device configured to:

process said one or more images of said seal membrane generated by said sensor; and
evaluate the integrity of the seal of said package based on said one or more images.

2. The apparatus of claim 1, further comprising an inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal membrane of said package.

3. The apparatus of claim 2, further comprising an inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member of said package and prior to the generating of one or more images of said seal membrane.

4. The apparatus of claim 3, wherein said inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal member, and said inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member are the same.

5. The apparatus of claim 3, wherein said inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal member, and said inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal member comprise two different inverters.

6. The apparatus of claim 1, wherein said vacuum plenum section comprises a vacuum plenum disposed beneath said conveyor.

7. The apparatus of claim 1, wherein said imaging sensor is disposed above said conveyor.

8. The apparatus of claim 1, wherein the electronic processing device is configured to evaluate the integrity of the seal of said package by determining if the seal of the package has been compromised.

9. The apparatus of claim 1, wherein said package is a hot-filled package, and said seal membrane comprises a foil seal membrane.

10. The apparatus of claim 1, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate the integrity of the seal of said package based on said determined shape of said seal membrane.

11. The apparatus of claim 1, wherein said imaging sensor is a first imaging sensor and said apparatus further comprises a second imaging sensor configured to generate one or more images of said seal membrane of said package prior to the application of a vacuum to said seal membrane, said electronic processing device configured to:

process said one or more images generated by said second imaging sensor; and

evaluate whether a vacuum was formed in said package based on said one or more images generated by said second imaging sensor.

12. The apparatus of claim 11, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate whether a vacuum was formed in said package based said determined shape of said seal membrane.

13. An apparatus for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried thereby, comprising:

a conveyor configured to move said package along a path and including a vacuum plenum section configured to create a sub-atmospheric pressure that is applied to said seal membrane of said package as said package moves through said vacuum plenum section, wherein said vacuum plenum section comprises a vacuum plenum disposed beneath said conveyor;

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a first inverter configured to invert said package prior to the application of a sub-atmospheric pressure to said seal membrane at said vacuum plenum section of said conveyor;
 a second inverter configured to invert said package following the application of a sub-atmospheric pressure to said seal membrane at said vacuum plenum section of said conveyor;
 an imaging sensor configured to generate one or more images of said seal membrane following the application of a sub-atmospheric pressure hereto at said vacuum plenum section and the inversion of said package by said second inverter; and
 an electronic processing device configured to:
 process said one or more images of said seal membrane generated by said sensor; and
 evaluate the integrity of the seal of said package based on said one or more images.

14. The apparatus of claim **13**, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate the integrity of the seal of said package based on said determined shape of said seal membrane.

15. The apparatus of claim **13**, wherein said imaging sensor is a first imaging sensor and said apparatus further comprises a second imaging sensor configured to generate one or more images of said seal membrane of said package prior to the application of a vacuum to said seal membrane, said electronic processing device configured to:
 process said one or more images generated by said second imaging sensor; and
 evaluate whether a vacuum was formed in said package based on said one or more images generated by said second imaging sensor.

16. The apparatus of claim **15**, wherein said electronic processing device is configured to process said one or more images of said seal membrane to determine a shape of said seal membrane, and to evaluate whether a vacuum was formed in said package based said determined shape of said seal membrane.

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17. A method for inspecting the integrity of a seal of a package that includes a container and a seal membrane carried thereby, comprising:

moving, by a conveyor, said package through a vacuum plenum section of said conveyor;

applying, by the vacuum plenum section, a sub-atmospheric pressure to said seal membrane of said package as said package passes through said vacuum plenum section;

acquiring, by an imaging sensor, one or more images of said seal membrane following said application of said sub-atmospheric pressure thereto;

processing, by an electronic processing device, said one or more images to evaluate the integrity of the seal of said package based on said one or more images of said seal membrane.

18. The method of claim **17**, further comprising inverting said package prior to applying a sub-atmospheric pressure to said seal membrane of said package.

19. The method of claim **17**, further comprising inverting said package following the application of a sub-atmospheric pressure to said seal membrane of said package and prior to said acquisition of said one or more images of said seal membrane.

20. The method of claim **17**, wherein said processing step comprises processing said one or more images of said seal membrane to determine a shape of said seal membrane, and evaluating the integrity of the seal of said package based on said determined shape of said seal membrane.

21. The method of claim **17**, further comprising:

acquiring one or more images of said seal membrane of said package prior to the application of a sub-atmospheric pressure to said seal membrane in said applying step; and

processing said one or more images to evaluate whether a vacuum was formed in said package during a sealing process performed on said package.

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