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1269810

THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

July 06, 2023

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APPLICATION NUMBER: 63/353,880

FILING DATE: *June 21, 2022*

RELATED PCT APPLICATION NUMBER: *PCT/US23/25900*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US63/353,880*



Certified by

Kathi

Performing the Functions and Duties of the
Under Secretary of Commerce
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Roberto	D.	SICILIA			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Ontario	State/Province		Country of Residence	CA	
Mailing Address of Inventor:						
Address 1	c/o F&S Tool, Inc.					
Address 2	2300 Powell Avenue					
City	Erie	State/Province	PA			
Postal Code	16506	Country	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	22208		
Email Address	ptonotices@marburylaw.com		Add Email Remove Email

Application Information:

Title of the Invention	POST-MOLD PROCESSING OF PREFORMS		
Attorney Docket Number	1610-011P	Small Entity Status Claimed ☒	
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	Suggested Figure for Publication (if any)	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
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Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	22208		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove

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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
------------------	---	------------------------

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

[Clear](#)

☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	F&S Tool, Inc.		
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Mailing Address Information For Applicant:

Address 1	2300 Powell Avenue		
Address 2			
City	Erie	State/Province	PA
Country	US	Postal Code	16506
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. [Add](#)

Assignee Information including Non-Applicant Assignee Information:

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		

Assignee	1
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Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

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Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				

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Signature:

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This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/John Paul Mello/		Date (YYYY-MM-DD)	2022-06-21
First Name	John Paul	Last Name	Mello	Registration Number
			61400	

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	1610-011P
		Application Number	
Title of Invention	POST-MOLD PROCESSING OF PREFORMS		

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1

Remove

Given Name

Middle Name

Family Name

City

State

Country j

Roberto

D.

SICILIA

Ontario

CA

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

Add

Title of Invention

POST-MOLD PROCESSING OF PREFORMS

Attorney Docket Number (if applicable)

1610-011P

Correspondence Address

Direct all correspondence to (select one):

☒ The address corresponding to Customer Number

☐ Firm or Individual Name

Customer Number

22208

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:

Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:

Entity Status**Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29**

- ☒ Applicant asserts small entity status under 37 CFR 1.27
- ☐ Applicant certifies micro entity status under 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
- ☐ No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	John Paul Mello/		Date (YYYY-MM-DD)	2022-06-21	
First Name	John Paul	Last Name	Mello	Registration Number (If appropriate)	61400

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

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.

POST-MOLD PROCESSING OF PREFORMS

BACKGROUND

[0001] Preforms are intermediate products formed through injection molding of material such as polyethylene terephthalate (PET). Through subsequent processing that includes blow-molding, these preforms can be formed into thin-walled, containers and/or packaging commonly used in high-volume production (e.g., food processing). For example, preforms can be formed into containers used in bottling liquids (e.g., soft drinks, water, etc.).

[0002] Preforms are typically malleable following removal from an injection molding machine. To increase manufacturing throughput, these preforms can be removed from an injection molding machine while the preforms are still malleable and then cooled, away from the injection molding machine, until the preforms have been cooled into a dimensionally stable form. Once dimensionally stable, the preforms can be transferred to one or more blow molding stages for formation into a final shape of a container and/or packaging.

[0003] To promote fast cooling, the receptacle is sized to have an interference fit with the malleable form of the preform initially introduced into the receptacle. The fastest cooling is generally achieved by sizing the diameter of the receptacle according to the final (dimensionally stable) diameter of the preform. However, the interference fit associated with such relative sizing can create significant transfer issues as the malleable form of the preform is introduced into the receptacle. Thus, as a compromise between reliable transfer of malleable preforms into the receptacle and efficient cooling of such preforms in the receptacle, the interference fit between the diameter of the receptacle and the corresponding diameter of the malleable preform is typically about one-half of the total shrinkage of the diameter of the preform as the preform is cooled in the receptacle. That is, reliable transfer of malleable preforms into the receptacle is generally achieved at the cost of decreased cooling efficiency.

SUMMARY

[0004] Devices, systems, and methods of the present disclosure are generally directed to cooling preforms in a receptacle having a controllable shape. As compared to cooling preforms in a receptacle having a fixed shape, the devices, systems, and method of the present disclosure may facilitate faster and more reliable post-processing of preforms. As an example, the devices, systems, and methods of the present disclosure may reduce the likelihood of transfer issues associated with

moving a preform into the cavity while also facilitating faster cooling of the preform disposed in the receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The foregoing and other objects, features and advantages of the devices, systems, and methods described herein will be apparent from the following description of particular embodiments thereof, as illustrated in the accompanying drawings. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the devices, systems, and methods described herein.

[0006] FIG. 1 is a schematic representation of a system for post-mold processing a preform.

[0007] FIG. 2A is a perspective view of a cooling device of the system of FIG. 1, with a preform shown positioned in the cooling device.

[0008] FIG. 2B is a perspective of the cooling device of FIG. 2A, with the cooling device shown exploded along a center axis defined by the cooling device.

[0009] FIG. 2C is a side, cross-sectional view of the cooling device of FIG. 2A, with the cross-sectional view taken along line 2C-2C in FIG. 2A.

[0010] FIG. 2D is an enlarged view of the cooling device of FIG. 2A along the area the area of detail 2D in FIG. 2C.

[0011] FIG. 3 is a flow chart of an exemplary method of post-mold processing of a preform.

DETAILED DESCRIPTION

[0012] The embodiments will now be described more fully hereinafter with reference to the accompanying figures, in which exemplary embodiments are shown. The foregoing may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein.

[0013] All documents mentioned herein are hereby incorporated by reference in their entirety. References to items in the singular should be understood to include items in the plural, and vice versa, unless explicitly stated otherwise or clear from the text. Grammatical conjunctions are intended to express any and all disjunctive and conjunctive combinations of conjoined clauses, sentences, words, and the like, unless otherwise stated or clear from the context. Thus, the term “or”

should generally be understood to mean “and/or,” and the term “and” should generally be understood to mean “and/or.”

[0014] Recitation of ranges of values herein are not intended to be limiting, referring instead individually to any and all values falling within the range, unless otherwise indicated herein, and each separate value within such a range is incorporated into the specification as if it were individually recited herein. The words “about,” “approximately,” or the like, when accompanying a numerical value, are to be construed as including any deviation as would be appreciated by one of ordinary skill in the art to operate satisfactorily for an intended purpose. Ranges of values and/or numeric values are provided herein as examples only, and do not constitute a limitation on the scope of the described embodiments. The use of any and all examples or exemplary language (“e.g.,” “such as,” or the like) is intended merely to better illuminate the embodiments and does not pose a limitation on the scope of those embodiments. No language in the specification should be construed as indicating any unclaimed element as essential to the practice of the disclosed embodiments.

[0015] Referring now to FIGS. 1 and 2A-2D, a system 100 for post-mold processing may include an end-of-arm tool 102, a robot 104, and a controller 106. The end-of-arm tool 102 includes one or more instances of a cooling device 108, with each instance of the cooling device 108 operable for post-mold processing a respective instance of a preform 109 according to the various different techniques described herein. The robot 104 may be coupled to the end-of-arm tool, and the robot 104 may be operable to move the preform 109 from an injection molding machine 101 and into a respective instance of the cooling device 108. The controller 106 may include one or more instances of a processor 110 and one or more non-transitory, computer-readable storage media 112. The one or more non-transitory, computer-readable storage media 112 may have stored thereon instructions for causing the one or more instances of the processor 110 to carry out operations according to any one or more of the various different methods described herein.

[0016] The cooling device 108 may include a base 220, a receptacle 222, and a membrane 224. The receptacle 222 may be disposed in a chamber 226 defined by the base 220. The receptacle 222 may include a flexible section 228 defining at least one portion of a cavity 230 and, in certain instances, the membrane 224 may be disposed between the base 220 and the flexible section 228 of the receptacle 222. For example, the membrane 224 and the base 220 may define a channel 232 therebetween and additionally, or alternatively, the membrane 224 may be in contact with the flexible section 228 of the receptacle 222 defining the cavity 230. Further, or instead, in response to pressure difference between the channel and the at least one portion of the cavity 230, the membrane

224 may be pliable along the channel 232 to adjust a shape of the at least one portion of the cavity 230 defined by the flexible section 228 of the receptacle 222. Advantageously, this pressure difference may be controlled (e.g., via the introduction of fluid in the channel) to adjust the shape of the at least one portion of the cavity 230 between a loose clearance fit and an interference fit relative to the preform 109 positioned in the cavity 230 of the receptacle 222. As compared to a receptacle having a fixed dimension, adjusting the shape of the at least one portion of the cavity 230 defined by the flexible section 228 of the receptacle 222 may reduce the likelihood of transfer issues associated with moving the preform 109 into the cavity 230 while achieving more efficient cooling of the preform 109 disposed in the cavity 230.

[0017] FIG. 3 is a flow chart of an exemplary method 300 of post-mold processing of a preform. For example, the exemplary method 300 may cool the preform 109 (FIGS. 1 and 2A-2D) using the system 100 (FIG. 1) including the cooling device 108 (FIG. 1 and FIGS. 2A-2D).

[0018] As shown in step 302, the exemplary method 300 may include inserting a body portion of a preform into a cavity defined by a receptacle.

[0019] As shown in step 304, the exemplary method 300 may include compressing a flexible section of the receptacle into contact with the body portion of the preform in the cavity.

[0020] As shown in step 306, the exemplary method 300 may include cooling the body portion of the preform in contact with the flexible section of the receptacle.

[0021] As shown in step 308, the exemplary method 300 may include, with the body portion of the preform cooled, expanding the flexible section of the receptacle away from contact with the body portion of the preform to define a clearance therebetween.

[0022] As shown in step 310, the exemplary method 300 may include, with the clearance defined between the flexible section of the receptacle and the body portion of the preform, removing the body portion of the preform from the cavity.

[0023] In certain implementations, as shown in step 312, the exemplary method may include receiving a feedback signal indicative of a temperature of the body portion of the preform in the cavity. Further, or instead, as shown in step 314, the exemplary method may include expanding the flexible section of the receptacle away from the body portion of the preform based on comparison of the temperature of the body portion to a predetermined target temperature.

[0024] Certain implementation examples are described in the following numbered clauses:

[0025] Clause 1 is directed to a cooling device for post-mold processing a preform, the cooling device comprising: a base defining a chamber; a receptacle disposed in the chamber, the

receptacle including a flexible section defining at least one portion of a cavity; and a membrane disposed between the base and the flexible section of the receptacle, the membrane and the base defining a channel therebetween, the membrane in contact with the flexible section of the receptacle defining the cavity, and the membrane pliable along the channel, in response to pressure difference between the channel and the at least one portion of the cavity, to adjust a shape of the at least one portion of the cavity defined by the flexible section of the receptacle.

[0026] Clause 2 is directed to the cooling device of clause 1, wherein the base defines one or more cooling passages in thermal communication with the cavity in the chamber.

[0027] Clause 3 is directed to the cooling device of clause 2, wherein the one or more cooling passages are fluidically isolated from the cavity and from the channel defined between the membrane and the base.

[0028] Clause 4 is directed to the cooling device of any one of clauses 2 or 3, wherein the one or more cooling passages circumscribe the at least one portion of the cavity defined by the flexible section of the receptacle.

[0029] Clause 5 is directed to the cooling device of any one of clauses 1-4, wherein the base and at least the flexible section of the receptacle are each formed of one or more metals.

[0030] Clause 6 is directed to the cooling device of any one of clauses 1-4, wherein, along one or more dimensions of the at least one portion of the cavity, the flexible section is elastically deformable between an expanded state and a compressed state in response to changes in pressure difference between the channel and the at least one portion of the cavity.

[0031] Clause 7 is directed to the cooling device of clause 6, wherein the flexible section of the receptacle is biased toward the expanded state in absence of a pressure difference between the channel and the at least one portion of the cavity.

[0032] Clause 8 is directed to the cooling device of clause 7, wherein the flexible section of the receptacle is compressible from the expanded state to the compressed state in response to pressure difference greater than about 2.5 atm and less than about 7 atm between the channel and the at least one portion of the cavity.

[0033] Clause 9 is directed to the cooling device of any one of clauses 6-8, wherein the flexible section of the receptacle defines a longitudinal axis extending through the at least one portion of the cavity, and the flexible section of the receptacle is elastically deformable between the expanded state and the compressed state at least along a radial dimension of the flexible section in response to pressure difference between the channel and the at least one portion of the cavity.

[0034] Clause 10 is directed to the cooling device of clause 9, wherein the cavity is symmetric about any plane containing the longitudinal axis.

[0035] Clause 11 is directed to the cooling device of any one of clauses 9 or 10, wherein the flexible section of the receptacle circumscribes the longitudinal axis along the at least one portion of the cavity.

[0036] Clause 12 is directed to the cooling device of clause 11, wherein, in absence of a pressure difference between the channel and the cavity, the flexible section of the receptacle is cylindrical.

[0037] Clause 13 is directed to the cooling device of any one of clauses 11 or 12, wherein the channel circumscribes the longitudinal axis at least along the flexible section of the receptacle.

[0038] Clause 14 is directed to the cooling device of clause 13, wherein the channel is an annulus about the longitudinal axis.

[0039] Clause 15 is directed to the cooling device of any one of clauses 9-14, wherein the flexible section of the receptacle includes a plurality of struts along the at least one portion of the cavity, the plurality of struts flexible in response to changes in pressure in the channel to move the flexible section in a radial dimension between the expanded state and the compressed state.

[0040] Clause 16 is directed to the cooling device of clause 15, wherein each one of the plurality of struts has a thickness, in a radial direction relative to the longitudinal axis, of greater than about 25.4 microns along the at least one portion of the cavity.

[0041] Clause 17 is directed to the cooling device of any one of clauses 15 or 16, wherein each one of the plurality of struts is elongate along the at least one portion of the cavity.

[0042] Clause 18 is directed to the cooling device of clause 17, wherein a respective longitudinal dimension of each one of the plurality of struts is parallel to the longitudinal axis defined by the flexible section of the receptacle.

[0043] Clause 19 is directed to the cooling device of any one of clauses 15-18, wherein, in absence of a pressure difference between the channel and the cavity, the plurality of struts are adjacent to one another such that each one of the plurality of struts and another one of the plurality of the struts define a respective slit therebetween.

[0044] Clause 20 is directed to the cooling device of any one of clauses 9-19, wherein the flexible section of the receptacle is continuous along the at least one portion of the cavity, the flexible section of the receptacle is formed of one or more metals along the at least one portion of the

cavity, and the flexible section of the receptacle has a thickness, in a radial direction relative to the longitudinal axis, of less than about 25.4 microns along the at least one portion of the cavity.

[0045] Clause 21 is directed to the cooling device of any one of clauses 9-19, wherein the receptacle further includes a first end section and a second end section, the flexible section is disposed between the first end section and the second end section, and the first end section and the second end section are each less flexible than the flexible section in response to changes in fluid pressure in the channel.

[0046] Clause 22 is directed to the cooling device of clause 21, the first end section defines a first orifice, the second end section defines a second orifice, the first orifice and the second orifice are in fluid communication with one another via the cavity.

[0047] Clause 23 is directed to the cooling device of clause 22, wherein the longitudinal axis extends through each of the first orifice and the second orifice.

[0048] Clause 24 is directed to the cooling device of any one of clause 1-23, wherein, at a temperature of 100 °C, the membrane is elastically deformable in response to pressure difference between the channel and the at least one portion of the cavity greater than about 2.5 atm and less than about 9 atm.

[0049] Clause 25 is directed to the cooling device of clause 24, wherein the membrane includes one or more elastomeric materials.

[0050] Clause 26 is directed to a method of post-mold processing, the method comprising: inserting a body portion of a preform into a cavity defined by a receptacle; compressing a flexible section of the receptacle into contact with the body portion of the preform in the cavity; cooling the body portion of the preform in contact with the flexible section of the receptacle; with the body portion of the preform cooled, expanding the flexible section of the receptacle away from contact with the body portion of the preform to define a clearance therebetween; and with the clearance defined between the flexible section of the receptacle and the body portion of the preform, removing the body portion of the preform from the cavity.

[0051] Clause 27 is directed to the method of clause 26, wherein the body portion of the preform is inserted into the cavity with the clearance defined between the flexible section of the receptacle and the body portion of the preform.

[0052] Clause 28 is directed to the method of claim any one of clauses 26 or 27, wherein inserting the body portion of the preform into the cavity includes securing a neck portion of the

preform in the receptacle with the neck portion of the preform outside of the cavity and the body portion of the preform spaced away from the flexible section of the receptacle in the cavity.

[0053] Clause 29 is directed to the method of clause 28, wherein inserting the body portion of the preform into the cavity includes positioning a closed portion of the preform in contact with the receptacle with the body portion of the preform spaced away from the flexible section of the receptacle.

[0054] Clause 30 is directed to the method of clause 29, wherein inserting the body portion of the preform into the cavity includes applying vacuum pressure along the closed portion of the preform in contact with the receptacle.

[0055] Clause 31 is directed to the method of any one of clauses 29 or 30, wherein removing the body portion of the preform from the cavity includes delivering pressurized air into the cavity to move the closed portion of the preform away from contact with the receptacle.

[0056] Clause 32 is directed to the method of any one of clauses 26-31, wherein compressing the flexible section of the receptacle into contact with the body portion of the preform in the cavity includes increasing fluid pressure in a channel in mechanical communication with the flexible section.

[0057] Clause 33 is directed to the method of clause 32, wherein increasing fluid pressure in the channel includes directing pressurized air into the channel.

[0058] Clause 34 is directed to the method of any one of clauses 32 or 33, wherein increasing fluid pressure in the channel includes forming a pressure difference between the channel and the cavity of greater than about 2.5 atm and less than about 9 atm.

[0059] Clause 35 is directed to the method of any one of clauses 32-34, wherein increasing fluid pressure in the channel includes increasing the fluid pressure in the channel according to a step function.

[0060] Clause 36 is directed to the method of any one of clauses 32-35, wherein increasing fluid pressure in the channel includes increasing the fluid pressure in the channel according to a continuous function over a predetermined period.

[0061] Clause 37 is directed to the method of any one of clauses 32-36, wherein expanding the flexible section of the receptacle away from contact with the body portion of the preform includes decreasing fluid pressure in the channel.

[0062] Clause 38 is directed to the method of clause 37, wherein decreasing fluid pressure in the channel includes interrupting a flow of fluid into the channel.

[0063] Clause 39 is directed to the method of any one of clauses 26-38, wherein the flexible section of the receptacle defines a longitudinal axis extending through the cavity, and compressing the flexible section of the receptacle into contact with the body portion of the preform in the cavity includes decreasing a radial dimension of the flexible section of the receptacle from an expanded state to a compressed state.

[0064] Clause 40 is directed to the method of clause 39, wherein the preform is formed of polyethylene terephthalate (PET), cooling the body portion of the preform shrinks the body portion of the preform in the radial dimension, and compressing the flexible section of the receptacle includes reducing the radial dimension of the flexible section of the receptacle by more than 50 percent of shrinkage, in the radial dimension, associated with cooling the body portion of the preform.

[0065] Clause 41 is directed to the method of any one of clauses 39 or 40, wherein expanding the flexible section of the receptacle includes increasing the radial dimension of the flexible section of the receptacle to move the flexible section of the receptacle from the compressed state to the expanded state, out of contact with the body portion of the preform.

[0066] Clause 42 is directed to the method of any one of clauses 26-41, wherein cooling the body portion of the preform in contact with the flexible section of the receptacle includes moving a coolant through a cooling circuit fluidically isolated from the cavity and in thermal communication with the body portion of the preform in the cavity.

[0067] Clause 43 is directed to the method of clause 42, wherein the coolant in the cooling circuit has a maximum pressure of between about 4 atm and about 9 atm.

[0068] Clause 44 is directed to the method of any one of clauses 42 or 43, wherein the coolant is water.

[0069] Clause 45 is directed to the method of any one of clauses 26-44, further comprising receiving a feedback signal indicative of a temperature of the body portion of the preform in the cavity, wherein expanding the flexible section of the receptacle away from the body portion of the preform is based on comparison of the temperature of the body portion to a predetermined target temperature.

[0070] Clause 46 is directed to a system for post-mold processing a preform, the system comprising:

[0071] an end-of-arm tool including one or more instances of the cooling device of any one of clauses 1-25;

[0072] a robot coupled to the end-of-arm tool, the robot operable to move one or more preforms into a respective instance of the cooling device; and

[0073] a controller in electrical communication with the robot and the cooling device, the controller including one or more processors and one or more non-transitory, computer-readable storage media, the one or more non-transitory, computer-readable storage media having stored thereon instructions for causing the one or more processors to carry out operations according to the method of any one of clauses 26-45.

[0074] The above systems, devices, methods, processes, and the like may be realized in hardware, software, or any combination of these suitable for a particular application. The hardware may include a general-purpose computer and/or dedicated computing device. This includes realization in one or more microprocessors, microcontrollers, embedded microcontrollers, programmable digital signal processors or other programmable devices or processing circuitry, along with internal and/or external memory. This may also, or instead, include one or more application specific integrated circuits, programmable gate arrays, programmable array logic components, or any other device or devices that may be configured to process electronic signals. It will further be appreciated that a realization of the processes or devices described above may include computer-executable code created using a structured programming language such as C, an object oriented programming language such as C++, or any other high-level or low-level programming language (including assembly languages, hardware description languages, and database programming languages and technologies) that may be stored, compiled or interpreted to run on one of the above devices, as well as heterogeneous combinations of processors, processor architectures, or combinations of different hardware and software. In another aspect, the methods may be embodied in systems that perform the steps thereof, and may be distributed across devices in a number of ways. At the same time, processing may be distributed across devices such as the various systems described above, or all of the functionality may be integrated into a dedicated, standalone device or other hardware. In another aspect, means for performing the steps associated with the processes described above may include any of the hardware and/or software described above. All such permutations and combinations are intended to fall within the scope of the present disclosure.

[0075] Embodiments disclosed herein may include computer program products comprising computer-executable code or computer-usable code that, when executing on one or more computing devices, performs any and/or all of the steps thereof. The code may be stored in a non-transitory fashion in a computer memory, which may be a memory from which the program executes (such as

random access memory associated with a processor), or a storage device such as a disk drive, flash memory or any other optical, electromagnetic, magnetic, infrared or other device or combination of devices. In another aspect, any of the systems and methods described above may be embodied in any suitable transmission or propagation medium carrying computer-executable code and/or any inputs or outputs from same.

[0076] It will be appreciated that the devices, systems, and methods described above are set forth by way of example and not of limitation. Absent an explicit indication to the contrary, the disclosed steps may be modified, supplemented, omitted, and/or re-ordered without departing from the scope of this disclosure. Numerous variations, additions, omissions, and other modifications will be apparent to one of ordinary skill in the art. In addition, the order or presentation of method steps in the description and drawings above is not intended to require this order of performing the recited steps unless a particular order is expressly required or otherwise clear from the context.

[0077] The method steps of the implementations described herein are intended to include any suitable method of causing such method steps to be performed, consistent with the patentability of the following claims, unless a different meaning is expressly provided or otherwise clear from the context. So, for example performing the step of X includes any suitable method for causing another party such as a remote user, a remote processing resource (e.g., a server or cloud computer) or a machine to perform the step of X. Similarly, performing steps X, Y and Z may include any method of directing or controlling any combination of such other individuals or resources to perform steps X, Y and Z to obtain the benefit of such steps. Thus, method steps of the implementations described herein are intended to include any suitable method of causing one or more other parties or entities to perform the steps, consistent with the patentability of the following claims, unless a different meaning is expressly provided or otherwise clear from the context. Such parties or entities need not be under the direction or control of any other party or entity, and need not be located within a particular jurisdiction.

[0078] It will be appreciated that the methods and systems described above are set forth by way of example and not of limitation. Numerous variations, additions, omissions, and other modifications will be apparent to one of ordinary skill in the art. In addition, the order or presentation of method steps in the description and drawings above is not intended to require this order of performing the recited steps unless a particular order is expressly required or otherwise clear from the context. Thus, while particular embodiments have been shown and described, it will be apparent to those skilled in the art that various changes and modifications in form and details may be

made therein without departing from the spirit and scope of this disclosure and are intended to form a part of the invention as defined by the following claims.

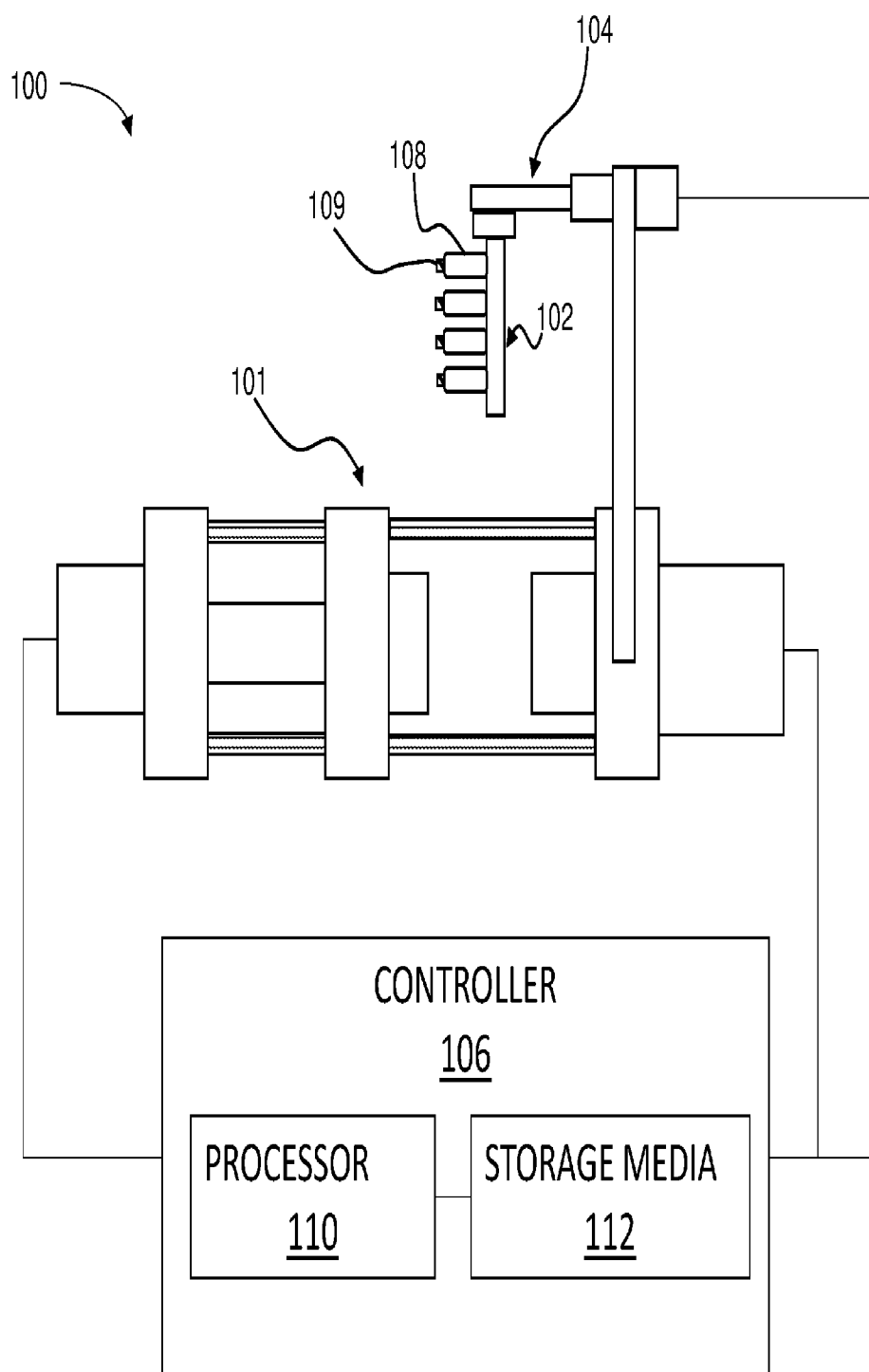


FIG. 1

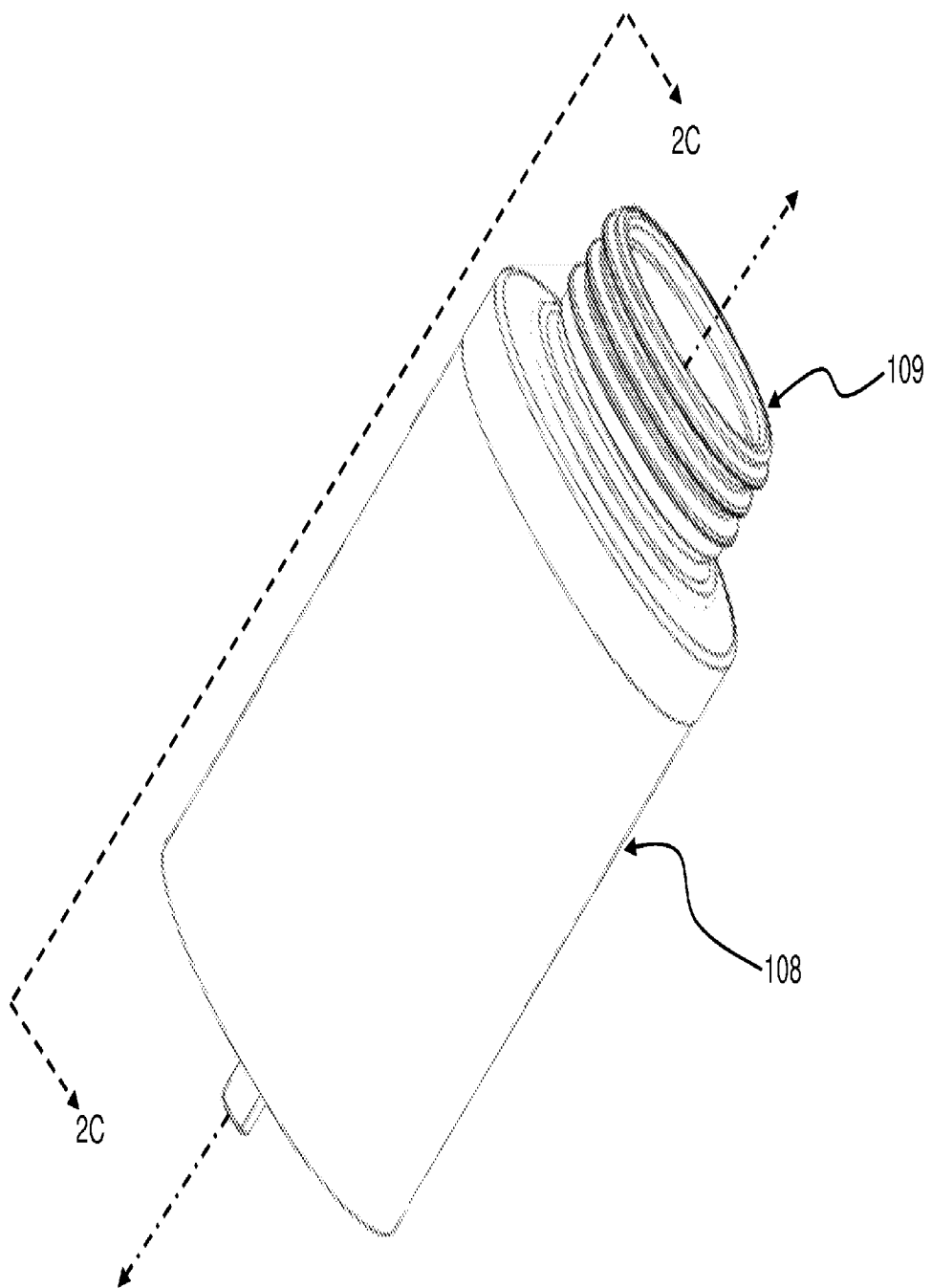


FIG. 2A

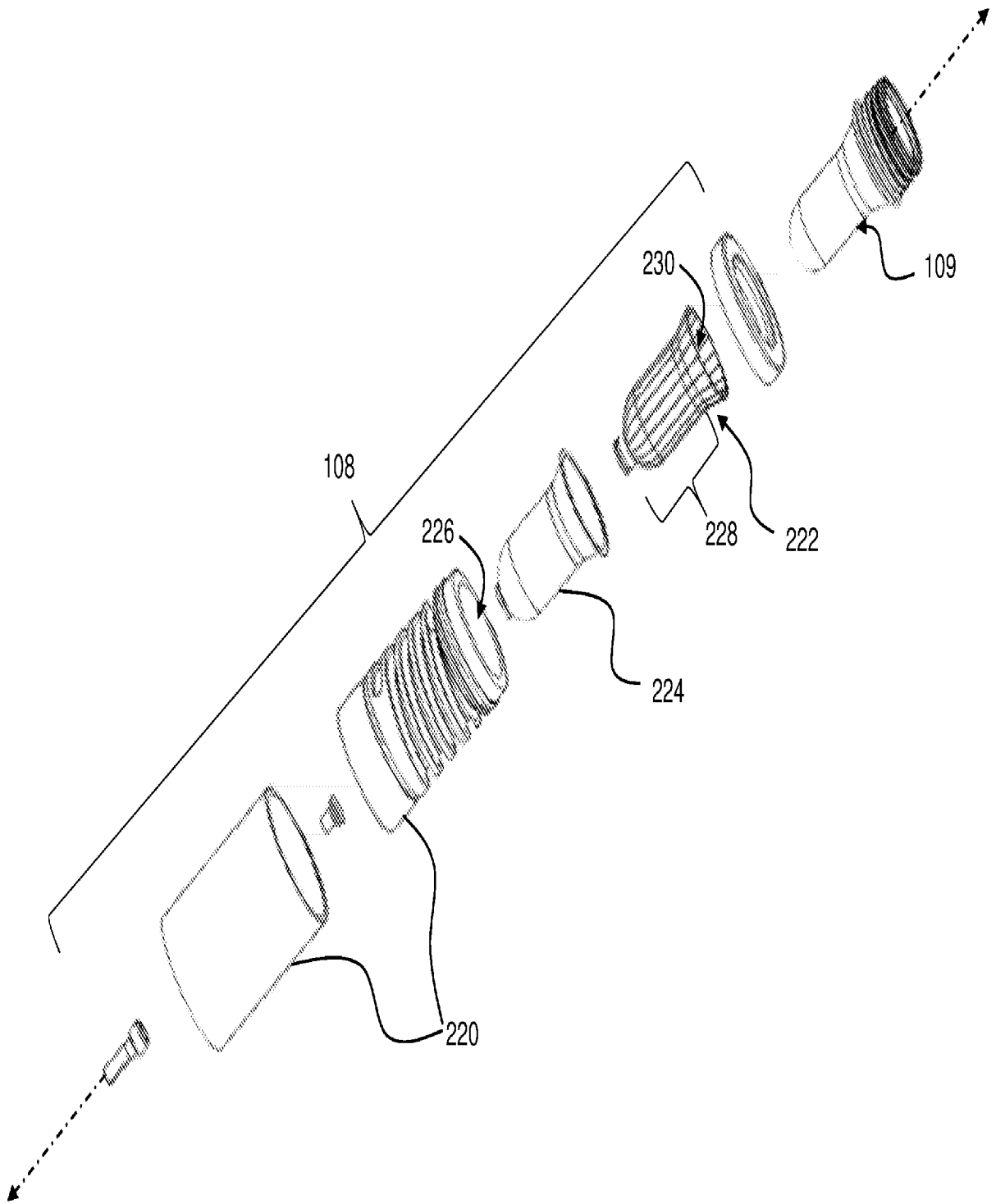


FIG. 2B

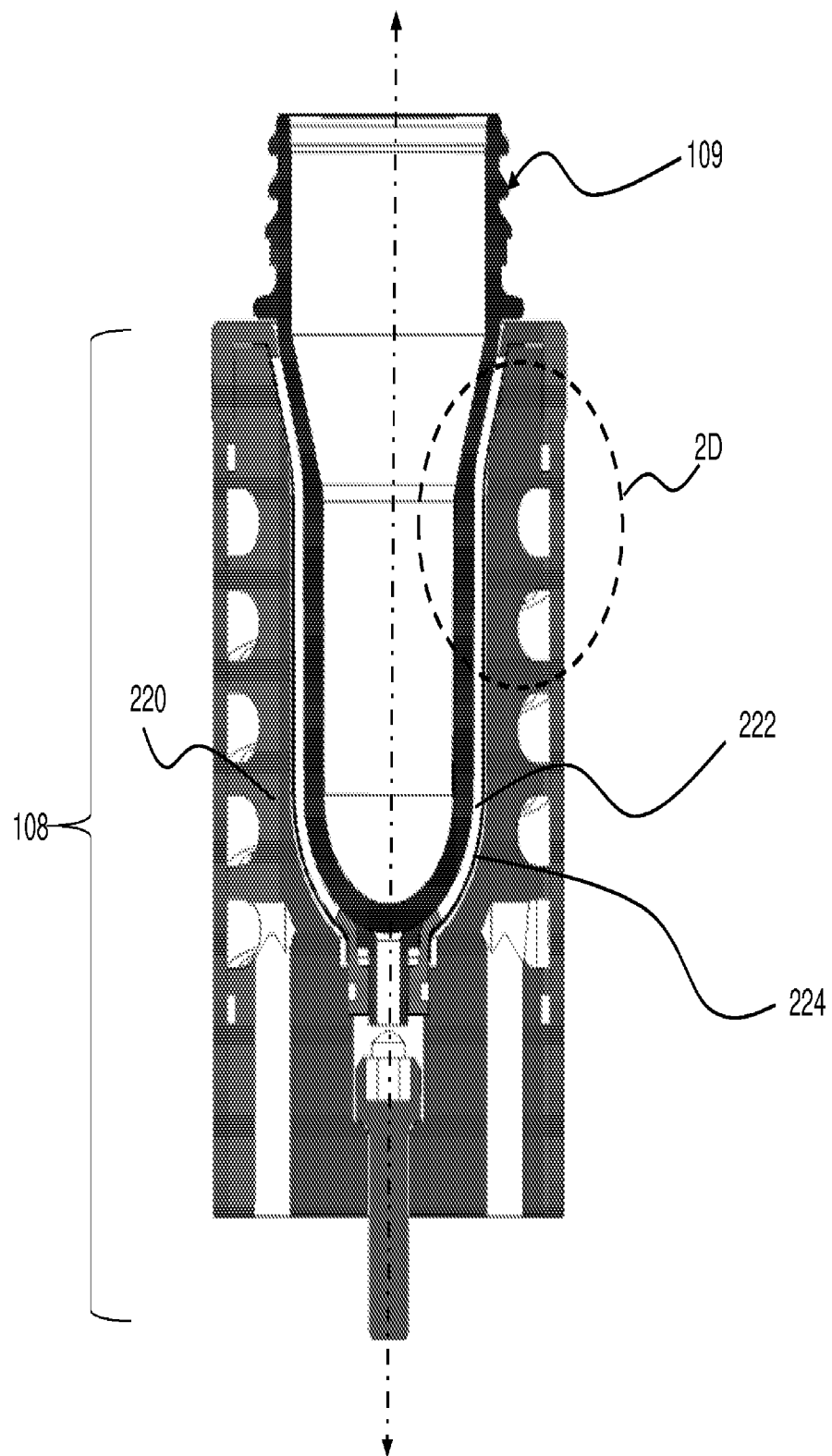


FIG. 2C

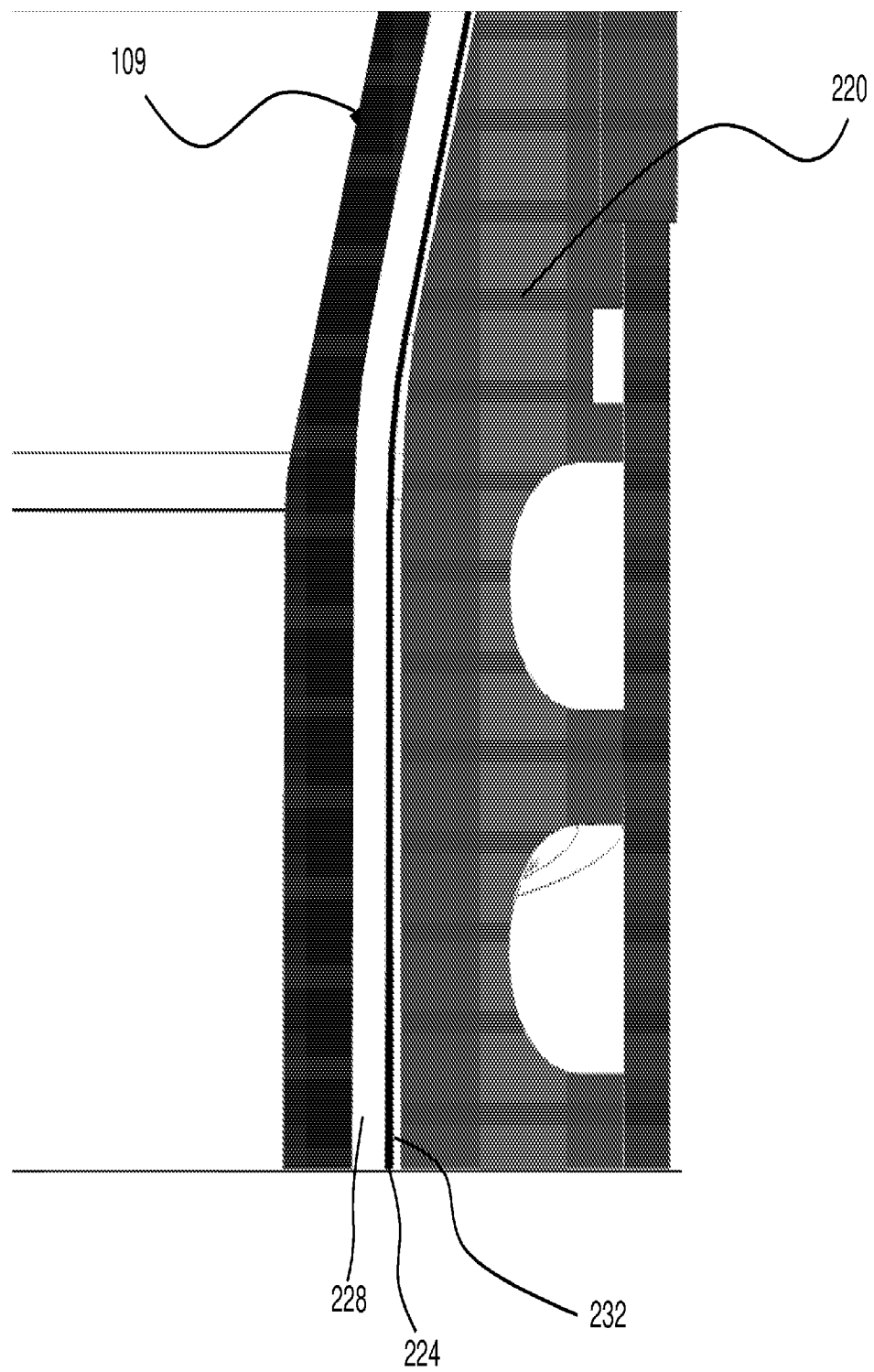


FIG. 2D

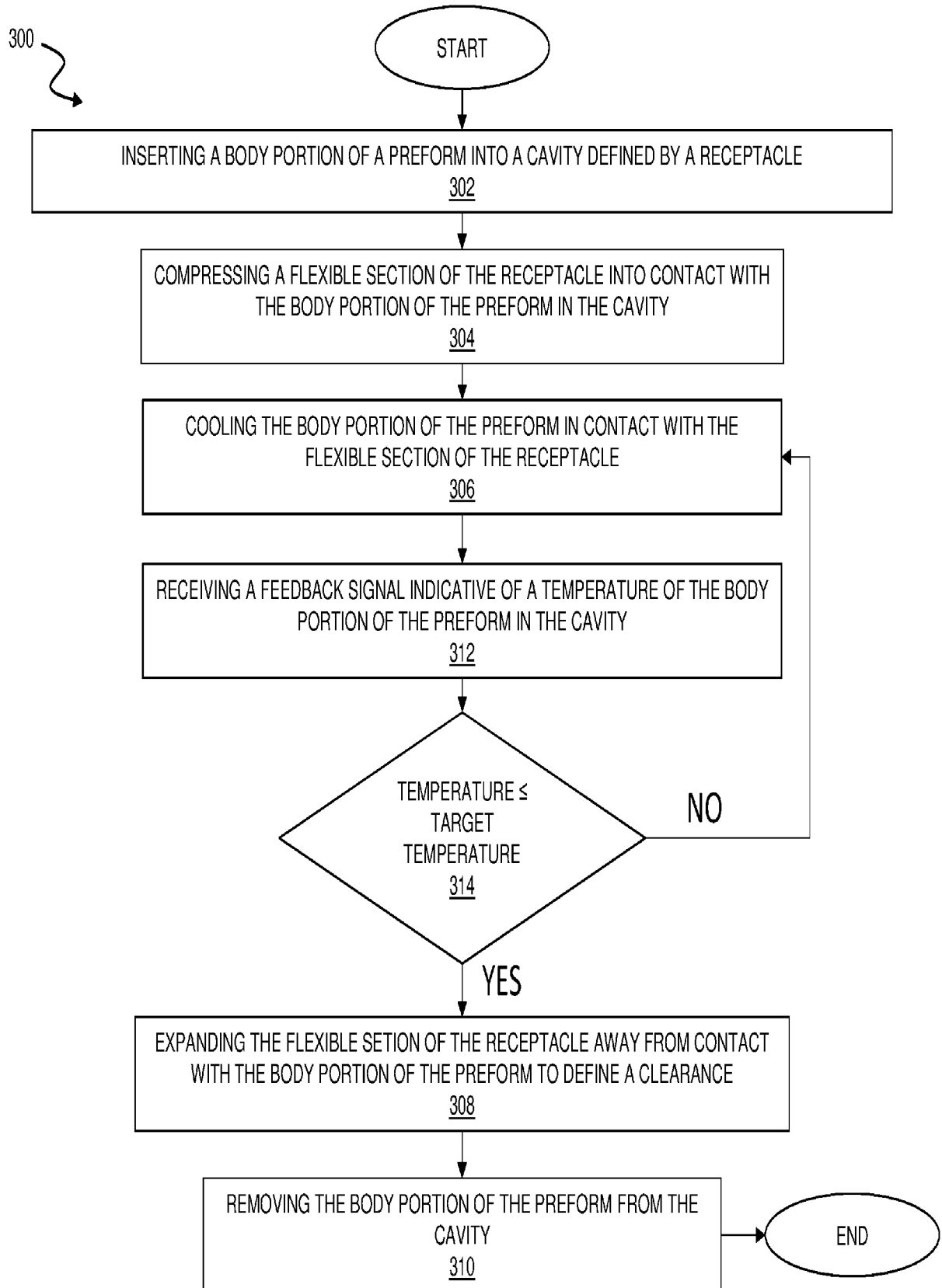


FIG. 3

Electronic Acknowledgement Receipt

EFS ID:	46000656
Application Number:	63353880
International Application Number:	
Confirmation Number:	5161
Title of Invention:	POST-MOLD PROCESSING OF PREFORMS
First Named Inventor/Applicant Name:	Roberto D. SICILIA
Customer Number:	22208
Filer:	Robert Magnus Hansen/Rosemarie Ross
Filer Authorized By:	Robert Magnus Hansen
Attorney Docket Number:	1610-011P
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Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 150
RAM confirmation Number	E20226KA18244719
Deposit Account	181579
Authorized User	Rosemarie Ross
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.21 (Miscellaneous fees and charges)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	1610-011P_ADS_.pdf	1255810	no	8
			d5fcb6279a114c374447c9f6852356dc14fa916a		
Warnings:					
Information:					
2	Provisional Cover Sheet (SB16)	1610-011P_CoverSheet_.pdf	2032269	no	3
			9ba05486c3064397c94cc18e0da6bf2bbaa a6b1d		
Warnings:					
Information:					
3		1610-011P_Specification.pdf	85712	yes	19
			9fa48efefe1fc81e9c84aff4f8813f5d7ad35d7d		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	12	
	Claims		13	18	
	Abstract		19	19	
Warnings:					
Information:					
4	Drawings-only black and white line drawings	1610-011P_Figures.pdf	398345	no	6
			ccce7de61b946c253074137e3a1eac839435ed4e		
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	37129	no	2
			68f3902463bf4a37807c67a75b7ef92407a54cc0		

Warnings:	
Information:	
Total Files Size (in bytes):	3809265
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	

CLAIMS

What is claimed is:

1. A cooling device for post-mold processing a preform, the cooling device comprising:
 - a base defining a chamber;
 - a receptacle disposed in the chamber, the receptacle including a flexible section defining at least one portion of a cavity; and
 - a membrane disposed between the base and the flexible section of the receptacle, the membrane and the base defining a channel therebetween, the membrane in contact with the flexible section of the receptacle defining the cavity, and the membrane pliable along the channel, in response to pressure difference between the channel and the at least one portion of the cavity, to adjust a shape of the at least one portion of the cavity defined by the flexible section of the receptacle.
2. The cooling device of claim 1, wherein the base defines one or more cooling passages in thermal communication with the cavity in the chamber.
3. The cooling device of claim 2, wherein the one or more cooling passages are fluidically isolated from the cavity and from the channel defined between the membrane and the base.
4. The cooling device of any one of claims 2 or 3, wherein the one or more cooling passages circumscribe the at least one portion of the cavity defined by the flexible section of the receptacle.
5. The cooling device of any one of claims 1-4, wherein the base and at least the flexible section of the receptacle are each formed of one or more metals.
6. The cooling device of any one of claims 1-4, wherein, along one or more dimensions of the at least one portion of the cavity, the flexible section is elastically deformable between an expanded state and a compressed state in response to changes in pressure difference between the channel and the at least one portion of the cavity.

7. The cooling device of claim 6, wherein the flexible section of the receptacle is biased toward the expanded state in absence of a pressure difference between the channel and the at least one portion of the cavity.
8. The cooling device of claim 7, wherein the flexible section of the receptacle is compressible from the expanded state to the compressed state in response to pressure difference greater than about 2.5 atm and less than about 7 atm between the channel and the at least one portion of the cavity.
9. The cooling device of any one of claims 6-8, wherein the flexible section of the receptacle defines a longitudinal axis extending through the at least one portion of the cavity, and the flexible section of the receptacle is elastically deformable between the expanded state and the compressed state at least along a radial dimension of the flexible section in response to pressure difference between the channel and the at least one portion of the cavity.
10. The cooling device of claim 9, wherein the cavity is symmetric about any plane containing the longitudinal axis.
11. The cooling device of any one of claims 9 or 10, wherein the flexible section of the receptacle circumscribes the longitudinal axis along the at least one portion of the cavity.
12. The cooling device of claim 11, wherein, in absence of a pressure difference between the channel and the cavity, the flexible section of the receptacle is cylindrical.
13. The cooling device of any one of claims 11 or 12, wherein the channel circumscribes the longitudinal axis at least along the flexible section of the receptacle.
14. The cooling device of claim 13, wherein the channel is an annulus about the longitudinal axis.
15. The cooling device of any one of claims 9-14, wherein the flexible section of the receptacle includes a plurality of struts along the at least one portion of the cavity, the plurality of struts flexible in response to changes in pressure in the channel to move the flexible section in a radial dimension between the expanded state and the compressed state.

16. The cooling device of claim 15, wherein each one of the plurality of struts has a thickness, in a radial direction relative to the longitudinal axis, of greater than about 25.4 microns along the at least one portion of the cavity.

17. The cooling device of any one of claims 15 or 16, wherein each one of the plurality of struts is elongate along the at least one portion of the cavity.

18. The cooling device of claim 17, wherein a respective longitudinal dimension of each one of the plurality of struts is parallel to the longitudinal axis defined by the flexible section of the receptacle.

19. The cooling device of any one of claims 15-18, wherein, in absence of a pressure difference between the channel and the cavity, the plurality of struts are adjacent to one another such that each one of the plurality of struts and another one of the plurality of the struts define a respective slit therebetween.

20. The cooling device of any one of claims 9-19, wherein the flexible section of the receptacle is continuous along the at least one portion of the cavity, the flexible section of the receptacle is formed of one or more metals along the at least one portion of the cavity, and the flexible section of the receptacle has a thickness, in a radial direction relative to the longitudinal axis, of less than about 25.4 microns along the at least one portion of the cavity.

21. The cooling device of any one of claims 9-19, wherein the receptacle further includes a first end section and a second end section, the flexible section is disposed between the first end section and the second end section, and the first end section and the second end section are each less flexible than the flexible section in response to changes in fluid pressure in the channel.

22. The cooling device of claim 21, the first end section defines a first orifice, the second end section defines a second orifice, the first orifice and the second orifice are in fluid communication with one another via the cavity.

23. The cooling device of claim 22, wherein the longitudinal axis extends through each of the first orifice and the second orifice.
24. The cooling device of any one of claims 1-23, wherein, at a temperature of 100 °C, the membrane is elastically deformable in response to pressure difference between the channel and the at least one portion of the cavity greater than about 2.5 atm and less than about 9 atm.
25. The cooling device of claim 24, wherein the membrane includes one or more elastomeric materials.
26. A method of post-mold processing, the method comprising:
 inserting a body portion of a preform into a cavity defined by a receptacle;
 compressing a flexible section of the receptacle into contact with the body portion of the preform in the cavity;
 cooling the body portion of the preform in contact with the flexible section of the receptacle;
 with the body portion of the preform cooled, expanding the flexible section of the receptacle away from contact with the body portion of the preform to define a clearance therebetween; and
 with the clearance defined between the flexible section of the receptacle and the body portion of the preform, removing the body portion of the preform from the cavity.
27. The method of claim 26, wherein the body portion of the preform is inserted into the cavity with the clearance defined between the flexible section of the receptacle and the body portion of the preform.
28. The method of claim any one of claim 26 or 27, wherein inserting the body portion of the preform into the cavity includes securing a neck portion of the preform in the receptacle with the neck portion of the preform outside of the cavity and the body portion of the preform spaced away from the flexible section of the receptacle in the cavity.
29. The method of claim 28, wherein inserting the body portion of the preform into the cavity includes positioning a closed portion of the preform in contact with the receptacle with the body portion of the preform spaced away from the flexible section of the receptacle.

30. The method of claim 29, wherein inserting the body portion of the preform into the cavity includes applying vacuum pressure along the closed portion of the preform in contact with the receptacle.

31. The method of any one of claims 29 or 30, wherein removing the body portion of the preform from the cavity includes delivering pressurized air into the cavity to move the closed portion of the preform away from contact with the receptacle.

32. The method of any one of claims 26-31, wherein compressing the flexible section of the receptacle into contact with the body portion of the preform in the cavity includes increasing fluid pressure in a channel in mechanical communication with the flexible section.

33. The method of claim 32, wherein increasing fluid pressure in the channel includes directing pressurized air into the channel.

34. The method of any one of claims 32 or 33, wherein increasing fluid pressure in the channel includes forming a pressure difference between the channel and the cavity of greater than about 2.5 atm and less than about 9 atm.

35. The method of any one of claims 32-34, wherein increasing fluid pressure in the channel includes increasing the fluid pressure in the channel according to a step function.

36. The method of any one of claims 32-35, wherein increasing fluid pressure in the channel includes increasing the fluid pressure in the channel according to a continuous function over a predetermined period.

37. The method of any one of claims 32-36, wherein expanding the flexible section of the receptacle away from contact with the body portion of the preform includes decreasing fluid pressure in the channel.

38. The method of claim 37, wherein decreasing fluid pressure in the channel includes interrupting a flow of fluid into the channel.

39. The method of any one of claims 26-38, wherein the flexible section of the receptacle defines a longitudinal axis extending through the cavity, and compressing the flexible section of the receptacle into contact with the body portion of the preform in the cavity includes decreasing a radial dimension of the flexible section of the receptacle from an expanded state to a compressed state.

40. The method of claim 39, wherein the preform is formed of polyethylene terephthalate (PET), cooling the body portion of the preform shrinks the body portion of the preform in the radial dimension, and compressing the flexible section of the receptacle includes reducing the radial dimension of the flexible section of the receptacle by more than 50 percent of shrinkage, in the radial dimension, associated with cooling the body portion of the preform.

41. The method of any one of claims 39 or 40, wherein expanding the flexible section of the receptacle includes increasing the radial dimension of the flexible section of the receptacle to move the flexible section of the receptacle from the compressed state to the expanded state, out of contact with the body portion of the preform.

42. The method of any one of claims 26-41, wherein cooling the body portion of the preform in contact with the flexible section of the receptacle includes moving a coolant through a cooling circuit fluidically isolated from the cavity and in thermal communication with the body portion of the preform in the cavity.

43. The method of claim 42, wherein the coolant in the cooling circuit has a maximum pressure of between about 4 atm and about 9 atm.

44. The method of any one of claims 42 or 43, wherein the coolant is water.

45. The method of any one of claims 26-44, further comprising receiving a feedback signal indicative of a temperature of the body portion of the preform in the cavity, wherein expanding the

flexible section of the receptacle away from the body portion of the preform is based on comparison of the temperature of the body portion to a predetermined target temperature.

46. A system for post-mold processing, the system comprising:

an end-of-arm tool including one or more instances of the cooling device of any one of claims 1-25;

a robot coupled to the end-of-arm tool, the robot operable to move one or more preforms into a respective instance of the cooling device; and

a controller in electrical communication with the robot and the cooling device, the controller including one or more processors and one or more non-transitory, computer-readable storage media, the one or more non-transitory, computer-readable storage media having stored thereon instructions for causing the one or more processors to carry out operations according to the method of any one of claims 26-45.