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(54) **PRESSURIZED TUBE SEALING FOR CONTAINERS**

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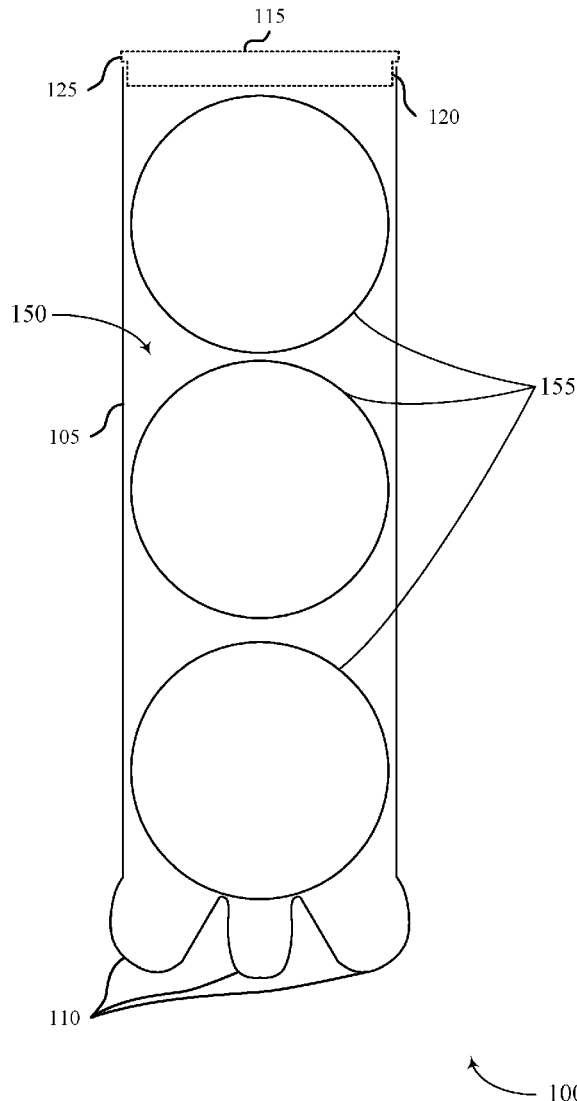
B65D 77/20 (2006.01)

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(57)

ABSTRACT

A sealed plastic container having an airtight chamber. The container includes an elongated body portion having at least one opening and at least one enclosure portion welded to the opening of the body portion, thereby hermetically sealing the chamber. The chamber may have a pressure above atmospheric pressure. The enclosure portion and the body portion may be biodegradable.



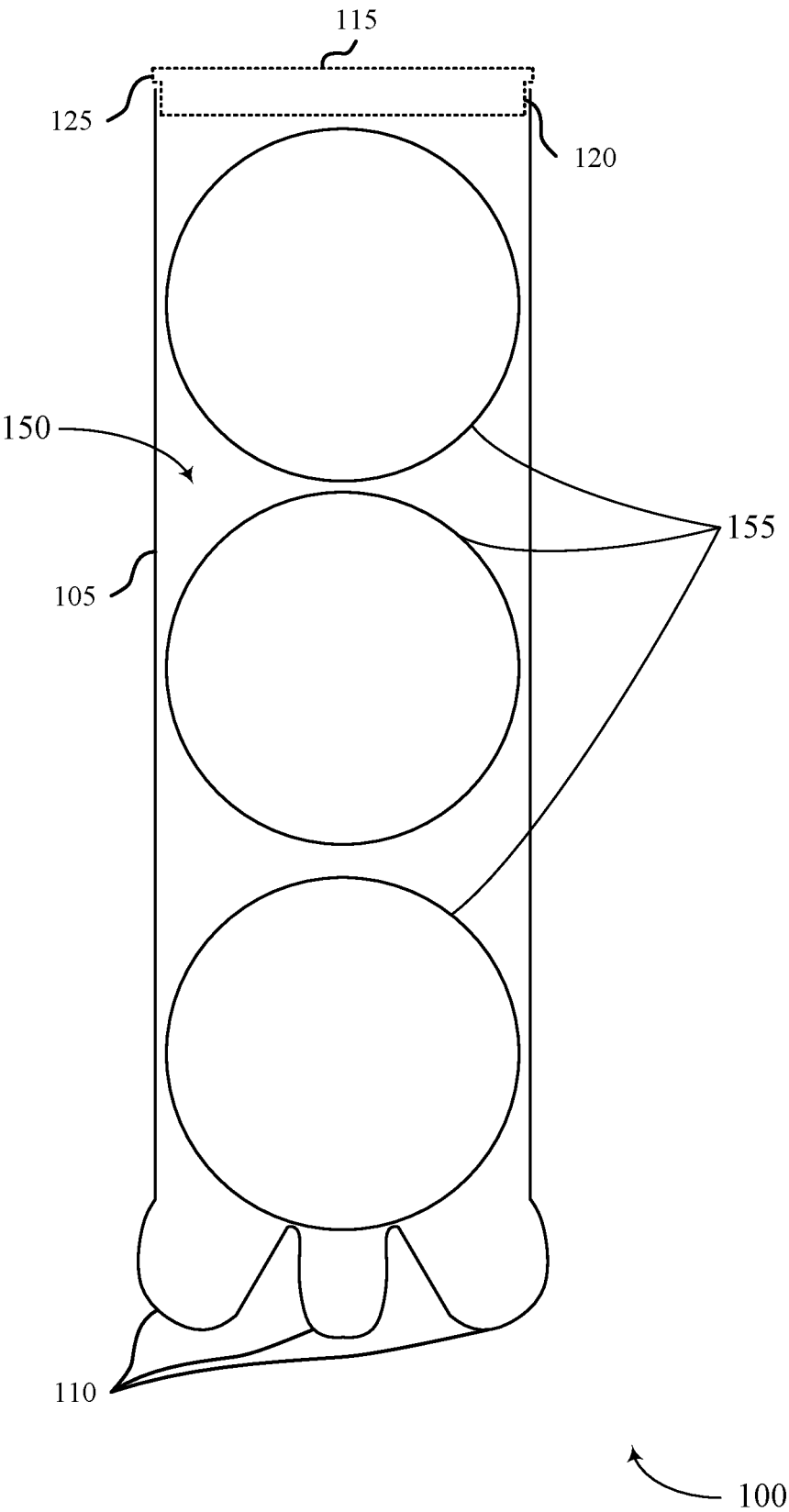


FIG. 1

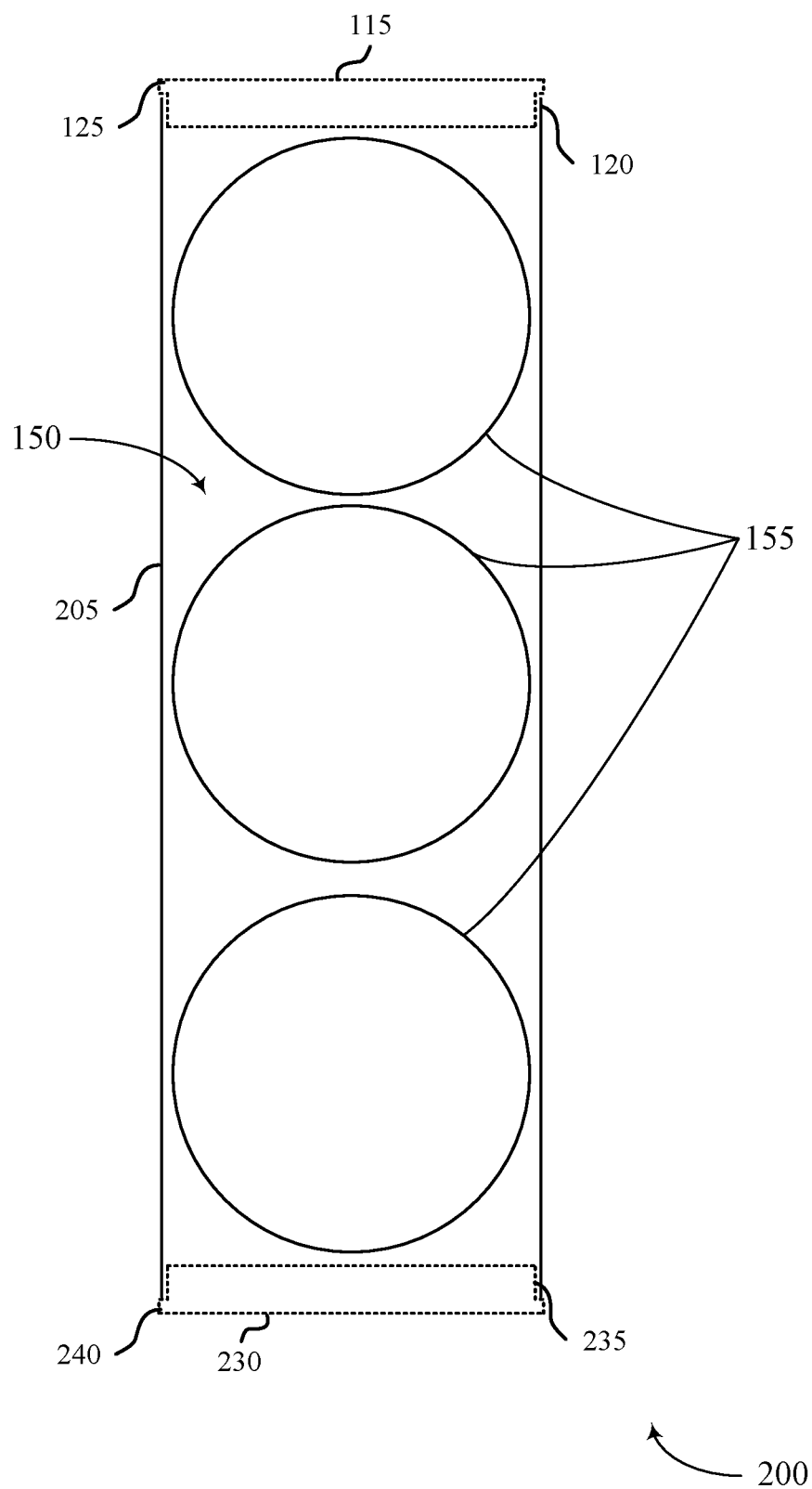


FIG. 2

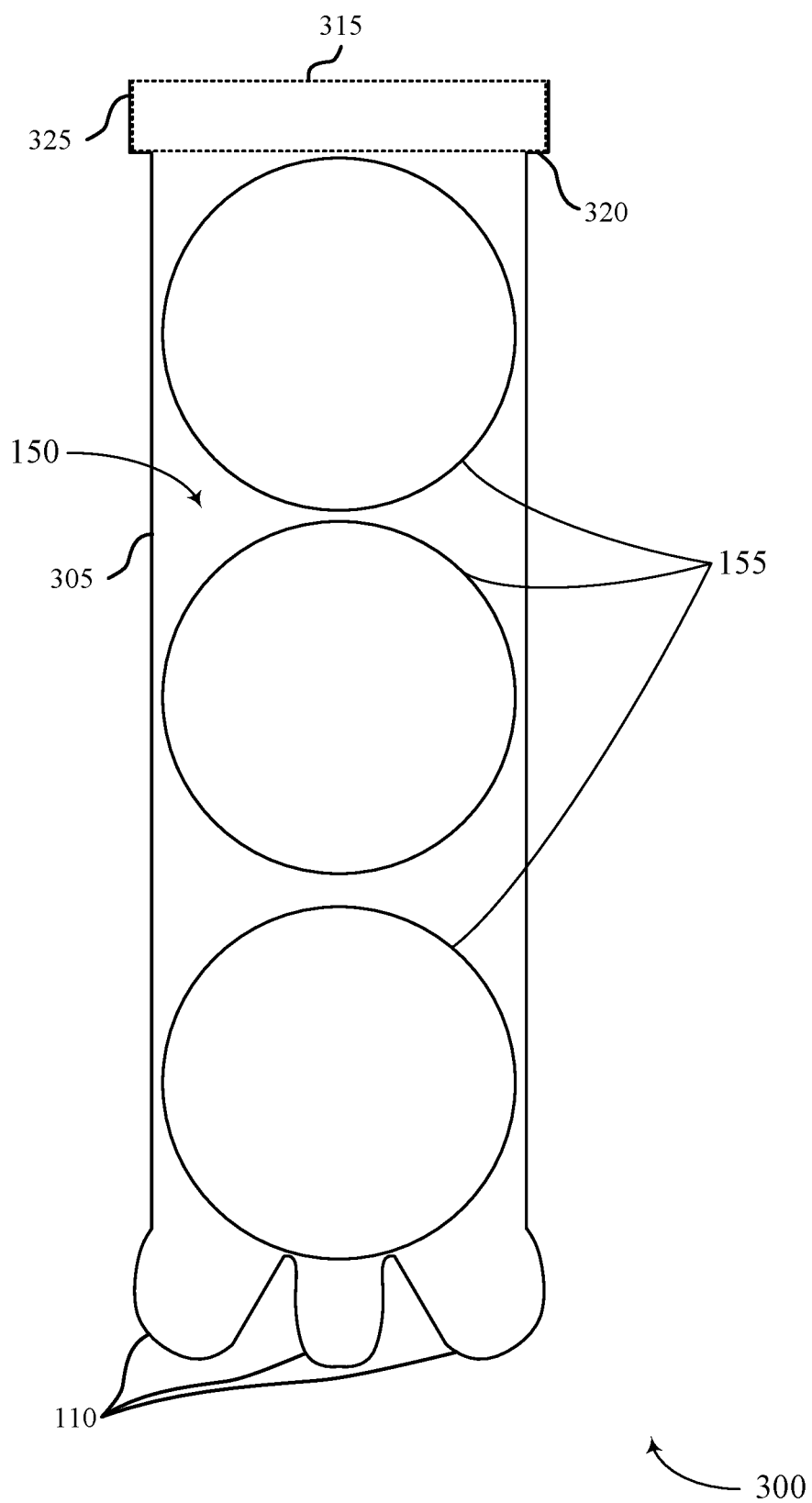


FIG. 3

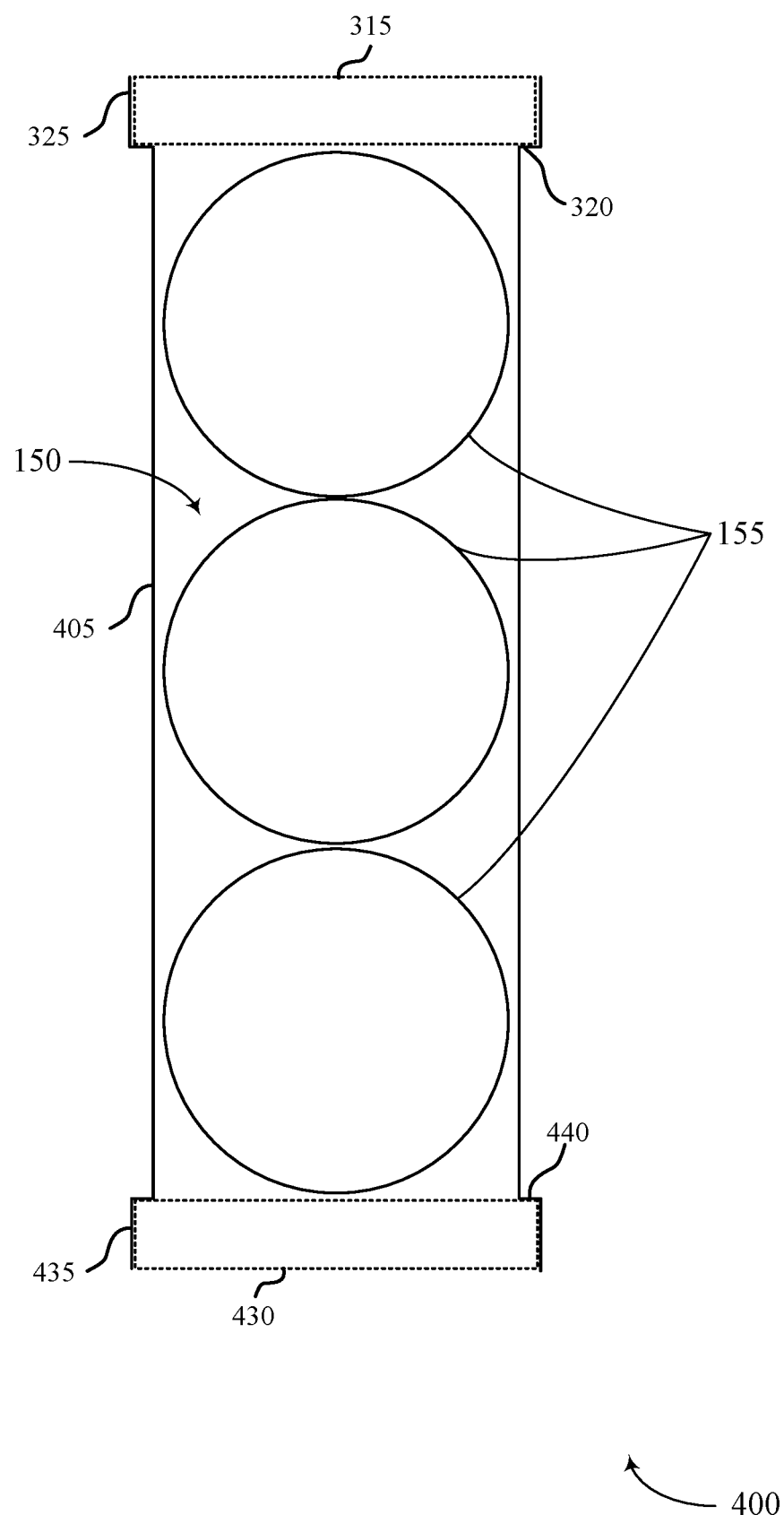


FIG. 4

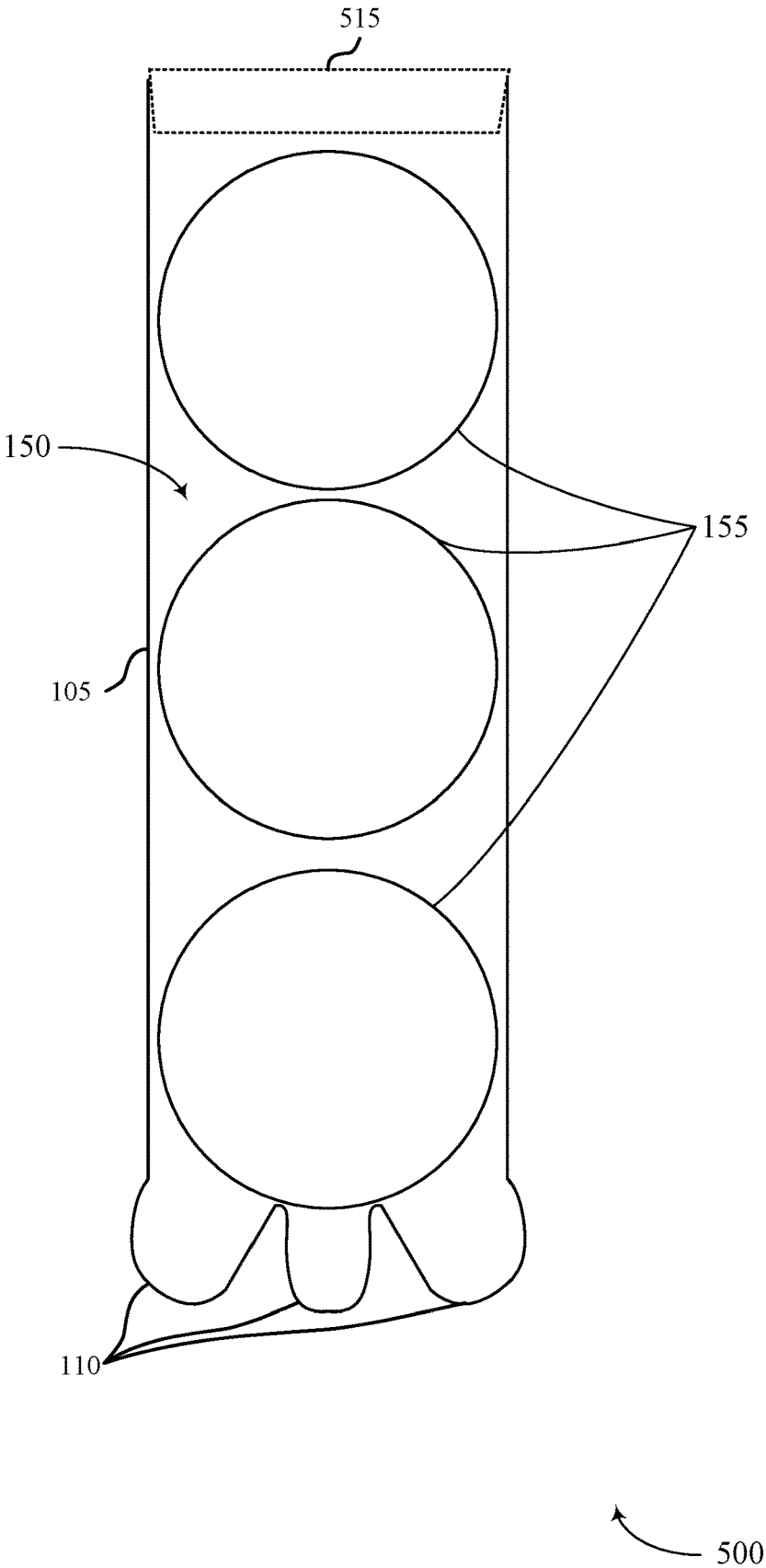


FIG. 5

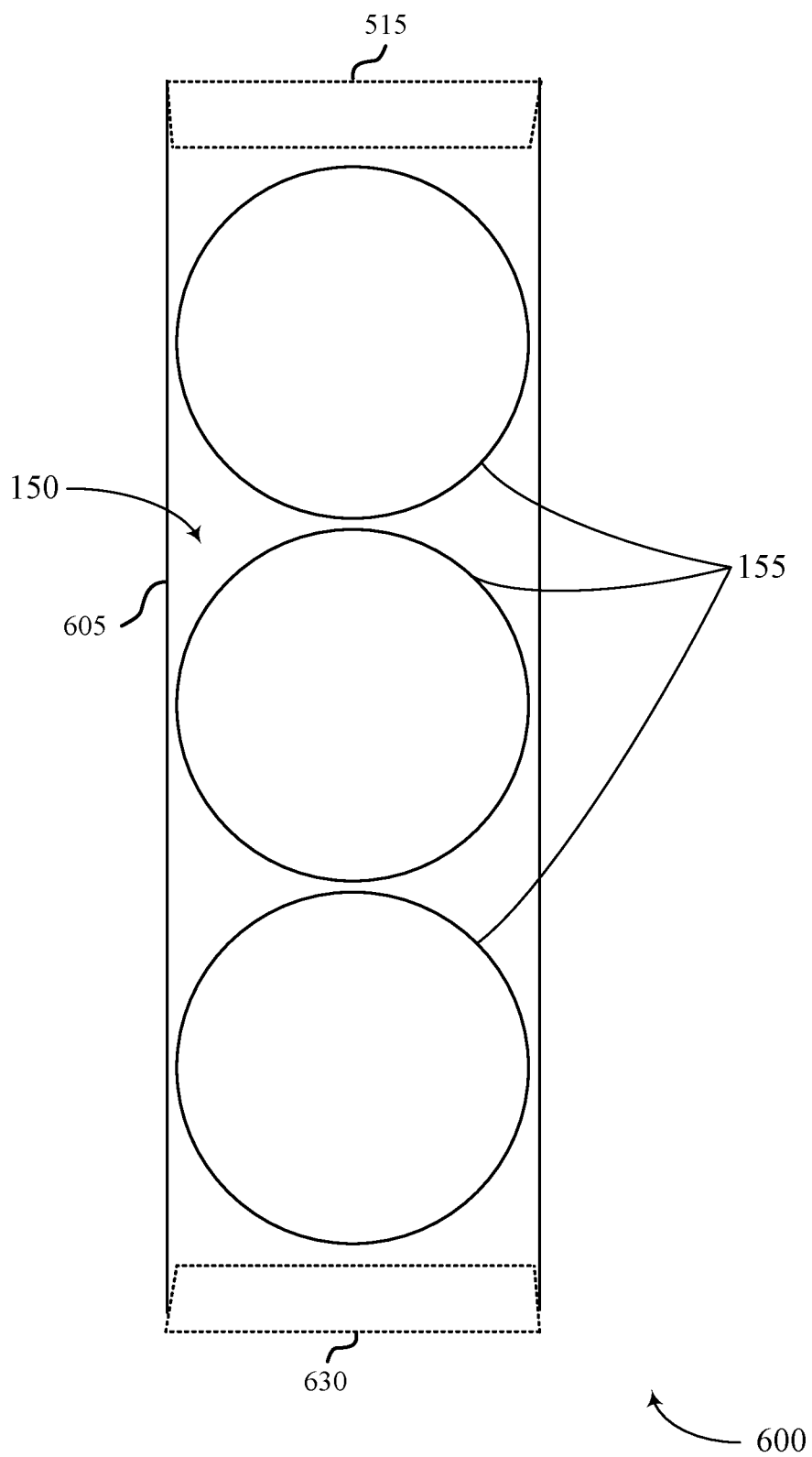


FIG. 6

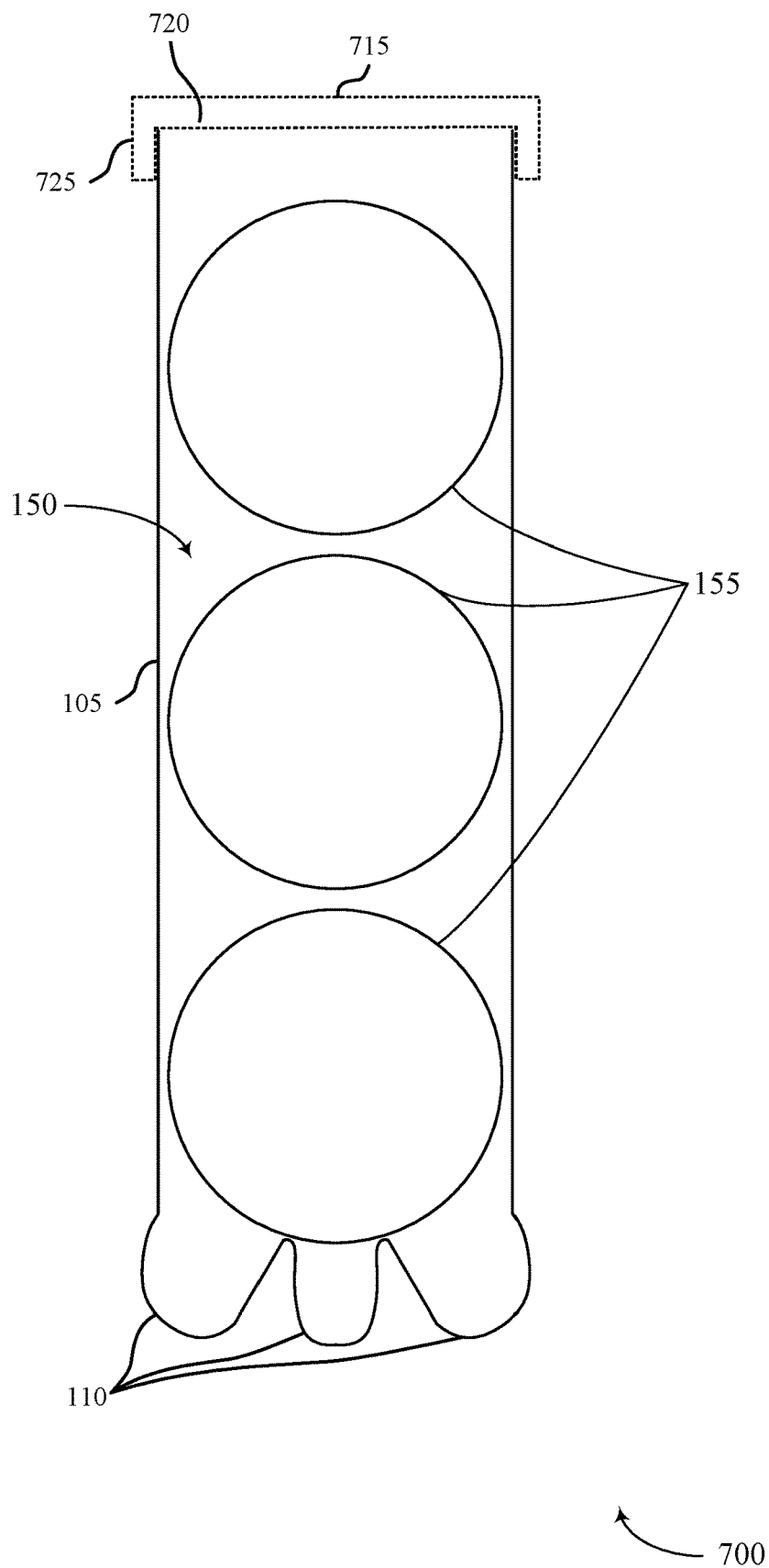


FIG. 7

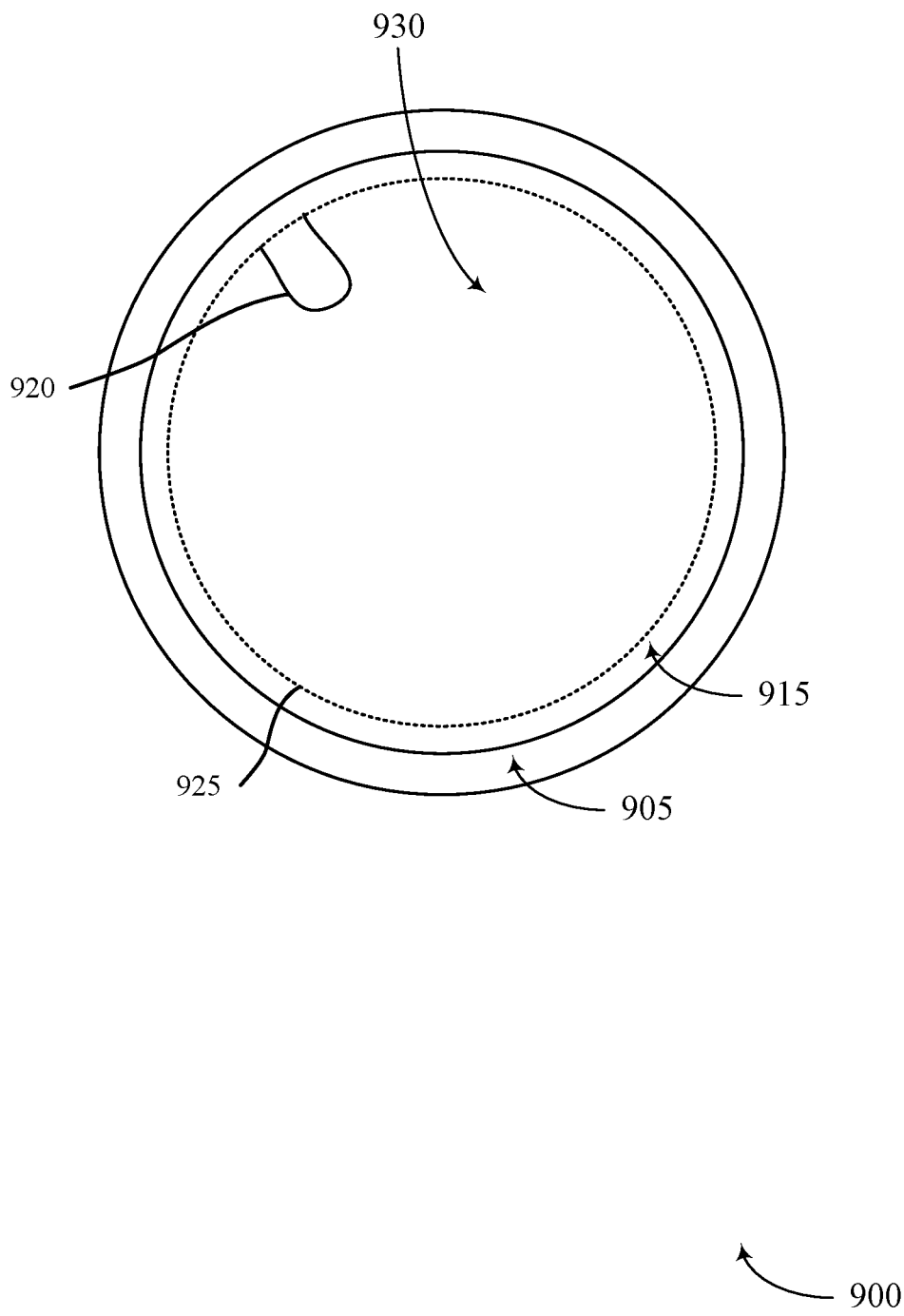


FIG. 9

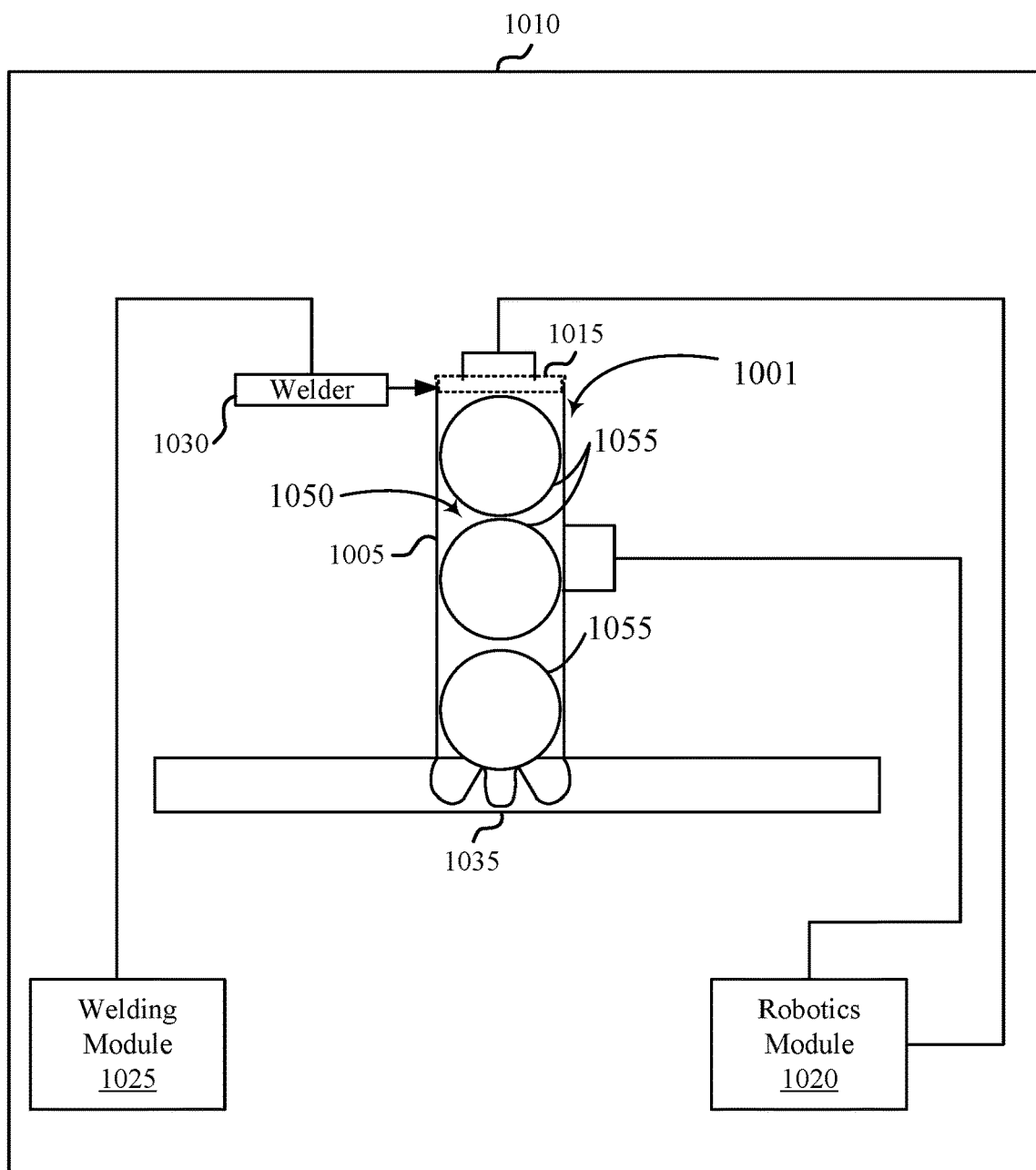
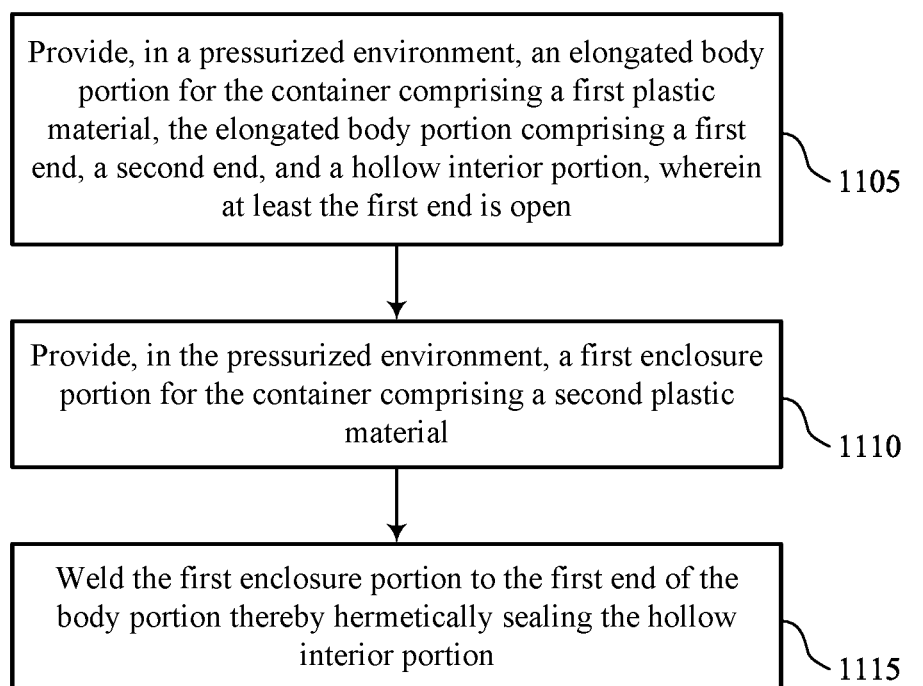


FIG. 10



1100

FIG. 11

PRESSURIZED TUBE SEALING FOR CONTAINERS

CROSS REFERENCE

[0001] The present Application for Patent claims the benefit of U.S. Provisional Patent Application No. 63/246,138 by Bodam et al., entitled "Pressurized Tube Sealing for Containers," filed Sep. 20, 2021, and expressly incorporated by reference herein.

FIELD OF TECHNOLOGY

[0002] The present disclosure relates generally to containers, and more specifically to pressurized sealed containers.

BACKGROUND

[0003] Plastic containers are commonly used for many products, including solid, semi-solid, and liquid items such as food, beverages, consumer products, sports equipment, lotions, chemicals, and the like. Plastic containers generate waste in the form of plastic, which may be non-biodegradable. Additionally, some plastic containers may contain objects under a pressure greater than normal atmospheric conditions. Some plastic containers may additionally include non-plastic components, such as lids made of materials such as aluminum alloys or other metal alloys, which non-plastic components may also be non-biodegradable.

SUMMARY

[0004] The systems, methods and devices of this disclosure each have several innovative aspects, no single one of which is solely responsible for the desirable attributes disclosed herein.

[0005] The described techniques relate to improved devices, apparatuses, methods, and systems, that support sealing for containers, including pressurized containers. Generally, the described techniques provide for a container including a body portion and one or more enclosure portions. The container includes a hollow interior chamber that is hermetically sealed by the enclosure portion(s) being welded to the body portion.

[0006] A container is described. The container may include an elongated body portion comprising a first plastic material, the elongated body portion having a first end and a second end, at least the first end being open, a first enclosure portion comprising a second plastic material that is welded to the body portion at the first end, and a hollow interior chamber which is hermetically sealed by the body portion being welded to the first enclosure portion, wherein the hollow interior chamber has an interior pressure that is greater than atmospheric pressure.

[0007] In some examples of the container described herein, the body portion may be cylindrical.

[0008] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the first plastic material may be transmissive of laser energy and the second plastic material may be absorptive of laser energy.

[0009] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the

first plastic material may be absorptive of laser energy and the second plastic material may be transmissive of laser energy.

[0010] In some examples of the container described herein, the elongated body portion may include operations, features, means, or instructions for a ledge extending around a first perimeter of the body portion proximate to the first end and a lip extending from the ledge around a second outer perimeter of the ledge to the first end, and wherein the first enclosure portion abuts the ledge and may be circumferentially surrounded by the lip.

[0011] In some examples of the container described herein, the first enclosure portion comprises a bottom planar surface and a top planar surface, a ring extends from the bottom planar surface, and an interior perimeter of the body portion surrounds and abuts an outer perimeter of the ring.

[0012] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the first plastic material may be transmissive of laser energy and the second plastic material may be absorptive of laser energy.

[0013] In some examples of the container described herein, the first plastic material may be transparent and the second plastic material may be black.

[0014] In some examples of the container described herein, the first plastic material and the second plastic material may be transparent.

[0015] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the laser plastic welding process comprises a clear-on-clear laser plastic welding process.

[0016] In some examples of the container described herein, a laser wavelength of the clear-on-clear laser plastic welding process may be a near infrared wavelength.

[0017] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the laser plastic welding process comprises a through transmission laser welding process.

[0018] In some examples of the container described herein, a laser wavelength of the through transmission laser welding process may be between 380 nanometers and 2500 nanometers.

[0019] In some examples of the container described herein, the first enclosure portion comprises a bottom planar surface and a top planar surface, a lip extends around a first perimeter of the bottom planar surface, and the lip surrounds and abuts a second perimeter of the first end of the body portion.

[0020] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to a laser plastic welding process and the first plastic material may be transmissive of laser energy and the second plastic material may be absorptive of laser energy.

[0021] In some examples of the container described herein, the first plastic material may be a first biodegradable plastic material and the second plastic material may be a second biodegradable plastic material.

[0022] In some examples of the container described herein, the first plastic material may be a biodegradable polyethylene terephthalate.

[0023] In some examples of the container described herein, the second end of the body portion may be opposite the first end of the body portion and comprises a plurality of legs.

[0024] In some examples of the container described herein, the interior pressure may be greater than 12 pounds per square inch above standard atmospheric pressure.

[0025] In some examples of the container described herein, at least a part of the first enclosure portion may be configured to be removed from the body portion via application of a pulling force to the pull tab.

[0026] In some examples of the container described herein, the first enclosure portion may be welded to the body portion according to one of a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a friction welding process, a radio frequency welding process, an infrared welding process, or a solvent bonding process.

[0027] A method for manufacturing a pressurized container is described. The method may include providing, in a pressurized environment, an elongated body portion for the container comprising a first plastic material, the elongated body portion comprising a first end, a second end, and a hollow interior portion, wherein at least the first end is open, providing, in the pressurized environment, a first enclosure portion for the container comprising a second plastic material, and welding the first enclosure portion to the first end of the body portion thereby hermetically sealing the hollow interior portion.

[0028] Some examples of the method described herein may further include operations, features, means, or instructions for placing a plurality of pressurized balls inside of the hollow body portion prior to welding the first enclosure portion to the body portion.

[0029] In some examples of the method described herein, press fitting the first enclosure portion into the body portion such that an outer perimeter of the body portion surrounds an outer perimeter of the first enclosure portion.

[0030] Some examples of the method described herein may further include operations, features, means, or instructions for welding the first enclosure portion to the first end of the body portion comprising applying one of a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a friction welding process, or a radio frequency welding process.

[0031] In some examples of the method described herein, welding the first enclosure portion to the first end of the body portion comprises applying a clear-on-clear laser plastic welding process.

[0032] Some examples of the method described herein may further include operations, features, means, or instructions for welding the first enclosure portion to the first end of the body portion comprising applying a through transmission laser welding process

[0034] FIG. 2 illustrates a cross-sectional view of an example of a container including enclosure portions that are welded to the body portion of the container at both ends of the container in accordance with aspects of the present disclosure.

[0035] FIG. 3 illustrates a cross-sectional view of another example of a container including an enclosure portion that is welded to the body portion of the container at one end of the container in accordance with aspects of the present disclosure.

[0036] FIG. 4 illustrates a cross-sectional view of another example of a container including enclosure portions that are welded to the body portion of the container at both ends of the container in accordance with aspects of the present disclosure.

[0037] FIG. 5 illustrates a cross-sectional view of another example of a container including an enclosure portion that is welded to the body portion of the container at one end of the container in accordance with aspects of the present disclosure.

[0038] FIG. 6 illustrates a cross-sectional view of another example of a container including enclosure portions that are welded to the body portion of the container at both ends of the container in accordance with aspects of the present disclosure.

[0039] FIG. 7 illustrates a cross-sectional view of another example of a container including an enclosure portion that is welded to the body portion of the container at one end of the container in accordance with aspects of the present disclosure.

[0040] FIG. 8 illustrates a cross-sectional view of another example of a container including enclosure portions that are welded to the body portion of the container at both ends of the container in accordance with aspects of the present disclosure.

[0041] FIG. 9 illustrates an example of an enclosure portion for a container in accordance with aspects of the present disclosure.

[0042] FIG. 10 illustrates an example of a diagram of a manufacturing system that supports pressurized sealing for containers in accordance with aspects of the present disclosure.

[0043] FIG. 11 show a flowchart illustrating a method that support pressurized sealing for containers in accordance with aspects of the present disclosure.

DETAILED DESCRIPTION

[0044] Plastic containers are commonly used for many products, as plastic containers are generally lightweight, can be molded easily at low cost, and may be used in various industries, such as the beverage industry, food industry, consumer products industry, and sports equipment industry. Plastic containers may include a pressurized chamber, and accordingly the chamber may be airtight. Conventionally, plastic containers may be air sealed via mechanical means, such as screw threads and liners as in soft drink bottle caps, or via chemically adhesive bonds. Some pressurized plastic containers may include a metal lid, for example an aluminum lid, which may be bonded to the plastic container via an adhesive. An example of such a container may be a conventional tennis ball container. Pressurized plastic containers sealed via mechanical or chemically adhesive bonding, however, may lose pressure over time. Plastic containers may generate waste in the form of plastic, which may be

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] FIG. 1 illustrates a cross-sectional view of an example of a sealed container including an enclosure portion that is welded to the body portion of the container at one end of the container in accordance with aspects of the present disclosure.

non-biodegradable. Some plastics, however, may be biodegradable. For example, biodegradable plastic may be made of bioplastics, where the components are derived from renewable raw materials, or plastics made from petrochemicals with biodegradable additives that enhance the biodegradation of the polymers by allowing microorganisms to utilize the carbon within the polymer chain as a source of energy. Examples of biodegradable additives include starches, certain microbial strains, and pro-oxidant additives (e.g., iron, manganese, and cobalt). However, the metal lids of some plastic containers are not biodegradable even if the body of the plastic containers are biodegradable, and thus metal lids may generate waste even if the plastic container is biodegradable.

[0045] A plastic container may include a plastic body portion having at least one open end, and at least one plastic lid or plastic enclosure portion which is welded to the body portion at the open end. The welding of the plastic lid to the plastic body portion may cause the lid and the body portion to fuse together, resulting in a strong and durable joint. The container may include a hollow interior chamber which is hermetically sealed by the enclosure portion being welded to the body portion. The hollow interior chamber may have an interior pressure that is greater than atmospheric pressure (e.g., 12 or more pounds per square inch (“psi”)), and the container may hold the interior pressure for several years. One or more objects, including pressurized objects such as tennis balls, racquet balls, and/or carbonated liquid may be placed inside of the pressurized hollow interior chamber prior to the lid being welded to the body. The plastic body portion and the plastic enclosure portion may both be made of biodegradable plastic (e.g., plastics treated with biodegradable additives), and thus the entire container may be biodegradable.

[0046] Aspects of the disclosure are initially described in the context of sealed containers. Examples of sealed containers and methods of manufacturing containers are described. Aspects of the disclosure are further illustrated by and described with reference to apparatus diagrams, system diagrams, and flowcharts that relate to sealed containers.

[0047] This description provides examples, and is not intended to limit the scope, applicability or configuration of the principles described herein. Rather, the ensuing description will provide those skilled in the art with an enabling description for implementing various aspects of the principles described herein. As can be understood by one skilled in the art, various changes may be made in the function and arrangement of elements without departing from the application.

[0048] FIG. 1 is a cross-sectional view of an example container 100 in accordance with aspects of the current disclosure. The container 100 may include an elongated body portion 105 having an opening and an enclosure portion (e.g., a lid) 115 welded to the body portion 105 at the opening. The body portion 105 and the enclosure portion 115 may both be plastic (e.g., made of polymers). In some examples, the body portion 105 and the enclosure portion 115 may both be biodegradable plastics (e.g., both the body portion 105 and the enclosure portion 115 may include biodegradable additives). For example, one or both of the body portion 105 and/or the enclosure portion 115 may be made of a biodegradable polyethylene terephthalate material. In some examples, the body portion 105 may have a cylindrical shape, and the enclosure portion 115 may have a

generally circular shape (e.g., when viewed from the top or bottom of the enclosure portion 115). In some examples, the body portion 105 and the enclosure portion 115 may have other shapes (e.g., square, rectangular, oval). The container 100 may include a plurality of legs 110 at an end that is opposite the enclosure portion 115 or any other feature or shape that enhances the stability of the container 100 when standing upright.

[0049] The enclosure portion 115 may include a smaller radius portion 120 (bottom portion) and a larger radius portion 125 (top portion). The smaller radius portion 120 may extend into the body portion 105 (e.g., be surrounded by a perimeter of the body portion), and the larger radius portion 125 may extend beyond the smaller radius portion 120 (e.g., the radius of the larger radius portion 125 may be greater than the radius of the smaller radius portion 120). During a manufacturing process for the container 100, the enclosure portion 115 may be press fit into the body portion 105 (e.g., the smaller radius portion 120 may be pressed into the interior portion of the body portion 105), and the larger radius portion 125 hitting the top perimeter of the body portion 105 may prevent the enclosure portion 115 from being pressed further into the body portion 105. Thus, the larger radius of the larger radius portion 125 may provide a stopping point for the press fitting process.

[0050] During manufacturing of the container 100, the enclosure portion 115 may be welded to the body portion 105 around the entire perimeter of the enclosure portion 115 and the body portion 105. The enclosure portion 115 may be welded to the body portion 105 according to any plastic welding process. For example, the enclosure portion 115 may be welded to the body portion 105 according to a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a friction welding process, a radio frequency welding process, an infrared welding process, or a solvent bonding process.

[0051] In some examples, the enclosure portion 115 may be welded to the body portion 105 according to a laser plastic welding process. For example, during a manufacturing process, a laser may be applied to the joint between the bottom portion 120 of the enclosure portion 115 and the body portion 105. Application of the laser provides electromagnetic energy, which is converted to heat when it is absorbed by the plastic materials, which melts the plastic materials of the enclosure portion 115 and the body portion 105, thereby fusing the materials of the enclosure portion 115 and the body portion 105. In some examples, the laser welding process may be a through transmission laser welding process. For example, the enclosure portion 115 may be made of a material that is absorptive of laser energy, and the body portion 105 may be made of a material that is transmissive of laser energy. For example, the enclosure portion 115 may include carbon black (or have a black color) that may be absorptive of laser energy, and the body portion 105 may be transparent or translucent. In some examples, the enclosure portion 115 may include another colorant or additive other than black which may be absorptive of laser energy and the body portion 105 may be transparent or translucent (e.g., transmissive of laser energy). In some examples, a wavelength of the laser energy applied may be between approximately 380 and 2500 nanometers. In some examples, both the enclosure portion 115 and the body portion 105 may be transparent or translucent. For example,

the enclosure portion 115 may be welded to the body portion 105 via a clear-on-clear laser plastic welding process. For example, the enclosure portion 115 and/or the body portion 105 may include Clearweld® plastic additive, which may enable the enclosure portion 115 and/or the body portion to be absorptive of laser energy. A clear-on-clear laser plastic welding process may use a laser wavelength that has a near infrared wavelength. In some examples, a clear-on-clear welding process may use a laser wavelength of approximately 2000 nanometers.

[0052] The container 100 may include a hollow interior chamber 150, which may be airtight via the welding of the top enclosure portion 115 to the body portion 105. In some examples, the hollow interior chamber 150 may have a pressure that is greater than standard atmospheric pressure (i.e., 14.696 psi). In some examples, the hollow interior chamber 150 may have a pressure of approximately 12 psi, 14 psi, or 17 psi above standard atmospheric pressure. In some examples, the hollow interior chamber 150 may have a pressure between approximately 27 and 29 psi above standard atmospheric pressure.

[0053] In some examples, one or more objects, such as sports balls 155 (e.g., tennis balls or racquet balls) may be placed in the hollow interior chamber 150 prior to welding the enclosure portion 115 to the body portion 105. For example, pressurized tennis balls may have an interior pressure of approximately 12 to 14 psi above standard atmospheric pressure.

[0054] The hollow interior chamber 150 may be pressurized to a pressure approximately the same as the interior pressure of a pressurized tennis ball (e.g., 12-14 psi above standard atmospheric pressure), and then one or more tennis balls may be placed in the chamber 150 prior to welding the enclosure portion 115 to the body portion 105. Accordingly, the pressure inside the tennis balls may be maintained by the pressure of the chamber 150.

[0055] FIG. 2 illustrates a cross-sectional view of an example of a container 200 including enclosure portions 115 and 230 that are welded to the body portion 205 of the container 200 at openings of the body portion 205 in accordance with aspects of the present disclosure. As illustrated, the container 200 is similar to the container 100 of FIG. 1, but the second end of the body portion 205 has a second opening at which a second, bottom, enclosure portion 230 (which may be substantially identical to the first, top, enclosure portion 115) is welded to the body portion 205. Accordingly, for the container 200, the chamber 150 may be air-tight once the first, top, enclosure portion 115 and the second, bottom, enclosure portion 230 are welded to the body portion 205.

[0056] Similar to the top enclosure portion 115, the bottom enclosure portion may include a smaller radius portion 235 and a larger radius portion 240. The smaller radius portion 235 may extend into the body portion 205 (e.g., be surrounded by a perimeter of the body portion), and the larger radius portion 240 may extend beyond the smaller radius portion 235 (e.g., the radius of the larger radius portion 240 may be greater than the radius of the smaller radius portion 235). During a manufacturing process for the container 100, the enclosure portion 230 may be press fit into the body portion 205 (e.g., the smaller radius portion 235 may be pressed into the interior portion of the body portion 205), and the larger radius portion 240 hitting the top perimeter of the body portion 205 may prevent the enclosure portion 230

from being pressed further into the body portion 205. Thus, the larger radius of the larger radius portion 240 may provide a stopping point for the press fitting process. The example container 200 may provide for a slightly more compact container design as compared to contain 100 having the legs (e.g., a shorter container holding the same number of balls or contents), and the container 200 may require less plastic material than the contain 100. These advantages may result in cost savings associated with shipping (e.g., due to the smaller size when multiple containers 200 are stacked) and/or cost savings associated with manufacturing (e.g., due to the less material being used per container 200).

[0057] FIG. 3 illustrates a cross-sectional view of another example of a container 300 including an enclosure portion 315 that is welded to the body portion 305 of the container 300 at one end of the container 300 in accordance with aspects of the present disclosure. As illustrated, the container 300 is similar to the container 100 of FIG. 1, but the body portion 305 includes a ledge 320 and a lip 325 extending upwardly from the ledge 320. As illustrated, the enclosure portion 315 may be pressed into the body portion 305 and rest upon the ledge 320. A perimeter of the enclosure portion 315 may be surrounded by an inner perimeter of the lip 325, and the enclosure portion 315 may be welded to the lip 325 along the perimeters of the lip 325 and the enclosure portion 315.

[0058] FIG. 4 illustrates a cross-sectional view of an example of a container 400 including enclosure portions 315 and 430 that are welded to the body portion 405 of the container 400 in accordance with aspects of the present disclosure. As illustrated, the container 400 is similar to the container 300 of FIG. 3, but the second end of the body portion 405 has a second opening at which a second, bottom, enclosure portion 430 (which may be substantially identical to the first, top, enclosure portion 315), is welded to the body portion 405. The body portion 405 may include a second ledge 440 and a second lip 435. As illustrated, the bottom enclosure portion 430 may be pressed into the body portion 405 and rest upon the second ledge 440. A perimeter of the enclosure portion 430 may be surrounded by an inner perimeter of the second lip 435, and the bottom enclosure portion 430 may be welded to the second lip 435 along the perimeters of the second lip 435 and the bottom enclosure portion 430.

[0059] FIG. 5 illustrates a cross-sectional view of another example of a container 500 including an enclosure portion 515 that is welded to the body portion 105 of the container 500 at one end of the container 500 in accordance with aspects of the present disclosure. As illustrated, the container 500 is similar to the container 100 of FIG. 1, except the enclosure portion 515 has a tapered shape. The enclosure portion 515 may be press fit into the body portion 105 of the container 500 prior to welding the enclosure portion 515 to the body portion 105, and the friction caused by the tapered shape of the enclosure portion 515 being pressed into the body portion 105 may provide a stop point during the press fitting process.

[0060] For example, the top of the enclosure portion 515 may be approximately flush with the top of the body portion 105 after the enclosure portion 515 is pressed into the body portion 105. After the enclosure portion 515 is press fit into the body, the enclosure portion 515 may be welded to the body portion 105, similarly to the container 100 of FIG. 1.

[0061] FIG. 6 illustrates a cross-sectional view of an example of a container 600 including enclosure portions 515 and 630 that are welded to the body portion 205 of the container 600 in accordance with aspects of the present disclosure. As illustrated, the body portion 205 of the container 600 may be the same as the body portion 205 of the container 200 of FIG. 2, and the container 600 is similar to the container 500 of FIG. 5, but the second end of the body portion 205 has a second opening at which a second, bottom, enclosure portion 630 (which may be substantially identical to the first, top, enclosure portion 515) is welded to the body portion 205.

[0062] FIG. 7 illustrates a cross-sectional view of another example of a container 700 including an enclosure portion 715 that is welded to the body portion 105 of the container 700 at one end of the container 700 in accordance with aspects of the present disclosure. As illustrated, the body portion 105 may be the same as the body portion 105 of the container 100 of FIG. 1. The enclosure portion 715 may include an approximately flat surface 720 and a lip 725 extending from the flat surface 720 around a perimeter of the flat surface 720. The enclosure portion 715 may be placed on the body portion 105 such that the lip 725 surrounds the perimeter of the body portion 105.

[0063] In some examples, the enclosure portion 715 may be laser welded to the body portion 105 via a through transmission laser welding process. For example, during a manufacturing process of the container, a laser may be applied to the joint between the lip 725 and the body portion 105. Application of the laser provides heat, which melts the plastic materials of the enclosure portion 715 and the body portion 105, thereby fusing the materials of the enclosure portion 715 and the body portion 105. In some examples, the enclosure portion 715 may be made of a material that is transmissive of laser energy, and the body portion 105 may be made of a material that is absorptive of laser energy. For example, the body portion 105 may include plastic additives and/or colorants that may be absorptive of laser energy (e.g., or a black color or other colors), and enclosure portion 715 may be transparent or translucent and/or transmissive of laser energy. For example, the enclosure portion 715 may be transmissive of laser energy with a centered output wavelength between 380 nanometers and 2500 nanometers, and the body portion 105 may be absorptive of laser energy with a centered output wavelength between 380 nanometers and 2500 nanometers. In some examples, the laser energy may be provided by a continuous wave laser. In some examples, the laser energy may be provided by a Q-switched (i.e., giant pulse formation or Q-spoiling) laser. In some examples, both the enclosure portion 715 and the body portion 105 may be (transparent or translucent). For example, the enclosure portion 715 may be welded to the body portion 105 via a clear-on-clear laser plastic welding process.

[0064] In some examples, an inner portion of the lip 725 may include screw threads that are compatible with screw threads on the top outer portion of the body portion 105. The enclosure portion 715 may screw onto the body portion 105 via the compatible screw threads of the lip 725 and body portion 105 before being laser welded together. The enclosure portion 715 may be removed from the body portion 105 by unscrewing the enclosure portion 715 from the body portion 105.

[0065] FIG. 8 illustrates a cross-sectional view of an example of a container 800 including enclosure portions 715

and 830 that are welded to the body portion 205 of the container 800 in accordance with aspects of the present disclosure. As illustrated, the body portion 205 of the container 800 may be the same as the body portion 205 of the container 200 of FIG. 2, and the container 800 is similar to the container 700 of FIG. 7, but the second end of the body portion 205 has a second opening at which a second, bottom, enclosure portion 830 (which may be substantially identical to the first, top, enclosure portion 715) is welded to the body portion 205. The second enclosure portion 830, similarly to the first enclosure portion 715, may include an approximately flat surface 835 and a lip 840 extending from the flat surface 835 around a perimeter of the flat surface 835. The enclosure portion 830 may be placed on the body portion 105 such that the lip 840 surrounds the perimeter of the body portion 205.

[0066] In some examples, an inner portion of the lip 725 may include screw threads that are compatible with screw threads on the top outer portion of the body portion 105. The enclosure portion 715 may screw onto the body portion 205 via the compatible screw threads of the lip 725 and body portion 205 before being laser welded together. The enclosure portion 715 may be removed from the body portion 205 by unscrewing the enclosure portion 715 from the body portion 205.

[0067] In some examples, an inner portion of the lip 840 may include screw threads that are compatible with screw threads on the bottom outer portion of the body portion 205. The enclosure portion 830 may screw onto the body portion 205 via the compatible screw threads of the lip 840 and body portion 205 before being laser welded together. The enclosure portion 830 may be removed from the body portion 205 by unscrewing the enclosure portion 830 from the body portion 205.

[0068] FIG. 9 illustrates a top view of an example of a container 900 in accordance with aspects of the present disclosure. The container 900, which may for example be the same as container 100 of FIG. 1, includes a body portion 905 and an enclosure portion 915. The enclosure portion 915 may include a peel tab 920, which a user may grasp and pull in order to open the container 900. The peel tab 920 may be connected to a weakened line 925 that is configured to break upon the application of a pulling force to the peel tab 920 and thereby remove an opening portion 930 from the enclosure portion 915. Removal of the opening portion 930 via application of a pulling force to the peel tab 920 allows a user to access the chamber of the container (e.g., the chamber 150 of container 100 of FIG. 1).

[0069] FIG. 10 illustrates a block diagram of an example manufacturing system 1000 for manufacturing a container 1001, for example any of the containers 100-800 as described with respect to FIGS. 1-8. The manufacturing system 1000 may include a pressurized chamber 1010. In some examples, the chamber 1010 may have a pressure of approximately 27-29 psi. The manufacturing system 1000 may include a robotics module 1020 and a welding module 1025. The robotics module may deliver a body portion 1005 of the container 1001 and an enclosure portion 1015 of the container to a staging area or platform 1035. In some examples, the robotics module 1020 may press fit the enclosure portion 1015 onto (or into) the body portion 1005. In some examples, the robotics module may deliver one or more objects, such as tennis balls 1055 into the chamber 1050 of the container 1001 prior to press fitting the enclosure

portion **1015** onto (or into) the body portion **1005**. The tennis balls **1055** may have an interior pressure that is approximately the same as the pressure of the chamber **1010**.

[0070] After the enclosure portion **1015** is placed on (or pressed into or onto) the body portion **1005**, the welding module **1025** may apply, via a welder **1030**, thermal energy to the joint between the enclosure portion **1015** and the body portion **1005** in order to melt the plastic materials of the enclosure portion **1015** and the body portion **1005** and thereby fuse the materials of the enclosure portion **1015** and the body portion **1005**. The welding energy is applied around the entire perimeter of the joint between the enclosure portion **1015** and the body portion **1005**, thereby fusing the entire joint and creating an air-tight seal for the chamber **1050**. Accordingly, once the container **1001** is removed from the chamber **1010** and exposed to atmospheric pressure, the chamber **1050** has a pressure that is higher than atmospheric pressure (e.g., approximately 27-29 psi).

[0071] It should be appreciated by a person skilled in the art that one or more aspects of the disclosure may be implemented in a system **1000** to additionally or alternatively solve other problems than those described above. Furthermore, aspects of the disclosure may provide technical improvements to “conventional” systems or processes as described herein. However, the description and appended drawings only include example technical improvements resulting from implementing aspects of the disclosure, and accordingly do not represent all of the technical improvements provided within the scope of the claims.

[0072] FIG. **11** shows a flowchart illustrating a method **1100** that supports pressurized tube sealing for containers in accordance with aspects of the present disclosure. The operations of the method **1100** may be implemented by a pressurized plastic welding system or its components as described herein. For example, the operations of the method **1100** may be performed by a manufacturing system as described with reference to FIG. **10**.

[0073] At **1105**, the method may include providing, in a pressurized environment, an elongated body portion for the container comprising a first plastic material, the elongated body portion comprising a first end, a second end, and a hollow interior portion, wherein at least the first end is open. The operations of **1105** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1105** may be performed by a robotics module **1020** as described with reference to FIG. **10**.

[0074] At **1110**, the method may include providing, in the pressurized environment, a first enclosure portion for the container comprising a second plastic material. The operations of **1110** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1110** may be performed by a robotics module **1020** as described with reference to FIG. **10**.

[0075] At **1115**, the method may include welding the first enclosure portion to the first end of the body portion thereby hermetically sealing the hollow interior portion. The operations of **1115** may be performed in accordance with examples as disclosed herein. In some examples, aspects of the operations of **1115** may be performed by a welding module **1025** as described with reference to FIG. **10**.

[0076] In some examples, an apparatus as described herein may perform a method or methods, such as the method **1100**. The apparatus may include, features, circuitry, logic, means,

or instructions (e.g., a non-transitory computer-readable medium storing instructions executable by a processor) for providing, in a pressurized environment, an elongated body portion for the container comprising a first plastic material, the elongated body portion comprising a first end, a second end, and a hollow interior portion, wherein at least the first end is open, providing, in the pressurized environment, a first enclosure portion for the container comprising a second plastic material, and welding the first enclosure portion to the first end of the body portion thereby hermetically sealing the hollow interior portion.

[0077] Some examples of the method **1100** and the apparatus described herein may further include operations, features, means, or instructions for placing a plurality of pressurized balls inside of the hollow body portion prior to welding the first enclosure portion to the body portion.

[0078] Some examples of the method **1100** and the apparatus described herein may further include operations, features, means, or instructions for press fitting the first enclosure portion into the body portion such that an outer perimeter of the body portion surrounds an outer perimeter of the first enclosure portion prior to welding the first enclosure portion to the body portion.

[0079] Some examples of the method **1100** and the apparatus described herein may further include operations, features, means, or instructions for welding the first enclosure portion to the first end of the body portion according to one of a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a friction welding process, a radio frequency welding process, an infrared welding process, or a solvent bonding process.

[0080] In some examples of the method **1100** and the apparatus described herein, welding the first enclosure portion to the first end of the body portion comprises applying a clear-on-clear laser plastic welding process. In some examples, a laser used for a clear-on-clear welding process may have a wavelength of approximately 2000 nanometers (e.g., in the 2 μ m spectrum), and the body portion and/or enclosure portion may be optically transmissive in the 2 μ m spectrum.

[0081] In some examples of the method **1100** and the apparatus described herein, welding the first enclosure portion to the first end of the body portion comprises applying a through transmission laser welding process. In some examples, a laser used for a through welding process may have a centered wavelength of approximately 380 nanometers to 2500 nanometers, and an absorptive portion of the apparatus (e.g., the body portion or enclosure portion) may be absorptive of laser energy having a wavelength of approximately 380 nanometers to 2500 nanometers and a transmissive portion of the apparatus (e.g., the body portion or enclosure portion) may be transmissive of laser energy having a wavelength of approximately 380 nanometers to 2500 nanometers.

[0082] It should be noted that these methods describe examples of implementations, and that the operations and the steps may be rearranged or otherwise modified such that other implementations are possible. In some examples, aspects from two or more of the methods may be combined. For example, aspects of each of the methods may include steps or aspects of the other methods, or other steps or

techniques described herein. Thus, aspects of the disclosure may provide for consumer preference and maintenance interface.

[0083] The description set forth herein, in connection with the appended drawings, describes example configurations and does not represent all the examples that may be implemented or that are within the scope of the claims. The term “exemplary” used herein means “serving as an example, instance, or illustration,” and not “preferred” or “advantageous over other examples.” The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some instances, well-known structures and devices are shown in block diagram form in order to avoid obscuring the concepts of the described examples.

[0084] In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If just the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0085] Information and signals described herein may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof

[0086] The various illustrative blocks and modules described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a DSP, an ASIC, an FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration).

[0087] The functions described herein may be implemented in hardware, software executed by a processor, firmware, or any combination thereof. If implemented in software executed by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described above can be implemented using software executed by a processor, hardware, firmware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations. Also, as used herein, including in the claims, “or” as used in a list of items (for example, a list of items prefaced by a phrase such as “at least one of” or “one or more of”)

indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or

[0088] AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase “based on” shall not be construed as a reference to a closed set of conditions. For example, an exemplary step that is described as “based on condition A” may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase “based on” shall be construed in the same manner as the phrase “based at least in part on.”

[0089] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, non-transitory computer-readable media can comprise RAM, ROM, electrically erasable programmable read only memory (EEPROM), compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, include CD, laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above are also included within the scope of computer-readable media.

[0090] The various illustrative blocks and modules described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a digital signal processor (DSP), an ASIC, an field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration). The functions of each unit may also be implemented, in whole or in part, with instructions embodied in a memory, formatted to be executed by one or more general or application-specific processors.

[0091] In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If just the

first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0092] The description herein is provided to enable a person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein, but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

What is claimed is:

1. A container comprising:
an elongated body portion comprising a first plastic material, the elongated body portion having a first end and a second end, at least the first end being open;
a first enclosure portion comprising a second plastic material that is welded to the body portion at the first end; and
a hollow interior chamber which is hermetically sealed by the body portion being welded to the first enclosure portion, wherein the hollow interior chamber has an interior pressure that is greater than atmospheric pressure.
2. The container of claim 1, wherein the body portion is cylindrical.
3. The container of claim 1, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the first plastic material is transmissive of laser energy and the second plastic material is absorptive of laser energy.
4. The container of claim 1, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the first plastic material is absorptive of laser energy and the second plastic material is transmissive of laser energy.
5. The container of claim 1, wherein the elongated body portion comprises:
a ledge extending around a first perimeter of the body portion proximate to the first end;
a lip extending from the ledge around a second outer perimeter of the ledge to the first end, and wherein the first enclosure portion abuts the ledge and is circumferentially surrounded by the lip.
6. The container of claim 1, wherein
the first enclosure portion comprises a bottom planar surface and a top planar surface,
a ring extends from the bottom planar surface, and
an interior perimeter of the body portion surrounds and abuts an outer perimeter of the ring.
7. The container as in claim 5 or 6, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the first plastic material is transmissive of laser energy and the second plastic material is absorptive of laser energy.
8. The container as in claim 5 or 6, wherein the first plastic material is transparent and the second plastic material is black.
9. The container of claim 1, wherein the first plastic material and the second plastic material are transparent.

10. The container of claim 1, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the laser plastic welding process comprises a clear-on-clear laser plastic welding process.

11. The container of claim 10, wherein a laser wavelength of the clear-on-clear laser plastic welding process is a near infrared wavelength.

12. The container of claim 12, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the laser plastic welding process comprises a through transmission laser welding process.

13. The container of claim 12, wherein a laser wavelength of the through transmission laser welding process is between 380 nanometers and 2500 nanometers.

14. The container of claim 1, wherein
the first enclosure portion comprises a bottom planar surface and a top planar surface,
a lip extends around a first perimeter of the bottom planar surface, and
the lip surrounds and abuts a second perimeter of the first end of the body portion.

15. The container of claim 14, wherein
the first enclosure portion is welded to the body portion according to a laser plastic welding process, and
the first plastic material is transmissive of laser energy and the second plastic material is absorptive of laser energy.

16. The container of claim 1, further comprising a pull tab coupled to the first enclosure portion, wherein at least a part of the first enclosure portion is configured to be removed from the body portion via application a pulling force to the pull tab.

17. The container of claim 1, wherein the first enclosure portion is welded to the body portion according to one of a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a friction welding process, a radio frequency welding process an infrared welding process, or a solvent bonding process.

18. A method for manufacturing a pressurized container, comprising:

providing, in a pressurized environment, an elongated body portion for the container comprising a first plastic material, the elongated body portion comprising a first end, a second end, and a hollow interior portion, wherein at least the first end is open;

providing, in the pressurized environment, a first enclosure portion for the container comprising a second plastic material; and

welding the first enclosure portion to the first end of the body portion thereby hermetically sealing the hollow interior portion.

19. The method of claim 18, further comprising:
press fitting the first enclosure portion into the body portion such that an outer perimeter of the body portion surrounds an outer perimeter of the first enclosure portion.

20. The method of claim 18, further comprising:
welding the first enclosure portion to the first end of the body portion comprises applying one of a laser plastic welding process, an ultrasonic welding process, a hot gas welding process, a spin welding process, a vibration welding process, a hot plate welding process, a

friction welding process, a radio frequency welding process an infrared welding process, or a solvent bonding process.

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