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(54) Title: PACKAGING FOR FOOD, PROCESS FOR PACKAGING FOOD AND FOOD COMPOSITIONS

(57) Abstract: A container and a process of packaging food contents in the container, the container including a plastic cup and a lid. The process includes filling the plastic cup with wet pet food, sealing the plastic cup with the lid to obtain a filled container, and retort processing the food contents inside the filled container. The retort processing includes increasing an environmental temperature surrounding the container to a certain temperature, maintaining the certain temperature for a period of time, and cooling the container to a lower temperature.



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PACKAGING FOR FOOD, PROCESS FOR PACKAGING FOOD AND FOOD COMPOSITIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. provisional application ser. no. 60/778,390 filed on March 3, 2006, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to food packaging in general and more particularly to a process for packaging food, a container for packaging food and food compositions.

SUMMARY OF THE INVENTION

[0003] An aspect of the present invention is to provide a process of packaging food contents in a container including a plastic cup and a lid. The process includes filling the plastic cup with wet pet food, sealing the plastic cup with the lid to obtain a filled container, and retort processing the food contents inside the filled container. The retort processing includes increasing an environmental temperature surrounding the container to a certain temperature, maintaining the certain temperature for a period of time, and cooling the container to a lower temperature.

[0004] Another aspect of the present invention is to provide a container for holding wet pet food contents. The container includes a plastic cup having a sidewall defining a mouth of the cup and a bottom wall. The sidewall comprises a flange portion formed around the mouth of the cup. The container further includes a lid sealed on the flange portion of the cup. The container also includes wet pet food disposed in the sealed plastic cup. The pet food in the plastic cup is retort processed after sealing the cup with the lid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 is a transverse view of a cup for receiving food contents, according to an embodiment of the invention;

[0006] FIG. 2 is a transverse cross-section showing a stack of layers of plastic used for forming the cup, according to an embodiment of the present invention;

[0007] FIG. 3A is a schematic interior view of the lid showing the seal, according to an embodiment of the present invention;

[0008] FIG. 3B is a schematic interior view of the lid showing the seal, according to another embodiment of the present invention;

[0009] FIG. 4 is a flow chart showing a process for packaging food, according to an embodiment of the present invention;

[00010] FIG. 5 is a flow chart showing the detailed steps in the retort processing, according to an embodiment of the invention;

[00011] FIG. 6 is a graph showing the temperature variation inside the container (i.e., temperature of the food contents) and outside the container during a progress of the retort processing, according to an embodiment of the invention; and

[00012] FIG. 7 is a semi-log plot of the difference between the temperature of the retort and the inside temperature in the container against the process time, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[00013] FIGURE 1 is a transverse view of a cup for receiving food contents, according to an embodiment of the invention. The cup 10 has a generally tapered cylindrical shape. The cup 10 comprises a sidewall 12 defining a mouth 14 and further comprises a bottom wall 16. The sidewall 12 comprises a lip 18. The lip 18 has a flange portion 20 extending generally perpendicularly to the sidewall 12. The external diameter of the flange portion 20 of the lip 18 is greater than the diameter of the lip 18. The flange portion 20 is used to attach a lid (not shown) onto the cup 10. The lip 18 protrudes slightly from the sidewall 12. In other words, a diameter of the lip 18 is greater than a diameter of the sidewall 12 at the intersection of the sidewall 12 with the lip 18.

[00014] In this embodiment, the sidewall 12 is shown slightly curved and tapered towards the base or bottom wall 16. Specifically, a diameter of the sidewall 12 at the mouth 14 is greater than a diameter of the bottom wall 16. The lip 18 is also slightly inclined towards the inside of the cup by a slight angle relative to the vertical axis AA. The presence of the lip 18 plays a role in facilitating the release of the food contents while minimizing possible splashing of the liquid contents of the food.

[00015] In one embodiment of the invention, the base 16, i.e., the bottom of the cup 10 has a circular cross-section. In another embodiment, the base 16 has a square or rectangular cross-section. In yet another embodiment, the base 16 has a polygonal cross-section (e.g., hexagonal). In another embodiment, the base 16 has an elliptic cross-section. Similarly to the base 16, the mouth 14 can be formed in various shapes including square, rectangular, circular, polygonal and elliptical. The shape of the mouth 14 can be identical to the base 16 or different from the base 16. For example, the base 16 can be provided with a circular cross-section while the mouth 14 can be provided with a square or rectangular cross-section.

[00016] The bottom wall or base 16 is provided with a depression or bottom button 22. The bottom depression 22 is slightly elevated relative to plane P on which the cup 10 rests. The external diameter of the bottom depression is less than the diameter of the bottom wall 16 resulting in a bottom step 24. The bottom step 24 provides additional strength on the bottom wall 16 and helps reduce bottom failure that may result from top load and paneling. The bottom depression 22 provides additional functionality during the packaging process by

allowing some flexibility in the bottom wall 16 in absorbing differential pressure that may develop during the packaging process and thus reduce the likelihood of paneling.

[00017] In an embodiment of the invention, the cup 10 is integrally formed from a rigid plastic. In an embodiment of the invention, the cup is formed from a multilayered polypropylene (PP) based structure. In an embodiment of the invention, the cup is pressure formed from a PP sheet using a Solid Phase Pressure Forming (SPPF) process.

[00018] FIGURE 2 is a transverse cross-section showing the stack of layers of plastic in the sheet of plastic used for forming the cup, according to an embodiment of the present invention. The sheet of plastic used for forming the cup 10 comprises a first PP layer 30, a first recycled plastic (e.g., recycled PP) 32, a first adhesive layer 34, an ethylene vinylalcohol copolymers (EVOH) layer 35, a second adhesive layer 36, a second recycled plastic (e.g., recycled PP) 38 and a second layer of PP 40. The layer of EVOH 35 is thus sandwiched between a first stack of layers 31 and a second stack of layers 41, the first stack of layers 31 comprising the first PP layer 30, the recycled plastic layer 32 and the first adhesive layer 34 and the second stack of layers 41 comprising the second PP layer 40, the second recycled plastic layer 38 and the second adhesive layer 36.

[00019] In this embodiment, polypropylene is selected for use as the internal layer 30 and external layer 40 because PP has a lower density and a lower cost than comparable materials. Furthermore, PP provides an excellent moisture barrier as well as good sensory properties, i.e., there is substantially no transfer of taste from the plastic PP to the food contents. Furthermore, PP has a relatively good stiffness making it suitable for use in the manufacture of food containers. Although layers 30 and 40 are made of PP, it must be appreciated that any thermoplastic may be used including copolymer plastics, reinforced plastics and other types of plastics.

[00020] In addition, although in this embodiment recycled plastic is used, such as in layers 32 and 38, it must be appreciated that the use of recycled plastic is optional. Indeed, in other embodiments, it is also contemplated forming the cup from a sheet of plastic with no layer of recycled plastic or forming the cup from a sheet of plastic with one or more layers of recycled plastic. The recycled plastic is merely used to reduce the overall cost of the packaging container. In an embodiment of the invention, the outside layer (cap layer) 40 is selected to

be made from a non-recycled PP as a non-recycled PP provides a clean appealing outer layer, thus improving the overall appearance of the cup 10. However, it must be appreciated that the outside layer (cap layer) may also be made from a recycled plastic in certain application if appearance is not particularly important for the application sought.

[00021] In this embodiment, the EVOH is shown sandwiched between the first stack of layers 31 and the second stack of layers 41. The EVOH layer is positioned such that the EVOH layer does not come in contact with the food contents so as to comply with food regulations. However, it must be appreciated that the EVOH layer 35 can be positioned anywhere in the multilayer structure including, for example, placing the EVOH layer 35 between the PP layer 40 and the recycled plastic layer 38. In the embodiment illustrated in FIGURE 2, the EVOH layer 35 is bonded to layers 32 and 38 using two adhesive layers 34 and 36. The adhesive used in layers 34 and 36 can be any adhesive suitable for bonding plastics. For example, in one embodiment, the adhesive used in layers 34 and 36 comprises a maleic anhydride modified PP which promote good bonding between PP layers or recycled PP layers and the EVOH layer.

[00022] The EVOH layer 35 is used primarily as an oxygen barrier to block oxygen in the atmosphere from penetrating inside the cup 10 when the cup is sealed. EVOH provides an effective oxygen barrier compared to some other plastics. Hence, the incorporation of an EVOH layer in the plastic sheet used in the fabrication of the cup allows to minimize oxidation of the food contents in the cup when sealed. As a result, the shelf life of the food contents in the cup can be increased. Alternatively or in addition to EVOH, polyphenylene oxide/polyethylene terephthalate/polyphenylene oxide (PPO/EVOH/PPO), polyvinylidene chloride/polyethylene terephthalate (PVdC/PET), polyethylene terephthalate/polyamide (PET/Nylon MXD-6), aluminum foil or SiOx coatings, or any combination of two or more thereof may be employed.

[00023] Because PP is translucent in its natural state, a dye (for example, an orange dye) is added (for example between 4% to 6%, or more, by weight) to increase the opacity of the plastic so as to reduce show through of the food contents and to increase the overall appeal of the packaging container. In an embodiment of the invention, the dye is incorporated in all layers of PP (i.e., layers 30, 32, 38 and 40) in the multilayer structure to provide a uniform density of color. However, it must be appreciated that the dye can also be incorporated in

one or more layers of PP (for example, in the outside PP layer 40) in the multilayer structure. A selected design logo can also be embossed onto the sidewall 12 of cup 10. For example, in addition to the art work printed on the lid and the color of the cup, a logo can be embossed onto the sidewall of the cup to give the whole packaging an additional branding distinction.

[00024] As stated above, in addition to the cup, the food packaging is also comprised of a lid provided for sealing the cup to hold the food contents inside the cup. Hence, the lid along with the cup act together to produce a container to hold a food product.

[00025] In an embodiment of the invention, the lid comprises a tri-laminate including an aluminum sheet or foil, a plastic film (e.g., a polyester film such as polyethylene terephthalate (PET)), and a polypropylene based sealant film. The aluminum foil is selected for its excellent oxygen barrier properties and low moisture transmission rate and for its stability at retort conditions. In addition, the aluminum sheet provides a glossy metallic surface which can be used for graphics on the lid. The aluminum sheet is used as an inner layer facing the food contents inside the cup. Hence, the aluminum layer is disposed in sealed contact with the cup to close the mouth of the lid 10 (see FIGURE 1). The aluminum layer can have a thickness in the range of about 0.0003 inch (0.3 mil) to about 0.001 inch (1.0 mil). For example, the aluminum layer can have a thickness of about 12.7 μ .

[00026] The plastic film (e.g., polyester film) is used as an outer layer and applied on top of the aluminum layer. To allow printing of images and graphic on the lid, the polyester film is reverse printed. The side of the polyester film carrying the graphic images is brought in contact with the aluminum layer. By reverse printing on the polyester film and applying the printed side on the aluminum layer, the ink graphics are sandwiched between the aluminum sheet and the polyester film. As a result, the graphic images can be protected from scratching, leaching, fading and the like. Although a polyester film is discussed herein, it must be appreciated that a polyamide, a polycarbonate or laminates of these materials can also be used. For example, instead or in addition to the polyester film (e.g., PET), a film of polybutylene terephthalate (PBT), or a film of a polyamide (such as NYLON), or a stack of films of these polymers can be used as the plastic film. The plastic film can have a thickness in the range of about 0.0004 inch (0.4 mil) to about 0.002 inch (2.0 mil). For example, the

polyester film (e.g., PET) can have a thickness of about 12 μ . The plastic film thickness can be varied according to the desired lid stiffness and/or lid cost target.

[00027] The sealant film is applied on the inner layer of aluminum sheet, for example at an edge corresponding to the flange portion 20 of lip 18, so that the aluminum layer adhere to the flange portion 20 of lip 18 of the cup 10. The sealant is selected to provide a hermetic, peelable seal with the flange portion 20. The sealant is tailored to withstand retort processing at temperatures up to 132 °C and pressures between 0.01 to 2.2 bar. In an embodiment of the invention, the sealant film comprises PP or Ethylene-Propylene (EP) co-polymers. The sealant film can have a thickness in the range of about 0.001 inch (1.0 mil) to about 0.005 inch (5.0 mil). For example, the sealant film can have a thickness of about 50 μ .

[00028] Various tests were performed at various thicknesses for the aluminum sheet, the PET film and the sealant to determine the optimal thickness of the three layers (aluminum, PET and sealant) that provide good sealing conditions, good adhesion to the cup (i.e., no separation of the lid from the cup), with a smooth lid appearance (i.e., not wrinkled), substantially no mechanical defects such as tears or cracks (pre and post retort process) while providing a relatively easy peeling lid. At the processing conditions which will be discussed in the following paragraphs, the best thicknesses for the three layers were determined to be respectively, about 12 μ for the PET film, about 12.7 μ for the aluminum layer and about 50 μ for the sealant layer. However, it must be appreciated that one can depart from these thicknesses depending on the results sought. For example, one may increase or decrease the thickness of each layer to accommodate a certain processing condition (for example a higher temperature or pressure) or to accommodate the type of seal used, etc.

[00029] In another embodiment of the invention, the lid comprises a four-laminate including an aluminum sheet or foil, a first plastic film (e.g., a polyester film such as polyethylene terephthalate (PET)), a second plastic film (e.g., a polyamide film such as a stretch NYLON film (ONY)) and a sealant film (e.g., a polypropylene based sealant film). Similar to the tri-laminate embodiment of the lid, the polyester film is applied on top of the aluminum layer. The polyester film is used as an outer layer. The polyester film is reverse printed to allow printing of images and graphics on the lid. The side of the polyester film carrying the graphic images is brought in contact with the aluminum layer. By reverse printing on the polyester

film and applying the printed side on the aluminum layer, the ink graphics are sandwiched between the aluminum sheet and the polyester film. Although a polyester film is discussed herein, it must be appreciated that a polyamide, a polycarbonate or laminates of these materials can also be used. For example, instead or in addition to the polyester film (e.g., PET), a film of polybutylene terephthalate (PBT), or a film of a polyamide or a stack of films of these polymers can be used as the first plastic film. In one embodiment, the aluminum layer can have, for example, a thickness of about 7 μ . In one embodiment, the polyester film (e.g., PET) can have a thickness of about 12 μ . However, the thickness of first plastic film and/or the thickness of the aluminum layer can be varied according to the desired lid stiffness and/or lid cost target.

[00030] The second plastic film (e.g., the polyamide layer (ONY layer)) is applied on a surface of the aluminum layer opposite the first plastic film (e.g., polyester layer). In one embodiment, the polyamide layer can have a thickness of about 15 μ . However, the polyamide layer can have any desired thickness. In the four-laminate embodiment, the sealant film is applied on the inner layer of the polyamide layer instead of the inner layer of the aluminum layer as in the tri-laminate embodiment. For example, the sealant film can be applied at an edge corresponding to the flange portion 20 of lip 18, so that the lid adhere to the flange portion 20 of lip 18 of the cup 10.

[00031] In order to provide an appropriate seal, heat and pressure and time sealing parameters were also tested to determine the best seal conditions while providing a relatively easy peeling of the lid. For example, excessive flow of sealant may not be desirable as this may be a cause of separation or delamination of the sealant layer from the aluminum layer. The delamination may lead to spilling and/or contamination of the food contents inside the cup. In an embodiment of the invention, a flat head sealing mechanism can be used to reduce the sensitivity to temperature and/or pressure variations in the sealing apparatus. Alternatively, a sealing mechanism with a rounded head can be used to assist removal of contaminants that may be on the sealing surface after filling.

[00032] In addition, in order to improve the releasing characteristics of the lid, a double ring seal can be used. FIGURE 3A is a schematic interior view of the lid showing the seal, according to an embodiment of the present invention. Lid 60 includes sealant film layer 62.

The sealant film layer 62 comprises two ring-like seals 62A and 62B which are applied on the inner surface of aluminum sheet 64, for example at an edge corresponding to the flange portion 20 of lip 18 of cup 10. In this embodiment two ring-like seals 62A and 62B are used. However, it must be appreciated that one or more ring-like seals can be employed. The ring-like seals 62A and 62B include recessed notches 66A and 66B adjacent tab 68. The tab 68 is a portion of the lid 60 provided for pulling and peeling the lid 60 from the cup 10. Recessed notches 66A and 66B are provided to reduce the footprint of the ring seals to allow for easier release of the lid 60. In this way a user can pull the tab 68 farther to the interior of the lid allowing easier initiation of the peeling process. As a result, the recessed notches 66A and 66B provide an enhanced releasing feature that can reduce or substantially eliminate potential splash of the food contents on the hands of the user. In addition, the ring-like seals 62A and 62B can be configured to provide a two step peeling process. For example, the ring-like seal (outer ring seal) 62B can be configured to provide a seal strength of about 0.7 kgf to about 1.5 kgf at initiation of the peel process while the ring-like seal (inner ring seal) 62A can be configured to provide a seal strength of about 0.8 kg to about 2.0 kg at initiation of the peeling process. By providing the outer ring seal 62B with a lower peeling strength than the inner seal ring 62A, the initiation of the lid release is facilitated and by providing an inner seal ring 62A with a higher peeling strength, "a rapid" release of the lid is prevented thus reducing the likelihood of food splash.

[00033] FIGURE 3B is a schematic interior view of the lid showing the seal, according to another embodiment of the present invention. Lid 70 shown in FIGURE 3B is similar to some extent to lid 60 shown in FIGURE 3A except that instead of recessed notches on the two ring-like seals, bump portions are provided on the two ring-like seals. Specifically, the Lid 70 includes sealant film layer 72. The sealant film layer 72 comprises two ring-like seals 72A and 72B which are applied on the inner surface of aluminum sheet 74, for example at an edge corresponding to the flange portion 20 of lip 18 of cup 10. In this embodiment two ring-like seals 72A and 72B are used. However, similar to lid 60, it must be appreciated that one or more ring-like seals are also within the scope of the present invention. The ring-like seals 72A and 72B include bump portions 76A and 76B adjacent tab 78. The tab 78 is a portion of the lid 70 provided for pulling and peeling the lid 70 from the cup 10. Bump portions 76A and 76B are provided to reduce the footprint of the ring seals to allow for easier release of the lid 70. Bump portions 76A and 76B extend in a direction of the tab 78. In this way, by pulling on the tab 78, the peeling process is initiated at the bump portions allowing a

gradual release of the lid. As a result, the recessed notches 76A and 76B provide an enhanced releasing feature that can reduce or substantially eliminate potential splash of the food contents on the hands of the user. Furthermore, similar to the lid 60, the lid 70 can also be provided with two ring-like seals 72A and 72B with a two step peeling process. For example, the ring-like seal (outer ring seal) 72B can be configured to provide a seal strength of about 0.7 kgf to about 1.5 kgf at initiation of the peel process while the ring-like seal (inner ring seal) 72A can be configured to provide a seal strength of about 0.8 kg to about 2.0 kg at initiation of the peeling process. By providing the outer ring seal 72B with a lower peeling strength than the inner seal ring 72A, the initiation of the lid release is facilitated and by providing an inner seal ring 72A with a higher peeling strength, "a rapid" release of the lid is prevented thus reducing the likelihood of food splash.

[00034] Once the lid is applied and sealed on top of the cup, the cup is transferred to a cutting apparatus for cutting the lid so that the lid generally matches the shape of the top of the cup. However, the tab portion 68 (see Figure 6) is left out to provide a way for opening of the lid 60.

[00035] FIGURE 4 is a flow chart showing a process for packaging food, according to an embodiment of the present invention. The process includes filling a cup with food (for example, pet food such as, but not limited to, cat food), at S10. In an embodiment of the invention, the cup is the cup 10 shown in FIGURE 1 and described in detail in the above paragraphs. The process further includes drawing air from the filled cup, at S20, and introducing an inert gas (e.g., nitrogen) into the filled cup, at S30. Although in one embodiment nitrogen is used for flushing, one ordinary skill in the art would appreciate that other inert gases are also contemplated. For example, argon or helium may be used instead or in addition to nitrogen. The process progresses by sealing the cup with a lid, at S40. The process then progresses by cutting the excess lid sheet, for example in a shape corresponding to the mouth of the lid, at S50. After cutting the lid, the process progresses by retort processing the food contents inside the cup sealed with the lid, at S60. The above process can be performed on a plurality of cups. For example, in one embodiment of the invention, a platen of 20 filled cups are indexed on a belt and purveyed to a sealing machine which can be fitted with knives for cutting the lid. The indexing of the cups on the belt allows the cup platen, a lid cutter and a sealing bar in the machine to have the same horizontal and vertical alignment references.

[00036] One of the objectives of retort processing is to achieve controlled destruction of heat resistant bacteria that are naturally present in raw food material without over-cooking the food contents and without destroying the palatability of the food contents. To achieve this and other objectives, the retort process is implemented in an environment controlled apparatus in which variables such as temperature and pressure are adjusted for optimal result. Prior to initiation of the retort process, one or more food containers containing the food contents are loaded into a retort apparatus. The retort apparatus can be a fully automated, computer controlled, over-pressure processing system. For example, as shown in TABLE 1, the containers are exposed to an increasing environmental temperature up to about 122 °C over 25 min (A). For example, the retort apparatus is heated to 122 °C in two phases (phase 1 and phase 2) lasting, respectively, 5 minutes and 20 minutes. Then, the containers are held at an environmental temperature of about 122 °C (B) for 24 minutes (phase 3), prior to being rapidly cooled (C), for example, in five phases (phase 4 through phase 8).

	Phase	Temperature (in °C)	Time (in minutes)	Pressure (in Bar)
A	1	90	5	0.3
	2	122	20	1.85
B	3	122	24	2.15
C	4	90	2	1.3
	5	60	2	0.5
	6	45	5	0.5
	7	40	6	0.3
	8	38	8	0.01

TABLE 1

[00037] The conditions shown in TABLE 1 illustrate one of several time, temperature and pressure combinations that may be used. Examples of alternate sets of processing conditions are shown in TABLES 2 and 3.

[00038] In the example shown in TABLE 2, the retort apparatus is heated to 122 °C in four phases (phases 1 to 4), each lasting 5 minutes, 18 minutes, 1 minute and 1 minute, respectively. Once the processing temperature of 122 °C is achieved, the retort apparatus is held at that temperature for 24 minutes (phase 5), prior to being rapidly cooled in five phases (phases 6 to 10).

[00039] In the example shown in TABLE 3, the retort is heated to 122 °C in four phases (phases 1 to 4), each lasting 5 minutes, 18 minutes, 1 minute and 1 minute, respectively. Once the processing temperature of 122 °C is achieved, the retort is held at that temperature for 38 minutes (phase 5), prior to being rapidly cooled in three phases (phases 6 to 8).

	Phase	Temperature (in °C)	Time (in minutes)	Pressure (in Bar)
A	1	90	5	0.3
	2	123	18	1.85
	3	123	1	1.85
	4	122	1	1.85
B	5	122	24	2.15
C	6	90	2	1.3
	7	60	2	0.5
	8	45	5	0.5
	9	40	6	0.3
	10	38	8	0.01

TABLE 2

	Phase	Temperature (in °C)	Time (in minutes)	Pressure (in Bar)
A	1	90	5	0.3
	2	123	18	1.85
	3	123	1	1.85
	4	122	1	1.85
B	5	122	38	2.15
C	6	90	2	1.3
	7	60	2	0.5
	8	45	5	0.5

TABLE 3

[00040] The time and temperature combinations that are shown, for example, in phases 3, 5 and 5 in TABLES 1, 2 and 3, respectively, (i.e., phase B), are examples of some of the processing conditions that may be selected. However, a range of alternate conditions can also be used. These conditions may vary, for example, between 85 min at 113 °C to 13 min at 130 °C. Within these extremes, the maximum pressures in the retort will range from 1.0 bar at 113 °C to 3.0 bar at 130 °C, and in these cases the ramped pressures will increase to their maximum values (during heating) or decrease from their maximum values (during cooling) incrementally in a manner similar to that shown in TABLES 1, 2 and 3.

[00041] In an embodiment of the invention, the cooling is accomplished by supplying and circulating external water pre-cooled in evaporative cooling towers.

[00042] FIGURE 5 is a flow chart showing the detailed sub-processes implemented in the retort processing S60 (see FIGURE 4), according to an embodiment of the invention. FIGURE 6 is a graph showing the temperature at the slowest heating point in several containers (i.e., the temperature of the food contents), according to an embodiment of the present invention. In FIGURE 6, the single heating curve (curve 90) showing the most rapid rate of temperature increase corresponds to the temperature in the retort apparatus in which the containers are heat treated, i.e., the environmental temperature. The cluster of heating curves (curves 92) showing slower heating rates correspond to temperatures inside the

containers loaded into the retort apparatus. The x-axis represents the time elapsed (in minutes) and the y-axis represents the temperature (in °C). As shown in both FIGURES 5 and 6, the retort processing S60 comprises increasing the environmental temperature surrounding the container (i.e., the cup sealed with a lid and its food contents) to approximately 90 °C during a time period of about 5 minutes while increasing an environmental pressure surrounding the container to about 0.3 bar, at S80 (first leg of curve 90 in FIGURE 6). The pressures indicated herein are pressures above atmospheric pressure. That is, a pressure of 0.3 bar, for example, is equivalent to an absolute pressure of about 1.3 bar (the atmospheric pressure being equal to about 1 bar). The retort processing progresses by increasing the environmental temperature surrounding the container to approximately 122 °C during a time period of about 20 minutes while increasing the environmental pressure to about 1.85 bar, at S90 (second leg of curve 90 in FIGURE 6). Then the environmental temperature surrounding the container is held at about 122 °C while increasing the environmental pressure to about 2.15 bar during a time period of about 24 minutes, at S100 (third leg of curve 90 in FIGURE 6). The process progresses by decreasing the environmental temperature surrounding the container to 90 °C in a time period of about 2 minutes while reducing the environmental pressure to about 1.3 bar, at S110 (fourth leg of curve 90 in FIGURE 6). The process progresses by decreasing the environmental temperature to approximately 60 °C in a time period of about 2 minutes while decreasing the environmental pressure to about 0.5 bar, at S120 (fourth leg of curve 90 in FIGURE 6). The process progresses by decreasing the environmental temperature to approximately 45 °C in a time period of about 5 minutes while maintaining the environmental pressure at about 0.5 bar, at S130 (fourth leg of curve 90 in FIGURE 6). The process progresses by reducing the environmental temperature to approximately 40 °C in a time period of about 6 minutes while reducing the environmental pressure to about 0.3 bar, at S140 (fourth leg of curve 90 in FIGURE 6). Finally, the process progresses by reducing the environmental temperature to approximately 38 °C within a period of about 8 minutes while reducing the environmental pressure to about 0.01 bar, at S150 (fourth leg of curve 90 in FIGURE 6). While in this embodiment specific values of temperature and pressure are used, it must be appreciated that other temperature and pressure values, such as for example the values in TABLES 2 and 3, are also within the scope of the present invention.

[00043] The ramped environmental pressure profile is used to counterbalance the vapor pressure that is generated in the sealed cups during the heating process. The ramped

environmental pressure profile was determined through the evaluation of the inter-relationship between various parameters including peel strength, residual vacuum, heat sealing temperature, sealing head pressure, duration of heat sealing, headspace gas composition, product (i.e., food) composition and product viscosity, filling temperature, filling weight and pressure profile.

[00044] As shown in FIGURE 6, the temperature profile inside the container, represented by curve 92 in FIGURE 6, reflects the temperature profile outside the container, i.e., applied to the container, represented by curve 90. The degree to which the slope of product heating curve matches that of the retort is a function of the rate at which the retort is heated and cooled, the geometry of the container, the nature of the product (e.g., the temperature at which the product is filled into the container and the product's viscosity, fill weight and particulate size). However, in general, there is a temperature lag for the food product (for example, pet food) inside the container while the temperature of the food product approaches that of the retort (i.e. the environment). While the retort is heated to processing temperature, the temperature lag between the retort and the product is relatively large, and over time, as the retort is held at constant temperature (as shown at phases 3, 5 and 5 in TABLES 1, 2 and 3, respectively), the difference between the temperature of the product and the temperature of the retort, diminishes. Depending on the duration of phases 3, 5 and 5 in TABLES 1, 2 and 3, respectively, (i.e., phase B), the temperature in the container may be close to, or reach, that of the retort, as, for example, is shown in FIGURE 6, after approximately 49 minutes heating.

[00045] FIGURE 7 shows a semi-log plot of the difference between the temperature of the retort (T_{ret}) and the temperature at the slowest heating point of the product (T_{shp}) against process time according to an embodiment of the present invention. The x-axis in FIGURE 7 represents the time elapsed (in minutes) and the y-axis represents (on a log scale) the difference in temperature ($T_{ret} - T_{shp}$). The minimum temperature difference is found at approximately 50 minutes. From these data, heating parameters (f_h and j) can be been extracted and used for best determining appropriate heating and cooling conditions for optimal food processing. The f_h value of the packaged product is the time in minutes for the straight-line portion (delimited in the plot in FIGURE 7 by two vertical lines) of the semi-log plot of the time-temperature heating curve to traverse one log cycle. The f_h value is function of the thermal diffusivity (α) of the product and the dimensions of the container in which it is

packed, so that the higher the f_h value, the slower the heating rate. In an embodiment of the invention, the f_h value is 21.94 min. The j value is a measure of the heating lag that is experienced at the slowest heating point in the container while the container is heated in the retort. With the food product described herein, the j value can be, for example, 1.37. These values of the heating parameters f_h and j can be used in a thermal process modeling program to compute the various processing temperatures and processing times that may be needed to sterilize the food contents in the container(s). With the variety of food products and the dimensions of the packaging system that can be used, the f_h values can range between 20 minutes and 24 minutes, and the j values can range between 1.1 and 1.5.

[00046] In order to validate the efficacy of the heat sealing operation and the adequacy of the ramped over pressure profile used for the retort processing of the sealed cup, a microbiological challenge test (biotest) is performed. In particular, the biotest was performed to evaluate the sealing temperature, pressure over time, peel strength, the cleanliness of filling and contamination of the sealing flange on the cup, the vacuum and back flushing, and fill weight and/or head space (i.e., space between the contents of the cup and the lid). In one embodiment, after retort processing, a plurality of containers are submerged in a solution containing approximately 10^5 to 10^6 *Enterobacter aerogenes*/mL in 0.1% peptone solution at ambient temperature. The contamination level in the immersion solution was selected as it represents between 10 to 100 times that considered acceptable for microbiological quality of cooling water in double seamed cans. This level of contamination represents an extreme condition as the water used for cooling during the retort process is sterile and is substantially free of viable microorganisms. After immersion for 20 minutes, the test containers and various other control containers are removed from the solution and stored for incubation at ambient temperatures (30 °C to 35 °C) for up to 21 days. The objective of the biotest is to induce a detectable level of spoilage in the test containers and in control containers. A positive result was considered one in which the test container and/or control produced gas and was swollen because of bacterial action inside the container.

[00047] There are no clearly defined limits as to the maximum failure rates that are acceptable with biotests, as this depends on the nature of the hermetic seal, the damage it suffers in handling, the duration of the exposure to the microbial solution and the level of contamination to which the hermetic seal is exposed. However, for the purpose of these tests, a determination is made that failure rates above 2% were considered unacceptable, failure

rates between 1.5 and 2% were considered marginal and failure rates less than 1% were considered acceptable.

[00048] TABLE 4 summarizes the biotest results for the heat sealed cups following immersion in the bacterial solution. As can be seen in Table 2, the frequency of test failures for standard commercial production and for test containers in which the peel strength is 1.2 kgf was satisfactory. On the other hand, containers sealed with a peel strength of less than 1.2 kgf (0.8 kgf and 1.0 kgf), the test failure frequency is unsatisfactory. Using partially these results it was determined that a minimum peel strength of 1.2 kgf can provide integrity of the contents in the container.

Product Codes	Product Description	Total Product	Total failure	% failure
P	Standard Commercial Production (SCP)	1120	5	0.45
PD	SCP -- Drop tested	100	0	0.00
1	Peel Strength 0.8 kgf	560	59	10.54
1D	Peel Strength 0.8 kgf drop tested	90	18	20.00
2	Peel Strength 1.0 kgf	625	4	0.64
2D	Peel Strength 1.0 kgf drop tested	90	4	4.44
3	Peel Strength 1.2 kgf	595	0	0.00
3D	Peel Strength 1.2 kgf drop tested	82	1	1.22

TABLE 4

[00049] Compositions of food contents for pets are also contemplated. In an embodiment of the invention, compositions of food contents for cats are developed taking into account the cats' taste and enhancing the overall palatability of the food contents for cats. The following tables list some examples of food compositions developed.

[00050] TABLE 5A is a composition (LCS) developed for a mixture of chunk and gravy with a "topping." Ingredient used in mixture of chicken (chunks) in sauce (gravy) with real shrimp (topping) and their respective ranges of percentages by weight are listed in TABLE 5A. The real shrimp is incorporated as a "topping" into the food composition. TABLE 5B is an example of LCS composition listing specific percentages by weight of each of the ingredients used.

[00051] TABLE 6A is a composition (LCL) developed for a flaked and chunk type mixture. Ingredients used in a mixture of chicken (chunk), liver represented by a flaked red meat tuna (flakes) and gravy (sauce) and their respective ranges of percentages by weight are listed in TABLE 6A. In this food composition, the chunks (e.g., chunks of chicken) are initially processed by a steam chunk process and formed into chunks. These chunks are then combined with tuna red meat flakes and added to a gravy sauce to form the final food composition. TABLE 6B is an example of LCL composition listing specific percentages by weight of each of the ingredients used.

[00052] TABLE 7A is a composition (LTS) developed for a flaked mixture. Ingredients used in a mixture of real tuna (flakes) and whole shrimp (topping) added in a gravy sauce to form the final food composition and their respective ranges of percentages by weight are listed in TABLE 7A. TABLE 7B is an example of LTS composition listing specific percentages by weight of each of the ingredients used.

[00053] The role of each ingredient used in the composition is indicated herein. Tuna red meat, shredded tuna and mackerel and/or fish is a source of tuna, mackerel and/or fish meat. Chicken carcass, chicken liver is a source of chicken meat. Shrimp is used as a topping in LCS and LTS food compositions. Soybean oil is source of fat supplemented to the main ingredients to increase the fat content. Tricalcium phosphate, calcium phosphate, calcium sulfate, and/or potassium chloride are added as calcium and/or phosphorous supplements (mineral supplements) as needed for cats' health and nutrition. Guar gum and/or carrageenan is used as binding ingredient to help in the mixing of the ingredients in the mixture and/or to increase general appeal of the food composition by improving the shininess of the food composition. Sodium nitrite is used as a preservative or for color retention. Sodium nitrite is added for color retention of the flaked fish and meats. Sodium nitrate gives a reddish tone to the food products as it ages. Vitamin premix, choline chloride and/or taurine are added as food supplements for cats' nutrition and health. Wheat gluten is added to the chunk portion (main ingredient) for binding and to increase the protein contents of the food composition. Tapioca starch (tapioca starch) and thick flow (modified tapioca starch) are added either for binding the meat chunks or for thickening the viscosity of the gravy. Titanium dioxide is white and is added to give the whole food mixture a lighter color. Sodium tripolyphosphate (STTP) is used in the mixture to help improve the binding of the chunks and in some food compositions to enhance palatability. Salt is added as a source of sodium and for taste.

Canthaxanthin is used a colorant to give the shrimp mixture a more consistent "shrimp color." Egg spray dried is added as a source of protein and also to enhance palatability. Fish extract is used as a source of fish broth and also for enhancing palatability. Sugar (sucrose) is added in the gravy (sauce) portion as a flavor source or a flavor precursor that reacts with the amino acids present in the food mixture under heat to produce flavor compounds.

<i>Real Chicken and Whole Shrimp in Sauce</i>	Weight Range in percent
<u>Cooked Shrimp Topping mixture:</u>	
Shrimp Cooked	0.1 -- 10
Canthaxanthin	0 -- 0.001
Water	0.08 -- 10
<u>Sauce/Gravy:</u>	
Thick Flow Starch	0.2 -- 5
Guar Gum 200	0.1 -- 1
Flavor Enhancer	0.2 -- 1.5
Sugar/Sucrose	0.1 -- 4
Choline Chloride, Liquid, 70%	0 -- 0.03
Potassium Chloride	0 -- 0.4
Taurine	0 -- 0.07
Fish Extract TUM	0 -- 1.5
Sodium Nitrite	0 -- 0.005
Water	40 -- 65
<u>Chicken Chunk:</u>	
Chicken Carcass	5 -- 40
Chicken Liver	0 -- 20
Wheat Gluten MI	1 -- 10
Tapfill 8 Starch	0 -- 5
Egg, Spray Dried	0 -- 3
Titanium Dioxide	0 -- 1
Calcium Sulfate	0 -- 0.6
TriCalcium Phosphate	0 -- 0.5
Sodium Tripolyphosphate	0 -- 0.5
Salt, Iodized	0 -- 0.5
Vitamin Premix Feline	0.01 -- 0.05
Mineral Mix Feline	0.01 -- 0.05
Taurine	0 -- 0.05
Water	0 -- 6

TABLE 5A

<i>Real Chicken and Whole Shrimp in Sauce</i>	Weight in percent
<u>Cooked Shrimp Topping mixture:</u>	
Shrimp Cooked	1.412
Canthaxanthin	0.0007
Water	0.087
<u>Sauce/Gravy:</u>	
Thick Flow Starch	0.862
Guar Gum 200	0.180
Flavor Enhancer	0.259
Sugar/Sucrose	1.247
Choline Chloride, Liquid, 70%	0.065
Potassium Chloride	0.390
Taurine	0.065
Fish Extract TUM	0.0
Sodium Nitrite	0.002
Water	63.500
<u>Chicken Chunk:</u>	
Chicken Carcass	10.365
Chicken Liver	3.879
Wheat Gluten MI	3.282
Tapfill 8 Starch	3.282
Egg, Spray Dried	0.597
Titanium Dioxide	0.239
Calcium Sulfate	0.549
TriCalcium Phosphate	0.328
Sodium Tripolyphosphate	0.298
Salt, Iodized	0.298
Vitamin Premix Feline	0.050
Mineral Mix Feline	0.050
Taurine	0.000
Water	4.019

TABLE 5B

<i>Real Chicken and Liver in Gravy</i>	Weight Range in percent
<u>Flaked Tuna Red Meat mixture:</u>	
Flaked Tuna	2 -- 35
Carrageenan	0 -- 0.4
Water	1 -- 6
<u>Sauce/Gravy:</u>	
Sugar/Sucrose	0.1 -- 4
Flavor Enhancer	0.2 -- 1.5
Guar Gum 200	0.1 -- 1
Choline Chloride, 60%	0 -- 0.05
Sodium Nitrite	0 -- 0.005
Water	40 -- 65
<u>Chicken and Liver Chunk:</u>	
Chicken Carcass	5 -- 40
Chicken Liver	0 -- 20
Wheat Gluten Mi	1 -- 10
Tapioca Starch	0 -- 5
Egg, Spray Dried	0 -- 3
Titanium Dioxide	0 -- 1
Calcium Sulfate	0 -- 0.5
TriCalcium Phosphate	0 -- 0.5
Sodium Tripolyphosphate	0 -- 0.5
Salt, Iodized	0 -- 1
Vitamin Premix Feline	0.01 -- 0.050
Mineral Mix Feline	0.01 -- 0.050
Taurine	0 -- 0.05
Water	0 -- 6

TABLE 6A

<i>Real Chicken and Liver in Gravy</i>	Weight in percent
<u>Flaked Tuna Red Meat mixture:</u>	
Flaked Tuna Red Meat	25.476
Carrageenan	0.050
Water	2.307
<u>Sauce/Gravy:</u>	
Sugar/Sucrose	0.510
Flavor Enhancer	0.213
Guar Gum 200	0.137
Choline Chloride, 60%	0.042
Sodium Nitrite	0.003
Water	48.335
<u>Chicken and Liver Chunk:</u>	
Chicken Carcass	9.900
Chicken Liver	2.42
Wheat Gluten MI	2.42
Tapfill 8 Starch	2.42
Egg, Spray Dried	0.440
Titanium Dioxide	0.110
Calcium Sulfate	0.466
TriCalcium Phosphate	0.275
Sodium Tripolyphosphate	0.220
Salt, Iodized	0.220
Vitamin Premix Feline	0.040
Mineral Mix Feline	0.040
Taurine	0.000
Water	2.589

TABLE 6B

<i>Real Tuna and Whole Shrimp in Sauce</i>	Weight Range in percent
<u>Flaked Tuna mixture:</u>	
Shredded Tuna	5 – 35
Flaked Tuna Red Meat	5 – 20
Flaked Mackerel	0 – 10
Soybean Oil, Crude Degummed	0 – 1.5
TriCalcium Phosphate	0 – 0.5
Calcium Sulfate	0 – 0.05
Guar Gum 200	0.1 – 1
Carrageenan	0 – 0.5
Vit/Min Premix Fish Base	0.02 – 0.1
 <u>Gravy/Sauce:</u>	
Sodium Nitrite	0 – 0.005
Guar Gum 200	0.1 – 1
Flavor Enhancer	0.2 – 1.5
Water	35 – 50
 <u>Cooked Shrimp Topping mixture:</u>	
Shrimp Cooked	0.1 – 10
Chlorophyll Red	0 – 0.001
Water	0.1 – 10

TABLE 7A

<i>Real Tuna and Whole Shrimp in Sauce</i>	Weight in percent
<u>Flaked Tuna mixture:</u>	
Shredded Tuna	29.890
Flaked Tuna Red Meat	16.375
Flaked Mackerel	8.398
Soybean Oil, Crude Degummed	1.025
TriCalcium Phosphate	0.325
Calcium Sulfate	0.050
Guar Gum 200	0.038
Carrageenan	0.050
Vit/Min Premix Fish Base	0.100
<u>Gravy/Sauce:</u>	
Sodium Nitrite	0.0035
Guar Gum 200	0.150
Flavor Enhancer	0.500
Water	40.320
<u>Cooked Shrimp Topping mixture:</u>	
Shrimp Cooked	2.000
Chlorophyll Red	0.001
Water	0.124

TABLE 7B

[00054] In TABLES 5B, 6B and 7B, although specific amounts for each of the ingredients are indicated, it must be appreciated that the ingredients in the food mixture can be used in other proportions, for example in proportions within the percentage ranges given in TABLES 5A, 6A and 7A. For example, the amount of gravy can be increased or decreased depending on the solid contents (chunks or flakes) in the food composition. In addition, the amount of real shrimp added as a topping can be increased or decreased depending on the food consistency sought. Furthermore, the amounts of any of the ingredients including the glucose, the vitamins supplements, the minerals supplements such as the calcium, sodium and phosphorous, the preservatives, the sources of proteins, the binding agents, etc. can be varied as desired to achieve a desired food composition. In addition, components can be added or deleted as desired.

[00055] A food flavor enhancer can also be incorporated in the food mixture to enhance the palatability of the food. The chemical composition of a flavor enhancer, according to an embodiment of the present invention, is listed in TABLE 8A with a percentage by weight range for each compound used. TABLE 8B lists the percentage by weight of each ingredient used in an example of a flavor enhancer chemical composition, according to an embodiment of the present invention. Although a recent study has established that felines including cats lack the taste of sugar, the sugar in the food enhancer reacts with fish products, particularly amino acids, under heat, via a Maillard reaction to produce a flavor and texture similar to caramelizing.

[00056] In a Maillard reaction, the reactive carbonyl group of the sugar interacts with the nucleophilic amino group of the amino acid, and an interesting odor and flavor molecules result from the reaction. In the reaction process, hundreds of different flavor compounds can be created. These compounds in turn break down to form yet more new flavor compounds, and so on. Each type of food has a very distinctive set of flavor compounds that are formed during the Maillard reaction.

Ingredient	%
Glucose	25 -- 60
Glycine	15 -- 50
Ascorbic acid	0 -- 10
Egg yolk powder	0 -- 7.5
Citric acid	0 -- 4.4
Thiamine-HCL	0 -- 2
DL-Methionine	0 -- 1.3
L-Cysteine	0 -- 0.8

TABLE 8A

Ingredient	%
Glucose	57
Glycine	17
Ascorbic acid	10
Egg yolk powder	7.5
Citric acid	4.4
Thiamine-HCL	2
DL-Methionine	1.3
L-Cysteine	0.8
Total	100

TABLE 8B

[00057] In TABLE 8B, specific amounts of the different ingredients in the flavor enhancer are listed. However, it must be appreciated that other amounts are also within the scope of the present invention. For example, as shown in TABLE 8A glucose which is a flavor source or a flavor precursor can be used in an amount of about 25% to about 60% by weight.

Glycine which is also a flavor source or flavor precursor can be used in an amount of about 15% to about 50% by weight. Ascorbic acid which can be used as a flavor source and which may also help lower the pH of the food mixture (which cats prefer), can be used in amount between 0% and about 10% by weight. Egg yolk powder which can be used as a flavor source, protein source and/or as a binder can be used in an amount between 0% and about 7.5% by weight. Citric acid which is added into the formulation as a preservative can be used in an amount between 0% and about 4.4% by weight. Thiamin HCl which can be added as a source of vitamin can be used in an amount between 0% and about 2% by weight. DL-Methionine which can be added as a flavor source (amino acid) can be used in an amount between 0% and about 1.3% by weight. L-Cysteine which may be used as a flavor source and as an amino acid source can be used in amount between 0% and about 0.8% by weight.

[00058] As can be seen from these ranges, the use of ascorbic acid, egg yolk powder, citric acid, Thiamin HCl, DL-Methionine and L-Cysteine is optional.

[00059] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example, and not limitation. It will be apparent to persons skilled in the relevant art(s) that various changes in form and detail can be made therein without departing from the spirit and scope of the present invention. In fact, after reading the above description, it will be apparent to one skilled in the relevant art(s) how to implement the invention in alternative embodiments. Thus, the present invention should not be limited by any of the above-described exemplary embodiments. Accordingly, all suitable modifications and equivalents should be considered as falling within the spirit and scope of the invention.

[00060] In addition, it should be understood that the figures, are presented for example purposes only. The processes, formulations and packaging of the present invention are sufficiently flexible and configurable, such that it may be utilized in ways other than that shown in the accompanying figures.

[00061] Further, the purpose of the Abstract of the Disclosure is to enable the U.S. Patent and Trademark Office and the public generally, and especially the scientists, engineers and practitioners in the art who are not familiar with patent or legal terms or phraseology, to determine quickly from a cursory inspection the nature and essence of the technical disclosure of the application. The Abstract of the Disclosure is not intended to be limiting as to the scope of the present invention in any way.

WHAT IS CLAIMED:

1. A process of packaging pet food contents in a container including a plastic cup and a lid, comprising:
 - filling the plastic cup with wet pet food;
 - sealing the plastic cup with the lid to obtain a filled container;
 - retort processing the pet food contents inside the filled container, wherein the retort processing comprises:
 - increasing an environmental temperature surrounding the container to a certain temperature;
 - maintaining the certain temperature for a period of time; and
 - cooling the container to a lower temperature.
2. The process of claim 1, further comprising cutting the lid in a shape corresponding to a mouth of the cup.
3. The process of claim 1, wherein the increasing of the environmental temperature comprises increasing the environmental temperature surrounding the container to approximately 90 °C during a time period of approximately 5 minutes while increasing an environmental pressure surrounding the container to approximately 0.3 bar over atmospheric pressure and then further increasing the environmental temperature to approximately 122 °C during a period of approximately 20 minutes while increasing the environmental pressure to approximately 1.85 bar over atmospheric pressure.
4. The process of claim 3, wherein the maintaining of the environmental temperature comprises maintaining the environmental temperature at approximately 122 °C while increasing the pressure to approximately 2.15 bar over atmospheric pressure.
5. The process of claim 4, wherein the cooling comprises decreasing the environmental temperature to approximately 90 °C in a time period of approximately 2 minutes while reducing the pressure to approximately 1.3 bar over atmospheric pressure.

6. The process of claim 5, wherein the cooling further comprises decreasing the environmental temperature to approximately 60 °C in a time period of approximately 2 minutes while decreasing the pressure to approximately 0.5 bar over atmospheric pressure.
7. The process of claim 6, wherein the cooling further comprises decreasing the environmental temperature to approximately 45 °C in a time period of approximately 5 minutes while maintaining the pressure at approximately 0.5 bar over atmospheric pressure.
8. The process of claim 7, wherein the cooling further comprises decreasing the environmental temperature to approximately 40 °C in a time period of approximately 6 minutes while reducing the pressure to approximately 0.3 bar over atmospheric pressure.
9. The process of claim 8, wherein the cooling further comprises decreasing the environmental temperature to approximately 38 °C in a time period of approximately 8 minutes while reducing the pressure to approximately 0.01 bar over atmospheric pressure.
10. The process of claim 1, wherein the retort processing further comprises applying pressure to the container.
11. The process of claim 10, wherein the applying of the pressure comprises counterbalancing vapor pressure that is created inside the container during heating of the container.
12. The process of claim 1, wherein the maintaining of the environmental temperature comprises maintaining the environmental temperature until the environmental temperature equalizes with a temperature inside the container.
13. The process of claim 1, wherein the maintaining of the environmental temperature comprises maintaining the environmental temperature between approximately 113 °C and approximately 130 °C while correspondingly applying a pressure between approximately 1.0 bar and 3.0 bar over atmospheric pressure.
14. The process of claim 13, wherein the maintaining of the environmental temperature between approximately 113 °C and approximately 130 °C comprises maintaining the

environmental temperature between approximately 113 °C and approximately 130 °C during a time period ranging from approximately 85 minutes to approximately 13 minutes.

15. The process of claim 14, wherein the maintaining of the environmental temperature comprises maintaining the environmental temperature at approximately 113 °C during approximately 85 minutes.

16. The process of claim 14, wherein the maintaining of the environmental temperature comprises maintaining the environmental temperature at approximately 130 °C during approximately 13 minutes.

17. The process of claim 1, wherein the increasing of the temperature comprises increasing the environmental temperature surrounding the container until a temperature of the pet food inside the container reaches approximately 122 °C.

18. The process of claim 1, wherein the cooling comprises rapidly cooling the container.

19. The process of claim 1, further comprising:
calculating a difference between the environmental temperature and a temperature inside the container;
extracting process parameters from the difference; and
determining appropriate processing conditions using the process parameters.

20. The process of claim 1, wherein the wet pet food is wet cat food.

21. The process of claim 1, wherein the pet food comprises:
flaked cooked fish, chunks of meat, poultry, or a cooked shrimp mixture, or a combination of two or more thereof; and
a gravy sauce,
wherein the flaked cooked fish, the chunks of meat, the poultry, or the cooked shrimp mixture, or the combination of two or more thereof are packaged in the sealed plastic cup and retort processed.

22. The process of claim 21, wherein the pet food further includes a food flavor enhancer comprising:

glucose and glycine; and optionally ascorbic acid, egg yolk powder, citric acid, thiamine-HCL, DL-methionine, or L-cysteine, or a combination of two or more thereof.

23. The process of claim 22, further comprising adding the flavor enhancer to the pet food to enhance flavor of the pet food through a Maillard reaction taking place during processing of the pet food.

24. The process of claim 22, wherein glucose is used in an amount between approximately 25% and approximately 60% by weight.

25. The process of claim 22, wherein glycine is used in an amount between approximately 15% and approximately 50% by weight.

26. The process of claim 22, wherein L-cysteine is used in an amount no more than approximately 0.8% by weight.

27. The process of claim 21, wherein the pet food further comprises a protein supplement, a mineral supplement, a vitamin supplement, a food supplement, a binding agent, and a food colorant.

28. The process of claim 27, wherein the protein supplement comprises wheat gluten, spray dried egg, or a combination thereof.

29. The process of claim 28, wherein the wheat gluten is added in an amount between approximately 1 % and approximately 10 % by weight and the spray dried egg is added in an amount between approximately 0 % and approximately 3 % by weight.

30. The process of claim 27, wherein the mineral supplement comprises calcium sulfate, tricalcium phosphate, iodized salt, or feline mineral mix, or any combination of two or more thereof.

31. The process of claim 30, wherein the calcium sulfate is used in an amount between approximately 0 % and approximately 0.6 % by weight, the tricalcium phosphate is used in amount between approximately 0 % and approximately 0.5 % by weight, the iodized salt is used in an amount between approximately 0 % and approximately 1 % by weight and the feline mineral mix is used in amount between approximately 0.01% and approximately 0.05 % by weight.
32. The process of claim 27, wherein the vitamin supplement comprises a feline vitamin premix.
33. The process of claim 32, wherein the feline vitamin premix is used in an amount between approximately 0.01 % and approximately 0.05 % by weight.
34. The process of claim 27, wherein the food supplement comprises taurine.
35. The process of claim 34, wherein taurine is used in an amount between approximately 0 % and approximately 0.05 % by weight.
36. The process of claim 27, wherein the binding agent comprises wheat gluten, tapfill starch or sodium tripolyphosphate, or a combination thereof.
37. The process of claim 36, wherein the wheat gluten is used in an amount between approximately 1 % and approximately 10 % by weight, the tapfill starch is used in an amount between approximately 0 % and approximately 5 % by weight and the sodium tripolyphosphate is used in amount between approximately 0 % and approximately 0.5 % by weight.
38. The process of claim 27, wherein the food colorant comprises titanium dioxide.
39. The process of claim 38, wherein the titanium dioxide is used in an amount between approximately 0 % and approximately 1 % by weight.

40. The process of claim 21, wherein the gravy sauce comprises a thick flow starch, sugar, a binding agent, a mineral supplement, a food supplement, a food preservative, or a flavor enhancer, or a combination of two or more thereof.
41. The process of claim 40, wherein the thick flow starch is used in an amount between approximately 0.2 % and approximately 5 % by weight.
42. The process of claim 40, wherein the sugar is used in an amount between approximately 0.1 % and approximately 4 % by weight.
43. The process of claim 40, wherein the binding agent comprises guar gum.
44. The process of claim 43, wherein the guar gum is used in an amount between approximately 0.1 % and approximately 1 % by weight.
45. The process of claim 40, wherein the mineral supplement comprises potassium chloride.
46. The process of claim 45, wherein the potassium chloride is used in an amount between approximately 0 % and approximately 0.4 % by weight.
47. The process of claim 40, wherein the food supplement comprises taurine or choline chloride 70% , or a combination thereof.
48. The process of claim 47, wherein taurine is used in an amount between approximately 0 % and approximately 0.07 % by weight and choline chloride is used in an amount between approximately 0 % and approximately 0.03 % by weight.
49. The process of claim 40, wherein the food preservative comprises sodium nitrate.
50. The process of claim 49, wherein the sodium nitrate is used in an amount between approximately 0 % and approximately 0.005 % by weight.
51. The process of claim 40, wherein the flavor enhancer comprises a fish extract.

52. The process of claim 51, wherein the fish extract is used in an amount between approximately 0 % and approximately 1.5 % by weight.
53. The process of claim 21, wherein the cooked shrimp mixture comprises cooked shrimp and optionally canthaxanthin.
54. The process of claim 53, wherein the cooked shrimp is used in an amount between approximately 0.1 % and approximately 10 % by weight.
55. The process of claim 53, wherein the canthaxanthin is used in an amount between approximately 0 % and approximately 0.001 % by weight.
56. The process of claim 1, further comprising drawing air from the filled plastic cup.
57. The process of claim 56, further comprising introducing an inert gas into the filled plastic cup.
58. The process of claim 57, wherein the introducing of the inert gas comprises introducing nitrogen.
59. A container for holding wet pet food contents, comprising:
a plastic cup having a sidewall defining a mouth of the cup and a bottom wall, the sidewall comprising a flange portion formed around the mouth of the cup;
a lid sealed on the flange portion of the cup; and
wet pet food disposed in the sealed plastic cup,
wherein the pet food in the plastic cup is retort processed after sealing the cup with the lid.
60. The container of claim 59, wherein the sidewall further comprises a lip formed around the mouth of the cup and protruding from the sidewall.
61. The container of claim 60, wherein the lip has a dimension greater than a dimension of the sidewall at an intersection of the sidewall with the lip.

62. The container of claim 60, wherein the lip is inclined towards an interior of the cup by a slight angle.
63. The container of claim 60, wherein the lip is configured to facilitate release of the food contents in the cup while minimizing splashing.
64. The container of claim 59, wherein air is drawn from the filled plastic cup.
65. The container of claim 64, wherein an inert gas is introduced into the filled plastic cup.
66. The container of claim 59, wherein the bottom wall comprises a depression configured to provide flexibility to the cup during package processing with the food contents.
67. The container of claim 59, wherein the cup has a tapered cylindrical shape such that a dimension of the mouth of the cup is greater than a dimension of the bottom wall of the cup.
68. The container of claim 59, wherein the sidewall of the cup is slightly curved and tapered towards the bottom wall of the cup.
69. The container of claim 59, wherein the cup is integrally formed from plastic.
70. The container of claim 69, wherein the plastic comprises a plurality of layers of polypropylene.
71. The container of claim 70, wherein the plastic comprises a layer of ethylene vinyl alcohol copolymers sandwiched between two polypropylene layers.
72. The container of claim 59, wherein the cup is formed from polypropylene.
73. The container of claim 59, wherein the cup comprises an oxygen barrier.

74. The container of claim 73, wherein the oxygen barrier comprises ethylene vinylalcohol copolymers.
75. The container of claim 59, wherein the lid comprises a plurality of layers including a first layer of plastic, a layer of aluminum and a layer of sealant.
76. The container of claim 75, wherein the first layer of plastic is applied on top of the aluminum layer and the sealant layer is applied on an inner side of the aluminum layer facing the food contents.
77. The container of claim 76, wherein the first layer of plastic is reverse printed and applied on the aluminum layer such that the ink printing images are sandwiched between the aluminum layer and the plastic layer.
78. The container of claim 75, wherein the layer of sealant is applied at an edge corresponding to the flange portion of the cup.
79. The container of claim 75, wherein the first plastic layer comprises polyethylene terephthalate, polybutylene terephthalate, polyester, or polyamide, or any combination thereof.
80. The container of claim 75, wherein the sealant layer comprises polypropylene, ethylene-propylene co-polymers, or a combination thereof.
81. The container of claim 75, further comprises a second layer of plastic, wherein the second layer of plastic is applied on a surface of the aluminum layer opposite the first plastic layer.
82. The container of claim 81, wherein the second layer of plastic comprises a polyamide.
83. The container of claim 81, wherein the sealant layer is applied on a surface of the second layer of plastic.

84. The container of claim 75, wherein the sealant layer comprises a plurality of seal rings configured to provide a peelable lid.

85. The container of claim 84, wherein the sealant layer comprises a first ring-like seal having a recessed notch portion or a bump portion.

86. The container of claim 85, wherein the recessed notch portion or the bump portion is disposed adjacent a tab portion of the lid.

87. The container of claim 86, wherein the sealant layer comprises a second ring-like seal spaced apart from the first ring-like seal, the second ring-like seal is configured to provide a seal strength greater than a seal strength of the first ring-like seal at an initiation of a lid peeling process.

88. The container of claim 87, wherein the second ring-like seal is the inner seal and the first ring-like seal is the outer seal.

89. The container of claim 87, wherein the first ring-like seal and the second ring-like seal are configured to provide an easy release of the lid while preventing potential splash of the food contents in the container.

90. The container of claim 87, wherein the seal strength of the first ring-like seal is between 0.7 and 1.5 Kgf at the initiation of the peel and the seal strength of the second ring-like seal is between 0.8 and 2.0 Kgf at the initiation of the peel.

91. The container of claim 59, wherein the pet food comprises:

flaked cooked fish, chunks of meat, poultry, or a cooked shrimp mixture, or a combination of two or more thereof; and
a gravy sauce,

wherein the flaked cooked fish, the chunks of meat, the poultry, or the cooked shrimp mixture, or the combination of two or more thereof are packaged in the sealed plastic cup and retort processed.

92. The container of claim 91, wherein the pet food further includes a food flavor enhancer comprising:
glucose and glycine; and optionally ascorbic acid, egg yolk powder, citric acid, thiamine-HCL, DL-methionine, or L-cysteine, or a combination of two or more thereof.
93. The container of claim 92, further comprising adding the flavor enhancer to the pet food to enhance flavor of the pet food through a Maillard reaction taking place during processing of the pet food.
94. The container of claim 92, wherein glucose is used in an amount between approximately 25% and approximately 60% by weight.
95. The container of claim 92, wherein glycine is used in an amount between approximately 15% and approximately 50% by weight.
96. The container of claim 92, wherein L-cysteine is used in an amount no more than approximately 0.8% by weight.
97. The container of claim 91, wherein the pet food further comprises a protein supplement, a mineral supplement, a vitamin supplement, a food supplement, a binding agent, and a food colorant.
98. The container of claim 97, wherein the protein supplement comprises wheat gluten, spray dried egg, or a combination thereof.
99. The container of claim 98, wherein the wheat gluten is added in an amount between approximately 1 % and approximately 10 % by weight and the spray dried egg is added in an amount between approximately 0 % and approximately 3 % by weight.
100. The container of claim 97, wherein the mineral supplement comprises calcium sulfate, tricalcium phosphate, iodized salt, or feline mineral mix, or any combination of two or more thereof.

101. The container of claim 100, wherein the calcium sulfate is used in an amount between approximately 0 % and approximately 0.6 % by weight, the tricalcium phosphate is used in amount between approximately 0 % and approximately 0.5 % by weight, the iodized salt is used in an amount between approximately 0 % and approximately 1 % by weight and the feline mineral mix is used in amount between approximately 0.01% and approximately 0.05 % by weight.

102. The container of claim 97, wherein the vitamin supplement comprises a feline vitamin premix.

103. The container of claim 102, wherein the feline vitamin premix is used in an amount between approximately 0.01 % and approximately 0.05 % by weight.

104. The container of claim 27, wherein the food supplement comprises taurine.

105. The container of claim 104, wherein taurine is used in an amount between approximately 0 % and approximately 0.05 % by weight.

106. The container of claim 97, wherein the binding agent comprises wheat gluten, tapfill starch or sodium tripolyphosphate, or a combination thereof.

107. The container of claim 106, wherein the wheat gluten is used in an amount between approximately 1 % and approximately 10 % by weight, the tapfill starch is used in an amount between approximately 0 % and approximately 5 % by weight and the sodium tripolyphosphate is used in amount between approximately 0 % and approximately 0.5 % by weight.

108. The container of claim 107, wherein the food colorant comprises titanium dioxide.

109. The container of claim 108, wherein the titanium dioxide is used in an amount between approximately 0 % and approximately 1 % by weight.

110. The container of claim 91, wherein the gravy sauce comprises a thick flow starch, sugar, a binding agent, a mineral supplement, a food supplement, a food preservative, or a flavor enhancer, or a combination of two or more thereof.
111. The container of claim 110, wherein the thick flow starch is used in an amount between approximately 0.2 % and approximately 5 % by weight.
112. The container of claim 110, wherein the sugar is used in an amount between approximately 0.1 % and approximately 4 % by weight.
113. The container of claim 110, wherein the binding agent comprises guar gum.
114. The container of claim 113, wherein the guar gum is used in an amount between approximately 0.1 % and approximately 1 % by weight.
115. The container of claim 110, wherein the mineral supplement comprises potassium chloride.
116. The container of claim 115, wherein the potassium chloride is used in an amount between approximately 0 % and approximately 0.4 % by weight.
117. The container of claim 110, wherein the food supplement comprises taurine or choline chloride 70% , or a combination thereof.
118. The container of claim 117, wherein taurine is used in an amount between approximately 0 % and approximately 0.07 % by weight and choline chloride is used in an amount between approximately 0 % and approximately 0.03 % by weight.
119. The process of claim 110, wherein the food preservative comprises sodium nitrate.
120. The process of claim 119, wherein the sodium nitrate is used in an amount between approximately 0 % and approximately 0.005 % by weight.
121. The container of claim 110, wherein the flavor enhancer comprises a fish extract.

122. The process of claim 121, wherein the fish extract is used in an amount between approximately 0 % and approximately 1.5 % by weight.

123. The process of claim 91, wherein the cooked shrimp mixture comprises cooked shrimp and optionally canthaxanthin.

124. The container of claim 123, wherein the cooked shrimp is used in an amount between approximately 0.1 % and approximately 10 % by weight.

125. The container of claim 123, wherein the canthaxanthin is used in an amount between approximately 0 % and approximately 0.001 % by weight.

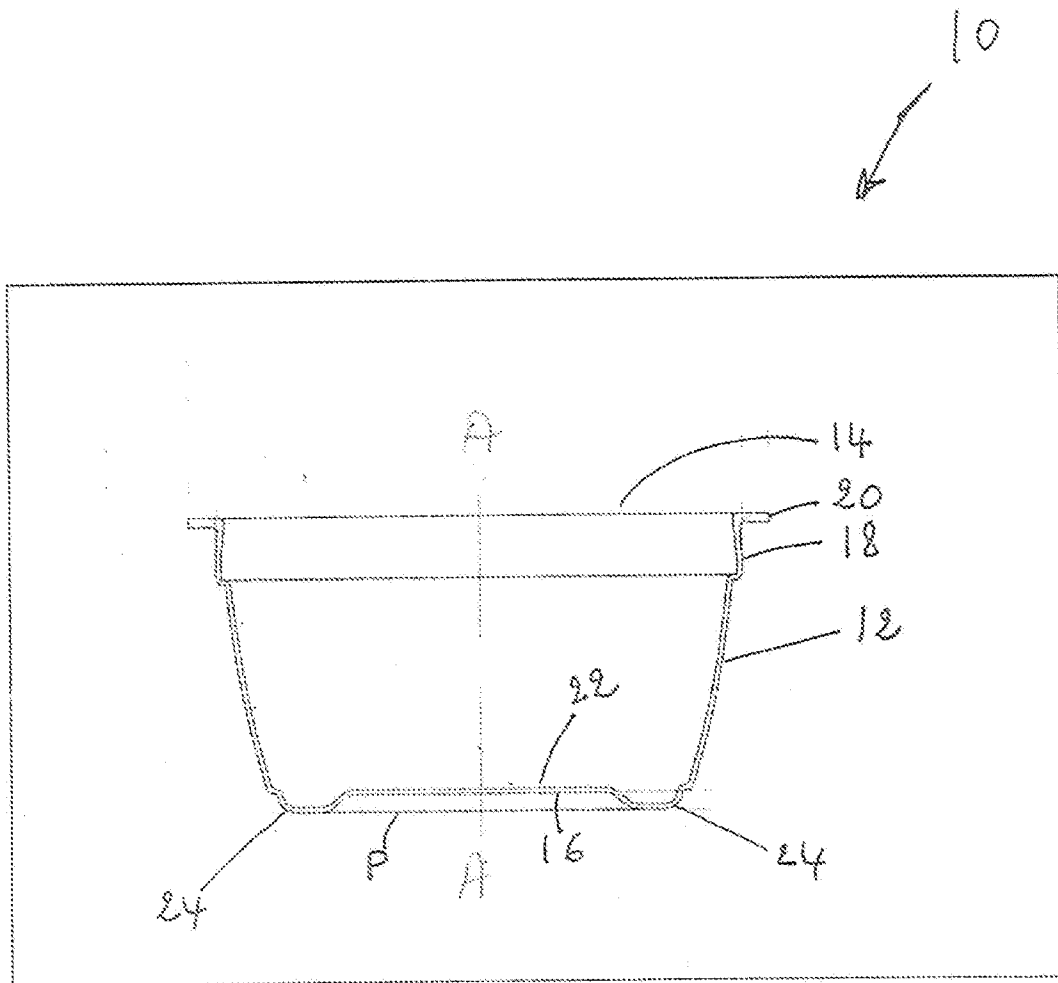


FIG. 1

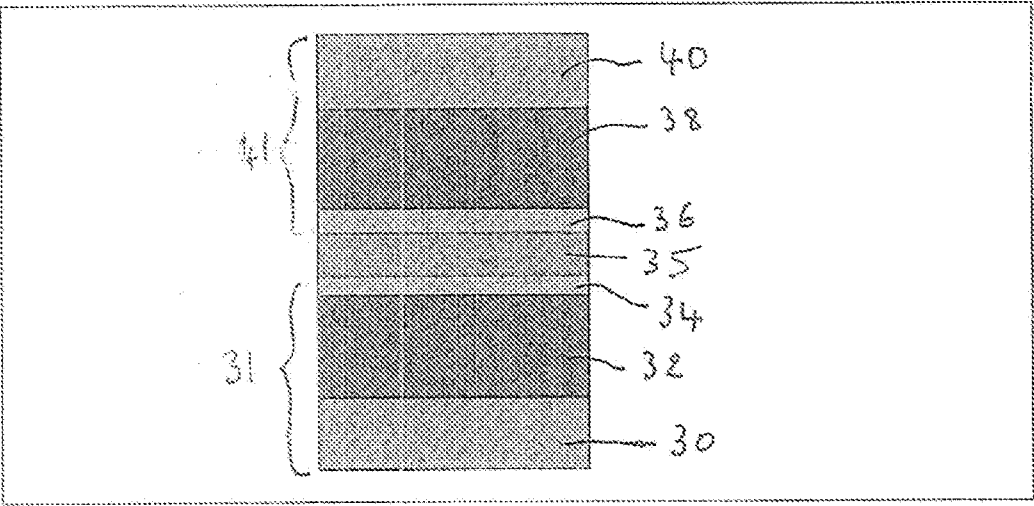


FIG. 2

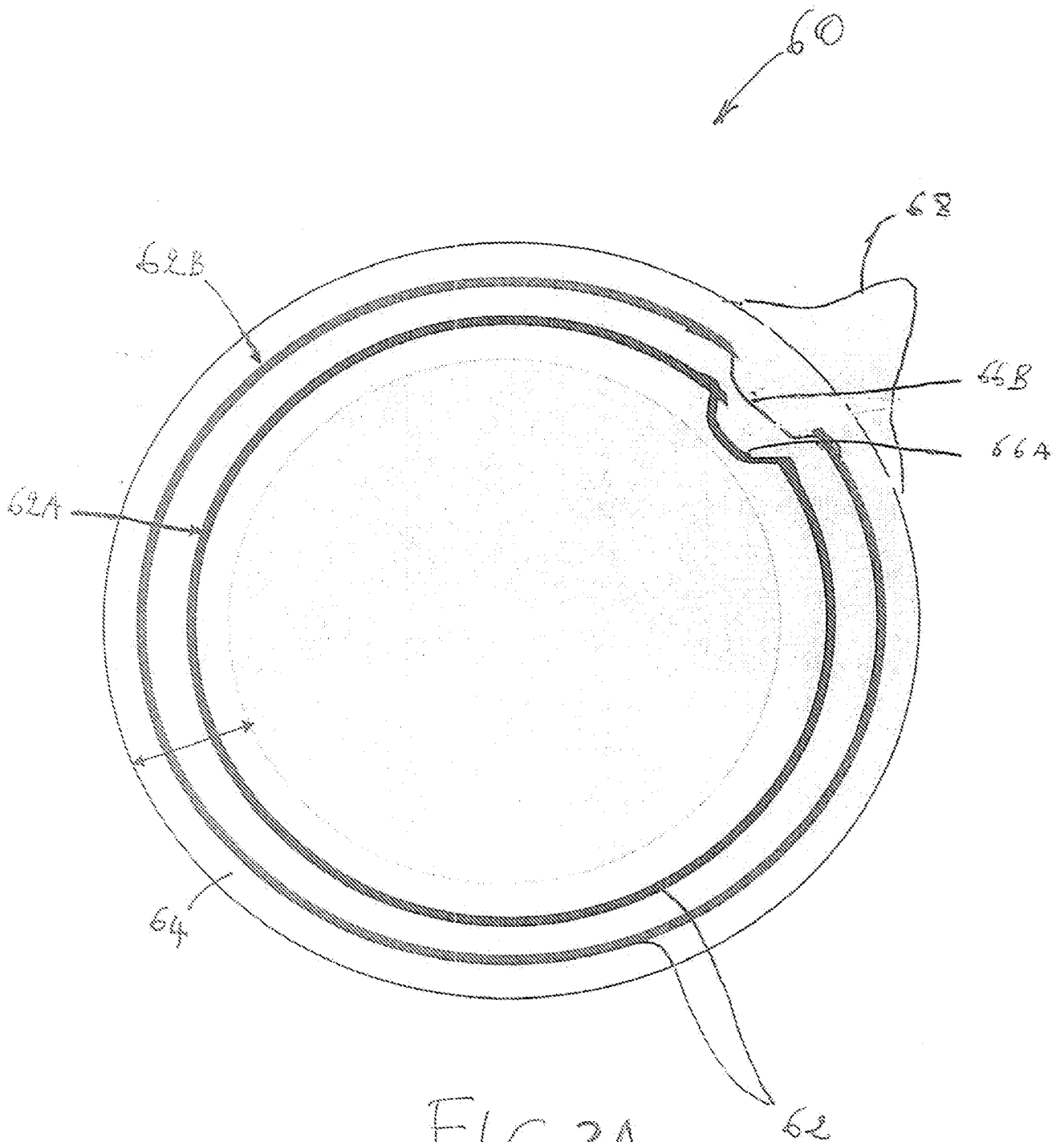


FIG. 3A

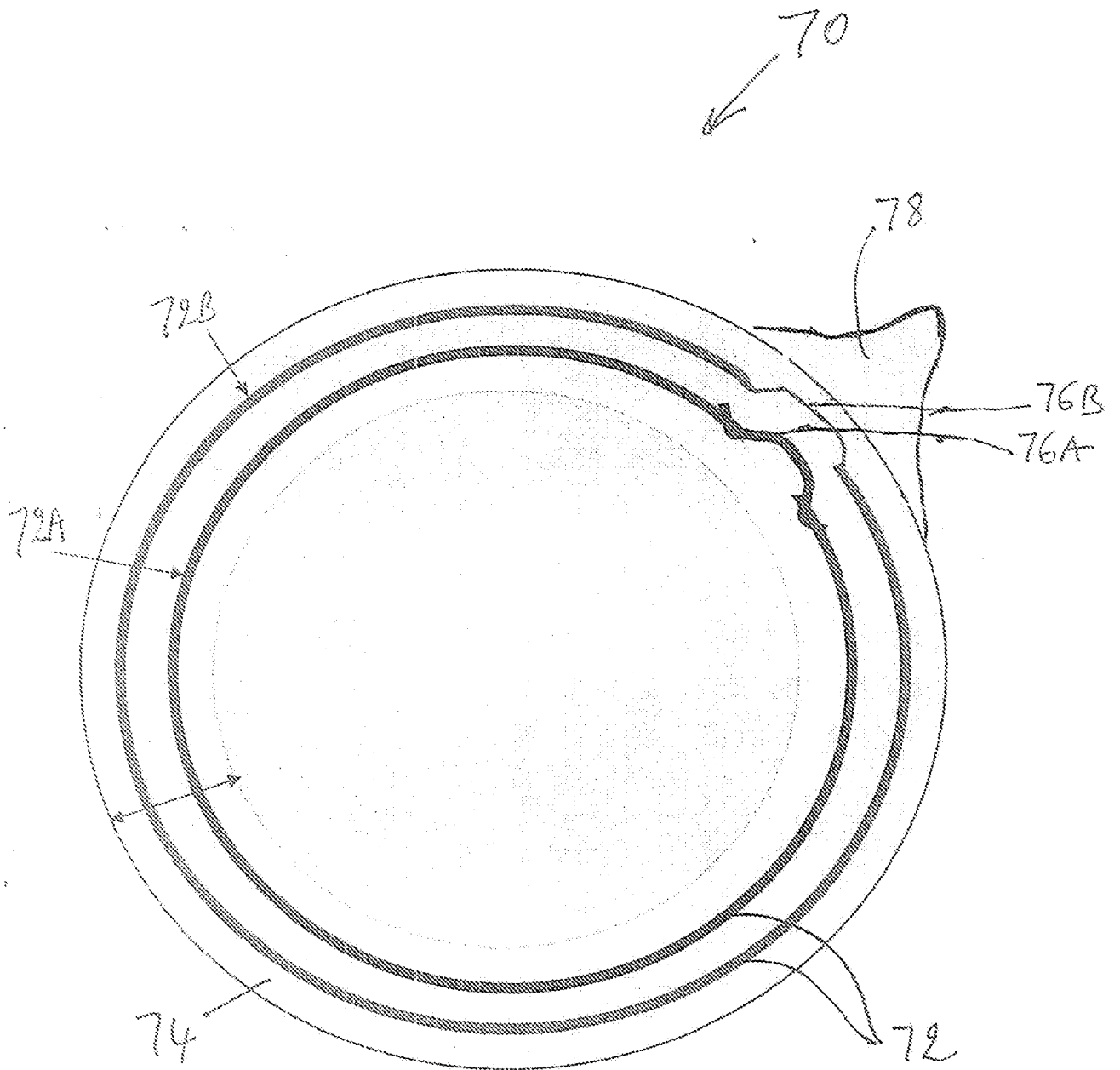


FIG. 3B

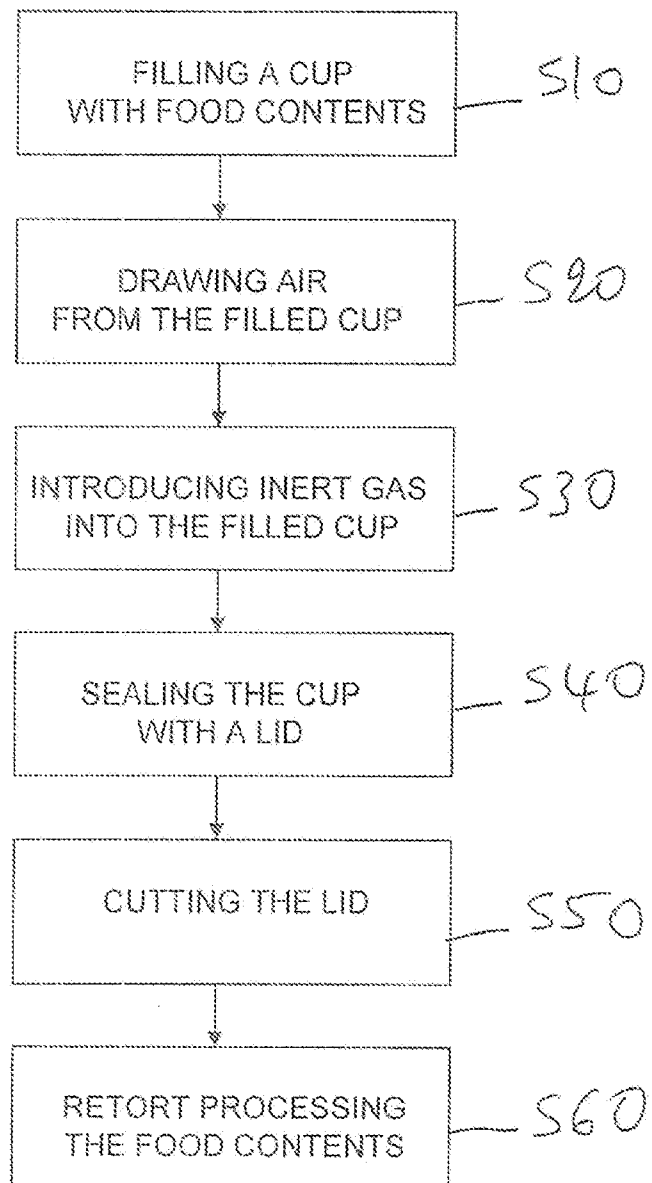


FIG. 4

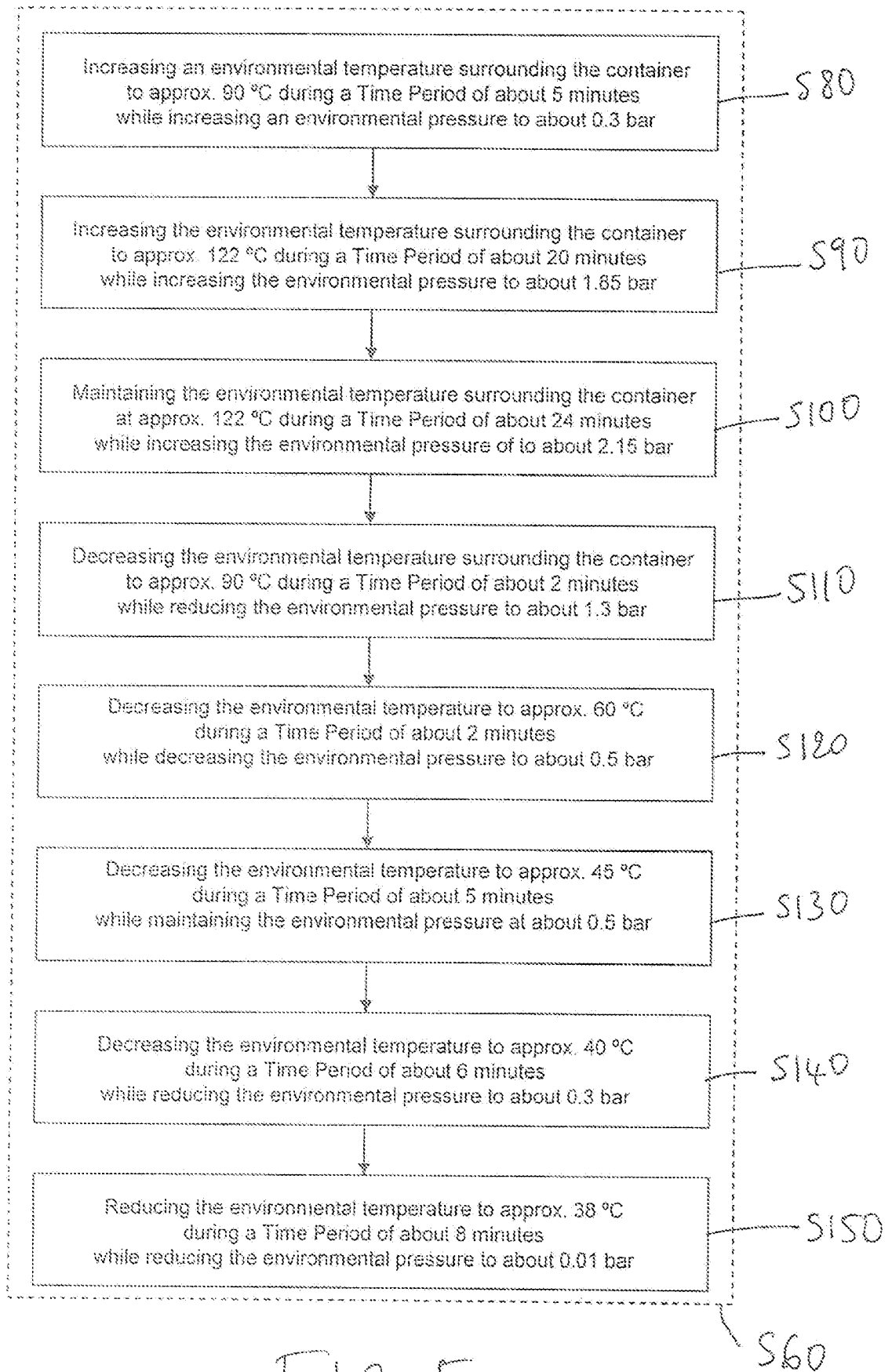


FIG. 5

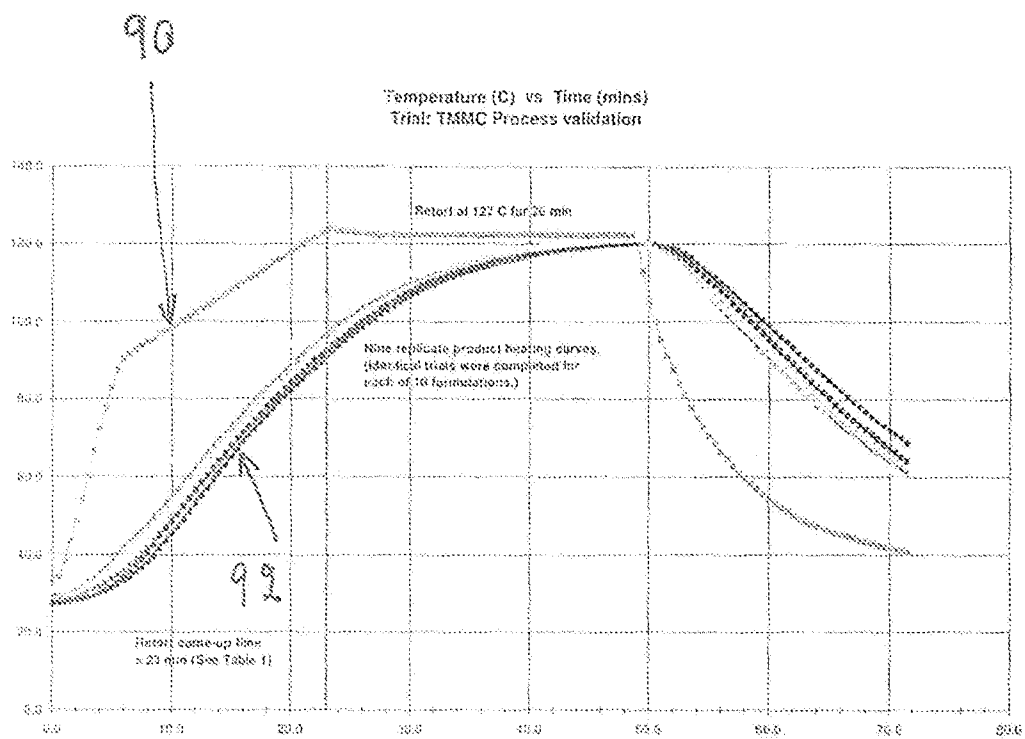


FIG. 6

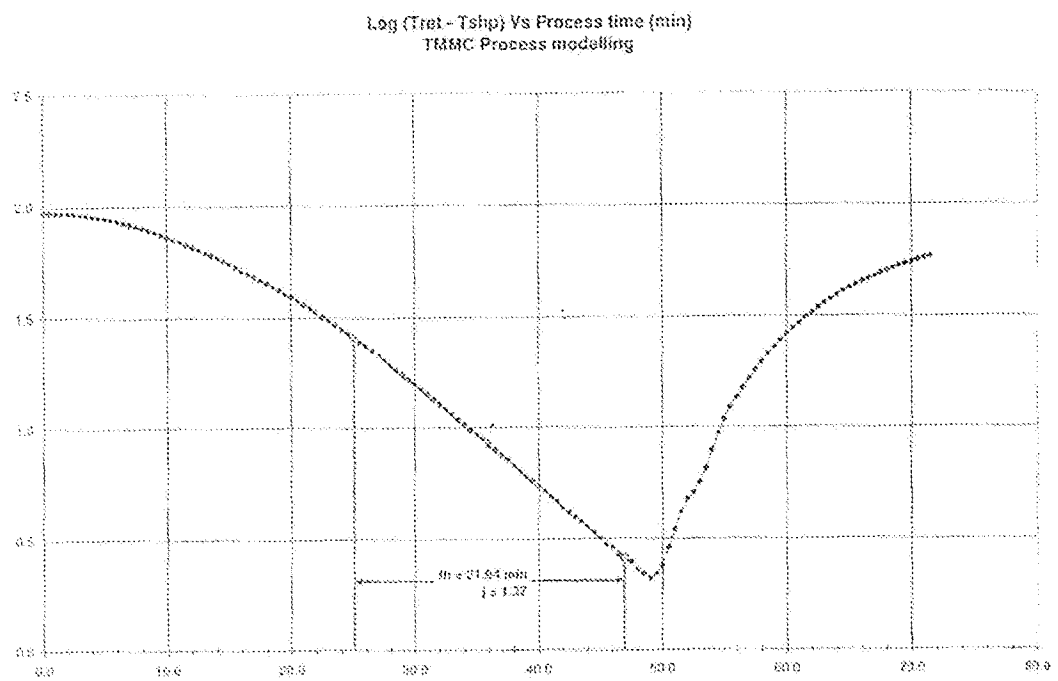


FIG. 7