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Birchmeier et al.(10) **Pub. No.: US 2021/0403222 A1**(43) **Pub. Date: Dec. 30, 2021**(54) **MICROWAVEABLE PACKAGED FOOD
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(57)

ABSTRACT

A package containing nuts and suitable for microwave heating is described herein. The package is configured to heat the nuts and provide an aroma reminiscent of traditional, freshly-roasted nuts. The freshly-roasted nut attributes include an aroma, temperature, texture and taste, which are reproduced with the microwave package. The package preferably, though not necessarily, incorporates one or more susceptors in order to provide additional heating, such as conductive heating, to the nuts. The package also preferably includes a sufficient headspace to allow for the aromas to develop.

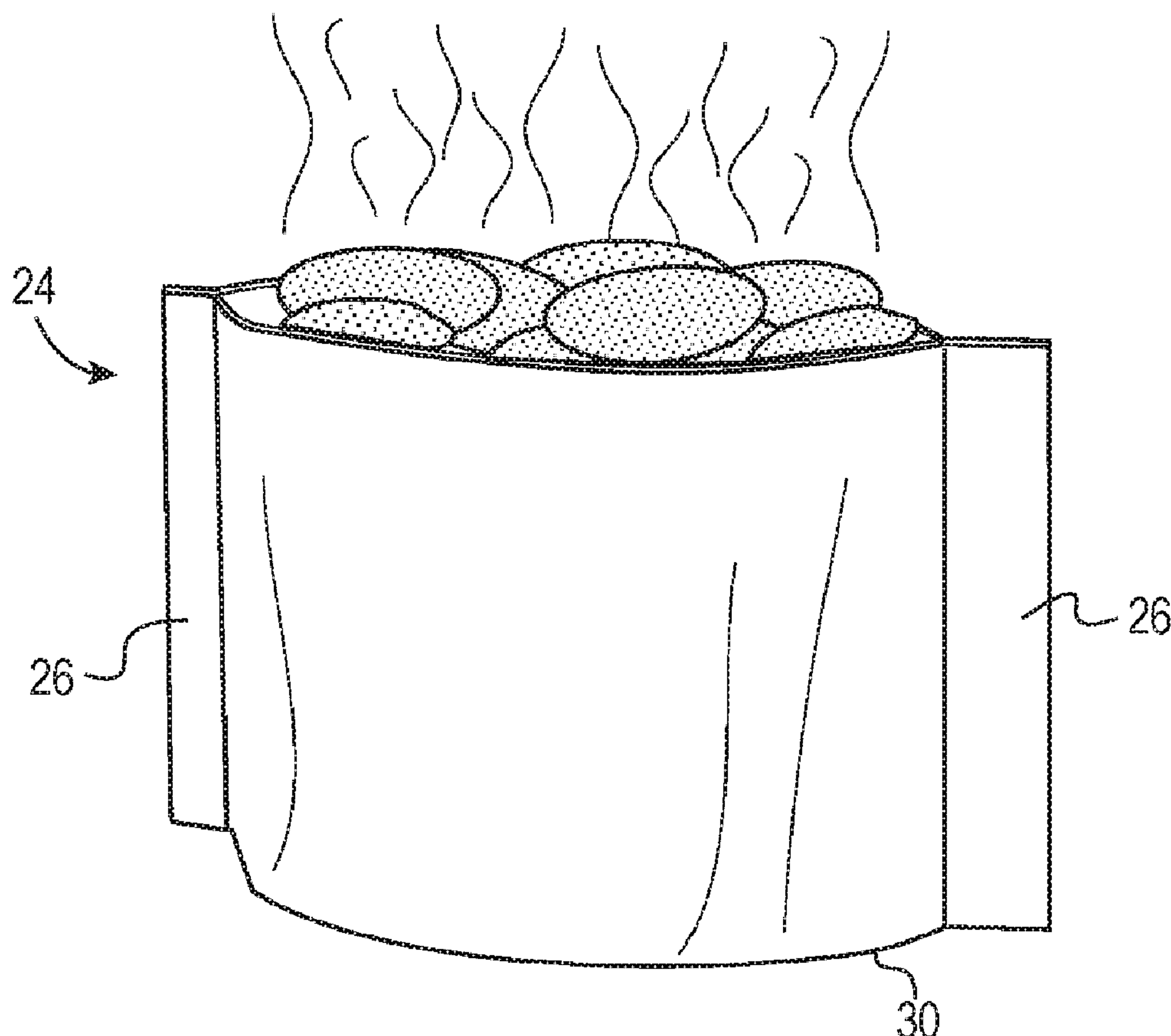


FIG. 1

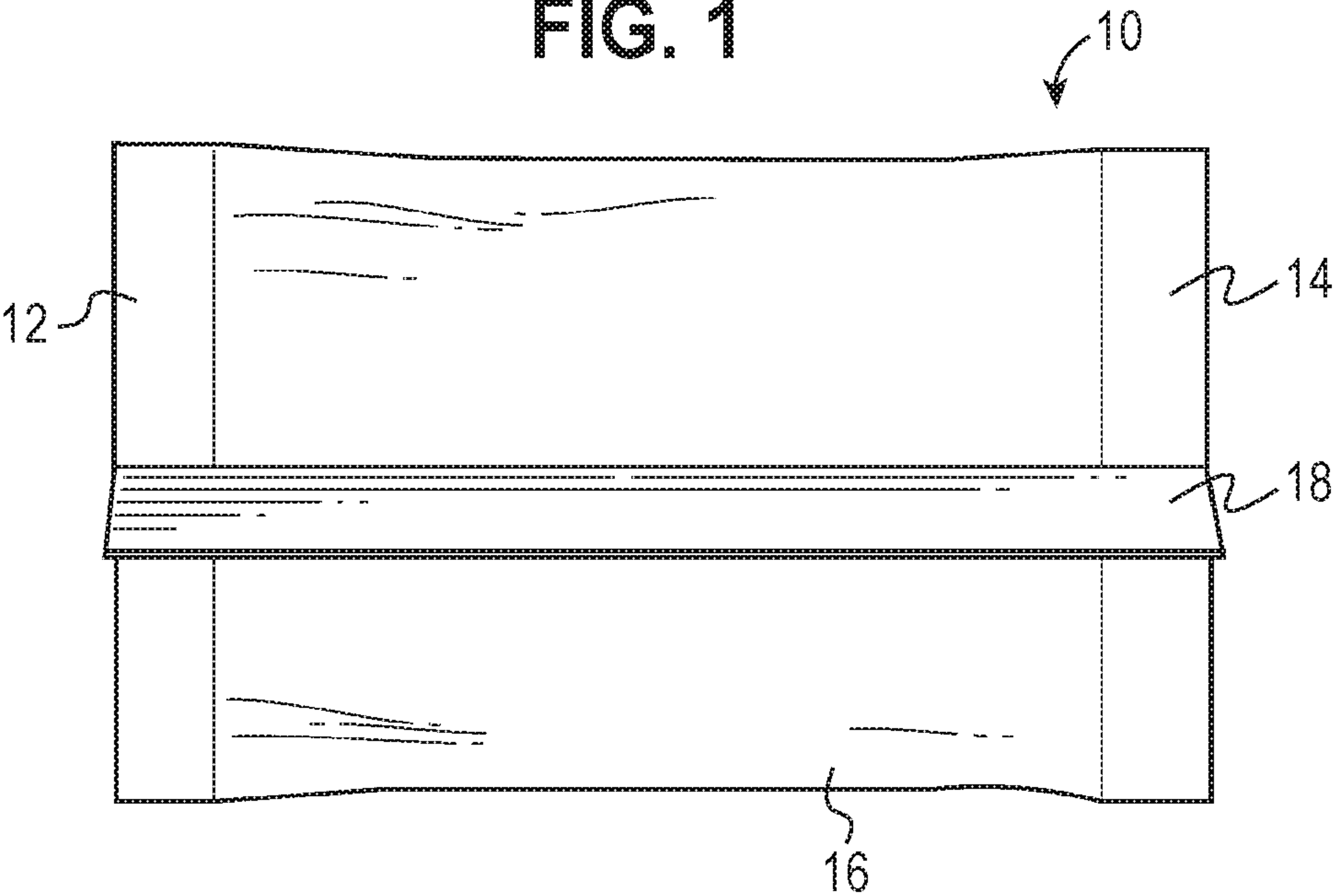


FIG. 2

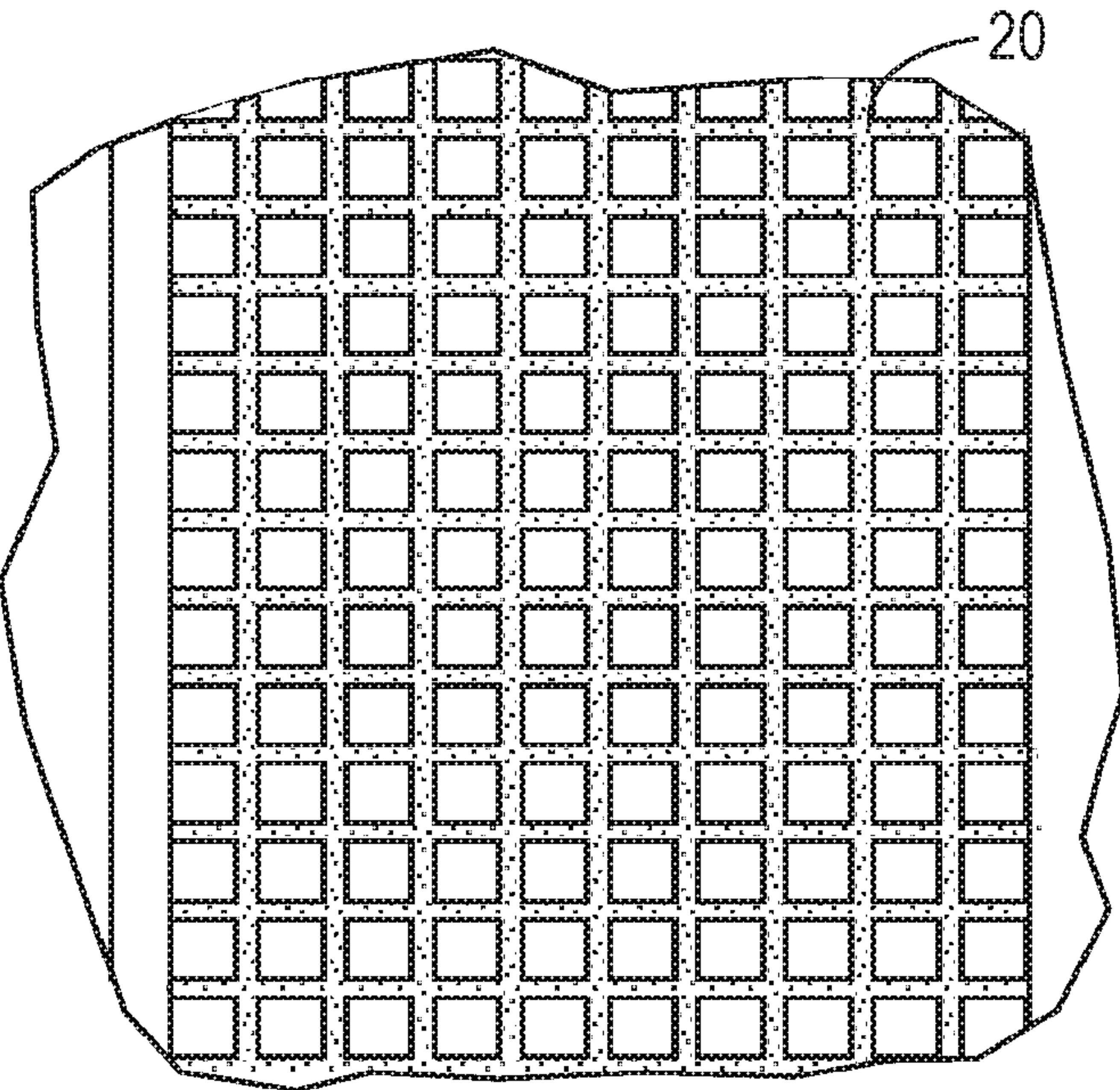


FIG. 3

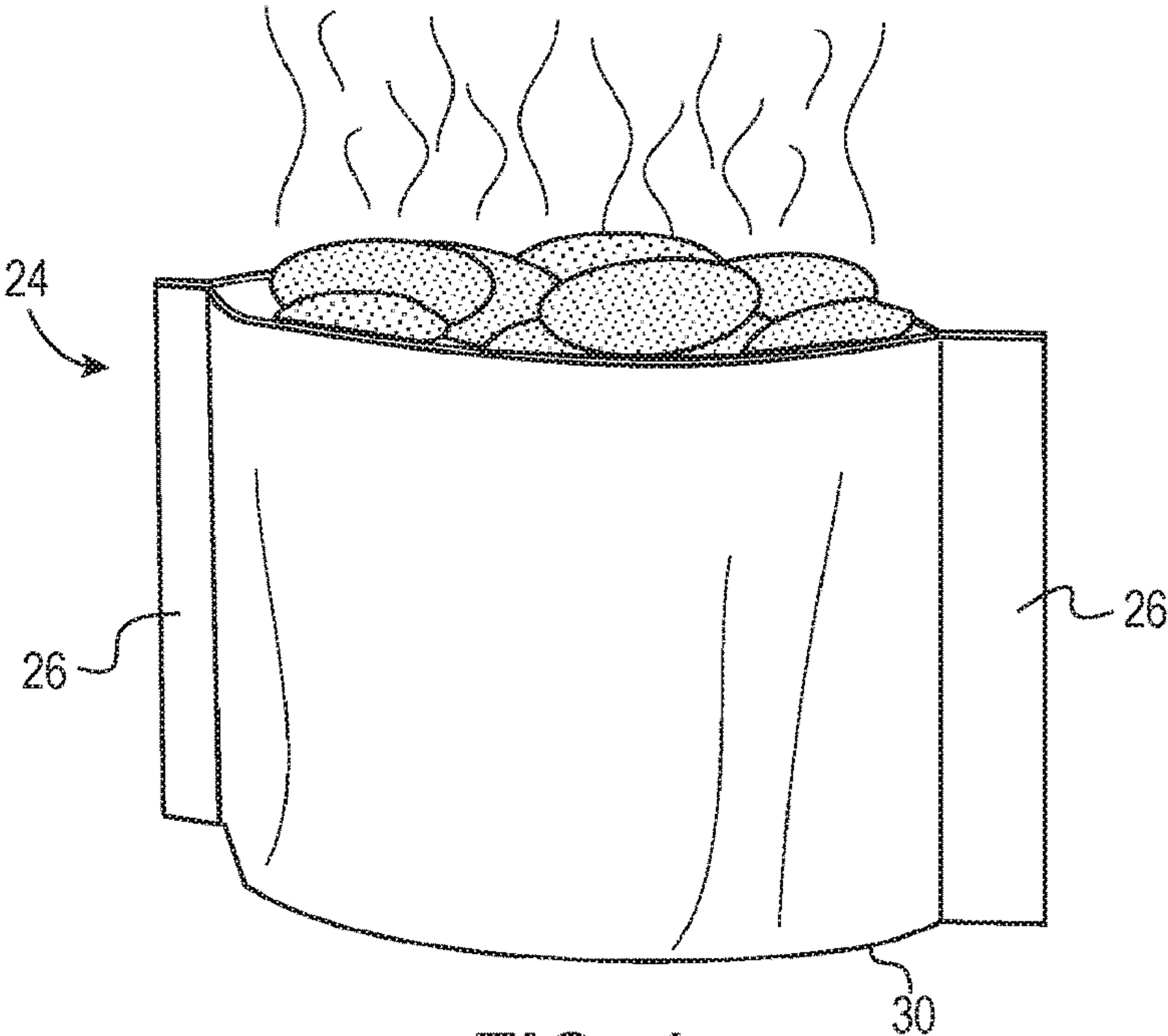


FIG. 4

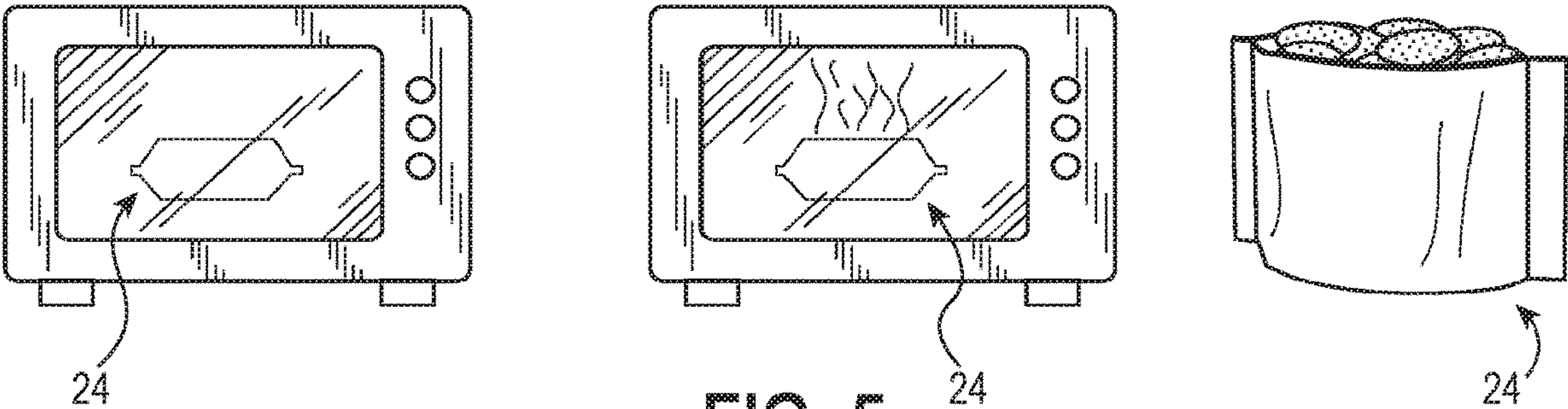


FIG. 5

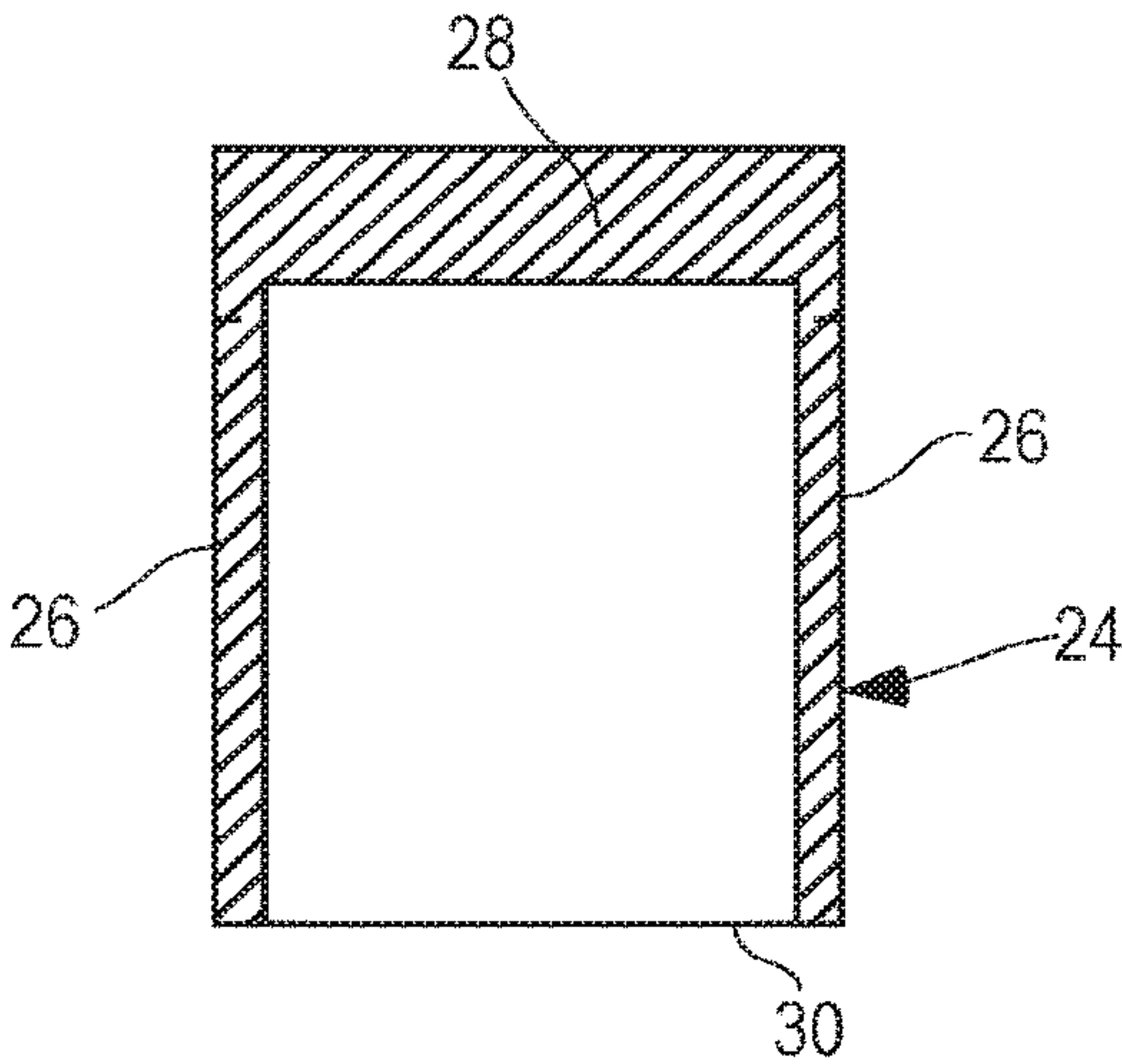


FIG. 6

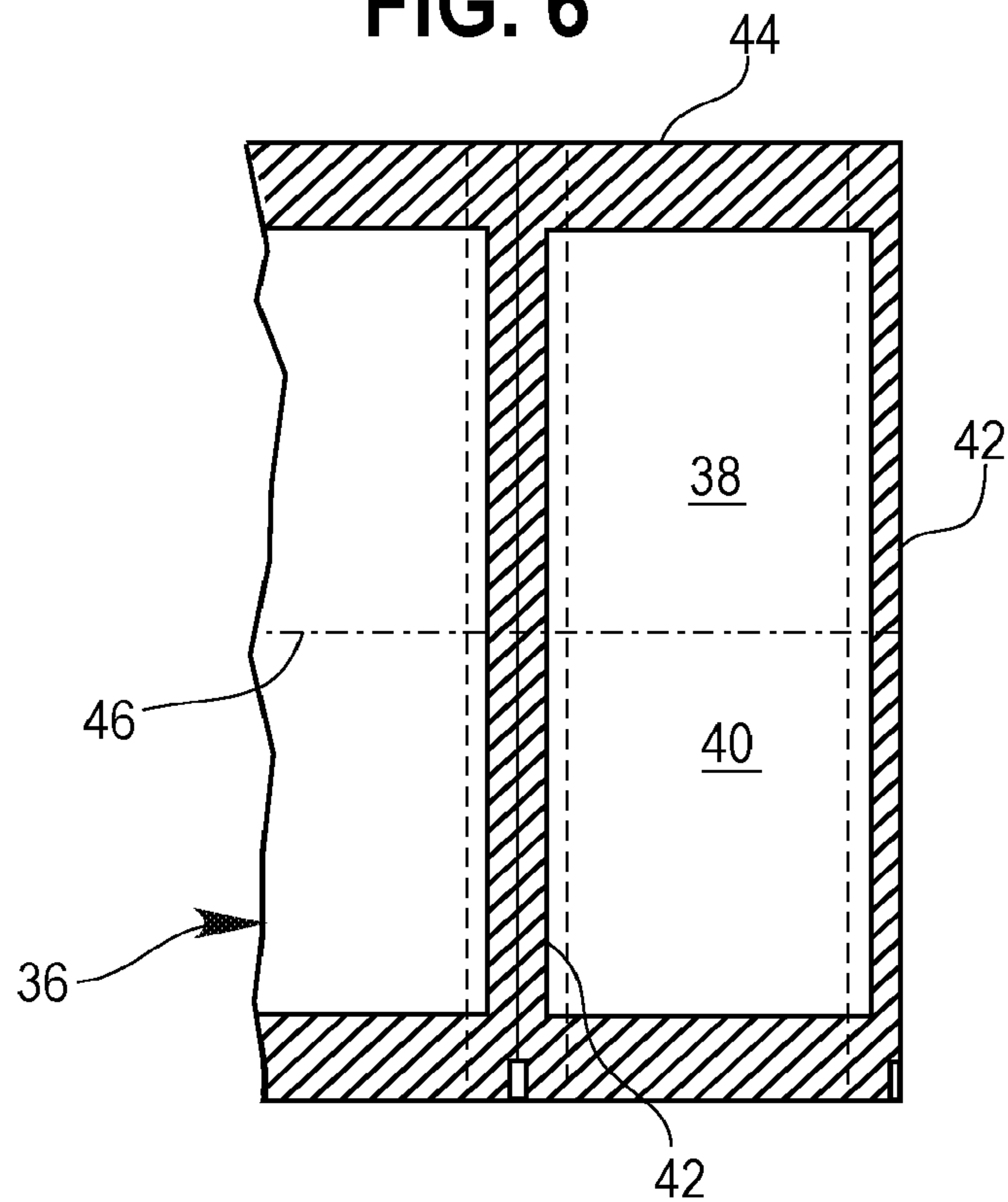
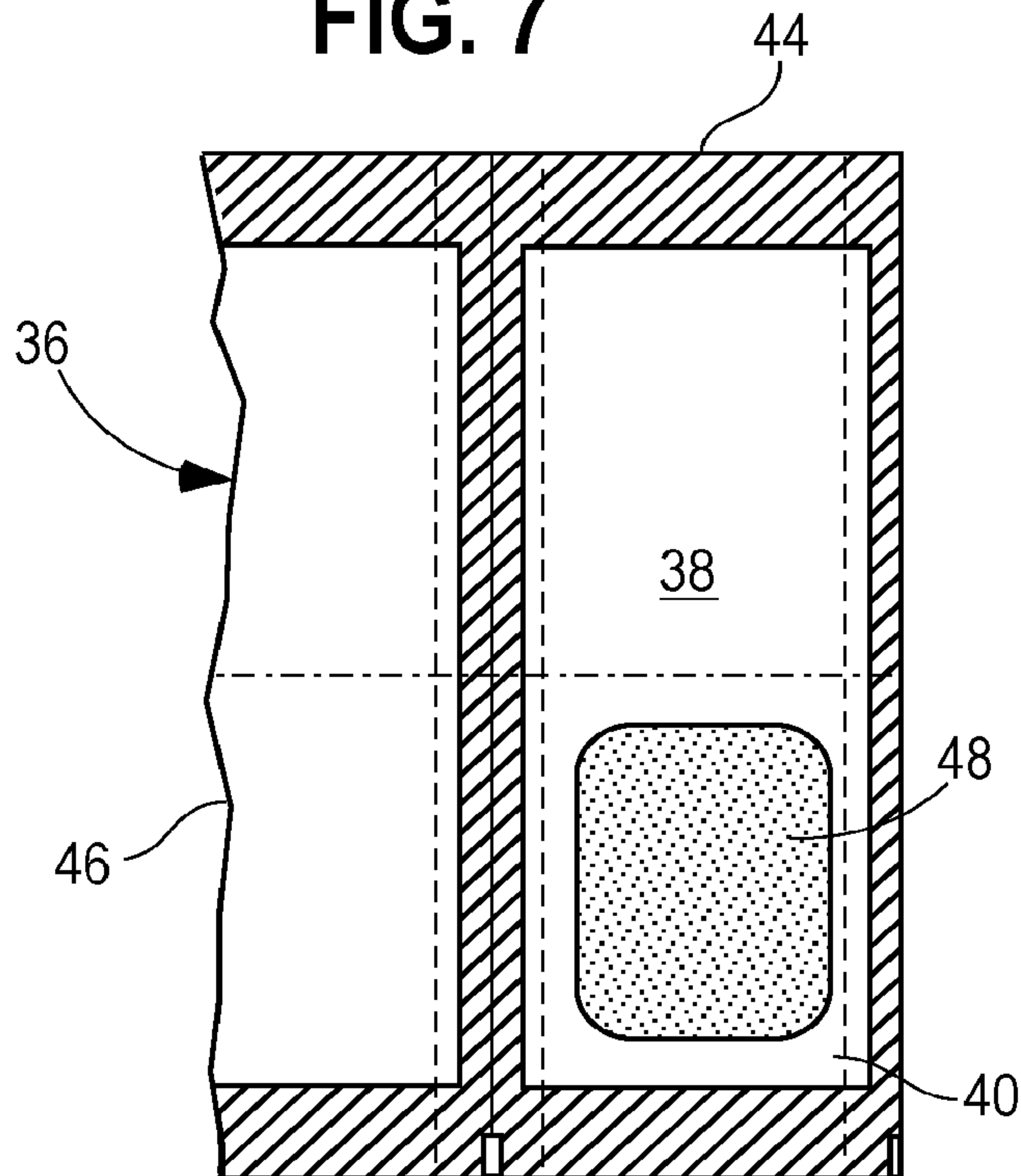


FIG. 7



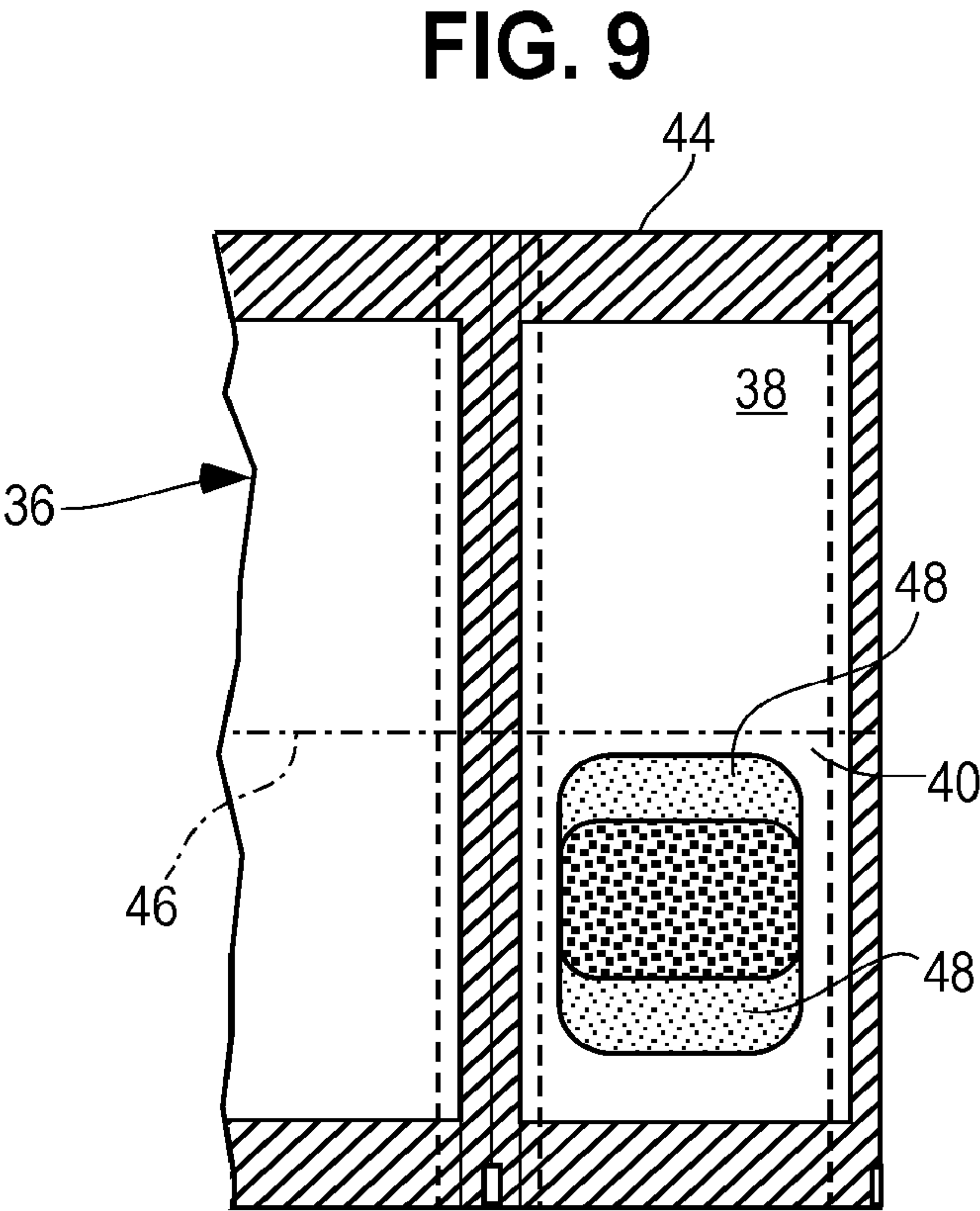
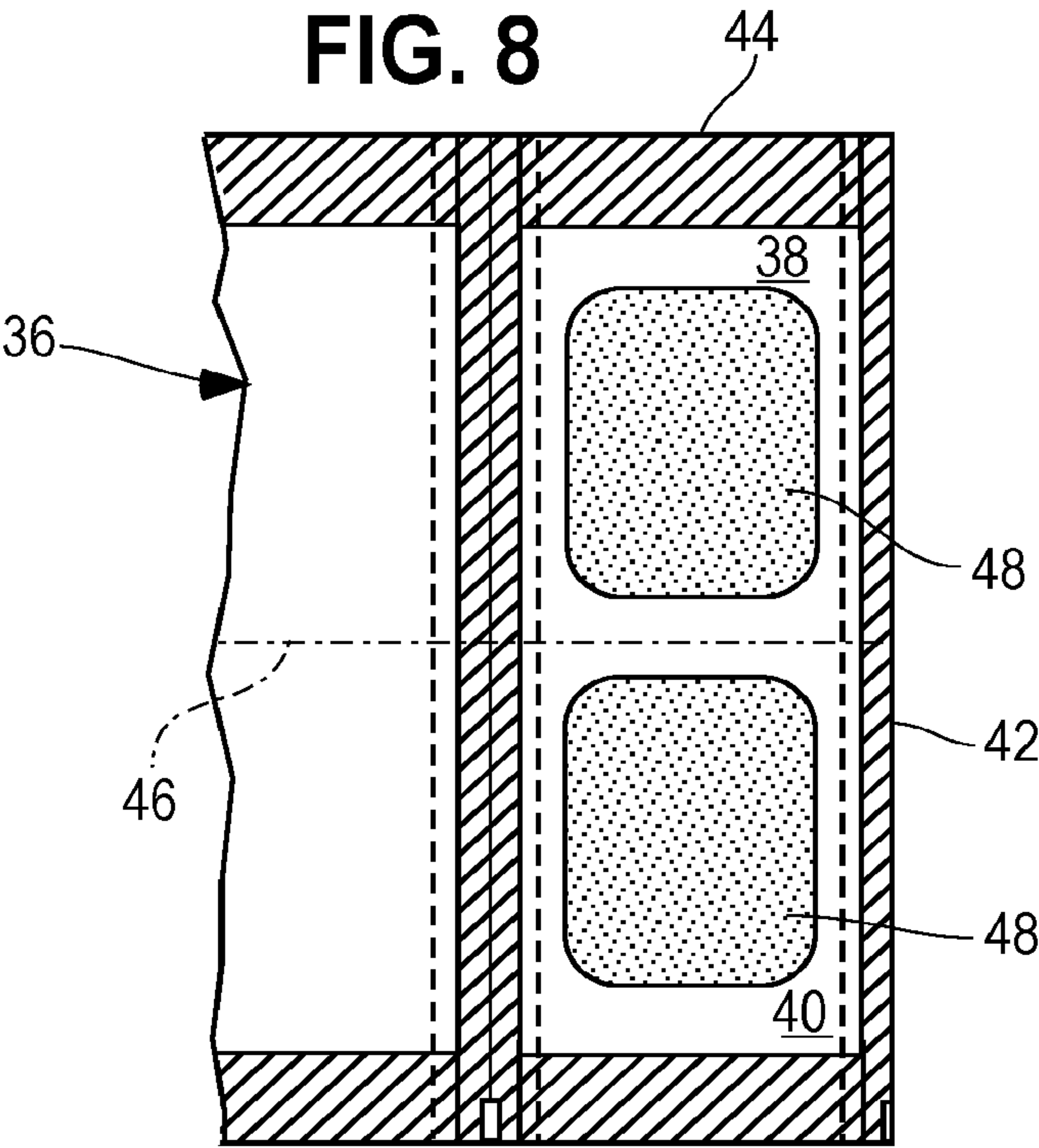


FIG. 10
Susceptor Headspace Aroma
Increase-Mixed Nuts

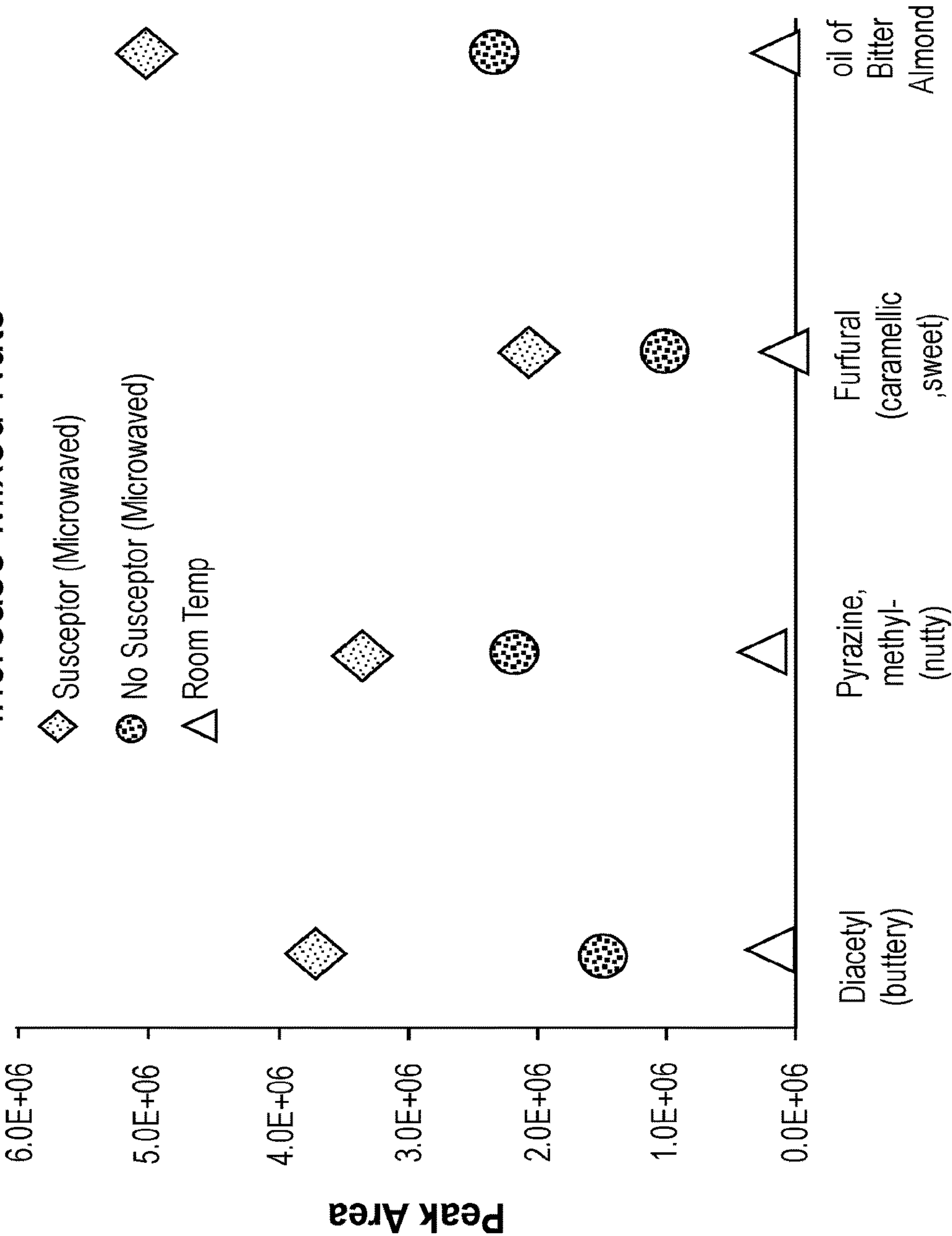


FIG. 11

Average Key indicator Aroma Preliminary Results	Pyrazine,ethyl-(Roasted)		Furfural (Carmel)		Diacetyl(Buttery)	
	Average Peak Area	Fold Increase	Average Peak Area	Fold Increase	Average Peak Area	Fold Increase
Treatment						
Almond_RT	34,000		570,000		120,000	
Almond_Warm	72,000	2	740,00	1	2,300,000	18
Carmel_Peanut_RT	5,600		140,00		34,000	
Carmel_Peanut_Warm	360,000	64	7,200,00	53	730,000	21
Cashew_RT	5,800		73,000		35,000	
Cashew_Warm	720,000	125	12,000,000	167	10,000,000	289
Cinnamon Almond_RT	29,000		330,000		360,000	
Cinnamon Almond_Warm	880,000	31	48,000,000	144	18,000,000	50
Coconut Cashew_RT	7,600		200,000		25,000	
Coconut Cashew_Warm	410,000	54	30,000,000	155	2,300,000	93

FIG. 12

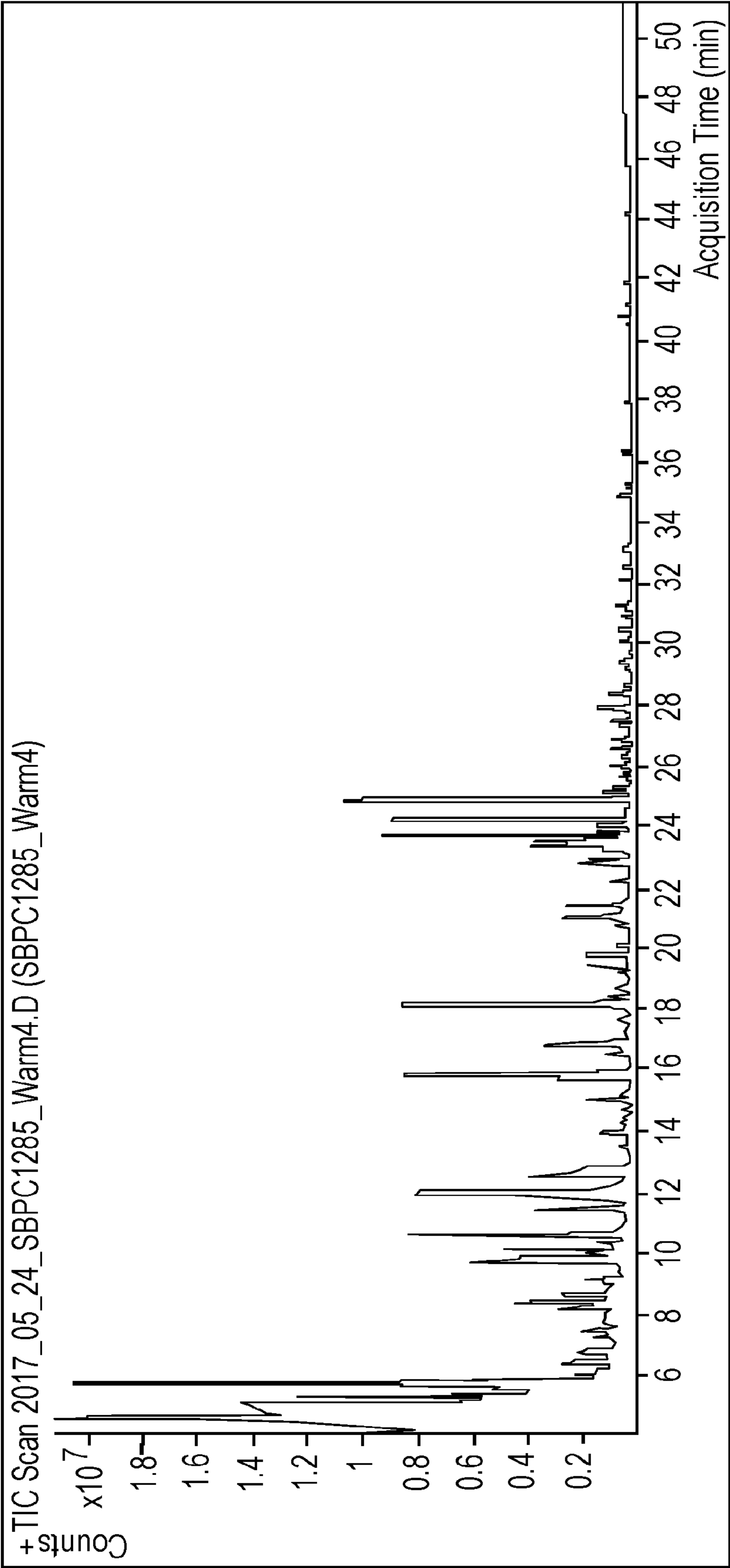


FIG. 13

Pyraztne, methyl-

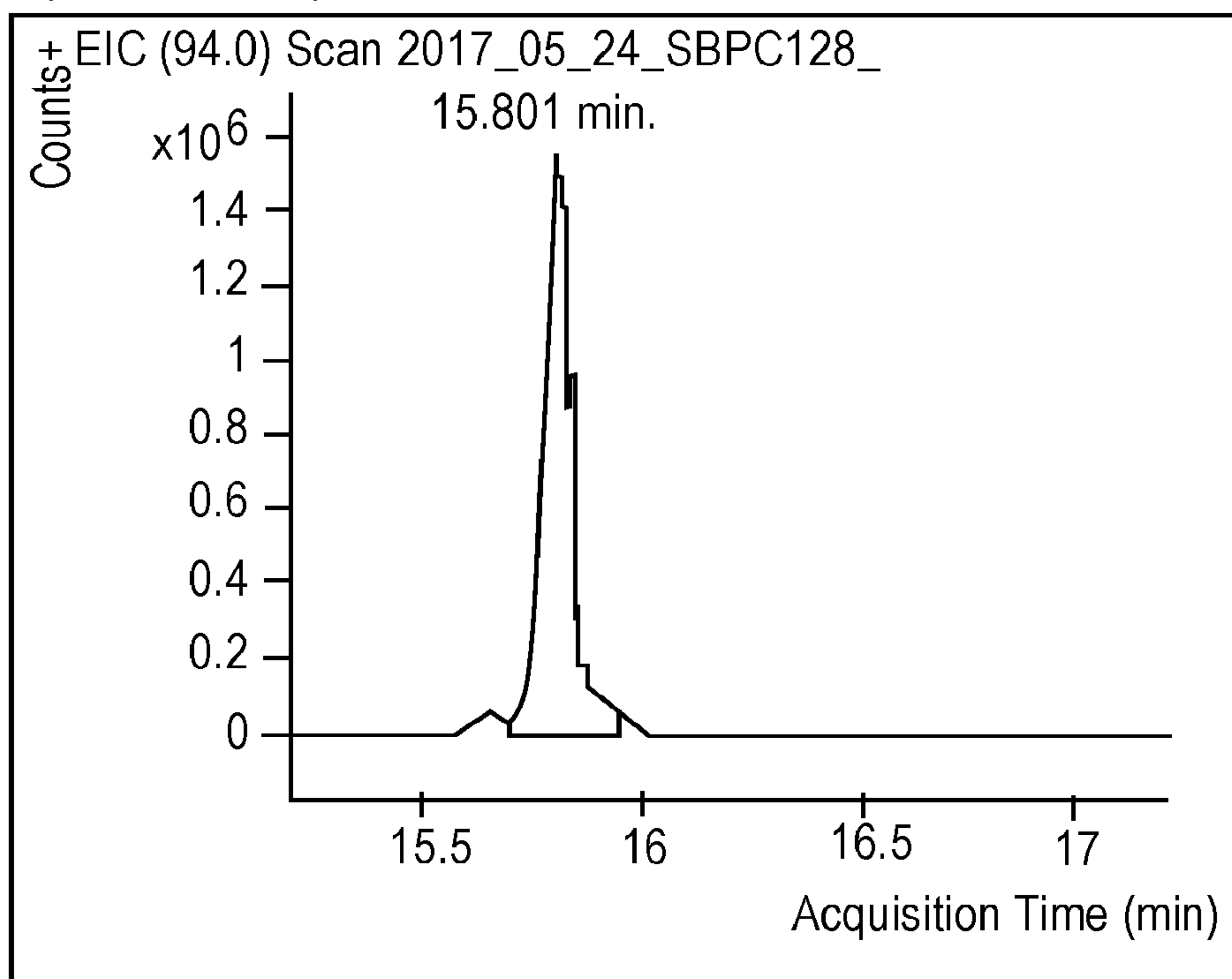


FIG. 14

Pyraztne, 2,5-Dimethyl-

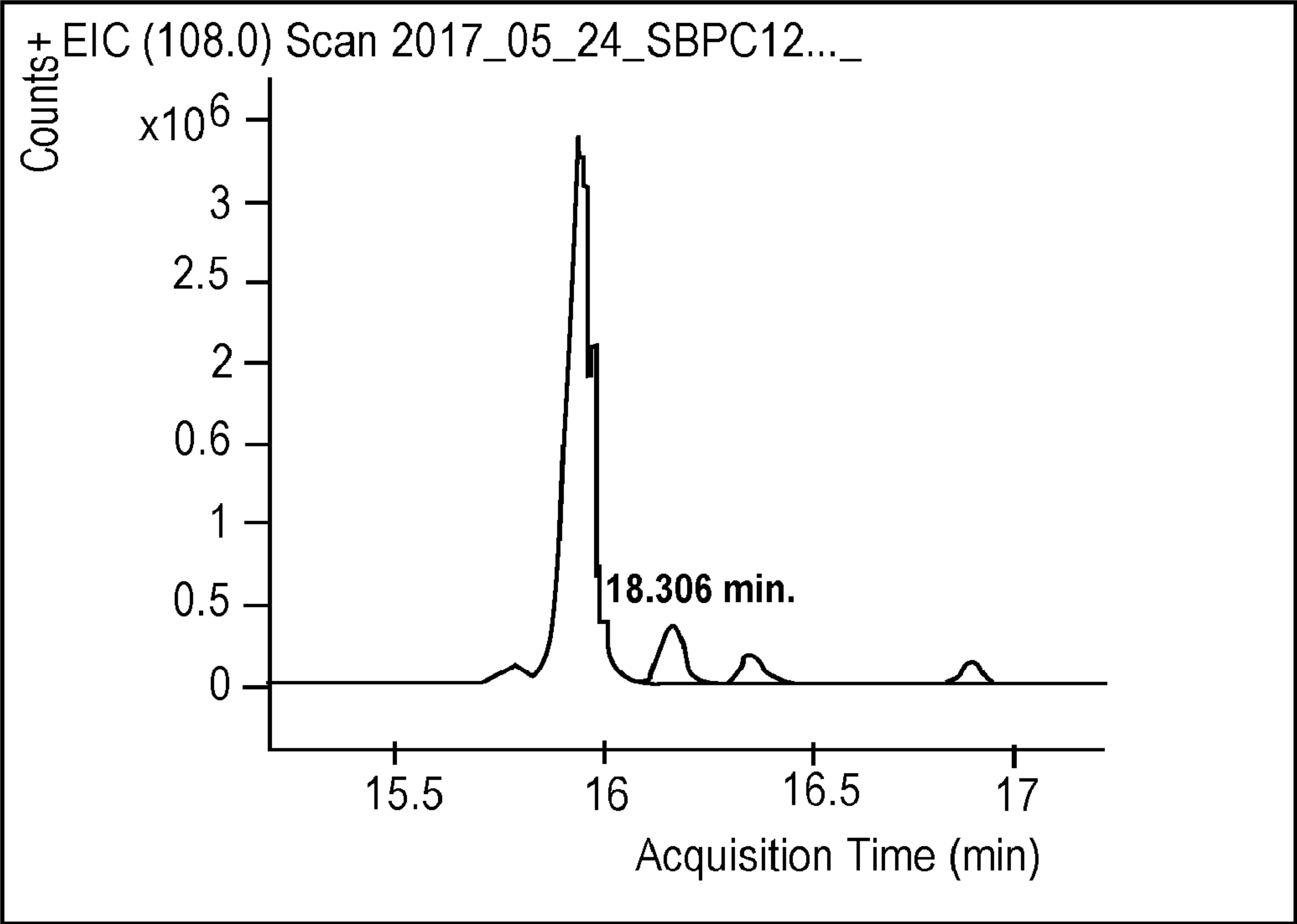


FIG. 15

Furfural

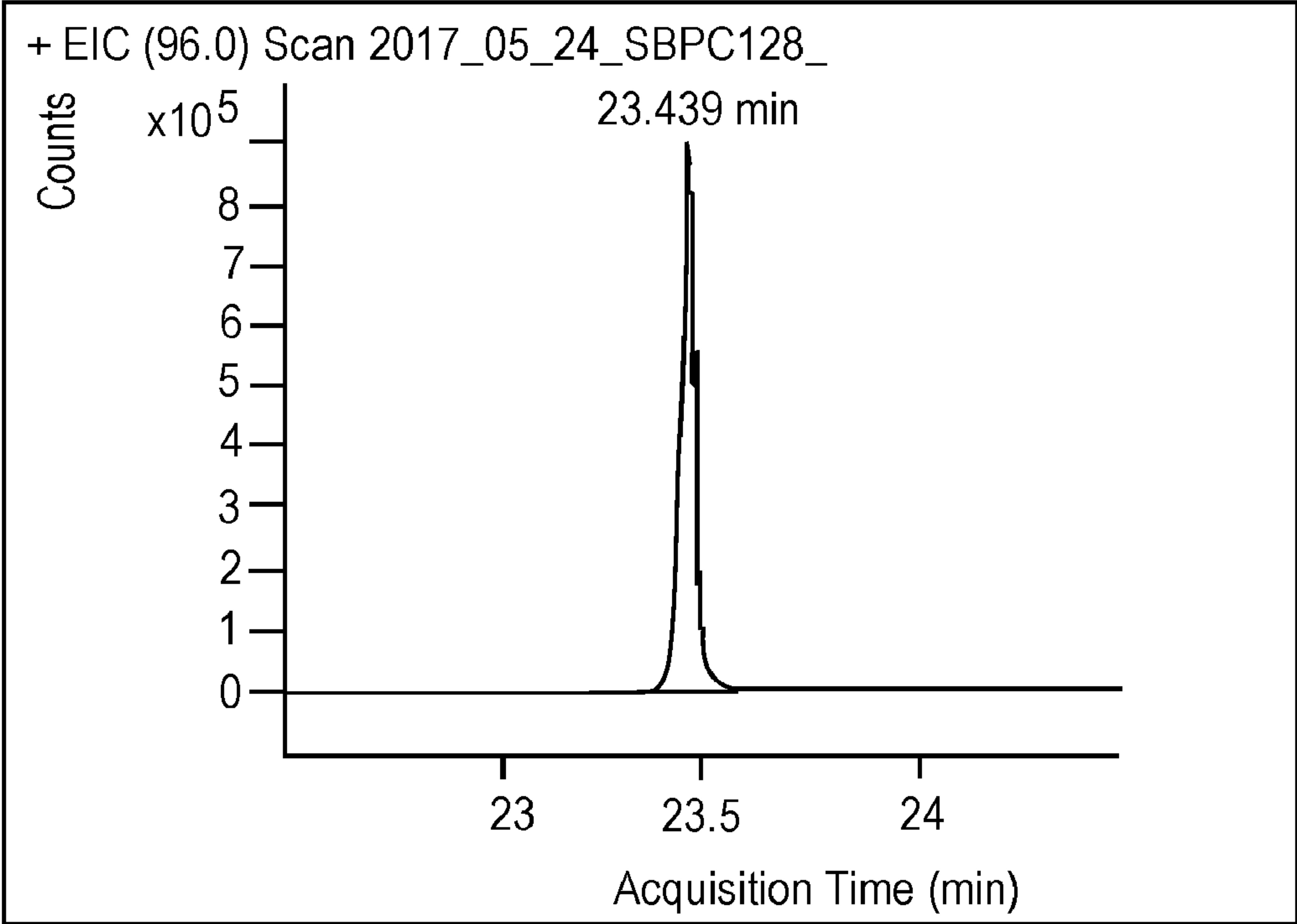


FIG. 16

	Diacetyl	Fold Increase	Pyrazine, methyl-	Fold Increase	Furfural	Fold Increase	Benzaldehyde	Fold Increase
Susceptor Heated	3,700,000	21	3,300,000	14	2,000,000	25	5,000,000	36
No Susceptor Heated	1,500,000	8	2,200,000	10	980,000	12	2,300,000	16
Not heated	180,000		230,000		79,000		140,000	

FIG. 17

Average Key indicator Aroma Preliminary Results	Furfural (Carmel)		Diacetyl(Buttery)		Pyrazine, methyl-(Roasted)	
	Average Peak Area	Fold Increase	Average Peak Area	Fold Increase	Average Peak Area	Fold Increase
Treatment						
Almond_RT	570,000		130,000		440,000	
Almond_Warm	740,000	1	2,300,000	18	720,000	2
Cinnamon Almond_RT	330,600		360,000		170,000	
Cinnamon Almond_Warm	47,000,000	144	18,000,000	50	9,600,000	56
Carmel_Peanut_RT	140,00		34,000		46,000	
Carmel_Peanut_Warm	7,200,000	53	730,000	21	3,000,000	64
Cashew_RT	73,000		34,000		69,000	
Cashew_Warm	12,000,000	167	10,000,000	289	3,900,000	56
Coconut Cashew_RT	200,000		25,000		58,000	
Coconut Cashew_Warm	30,000,000	155	2,300,000	93	5,800,000	100

FIG. 18

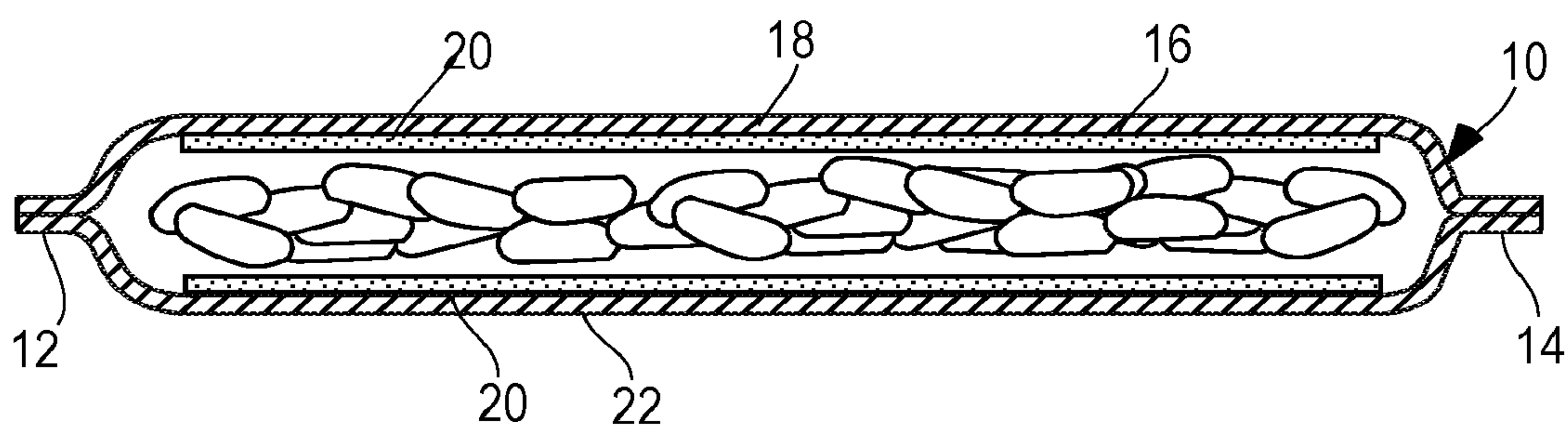


FIG. 19

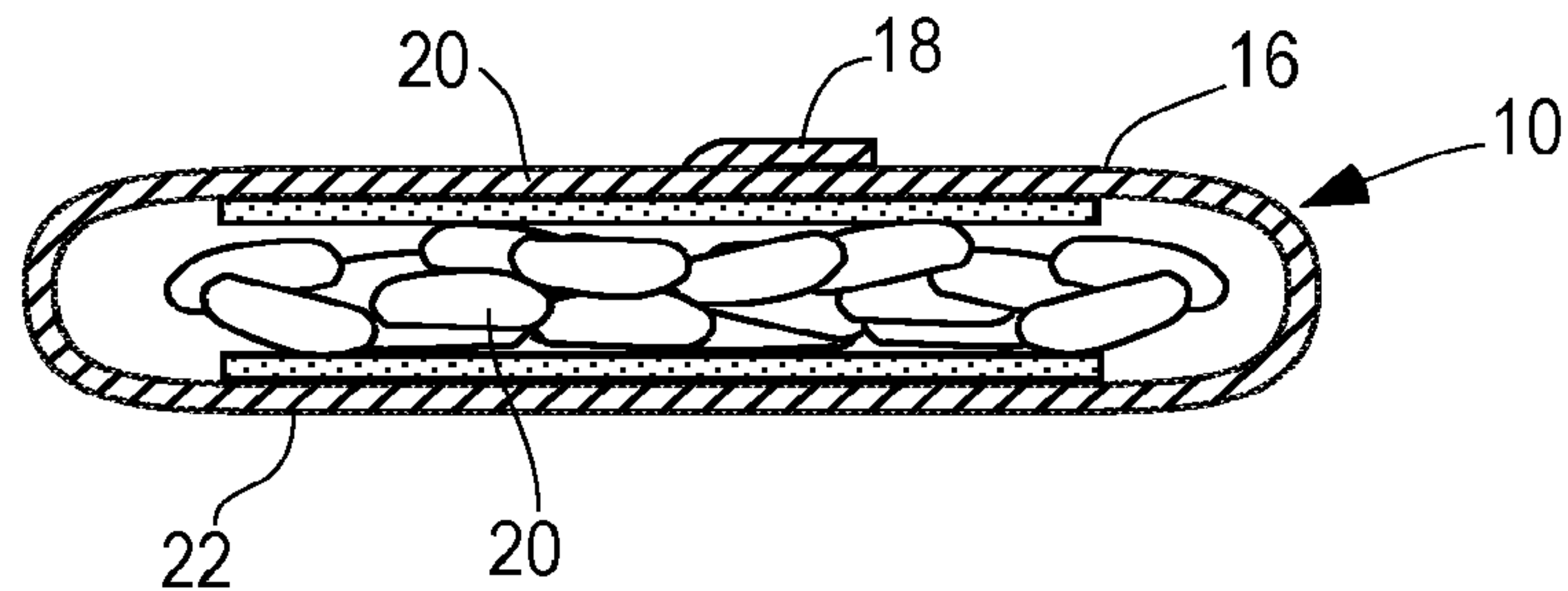


FIG. 20

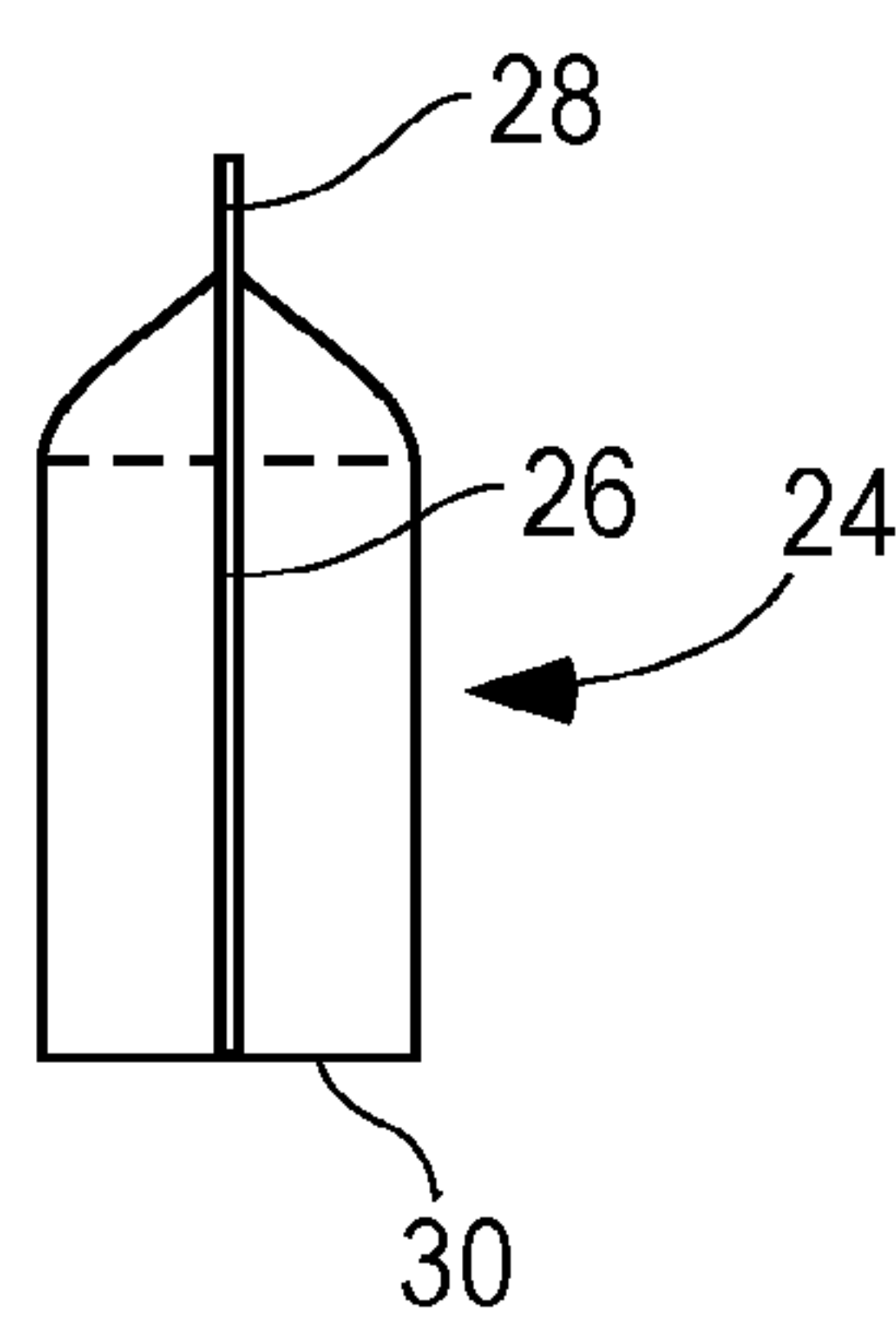
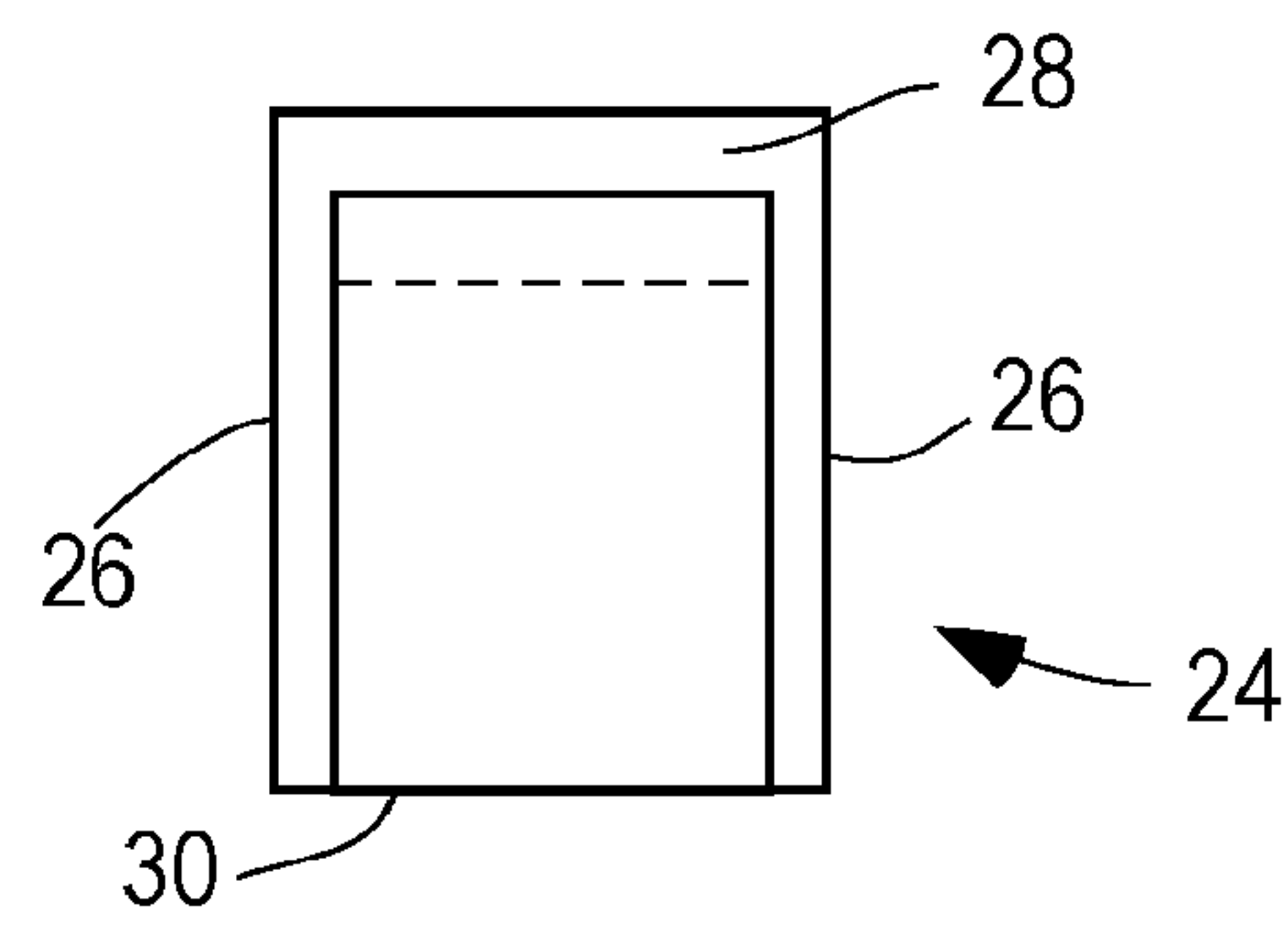


FIG. 21



MICROWAVEABLE PACKAGED FOOD PRODUCT

FIELD

[0001] This disclosure relates generally to microwaveable food products, and more specifically to a packaged food product for retail sale in which the packaging enables enhancement or optimization of organoleptic properties of the food product contained therein during microwave heating.

BACKGROUND

[0002] One of the challenges associated with microwave heating of certain food products is the need to avoid generation of undesired aroma components, e.g., those that may result from overheating or scorching, while achieving desired aroma notes and while warming the product generally uniformly.

[0003] Some food products have a well-defined configuration, e.g., solid, one-piece farinaceous food products, which can help to provide consistency and repeatability in response to exposure to microwave energy for a particular period of time at a particular power setting in a particular type of oven. A package of mixed, shelled nuts, on the other hand, can be subject to intra-package reconfiguration before, during and after heating, and accordingly different packages containing the same mass of shelled nuts can react differently to the same microwave energy exposure. One particular problem that can occur where nuts or nut pieces of various varieties and sizes are included in a single package is that small pieces may be susceptible to overheating, particularly if they are disposed in “hot spots,” e.g., in contact with a susceptor, or at locations where microwave energy is concentrated or of a higher magnitude due to variations in field strength within a microwave oven cavity.

[0004] Another problem is that variations in microwave field strength and configuration among various microwave ovens can present problems with respect to providing a package that will perform satisfactorily in a variety of commonly used, commercially available microwave ovens.

[0005] Another problem relates to quantification of desirable aroma characteristics. Different consumers may perceive the same aroma components in different ways. Thus, application of objective standards in order to provide desirable aroma characteristics while also reducing or eliminating undesirable aroma components can be difficult.

SUMMARY

[0006] Described herein is a packaged food product comprising a measured quantity of a food product contained within a package that optimizes or enhances organoleptic properties of the food product during microwave heating. The food product may comprise almonds, including, e.g., Mission, Carmel and Non-Pareil almonds, Brazil nuts, cashews including e.g. 320 cashews, chestnuts, granola, hazelnuts, macadamia nuts, peanuts including e.g. Jumbo Runner peanuts and Virginia Extra Large peanuts, pecans, pistachios, pine nuts, pumpkin seeds, sunflower seeds, walnuts, and/or other food items. The food product may include GMO ingredients, or may be free from GMO ingredients. In some embodiments, the nuts in the package are shelled nuts, i.e., nuts from which shells have been removed. In other embodiments, the nuts in the package may be partly or

entirely unshelled, i.e., they may include shells which have not been removed, or shells that have been only partially removed. In some embodiments, the nuts may include shells that have been partly opened to expose the kernels within the shells.

[0007] In some embodiments, the food product comprises one or more varieties of raw or partially-roasted shelled nuts. A modified atmosphere comprising, e.g., nitrogen, carbon dioxide, and/or combinations of these or other gases may be also provided by gas flushing the package, thereby reducing the volume of oxygen in the package. The package may be configured to cooperate with a microwave oven to heat the shelled nuts and provide an aroma reminiscent of traditional, freshly-roasted nuts, as well as additional freshly-roasted nut attributes including temperature, texture and taste. The package preferably, though not necessarily, incorporates one or more susceptors to provide localized enhanced heating, such as conductive heating, to certain components of the food product, while the entire food product is heated as a result of exposure to microwave energy. The package also may include a predetermined volume of headspace to facilitate aroma development.

[0008] In some embodiments, the package comprises a pouch formed of a flexible film. The pouch may be hermetically sealed. In some embodiments, the pouch may contain a measured quantity of a food product such as shelled nuts, wherein the total weight of the food product is at least 0.75 oz., and no more than 2 oz. In some embodiments, the food product may consist of about 1.0 oz. to about 1.5 oz., or about 1 oz., of shelled nuts. In other embodiments, the food product may include a larger quantity of nuts weighing, e.g., about 6 oz.

[0009] Where susceptors are employed, they are preferably disposed within the flexible film pouch, and may be incorporated into one or more walls of the pouch or attached thereto. The packaged food product may be capable of being microwaved while sealed in a closed configuration to roast the food product to a temperature of, e.g., about 120° F. to about 260° F., 150° F. to about 230° F., or 180° F. to 200° F. In some embodiments, the flexible film pouch may be capable of withstanding expansion and/or internal pressure generated during microwave heating so that it will remain sealed in closed configuration during heating. In other embodiments, the pouch may be equipped with a relief valve, frangible seal, vent, or other means to limit interior pressure to a desired level within the pouch during microwave heating, and/or to enable internal pressure to decrease at a desired rate after completion of microwave heating. The flexible film pouch can include a longitudinal seal extending between end seals, and the one or more vents can include a pin hole or other small opening at a juncture between two seals.

[0010] The pouch may be expandable to accommodate increased interior volume during heating.

[0011] In some embodiments wherein the food product comprises about 0.75 oz. to about 2 oz. of mixed, shelled nuts, the time period during which microwave heating of the packaged food product takes place may be, for example, between 20 seconds and 130 seconds, between 60 seconds and 90 seconds, or between 70 seconds and 80 seconds, using a 900 to 1200 W microwave oven. In other embodiments, wherein the food product comprises up to about 6 oz. of mixed, shelled nuts, the time period may be about 45 to 360 seconds, or 180 to 360 seconds, again using a 900 W to

1200 W microwave oven. In some embodiments, the packaging may include instructions that specify one or more time periods for microwaving at one or more power levels, with one or more longer time periods specified for lower powered microwave ovens, and one or more shorter time periods specified for higher powered microwave ovens. In some embodiments, the food product may comprise a 1 oz. package of mixed nuts comprising almonds, peanuts and cashews, and the instructions may specify heating for a time period such as 30 seconds or 40 seconds in a 1200 W microwave oven. The quantities of almonds, peanuts and cashews may be approximately equal or may vary, for example with each type of nut comprising about 10% to 50% of the total, by weight. In some embodiments, the microwave heating may comprise warming pre-roasted shelled nuts, finishing roasting of partially roasted shelled nuts, or roasting of raw shelled nuts.

[0012] The pouch may be made from a flexible material such as a multilayer flexible film. Examples of layers that may be included in the flexible material include a barrier layer; a printable film layer; an oriented film or PET layer; a sealable layer; a protective varnish; and a coefficient of friction modified layer. In some embodiments, the flexible material may include all of the above layers. In other embodiments, the flexible material may include fewer than all of these layers. In some embodiments, one or more of the above layers may extend over the entire area of the flexible material. In some embodiments, one or more of the above layers may be partial or patterned layers, extending over less than the entire area of the flexible material. In some embodiments, the pouch may include a paper layer that provides stiffness and insulation.

[0013] In some embodiments, the pouch may be a generally rectangular structure that includes a top seal, two side seals and one or more folds, with the fold(s) in the form of a gusset, which can provide the pouch with stand-up stability. In other embodiments, the pouch may comprise a generally rectangular structure having transverse end seals, a longitudinal seal along a top or bottom wall, and longitudinal folds connecting the top and bottom walls. In still other embodiments, the package may have a different from configuration. In some embodiments, a tear notch, area of weakness, or other means to facilitate opening of the pouch by a consumer can be provided in a seal such as a longitudinal seal, transverse seal, side seal, a top seal, or another location.

[0014] In some embodiments, headspace of the flexible film pouch can be reduced or minimized via vacuum packaging after shelled nuts are disposed therein, thereby reducing the overall volume of the package and providing efficiencies in connection with shipping, handling and storage. Reduction of headspace can also be advantageous from the standpoint of increasing the capacity of the package to accommodate expansion of nitrogen, carbon dioxide, water vapor, and/or other gases during heating. In other embodiments, the package may be sealed without taking steps to reduce or minimize headspace.

[0015] In some embodiments, where the food product comprises shelled nuts, the volume of shelled nuts may be less than 75% of a total internal package volume. In some embodiments, the volume of shelled nuts is between 20% and 40% of the total internal package volume. In some embodiments, the volume of shelled nuts is about 30% of the

total internal package volume. In some embodiments, the shelled nuts may be arranged in a single layer within the package.

[0016] The susceptor(s) may comprise discrete components that are attached to the film by adhesive bonding, heat sealing, or other means, or may comprise a layer deposited on the film or otherwise provided as an integral part of the film. In some embodiments, the susceptor(s) may consist of one or more metalized layers on the film. Such metalized layers may be treated with an acid solution that removes portions of the metalized layer, thereby forming a continuous metalized layer into a patterned susceptor. In some embodiments, the susceptor(s) may comprise one to three discrete susceptors. In some embodiments, a first wall of the pouch can have a first susceptor thereon, and a second wall of the pouch can have a second susceptor thereon spaced from the first susceptor, with care being taken to avoid contact between the susceptors. The susceptors can be positioned and configured to heat and brown portions of the shelled nuts and provide an aroma release without excessive heating or scorching. In some embodiments, the susceptor can be disposed in a pattern on the flexible film, spaced from package seals. In some embodiments, the packaged food product can include flavorings, which may include aroma-enhancing compositions, which may be applied to the nuts prior to placing them in the pouch, and/or otherwise placed in the package. Flavor application may comprise, e.g., soaking shelled or unshelled nuts in a liquid, spraying a liquid onto the nuts, tumbling the nuts in a drum with a particulate flavor treatment such as a powder or granular material, and/or spraying or otherwise introducing liquid and/or particulate flavor treatments into the package after the nuts have been placed therein. Methods of providing flavor treatments may alternatively or additionally further include at least one of: depositing flavoring on an inside surface of the multi-layer flexible film that forms the film tub; spraying flavoring into the film tube prior to forming the second seal of the flexible film pouch; and spraying flavoring onto the shelled nuts prior to depositing the shelled nuts in the flexible film pouch. The method can alternatively or additionally include depositing flavoring on an inside surface of the multi-layer flexible film prior to forming a film tube, and/or spraying flavoring into a film tube prior to forming it into a pouch, and/or other steps.

[0017] In some embodiments, flavorings may include without limitation one or more natural natural flavors, savory or sweet seasonings or spices. Examples include without limitation salt, black pepper, cinnamon, honey, sugar, peanut oil, caramel, coconut, and other liquid or dry seasonings. The flavor treatments may include a first coating and a second coating, wherein the first coating functions to improve retention of a second coating. The coating can be effective to absorb and/or reflect a portion of the microwave energy to which it is exposed while also being permeable to another portion of the microwave energy. To enhance flavor, aroma and/or other organoleptic properties, an aromatic compound can be disposed on an inside surface of the flexible film pouch prior to packaging the shelled nuts. Alternatively or in addition, a sprayable aromatic compound can be sprayed into the flexible film pouch after depositing the shelled nuts therein. In some embodiments, the shelled nuts can include one or more of whole nuts, halves, or other pieces with dimensions of about 1/4" to 1" in length and 1/8" to 1/2" in width. Shelled nuts may be pre-roasted at various

roast levels and/or steam pasteurized prior to packaging within the flexible film pouch. The shelled nuts may be partially roasted, with final roasting being accomplished by microwave heating by the consumer. The shelled nuts can have a moisture level that decreases by 15%-25% during pre-roasting, while increasing the composition of volatile compounds associated with a darker roast. The pre-roasted shelled nuts may optionally have undergone at least one of a dry roast or an oil roast. In some embodiments, the shelled nuts in the packaged food product comprise roasted or partially roasted peanuts and other nuts having a moisture level of about 1.1% to about 1.4%. Standard moisture levels for the shelled nuts may range from 2.6%-2.9% for almonds, 1.4-1.6% for peanuts, and 1.8%-2.4% for cashews. In some embodiments, savory coated nuts in the packaged food product may have a moisture level of 1.5%-2.6%, including moisture in the coating and nuts. In some embodiments, sweet glazed nuts in the packaged food product may have a moisture level of 1.0%-1.6%, including moisture in the glaze and nuts.

[0018] In some embodiments, the packaged food product can further include a sealed overwrap around the flexible film forming the pouch that is removed prior to microwaving. The overwrap can be gas flushed prior to sealing.

[0019] A method can be provided that includes wrapping a web of multi-layer flexible film into a film tube; providing at least one susceptor inside the film tube; forming a first end seal to partially form a flexible film pouch; depositing about 0.75 oz. to about 2 oz. shelled nuts in the partially formed flexible film pouch; gas flushing the partially formed flexible film pouch to reduce oxygen therein; forming a second end seal in the flexible film pouch; wrapping the flexible film pouch in an overwrap film thereby forming an overwrap pouch; gas flushing the overwrap pouch to reduce oxygen in the overwrap pouch; and sealing the overwrap pouch around the flexible film pouch. Gas flushing may comprise replacing oxygen with nitrogen, carbon dioxide, and/or another gas or mixture of gases so that less than about 2% oxygen is present in the pouch headspace to reduce or minimize oxidation during the product shelf life. In some embodiments, where the gas flushed pouch is made of a material that includes an oxygen barrier, the product may have a shelf life of about one year or 365 days, whereas a similar product without gas flushing may have a shelf life of only about one month.

[0020] A method of using a packaged food product is also provided herein. In some embodiments, the packaged food product may include about 1 oz. to about 1.5 oz. of shelled nuts. In some embodiments, the packaged food product may include about 1.0 oz. of shelled nuts. The packaged food product may also include a heat-activated aroma-release composition. In some embodiments, each of the shelled nuts individually has a mass of 28 grams+/-5 grams to 42 grams+/-5 grams. The shelled nuts may be arranged in a single layer on a susceptor within a sealed flexible package having a vent opening with a frangible closure, the shelled nuts comprising about 1.0% to about 2.0% moisture and having a predetermined aggregate surface area. The method may include first maintaining the packaged food product at ambient temperature and pressure; thereafter exposing the packaged food product to microwave energy for a period of about 25 seconds to about 100 seconds, or a period of about 30 seconds to 70 seconds, or a period of about 35 to 65 seconds, to heat the shelled nuts and reduce their moisture

content to between about 0.9% and about 1.3%, and simultaneously vaporizing moisture within the package to expand the package and increase its interior pressure, wherein the increase in interior pressure ΔP does not result in rupture of the package seals except for the frangible closure associated with the vent opening. Preferably, heating the nuts results in a darkening of portions of the aggregate nut surface area. In some embodiments, the darkened portions are in contact with or in close proximity to the susceptor during heating. The darkened portions may comprise, e.g., about 10% to about 25% of the aggregate nut surface area. The method may further include thereafter removing a portion of the package or otherwise opening the package to release a roasted-nut aroma, and in some embodiments, to provide an open-topped container to provide hand-held access to the heated shelled nuts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a front perspective view of a first embodiment of a microwave susceptor package containing unshelled nuts, showing a pair of end seals and a fin seal configured to form a top panel and a bottom panel;

[0022] FIG. 2 is a plan view of a segment of a susceptor material disposed on one of the panels of the package of FIG. 1;

[0023] FIG. 3 is a front perspective view of a second embodiment of a bottom-gusseted, standup microwave susceptor package containing unshelled nuts, showing a pair of side seals, a top portion having been removed, and showing a food product comprising shelled nuts following microwave heating;

[0024] FIG. 4 is a schematic diagram of a process for providing a heated food product, including placing a packaged food product in a microwave oven, heating the packaged food product, then removing a portion of the package to serve the food product;

[0025] FIG. 5 is a front elevation view of a packaged food product in accordance with FIG. 3, empty and prior to removal of the top of the package, showing a peripheral seal area along the top and sides of the package;

[0026] FIG. 6 is a plan view of a web of film showing sealing areas and cut lines for use in forming the package of FIG. 5;

[0027] FIG. 7 is a plan view of a first alternative web of film showing sealing areas and cut lines for use in forming the package of FIG. 5, similar to that of FIG. 6 but showing a susceptor added to the interior of what will be one of the panels of the package;

[0028] FIG. 8 is a plan view of a second alternative web of film showing sealing areas and cut lines for use in forming the package of FIG. 5, similar to that of FIG. 6 but showing susceptors added to the interior of what will be both panels of the package;

[0029] FIG. 9 is a plan view of a third alternative web of film showing sealing areas and cut lines for use in forming the package of FIG. 5, similar to that of FIG. 6 but showing one or more susceptors added to the interior of what will be one of the panels of the package;

[0030] FIG. 10 is a graph showing comparative magnitudes of selected aroma components associated with shelled mixed nuts at room temperature, and after warming with and without a susceptor;

[0031] FIG. 11 is a table showing comparative magnitudes of selected aroma components associated with individual

varieties of shelled nuts at room temperature and after warming with a susceptor; and

[0032] FIGS. 12-15 illustrate examples of raw data generated using gas chromatography-mass spectroscopy to measure aroma components.

[0033] FIG. 16 provides numerical data that is illustrated graphically in FIG. 10.

[0034] FIG. 17 is a table showing comparative magnitudes of selected aroma components associated with individual varieties of shelled nuts at room temperature and after warming with a susceptor.

[0035] FIG. 18 is a side elevational sectional view of the packaged food product of FIG. 1.

[0036] FIG. 19 is an end sectional view of the packaged food product of FIG. 1.

[0037] FIG. 20 is a side view of a packaged food product in accordance with FIG. 3.

[0038] FIG. 21 is a front view of the packaged food product in accordance with FIG. 3.

DETAILED DESCRIPTION

[0039] Packaged food products suitable for microwave heating are described herein, including with reference to FIGS. 1-21.

[0040] In one embodiment, a packaged food product, shown in FIGS. 1, 18 and 19, has a low profile and is configured to be microwaved on its side, i.e., in a generally horizontal position such that its length and width are greater than its height. In this embodiment, the packaged food product includes a pouch or package 10 that includes an uninterrupted, continuous bottom wall 22, pair of end seals 12, 14 and a top wall 16 having a fin seal 18 extending longitudinally thereof. In some embodiments, the package 10 may be made in a high-speed, high volume automated form-fill-seal operation in which a web of film is formed into a tube, with edges brought together to form the longitudinal fin seal, and with the transverse end seals formed at predetermined spacing before and after loading of product and gas flushing, and with the packages being separated from one another by cuts through the end seals. The interior of the package optionally includes one or more susceptors 20. For example, a grid-like susceptor material, shown in FIG. 2, can be provided on one or both sides, i.e., on one or both of the top and bottom of the package so as to be positioned above, below, or both above and below the food product during heating. In some embodiments, the package contains a large number of discrete food items, e.g., a mixture of shelled nuts, such as almonds, cashews and peanuts. In some embodiments, the food items may be arranged in a single layer or primarily in a single layer, with all or most of the discrete food items being in contact with or at least in close proximity to the bottom of the package during heating. In these embodiments, most or all of the food items may also be in contact with, or at least in close proximity to, the top of the package as well, at least initially during microwave heating. As microwave heating progresses, expansion of the pouch may lift the top surface and an associated susceptor from the food items, which may have a self-regulating effect on the heating operation to reduce or avoid overheating and/or or scorching due to variations in microwave energy, heating time or other parameters. Expansion of the pouch may also result in the edges of the bottom wall being raised from the floor of the microwave oven, and may change the arrangement of some or all of the food items from a

single-layer configuration to a multiple-layer configuration in which some of the food items to overlie others, which may also have a self-regulating effect on the heating operation to help reduce or avoid overheating and/or scorching.

[0041] In a second embodiment, shown in FIGS. 3, 5, 20 and 21, a packaged food product includes a package or pouch 24 that is configured to stand up during and/or following microwave heating. The pouch 24 can include a pair of side seals 26, a top seal 28 and a bottom 30, shown schematically in FIG. 5. A top portion of the pouch, which encompasses the top seal, is configured for removal. The pouch is shown after removal of the top portion in FIG. 3.

[0042] As shown in the schematic diagram of FIG. 4, in some embodiments, a packaged food product such as either of the above-described packaged food products can be inserted into a microwave oven, heated using microwave energy, then removed from the microwave oven, after which a portion of the package may be removed, separated or otherwise opened to provide access to the contents.

[0043] In some embodiments including but not limited to those described above, the pouch can be formed from a web of film 36, various examples of which are shown in FIGS. 6-9. The web of film can be folded so that regions 38 and 40 form the front and rear of the package, with seals 42 and 44 being formed on the sides and top. In some embodiments, the bottom can comprise a single fold along line 46. Alternatively, a gusseted bottom may be provided. A web of film can be configured without a susceptor, as shown in FIG. 6, or with one or more susceptors 48 added prior to singulating the package from the web of film, as shown in FIGS. 7-9. For example, a single susceptor 48 can be attached to the web of film in an area that will be an interior surface of one of the front or rear walls of the package, as shown in FIG. 7. Alternatively, a pair of susceptor surfaces can be provided on the web of film in areas that will be interior surfaces of the front and rear walls of the package, as shown in FIG. 8. In another alternative, multiple types of susceptors may be incorporated on a single panel, as shown in FIG. 9, or on other panels, to provide increased localized conductive heat transfer in a particular region of a susceptor. Optionally, the susceptor surfaces can be positioned closer to the bottom of the package than the top such that they will be adjacent the food product near the bottom of the package during microwave heating.

[0044] Aroma is created during microwave heating due to a combination of the product and the packaging, and is released upon opening of the package following microwave heating, and/or through a vent during heating. The aroma from the product can be generated not only by the nuts but also by additional ingredients. Liquid coatings, dry seasonings and/or other ingredients may include heat stable components that are added to nuts prior to packaging and provide aroma upon opening of the package following microwave heating. In addition to a dry seasoning or coating, a liquid seasoning can optionally be added to the nuts either before or after the application of a dry seasoning to increase the amount of volatile components released during microwave heating. One option is to also or instead add aroma-contributing compounds to the packaging material, such as by spraying the compounds on one or more interior surfaces of the package, such as in the headspace, after depositing the nuts and prior to sealing.

[0045] The blend of sizes of particulates in the coating as well as the physical characteristics, such as high melting

temperatures, can help to moderate heating of nuts by absorbing or reflecting microwave energy and/or by shielding shelled nuts from microwave energy. This can advantageously reduce the amount of microwave energy that is absorbed by the interior and surface of the nut, thereby leading to increased homogeneity of the heating among the nuts and allowing the product to achieve an overall higher temperature without overheating individual areas of the nuts. Certain coatings may tend to increase susceptor temperature by reflecting microwave energy that would otherwise be absorbed by shelled nuts or other edible substrates to which the coatings are applied. This can help to provide desirable organoleptic properties such as crunchiness of the coatings and underlying shelled nuts, while avoiding undesirable organoleptic properties such as undesirable softness of the shelled nuts. Other coatings may tend to decrease susceptor temperature by absorbing microwave energy.

[0046] In some embodiments, low-moisture sugar-based coatings or other low-moisture coatings may be preferable to higher moisture coatings including those based on corn syrup from the standpoint that coatings based on corn syrup may tend to flow more easily when heated to temperatures of, e.g., 215° or 230° F., with portions of the coatings undesirably liquefying and running off the underlying food items when heated rather than remaining adhered thereto. Specific flavor notes that may be provided by the food products and/or coatings include but are not limited to sweet, savory, and salty flavor notes, and combinations thereof. Specific flavors for food products and/or coatings may include but are not limited to, e.g., salted caramel, cinnamon almond, and sweet roasted cashew flavors. Examples of specific product formulas that may be used in some embodiments are provided below.

Seasoned Cashew	
Ingredient	Range (%)
Cashew	92-98
Peanut oil	0.5-2.5
Powdered seasoning	2-6

Sea Salt Nut Blend	
Ingredient	Range (%)
Almond	30-50
Cashew	24-44
Peanut	16-36

Sea Salt Almond	
Ingredient	Range (%)
Almond	94-99
Peanut oil	0.5-3
Salt	0.5-3

Coconut Cashew	
Ingredient	Range (%)
Cashews	60-85
Sugar	20-40
Coconut	2-5
Corn syrup	2.5-5
Butter	1-2
Salt	0.5-2
Flavor	0.05-.2

Salted Caramel Peanut	
Ingredient	Range (%)
Peanuts	60-85
Sugar	20-40
Salt	0.5-2
Caramel seasoning	0.25-0.75

Cinnamon Almond	
Ingredient	Range (%)
Almonds	55-85
Sugar	20-40
Salt	0.5-2
Cinnamon	0.5-3

[0047] In some embodiments, thicker coatings can contribute to increased cooking homogeneity. In some embodiments, coatings may have a thickness of about 1 to 3 mm, and in some cases may have an average thickness of about 1 mm.

[0048] The packaging can contribute to the aroma by providing suitable barrier layers and a headspace for the aroma to accumulate. For example, the pouch can be a multilayered structure that contains a barrier material, such as EVOH (ethylene vinyl alcohol), AlO_x (aluminum oxide) or SiO_x (silicon oxide), that limits the migration of aroma components through the package during both shelf life and microwave heating. The barrier material can be provided either as part of the pouch or in outer packaging that is removed prior to microwave heating. The package is preferably sealed during microwave heating so that volatile compounds that provide the aroma do not leave the package until opened. It can be desirable to optimize the headspace in the package in order to enable a more concentrated aroma while also ensuring space for the aroma to develop.

[0049] The temperatures achieved during microwave heating contribute to the aroma as well as to heating of the nuts. One way to use temperatures during microwave heating to contribute to aroma is to design the coating and dry seasoning ingredients to maximize their dielectric properties when applied to a nut to enable more quick and homogenous heating. Another way to use temperatures during microwave heating to contribute to aroma is to add one or more susceptors within the package to enable localized, conductive heating with the package. The susceptor can be disposed and/or more concentrated in an area of the package most likely to contain the nuts, e.g., the bottom portion in a stand-up package.

[0050] In one example, the package contains about 1 to 1.5 ounces of either cashews, almonds or shelled peanuts, or combinations thereof. The package can include a susceptor to optimize heating of the nuts during microwave heating. The package can optionally be gas-flushed. The package can be heated in a microwave for between 30 and 60 seconds, for example.

[0051] In some embodiments, strategically-configured susceptors are provided in a configuration that enables localized heating of certain portions of the mixed nuts to a higher temperature that enhances the aroma characteristics of the product without unacceptably overheating the shelled nuts, optionally in combination with one or more coatings that may provide quantitative and qualitative aroma enhancements. Coatings may also enable positive or negative variation of the shelled nuts' thermal response to microwave heating.

[0052] The aroma data in FIGS. 10 and 11 were compiled by exposing shelled nuts to microwave energy with and without susceptors, and using gas chromatography-mass spectroscopy to quantify increases in particular aroma components as a result of use of a particular susceptor configuration.

[0053] FIGS. 11 and 17 show data from shelled nuts, some including flavor treatments, measured at room temperature and after microwave heating with a susceptor in a package as described above. FIG. 11 shows, for example, that microwave warming of almonds resulted in about a two-fold increase in an ethyl-pyrazine aroma component, which is associated with a "roasted" or "nutty" aroma, an eighteen-fold increase in a diacetyl aroma component, which is associated with a "buttery" aroma, and a relatively small increase in furfural (caramel) aroma. FIG. 17 provides additional data for the same microwave warming, showing that it resulted in a two-fold increase of methyl pyrazine (roasted) aroma.

[0054] In some embodiments, microwave heating of a 1 oz. package of cinnamon almonds, i.e. almonds with a cinnamon coating as described above, according to instructions provided on packaging as described above, may desirably result in a significant increase of aroma components in the headspace, e.g., an increase in furfural aroma by a factor of 100 to 200, or more specifically a factor of 120 to 170, or a factor of about 144; an increase in ethyl pyrazine aroma by a factor of 10 to 50, or more specifically, a factor of about 31; an increase in methyl pyrazine by a factor of 15 to 100, or by a factor of about 50 to 60, or by a factor of about 56; and an increase in diacetyl aroma by a factor of 5 to 200, a factor of 40 to 60, or a factor of about 50. (See FIGS. 11 and 17.)

[0055] In some embodiments, microwave heating of a 1 oz. package of cashews according to instructions provided on the packaging as described above may desirably result in a significant increase of aroma components in the headspace, e.g., an increase in furfural aroma by a factor of 100 to 250, or more specifically a factor of 150 to 200, or a factor of about 167; an increase in ethyl pyrazine aroma by a factor of 50 to 200, or more specifically, a factor of 100 to 150, or a factor of about 125; an increase in methyl pyrazine by a factor of 25 to 80, or by a factor of about 50 to 60, or by a factor of about 56; and an increase in diacetyl aroma by a factor of 200 to 400, a factor of 250 to 350, or a factor of about 289. (See FIGS. 11 and 17.)

[0056] FIGS. 10 and 16 illustrates differences in aroma values that result from using a particular susceptor package or a non-susceptor package in microwave heating of mixed nuts.

[0057] The data in FIGS. 10, 11, 16 and 17 correspond to desirable aroma properties of packaged food products described herein, and such packaged food products in some embodiments may enable consumers to achieve increases in various key aroma components similar to those described herein, e.g., within 10%, 20%, 30%, 40% or 50% of the values in FIGS. 10, 11, 16 and 17, while also providing other desirable organoleptic properties, without scorching or generation of undesirable aromas.

[0058] Examples of raw data generated using gas chromatography-mass spectroscopy to measure selected individual aroma components are provided in FIGS. 12-15. The areas under the plots shown in FIGS. 12-15 is the "Peak Area" represented by the y-axis in FIG. 10.

[0059] Data shown in FIGS. 12-15 was gathered by collecting gases from within pouches containing a mixture of shelled nuts, specifically almonds, cashews and peanuts, on thermal desorption tubes before and after microwaving with and without susceptors. Sampling was performed using adhesive septas (Illinois Instrument PPL-193456). Head-space samples were collected for 2 min using a vacuum pump pulling 50 mL/min (FIG. 1). Gas displaced was replaced using food grade nitrogen.

[0060] The following additional equipment was used in sampling and analysis:

Agilent Technologies 5975 Mass Spectrometer

Agilent Technologies 6890N Network GC System

Gerstel TDS3 Thermal Desorption System

Gerstel TDSA Thermodesorption Autosampler

Envirochem Multiple Tube Conditioner

[0061] Thermal Desorption tubes; 3.8 mm Tenax-TA, 2.0 mm Carboxen 1003

[0062] Additional information on equipment and parameters used is set forth below:

[0063] GC-MS Parameters:

[0064] Oven

Equilibration time: 1.00 min

Maximum temp: 250 C

Initial temp: 35 C (On)

Initial time: 4.00 min

[0065] Ramps:

#	Rate	Final Temperature	Final Time
1	3.00	82	0.00
2	6.00	210	10.00
3	0 (off)		

Post temp: 240 C

Post time: 5.00 min

Run time: 51.00 min

Column: Agilent VF-WAX P/N CP9295

[0066] Back Inlet (CIS4)

Mode: Solvent Vent

[0067] Initial temp: 0 C (Off)

Pressure: 8.8 psi (On)

[0068] Vent time: 0.00 min

Vent flow: 50.0 mL/min

Vent Pressure: 8.8 psi

[0069] Purge flow: 50.0 mL/min

Purge time: 2.00 min

Total flow: 54.0 mL/min

Gas saver: Off

Gas type: Helium

[0070] Thermal AUX 2

Initial temp: 240 C (On)

[0071] Gerstel Maestro

[0072] System Settings

Maestro Runtime: 55.99 min

GC Cool Down Time: 8.00 min

Cryo Timeout: 25.00 min

1-18. (canceled)

19. A packaged food product, comprising:

a flexible film forming a pouch having an interior cavity formed by a first end seal and a second end seal with a longitudinal fin seal extending therebetween, the flexible film pouch being substantially hermetically sealed in a closed configuration;

at least one susceptor disposed on a majority of an interior surface of the flexible film pouch without contacting the first end seal, the second end seal, or the fin seal;

about 0.75 oz. to about 2.00 oz. pasteurized or at least partially roasted shelled nuts disposed within the interior cavity of the flexible film pouch, the shelled nuts having been pasteurized or at least partially roasted prior to being disposed within the flexible film pouch;

a coating on the shelled nuts being one of:

a sweet glaze on the shelled nuts, wherein the sweet glaze and the shelled nuts have a combined moisture level within the range of 1.0% to 1.6%; or

a savory coating on the shelled nuts, wherein the savory coating and the shelled nuts have a combined moisture level within the range of 1.5% to 2.6%;

wherein the packaged food product is configured and arranged to be heated in a microwave oven in the closed configuration to roast the shelled nuts to a temperature of about 120° F. to about 260° F.; and

wherein the coating and the at least one susceptor are configured and arranged to moderate heating of the shelled nuts by absorbing and/or reflecting microwave energy thereby reducing an amount of microwave energy absorbed by the shelled nuts and increasing homogeneity of heating the shelled nuts.

20. The packaged food product of claim 19, wherein the flexible film is a multilayered film including a barrier material configured and arranged to limit migration of aroma components through the flexible film during storage and during microwave heating.

21. The packaged food product of claim 20, wherein the barrier material is selected from the group consisting of EVOH, AlO_x, and SiO_x.

22. The packaged food product of claim 19, wherein the first end seal, the second end seal, and the fin seal are configured and arranged to remain sealed and not rupture during microwave heating.

23. The packaged food product of claim 19, wherein a volume of shelled nuts is less than 75% of a total internal package volume, and wherein a volume of oxygen is less than 2% within the interior cavity of the flexible film pouch, further comprising a headspace within the interior cavity between the shelled nuts and the flexible film configured and arranged to allow aroma to develop during microwave heating.

24. The packaged food product of claim 19, wherein the coating is 1 mm to 3 mm thick on each of the shelled nuts.

25. The packaged food product of claim 19, wherein the flexible film includes a bottom wall portion and a top wall portion interconnected by the first end seal and the second end seal, the fin seal extending between the first end seal and the second end seal on the top wall portion, and wherein the at least one susceptor includes a first discrete susceptor on the bottom wall portion and a second discrete susceptor on the top wall portion.

26. The packaged food product of claim 19, further comprising nut flavorings comprising at least one of salt, black pepper, cinnamon, honey, sugar, peanut oil, caramel, and coconut.

27. The packaged food product of claim 19, wherein the sweet glaze or the savory coating is adapted to absorb and/or reflect microwave energy during exposure of the packaged food product thereto and be permeable to a portion of the microwave energy.

28. The packaged food product of claim 19, wherein the shelled nuts are pasteurized with a moisture level decreased by 15% to 25% during pasteurization.

29. The packaged food product of claim 19, wherein the shelled nuts are at least partially roasted having a moisture level between about 1.1% to about 1.4% due to the at least partial roasting.

30. The packaged food product of claim 19, wherein the shelled nuts are caramel peanuts having about a 64-fold increase in ethyl-pyrazine aroma compounds, about a 53-fold increase in furfural aroma compounds, and about a 21-fold increase in diacetyl aroma compounds after microwave heating.

31. The packaged food product of claim 19, wherein the shelled nuts are cinnamon almonds having about a 31-fold increase in ethyl-pyrazine aroma compounds, about a 144-fold increase in furfural aroma compounds, and about a 50-fold increase in diacetyl aroma compounds after microwave heating.

32. The packaged food product of claim 19, wherein the shelled nuts are coconut cashews having about a 54-fold increase in ethyl-pyrazine aroma compounds, about a 155-fold increase in furfural aroma compounds, and about an 93-fold increase in diacetyl aroma compounds after microwave heating.

33. The packaged food product of claim 19, wherein the food product includes 20% to 40% sugar.

34. A packaged food product, comprising:

a flexible film forming a pouch having an interior cavity formed by a bottom wall portion and a top wall portion, the bottom wall portion and the top wall portion being interconnected by a first end seal and a second end seal, a longitudinal fin seal extends between the first end seal

and the second end seal on the top wall portion, the flexible film pouch including a barrier the flexible film pouch being substantially hermetically sealed in a closed configuration;

at least one susceptor disposed on a majority of an interior surface of the flexible film pouch on the bottom wall portion and the top wall portion without contacting the first end seal, the second end seal, or the fin seal;

about 0.75 oz. to about 2.00 oz. pasteurized or at least partially roasted shelled nuts disposed within the interior cavity of the flexible film pouch, the shelled nuts having been pasteurized or at least partially roasted prior to being disposed within the flexible film pouch;

a coating on the shelled nuts being one of:

- a sweet glaze on the shelled nuts, wherein the sweet glaze and the shelled nuts have a combined moisture level within the range of 1.0% to 1.6%; or
- a savory coating on the shelled nuts, wherein the savory coating and the shelled nuts have a combined moisture level within the range of 1.5% to 2.6%;

a headspace between the shelled nuts and the flexible film;

wherein the packaged food product is configured and arranged to be heated in a microwave oven in the closed configuration to roast the shelled nuts to a temperature of about 120° F. to about 260° F., and wherein the first end seal, the second end seal, and the fin seal are configured and arranged to remain sealed and not rupture during microwave heating; and

wherein the coating and the at least one susceptor are configured and arranged to moderate heating of the shelled nuts by absorbing and/or reflecting microwave

energy thereby reducing an amount of microwave energy absorbed by the shelled nuts and increasing homogeneity of heating the shelled nuts.

35. The packaged food product of claim **34**, wherein the flexible film is a multilayered film including a barrier material configured and arranged to limit migration of aroma components through the flexible film during storage and during microwave heating.

36. The packaged food product of claim **34**, wherein a volume of shelled nuts is less than 75% of a total internal package volume, wherein a volume of oxygen is less than 2% within the interior cavity of the flexible film pouch, and wherein the shelled nuts and the headspace are configured and arranged to allow aroma to develop during microwave heating.

37. The packaged food product of claim **34**, wherein the sweet glaze or the savory coating is adapted to absorb and/or reflect microwave energy and be permeable to a portion of the microwave energy during exposure of the packaged food product thereto.

38. The packaged food product of claim **34**, wherein the shelled nuts are pasteurized with a moisture level decreased by 15% to 25% during pasteurization.

39. The packaged food product of claim **34**, wherein the shelled nuts are at least partially roasted having a moisture level between about 1.1% to about 1.4% due to the at least partial roasting.

40. The packaged food product of claim **34**, wherein the food product includes 20% to 40% sugar.

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