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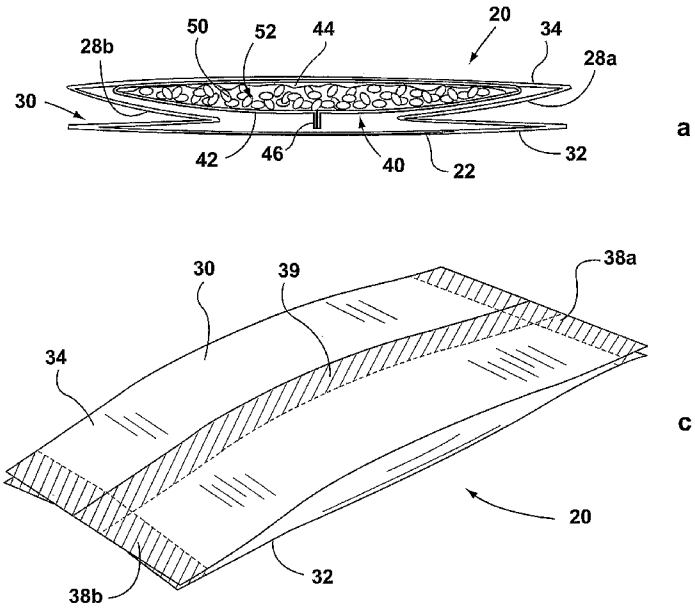
(54) Title: MICROWAVE FOOD CONTAINER WITH INNER ENCLOSURE



(57) Abstract: An expandable microwave popcorn bag (20) comprises a generally microwave transmissible outer enclosure (30) enclosing an outer cavity. The outer enclosure comprises a top panel (34), and a bottom panel (32) positioned opposite to the top panel. An inner pouch (40) is located within the outer cavity and contains a plurality of unpopped popcorn kernels (50) enclosed in said inner pouch. At least some of the plurality of kernels will be released from said inner pouch to pop when the bag is subjected to microwave radiation, and the bag will expand to accommodate the popped kernels. The inner pouch is attached to the top panel of the outer enclosure. A susceptor is associated with the bottom panel of the outer enclosure, and is positioned generally opposite to the inner pouch.

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MICROWAVE FOOD CONTAINER WITH INNER ENCLOSURE

FIELD OF THE INVENTION

[0001] The present invention relates to microwave food containers, including microwave popcorn bags, with an inner enclosure such as a pouch, for holding the popcorn kernels.

BACKGROUND OF THE INVENTION

[0002] Microwave popcorn containers are well known. One of the known types of microwave popcorn containers are microwave popcorn bags. Generally, such bags contain popcorn kernels, and usually a popcorn charge or slurry comprising for example, a cooking oil and possibly seasonings/flavorings. The bags are placed into a microwave oven and are subjected to microwave radiation. The kernels are thus heated, which creates steam inside the kernels as the water evaporates. This creation of steam causes the kernels to pop, thereby creating popcorn. If the kernels are held in a confined space, the pressure will rise, possibly causing the container to expand, if capable of the same. It is desirable to provide a container, including a bag, of popcorn wherein most, if not substantially all, of the kernels create popcorn, and in which the popcorn and kernels are not charred. It is also desirable to have a container, which is capable of holding a variety of different types of charges, flavorings and the like.

[0003] Typical microwave popcorn bags are fabricated from a laminated web of material that can be folded and sealed to form a bag comprised of a front (i.e. top) panel and a back (or bottom) panel that are interconnected by longitudinally oriented, gussetted side panels (i.e. folded side panels). To improve the heating performance of microwave popcorn bags and other containers, the use of susceptors has become widespread in the industry to assist with the heating of the food product, in particular microwave popcorn kernels and charges. Most of the materials forming the bag are microwave transparent and are not particularly well adapted to absorb heat energy. Susceptors, however, are designed to absorb microwave radiation and heat energy. In

doing so, susceptors rapidly heat up to a high temperature, and then radiate heat energy onto items located in close proximity thereto. Susceptors are usually made from a thin sheet of polyester film applied to the polyester sheet, such as by vacuum deposition, there is typically a metallic material that serves to absorb the microwave radiation and associated heat energy. The polyester sheet is laminated to a material that is dimensionally stable when subjected to relatively intense heat typically a paper-based substrate.

[0004] One of the problems associated with using a susceptor in a microwave popcorn bag is that the susceptor may reach very high temperatures, for example in the order of 370 degrees F or more. Aside from the fact that such high temperatures require a careful selection of the materials that can withstand the high temperature, due to the high temperatures created at the vicinity of the susceptor, it is not uncommon for a portion of the corn kernels held inside the bag in close proximity to the susceptor to be scorched and charred, thus leaving a significant percentage of the corn kernels originally placed in the bag unpopped. Moreover, a significant proportion of the corn kernels that have popped may also get charred as a result of being located too close, and for too long, near the susceptor.

[0005] It is therefore desirable to have popcorn containers, including popcorn bags, that reduce the tendency of corn kernels and popped corn from coming into prolonged contact with the susceptor.

[0006] One of the other difficulties of using susceptors with microwave food containers intended to be heated in the microwave oven, is that because of the intense heat generated in the immediate vicinity of the susceptor anything which is in direct contact with the susceptor area of the container, can have its stability or integrity impacted, including other materials used in forming the container. For example, it is not desirable to have some kinds of plastics located in the immediate vicinity of the susceptor. If subjected to high temperatures in the immediate vicinity of the susceptor, some plastics can degrade and potentially contaminate the food product. Yet plastics are useful materials in providing gas, moisture and grease/oil barriers to prevent food products from being compromised, such as for example by going stale, or leaking out of a container.

[0007] The problem of leakage has been a particular problem with microwave food products and tended to result in the use of oils that are provided in a non-liquid form, but which are viewed by many as not as healthy for consumers. Accordingly, it has been quite problematic in trying to use non-hydrogenated oils (e.g. oils with no trans-fatty acids therein) can be used in place of hydrogenated oils.

[0008] Hydrogenated oils are important for traditional microwave packages for shelf stability and oil resistance. Traditional grease resistant paper microwave bags would tend to leak and there would not be good shelf stability, if non-hydrogenated oils are used.

SUMMARY OF INVENTION

[0009] In accordance with the present invention, there is provided an expandable microwave popcorn bag which has an outer enclosure enclosing an outer cavity. The outer enclosure is made up of a top panel, and a bottom panel positioned opposite to the top panel. The expandable microwave popcorn bag also has an inner pouch located within the outer cavity which contains a plurality of unpopped popcorn kernels enclosed in the inner pouch. At least some of the plurality of kernels will be released from the inner pouch to pop when the bag is subjected to microwave radiation. The bag will expand to accommodate the popped kernels. The inner pouch is attached to the top panel of the outer enclosure. The expandable microwave popcorn bag also has a susceptor associated with the bottom panel of the outer enclosure which is positioned generally opposite to the inner pouch.

[0010] In accordance with the present invention, there is also provided a microwave food container which has an outer enclosure defining a cavity and a susceptor associated therewith. The microwave food container also has an inner enclosure which encloses a food product in an inner cavity. The inner enclosure is attached within the cavity. At least some of the food product will be released out of the inner enclosure within the cavity to be heated by heat emitted from the susceptor, when the container is subjected to microwave radiation.

[0011] In accordance with the present invention, there is also provided a microwave container which has an outer enclosure defining a cavity and a susceptor associated therewith. The outer enclosure does not provide a gas barrier which prevents oxygen from penetrating into the cavity from the environment. The microwave food container also has an inner enclosure which encloses a food product in an inner cavity. The inner enclosure is made from a material that provides a gas barrier. The inner enclosure is attached within the cavity. At least some of the food product will be released out of the inner enclosure within the cavity to be heated by heat emitted from the susceptor, when the container is subjected to microwave radiation.

[0012] In accordance with the present invention, there is also provided a microwave food container which has a generally microwave transmissible outer enclosure defining a cavity and a susceptor associated therewith. The outer enclosure does not provide an oil or grease barrier to prevent oil or grease from seeping from the cavity during storage of the container. The microwave food container also has an inner enclosure, which encloses a food product in an inner cavity. The inner enclosure is made from a material that provides an oil or grease barrier. The inner enclosure is attached within the cavity, wherein at least some of the food product will be released out of the inner enclosure within the cavity to be heated by heat emitted from the susceptor, when the container is subjected to microwave radiation.

[0013] In accordance with the present invention, there is also provided a web for use as an inner enclosure with an inner cavity, in a microwave popcorn container. The web is made from a material that provides an oil or grease resistant barrier for preventing a significant amount of a charge located inside the inner enclosure from seeping out of the inner cavity of the inner enclosure during storage of the container.

[0014] In accordance with the present invention, there is also provided a method of forming a container for microwave popcorn kernels comprised of: forming an inner enclosure, which has a releasable seal for releasing the kernels during heating of the container, with microwave popcorn kernels held inside; placing the inner enclosure in a partly formed outer enclosure; and sealing the outer enclosure to enclose the inner enclosure therein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] In drawings illustrating by way of example only, embodiments of the invention:

[0016] **Figure 1** is a cross-sectional view through a first portion of a web used to form a microwave popcorn bag;

[0017] **Figure 2** is a cross-sectional view through a second portion of the web of **Figure 1**, further illustrating the use of a susceptor employed as part of the web;

[0018] **Figure 3a** is a transverse cross-sectional view of an un-inflated popcorn bag constructed with the web of **Figures 1 and 2**;

[0019] **Figure 3b** is a longitudinal cross-sectional view of the popcorn bag of **Figure 3a**, but with the bag partially inflated;

[0020] **Figure 3c** is perspective view of the popcorn bag of **Figures 3a and 3b**;

[0021] **Figures 4a – 4e** are enlarged cross-sectional views through portions of example embodiments of webs that can be used to form an inner pouch for the popcorn bag of **Figures 3a-3c**;

[0022] **Figure 5a** is a schematic view showing part of an apparatus that can be used to form the popcorn bag of **Figures 3a-3c** from any of the webs of **Figures 4a-4e**;

[0023] **Figure 5b** is a schematic view showing a portion of the web of **Figures 4a-4e** partially folded on the apparatus used to form the popcorn bag of **Figures 3a-3c**;

[0024] **Figure 6** is a perspective bottom view of an inner pouch of the popcorn bag of **Figures 3a-3c**;

[0025] **Figures 7 and 7a** are transverse cross-sectional views of the partially expanded popcorn bag of **Figures 3a-3c**;

[0026] **Figure 7b** is a transverse cross-sectional elevation view of the fully expanded popcorn bag of **Figures 3a-3c**;

[0027] **Figure 7c** is a side perspective of the fully expanded popcorn bag of **Figures 3a-3c** having been opened at one end for consumption;

[0028] **Figure 8** is perspective view of an alternate embodiment of the invention, employing a self-erecting box;

[0029] **Figure 9** is a transverse elevation cross section view through the embodiment of **Figure 8**, prior to being subjected to microwave radiation in a microwave oven; and

[0030] **Figure 10** is the same view as **Figure 9**, showing the embodiment of **Figure 8** after having been exposed to microwave radiation.

DETAILED DESCRIPTION

[0031] In a preferred embodiment of the present invention, an inner pouch, the configuration and composition of which will be described below, is held inside an outer container or enclosure. The outer enclosure could be rigid or semi-rigid. Alternatively, the outer enclosure may be somewhat flexible, and may be expandable. For example it may in part be made out of a paper material and substantially form a bag. An outer enclosure can be formed in the same way and with the same materials as is described in US Patent No. 6,137,098 issued to Moseley et al., the contents of which are hereby incorporated herein by reference. The outer enclosure disclosed in the Moseley et al. patent has a susceptor, which is particularly suitable for use in the present invention. However, it will be appreciated that the inner pouch design may be used with numerous other outer enclosures, including other popcorn bags, having different configurations and made from different material compositions, and different types of susceptors.

[0032] With reference to Figure 1, part of a longitudinally extending web 12 for an outer enclosure 30 (See Figure 3c) is shown in detail in enlarged cross section.

Web 12 comprises an outer layer 18 that is preferably a suitable weight of Kraft paper such as 60 pound Kraft paper, and this forms a dimensionally stable base layer. Bonded to layer 18 using conventional suitable adhesives or other conventional bonding/lamination techniques, is a layer of a suitable polyester 20 that will remain stable when the bag formed therefrom is heated by microwave radiation. A suitable PET - polyethylene terephthalate – such as a semi-crystalline PET material can be utilized for this purpose.

[0033] In a portion of the web 12 that will form at least part of a bottom panel 32 (See Figure 3a and 3b) of the bag, the configuration varies somewhat, as is illustrated in Figure 2. In this portion of web 12, a susceptor layer 24 extends longitudinally and transversely in the web, and layer 24 is sandwiched between layers 18 and 20. It is this portion of the web 12 that will be utilized in forming the bottom panel 32 of the popcorn bag. Layer 24 can include a metalized material that can be applied to a material like a polyester material (e.g. a suitable polyethylene terephthalate – such as a semi-crystalline PET) in known ways, such as vacuum deposition. An example of a suitable polyester and metalized layer(s) is manufactured by A.D. Tech Inc. such as under designation PC 48G PTC AL – item no. P120 CA 01270 NBKZ. It will be appreciated that many other types of susceptors (i.e. heating elements) can be employed in this invention.

[0034] In addition to layers 18 and 20, an additional grease proof layer 19, such as a layer of a suitable grease proof paper can be employed on the inner face (i.e. and can be affixed to layer 20 with conventional techniques), if desired.

[0035] It should be noted that layers 18, 19 and 20 can be made of materials such that they permit the relatively easy transmission of microwaves therethrough, so that microwaves emitted in a microwave oven can impact susceptor layer 24.

[0036] Figures 3a and 3b show a popcorn bag 20 in cross section. Bag 20 generally consists of an outer enclosure 30 that can be made from web 12, and an inner pouch 40. Outer enclosure 30 can be formed entirely from a continuous section of web 12 and folded and sealed to provide an outer bag enclosure. Outer enclosure

30 comprises a bottom panel 32, a top panel 34 and two side gusset panels (folded side panels) 28a and 28b.

[0037] By appropriate folding, and providing appropriate end seals, as well as a longitudinal seal to connect the two longitudinal edges of the web 12, enclosed outer enclosure 30 can be formed, as is known in the art.

[0038] With further reference to Figure 3b and Figure 3c, outer enclosure 30 has transverse end seals 38a and 38b that extend along the entire width of outer enclosure 30 at its longitudinal ends. Seal 38b can be formed by bringing together the opposite edges along the width of top panel 34 with bottom panel 32 located at one longitudinal end of outer enclosure 30 of bag 20, and providing suitable adhesives to bond the material together. Suitable adhesive that can be used for both seals 38a and 38b are the laminating adhesives and heat seal coatings in the PWF-3000 and PWF-3003 series made by HB Fuller, and in particular the PWF-3003 heat seal coating. As the opposite edges of top panel 34 and bottom panel 32 are brought together and the two edges can be pressed together with a suitable conventional compression apparatus. Seal 38b typically can have a width of about 1/4 –1/2 inches (although the seal could be wider, or possibly narrower). Due to the thickness and strength of seal 38b, as well as to its relative non-proximate position to the area of the susceptor layer 24 which can be localized in a central area and portion of panel 32, seal 38b will not yield, even when subjected to the pressure created by the heating of the popcorn bag during the microwave heating cycle, as will become more apparent below.

[0039] On the other hand, seal 38a can be formed by applying a suitable adhesive such as is identified above, to the opposite edge faces along the width of top panel 34 and bottom panel 32 at the other longitudinal end of bag 20. A conventional seal forming pressing apparatus can be subsequently applied to the opposite edges along the width of top panel 34 and bottom panel 32 at the other end of bag 20 to close the seals 38a and 38b. As will be appreciated, the use of a heat activated adhesive to form seal 38a will cause seal 38a to soften during the heating process in the microwave oven, permitting relatively easy access into the bag when the popcorn has been created. By making the coating of seal 38b thicker and/or wider than seal 38a, the bag can be designed so that the bag will suitably vent through seal 38a and not

seal 38b. Additionally, seal 38a will be more easily opened up than seal 38b in such a design, so that a consumer will tend to open the top end of the bag at seal 38a.

[0040] In addition, as will be appreciated, a longitudinal seal 39 (such as for example a fin seal, or lap seal) to attach the opposite longitudinal edges of the web 12 can be formed to complete outer enclosure 30 and enclose therein a cavity. To form the longitudinal seal 39 of outer enclosure 30, web 12 can be folded so that the opposite longitudinal edges of web 12 are brought close together, and usually into overlapping relationship, typically to form a lap seal or a fin seal. The folded web 12, at this point, includes the bottom panel 32, made of a contiguous portion of web 12, two side gusset panels and a top panel 34, the latter being made of two separate sections of web 12, that are joined together with seal 39. Either of the adhesives used for seals 38a or 38b could be used for seal 39, and the higher coat weight used on the bottom seal 38b could be employed for fin or lap seal 39 since it is desirable that seal 39 will not yield. An example of an adhesive that could be used would be a polyvinyl acetate (PVA's) type of adhesive employing no plasticizer in the formulation, such as adhesive Code PD330 and PHF 3000 series made by HB Fuller. These types of adhesive are formulated for the microwave food industry and meet safety standards for that market. Most heat seal emulsions used in the packaging industry activate in the 200-275 degrees F range. The ones used in the microwave popcorn market are usually homopolymer PVA's. These are not normally used for heat seals because of their higher activation temperature range of 275-325 degrees F. These are ideal for the popcorn market because the paper can be heat sealed at higher temps and these higher activation temperatures are actually required to resist the heat activation of live steam (for example in the temperature range of 230-270 degrees F for the 3-5 min popcorn). The inner seals on most commercial popcorn bags are a pattern gravure coated homopolymer type adhesive. The venting and seal strength differences are changed by altering the coat weight or seal width on the package. The lighter coat weight, however, would make the end seal 38a more easily opened by a consumer when they want to access the bag to consume the popcorn by pulling apart the seal 39a. Of course, other types of known sealing can be used for outer enclosure 30.

[0041] During the process of forming outer enclosure 30, inner pouch 40 is inserted into the cavity defined by outer enclosure 30 before outer enclosure 30 is

sealed, and is attached to the top panel 34. This can be done during the folding sequence when outer enclosure 30 is being formed. For example, before the opposite edges of the two separate sections of top panel 34 are brought together, inner pouch 40 can be inserted in a suitable position so that as the two edges of top panel 34 are brought together to be bonded, they cover within the inner cavity of outer enclosure 30, inner pouch 40. An appropriate attachment mechanism, such as heat resistant adhesive can be used to bond the upward facing surface panel 44 of pouch 40 to the inner, downward facing surface of top panel 34.

[0042] A suitable conventional compression apparatus can be employed to ensure that the longitudinal seal 39 is formed and pouch 40 is bonded to the inner surface of top panel 34. The longitudinal seal 39 typically can have a width of about 1/4 –1/2 inches (although the seal could be wider, or possibly narrower). Due to the additional thickness and/or strength of the longitudinal seal 39 of outer enclosure 30, or choice of adhesives, the longitudinal seal 39 of outer enclosure 30 should not yield, even when subjected to the pressure created by the heating of the popcorn bag during the microwave heating cycle, as will become more apparent below.

[0043] It should be noted, that it is not necessary that the outer enclosure 30 itself, provide a moisture barrier or gas (particularly air or oxygen) barrier to preserve the quality of the food product held inside the inner pouch, during periods of storage.

[0044] With reference again to Figures 3a and 3b, additionally illustrating the configuration and structure of inner pouch 40, inner pouch 40 comprises a bottom, upward facing panel 44 which is attached to the inner surface of top panel 34 of outer enclosure 30, a top, downward facing panel 42 positioned directly above and generally spaced from bottom panel 32 of outer enclosure 30, longitudinal seals 48, 49, and a fin seal 46 which can be located proximate the middle of panel 42 and run along the entire length of inner pouch 40. Top panel 44 of inner pouch 40 may be attached to the inner surface of top panel 34 using conventional heat resistant adhesives such that inner pouch 40 will remain attached to top panel 34 of outer enclosure 30 during the microwave heating cycle. Inner pouch 40 can be formed from a web 60 constructed from a combination of several materials bonded, laminated or otherwise attached to each other, some examples of which are described hereinafter.

[0045] Placed inside inner pouch 40 are a plurality of unpopped corn kernels 50 and, any charge 52 comprising products such as hydrogenated or non-hydrogenated oils/fats that provide assistance in the heating of the kernels and can provide suitable flavouring. Additional flavourings and additives can also be housed in inner pouch 40. It will be appreciated that depending upon the choice of materials, a large degree of flexibility in the choice of products that can be held in pouch 40 is possible. Of particular importance, because the kernels and charge are held in a sealed inner pouch 40, certain products that previously have been unable to be included in microwave popcorn products, can be utilized. For example, liquid or semi-liquid oils, particularly those with no trans-fatty acids, are considered by many to be more healthy food additives than solid oils and fats. Pouches 30 can be constructed to be capable of holding such liquid or semi-liquid oils.

[0046] To reduce the chances that the charge contained within inner pouch 40 will seep outside the inner pouch 40, and also to reduce the risk of the kernels drying out during storage, prior to use, a multi-layer web can be used to form the inner pouch 40.

[0047] Generally the characteristics preferred for the web from which pouch 40 is formed, are that it provide (1) a moisture barrier to prevent water molecules from seeping out from the inner pouch through the web material (2) a gas barrier to prevent undesirable external gases (particularly air gases including oxygen) from entering the inner pouch and spoiling the product and (3) provide an oil and grease barrier to prevent the charge from seeping through the material and out of the pouch in which it is retained. However, it should be noted that if the outer envelope 30 has appropriate over-wrapping (as is now common with conventional microwave popcorn products) the web material may only be required to provide a suitable oil barrier and/or grease barrier. Additionally, the material should be sufficiently strong to resist puncturing from materials in the pouch, including the popcorn kernels, during storage, prior to cooking. It can also be selected so that it has an adequate degree of microwave transmissibility so that the material does not interfere with the heating process in the bag itself.

[0048] The moisture vapour transmission rate (MVTR) and Oxygen Transmission rate (OTR) can be measured for combinations of materials and size of pouch that is

exposed, at a given temperature and relative humidity using conventional testing techniques to ensure that the product will be maintained in a suitable state for consumption, given typical anticipated storage times. For example, it may be appropriate to ensure that the product will have a shelf life that lasts at least one year.

[0049] Although a single material could perhaps be identified which would perform all of the desired functions, it has been found that by selecting two or more materials which are bonded, laminated or otherwise attached to each other to form a composite web, all functions can be adequately fulfilled.

[0050] In some embodiments, the first layer of the web will primarily constitute of a material to form the moisture barrier and typically will form the inner most layer of pouch 40. The moisture barrier can be formed from one or more materials that maintain in the pouch the moisture inherent in the kernels and charge. The choice of materials to be used as the moisture barrier can be such that the moisture barrier allows the popcorn bag to have a reasonably long shelf life (e.g. at least one year) by preventing moisture inside pouch 40 from diffusing into the rest of the cavity of outer enclosure 30. A moisture barrier can be provided to have a maximum MVTR so the desired popping volume of the corn kernels would be maintained at a suitable level.

[0051] Bonded to the moisture barrier can be a material that forms a separate sealing oil/grease layer. The sealing layer is intended to prevent any oil and/or slurry placed inside the interior pouch from seeping outside the inner pouch 40 and into the rest of the cavity of outer enclosure 30. The extent to which oil and/or slurry seeps outside interior pouch 40 will also influence the expected shelf life of the popcorn bag 20, since excessive seepage of oil and/or slurry may not only also reduce the moisture level inside interior pouch 40, but may also weaken the materials making up the popcorn bag 20, thereby compromising the integrity of the bag 20. This in turn may cause ruptures in the bag, and possibly allow outside pollutants to enter the bag 20 (either into the interior of outer enclosure 30, or into inner portion 40). The sealing layer can also be selected to provide a minimum of a one-year shelf life.

[0052] Bonded to the other surface of the sealing layer can be a material that forms a separate gas barrier 66. The gas barrier is intended to limit the extent to

which gases, such as carbon dioxide (CO_2), nitrogen, oxygen, and other gases present in the air, permeate through the wall of the pouch 40 and enter into inner pouch. This can lead to rancidity of the oil and/or slurry contained in inner pouch 40.

[0053] The various layers of material chosen to form the composite web are suitably bonded, laminated or otherwise attached to one another to form a composite web that adequately satisfies the foregoing design criteria and will also retain unpopped kernels and charge prior to heating in the microwave oven. Examples of specific embodiments of materials that can be employed for web 60 of pouch 40 are detailed hereinafter.

[0054] To form inner pouch 40, web 60 can be folded and sealed. Figure 5a shows a portion of web 60 folded around a hollow tube member 90 that can be employed to form inner pouch 40. Tube member 90 forms part of the kernel and charge dispensing apparatus (not shown). The web 60 can be fed downwards and folded into a tube shape, such that bottom and top circular edges 82 and 84 on web 60 are formed around the circumferential ends of hollow tube member 90. A moisture barrier layer of web 60 can constitute the inner layer of circular edges 82 and 84 of the folded portion of the web 60 which is wrapped around the tube member. Subsequently, the moisture barrier 62 at circular edge 82 of the web 60, folded near and around the bottom end of tube member 90, is heated above the melting temperature of the material used as the gas and moisture barrier 62, and the folded section of web 60 near and around tubular member 90 is pressed together with a suitable conventional compression apparatus, known to the person of ordinary skill, thereby forming seal 48. Once left to cool, two layers 62 of the moisture and gas barrier will have bonded together to form the seal 48 at the bottom part of the web 60 folded around the tubular member 90. Alternate mechanisms for forming an appropriate seal are also possible. The bottom seal 48 can typically be in the range of about 1/4 -1/2 inches in width (although the seal could be wider, or possibly a little narrower). Further, when web 60 is folded around tube member 90, the opposite parallel edges of web 60, namely edges 80a and 80b, are brought closer together. The folding operation of web 60 and the placement of edges 80a and 80b proximate and essentially parallel to each other defines a narrow opening between edges 80a and 80b. In some embodiments, a heat activated hot melt adhesive can then be applied to

edges 80a and 80b. In other embodiments, a layer of heat activated adhesive is formed on the entire inner surface of the web (i.e. on top of the moisture barrier). These latter embodiments make the forming of all seals 46, 48 and 49 much easier during the pouch forming process.

[0055] A seal forming pressing apparatus can be applied to the edges 80a and 80b, in the folded position of web 60 to press edges 80a and 80b and create the fin seal 46 of length approximately equal to the length of tube member 90.

[0056] As will be appreciated, the use of a heat activated adhesive to form fin seal 46 will cause fin seal 46 to be released when the popcorn bag 20, and more specifically the heat activated adhesive, are subjected to microwave radiation and the temperature of the bag rises as a result. The fin seal 46 may also release simply from the increase in temperature generally in pouch 40 and outer enclosure 30. If the adhesive used to form seals 48 and 49 is the same as is used to create fin seal 46, then fin seal 46 should be preferably narrower in width. This should provide that during the heating process, the pouch will rupture along fin seal 46, to provide improved performance.

[0057] As will become more apparent below, once the bottom seal 48 and the fin seal 46 are formed, the web 60 is pulled downward so that the circular edge 84 is positioned around and about the bottom part of tube member 90. The corn kernel and charge are then deposited into the bottom of the bag from a kernel and charge dispenser (not shown) dispensed through the interior of hollow tube member 90. Once the kernels and charge have been deposited in the bag, the moisture barrier at circular edge 84 of the web 60, now folded near and around the bottom end of tube member 90, in some embodiments is heated above the melting temperature of the material used as the moisture barrier. Thereafter, the folded section of web 60, corresponding to circular edge 84 in Figure 5b, is pressed together with the compression apparatus (not shown), thereby forming seal 49. Once left to cool, two portions of the layer of the moisture barrier will have bonded together with the adhesive or adhesive layer to form the seal 49 at the bottom part of the web 60 folded around the tubular member 90. Of course, other sealing mechanisms are contemplated.

[0058] With reference to Figure 6, sealed inner pouch 40 is viewed from below and the specific configuration of seals of inner pouch 40 is shown which includes the fin seal 46 stretching longitudinally along the length of inner pouch 40. Additionally, located at one end of inner pouch 40 is seal 48, and located at the other longitudinal end of inner pouch 40 is seal 49. Pouch 40 encloses therein popcorn kernels and a charge.

[0059] The specific combination of materials that may be used to form web 60 may depend not only on the efficacy of the various materials used to achieve the objectives each layer of the web 60 is intended to achieve, but also on the monetary costs of using one combination of materials over another. As will be appreciated, while a particular combination of materials may have better design qualities, the cost associated therewith may render that particular combination of materials as commercially not viable.

[0060] Several material combinations for web 60 of varying efficacy have been identified. A first such combination of materials used to form web 60 is illustrated in Figure 4a. Web 60 is comprised of a first layer 62 which is itself a combination of two materials: a layer 62a of PET (polyester), selected for its puncture and heat resistance and a layer or coating 62b of (PVDC) polyvinylidene chloride selected for its ability to act as a gas and moisture barrier. The PET layer can be generally crystalline or semi-crystalline PET (as opposed to amorphous PET). An example of a suitable commercially available combination for layer 62 comprising layers 62a and 62b is a product called EMBLET 1215 made by Unitika Ltd. (Films Division).

[0061] Attached to layer 62, such as by a conventional smooth roll or gravure coating method, a second PVDC adhesive/primer layer 63 can be coated at 3-4 lbs/r (dry lbs of adhesive / 3000 sq ft ream) onto the PVDC layer 62b of layer 62. An example of a suitable PVDC primer is SERFENE 546 made by Rohm & Haas. Layer 63 is used as a tie layer and also provides a degree of protection as a moisture and gas barrier, and is used as an extrusion primer for bonding to an extrudable (LDPE) low density polyethylene core layer 64 which can be extruded at about 7.5 lbs/r. Layer 63 and layer 64 can be extruded in one pass onto layer 62. Thereafter the combination layers of 62, 63 and 64 can be put through another extrusion process to bond the

exposed surface of layer 64 to an oil resistant tie layer 66 which is an (EMAC) ethylene methyl acrylate copolymer which can have a thickness of about 0.4-0.5 mil. Layer 66 is extruded onto layer 64 in a final extrusion process where a copolymer hot melt coating 67 is extruded onto the layer 66. Hot melt coating 67 would be the inner most layer of a pouch 40 and can be a heat activated sealant that is used to create fin seal 46 (and in some embodiments seals 48 and 49 as well). One suitable layer 67 is a hot melt adhesive model HL9918X manufactured by HB Fuller at a coat weight of 10 -15lbs/r and having a thickness of about 0.75-1 mil. Testing performed on inner pouches formed from this particular combination of materials has shown that the hot melt is activated at relatively low temperatures, thus typically providing that fin seal 46 would open during heating in a typical microwave oven, and thereby release the contents of the inner pouch 46 into the interior of outer enclosure 30.

[0062] A second combination of materials used to form web 60 is shown in Figure 4b, which is a commercially available product made by Dow Chemical. This web is a 3 layer 2 mil film and has a first moisture barrier layer 162 formed from Low Density Polyethylene (LDPE) (referenced as XUR 970052-4), a middle nylon core layer 164 that acts as a gas barrier layer, and an oil resistant and heat sealant layer 166 formed from (EAA) ethylene acrylic acid skin. Layer 166 provides the heat-activated layer for forming the fin seal 39 in this embodiment. An example of this 3 layer structure is sold by Dow Chemicals under model no. XUR 970052-4. It is formed in one pass by a co-extrusion process reducing the overall production cost of the web.

[0063] In yet another combination of materials SARANEX 21 provides a suitable combination web material, and is a 3 layer 2 mil co-extruded film made by Dow Chemical and can also be formed in one pass in a co-extrusion process. In this embodiment as shown in Figure 4c, the moisture barrier is formed from the outer LDPE layer 262 and the middle PVDC barrier layer 264. The inner heat sealing and oil/grease barrier 266 is formed from an EVA (ethylene vinyl acetate) skin. The heat activated sealant layer 266 is used to form fin seal 46 and possibly seals 48 and 49 and is an EVA copolymer similar to the ELVAX line manufactured by Dupont.

[0064] In another embodiment (which can also be considered to be illustrated in Figure 4c) SARANEX 14 is used instead of SARANEX 21. In this embodiment,

layer 266 of EVA is substituted by a layer 266 of LDPE. It also can be co-extruded in a one-pass extrusion process.

[0065] As illustrated in Figure 4d, to more safely ensure adequate shelf life needs, a PET polyester layer 365a coated with a PVDC layer 356b can be laminated to the LDPE side of the SARANEX 14 or SARANEX 21 (layers 362, 364, 366) using a dry bond adhesive layer 365c such as WD4006 / XR2990 from HB Fuller of an appropriate thickness. Layer 362 can be the LDPE, layer 364 the PVDC layer and layer 366 either EVA or LDPE. Again EMBLET 1215 can be used for this additional combination of layers 365a and 365b. The additional moisture and gas barrier is provided by the PVDC layer, and the increased puncture resistance needed for popcorn kernels is provided by the PET. Testing performed on inner pouches 40 formed from this particular combination of materials (in particular with SARANEX 21) has revealed that the following: under ASTM test conditions in D 3985 at 100% oxygen, 24 degree Celsius, the pouches had a measured OTR of 0.4 cc/100 in^2 per day; under ASTM test conditions in F 1249 at 100% relative humidity and 100 degrees Fahrenheit, the pouches had a measured MVTR of 0.245 g/100 in^2 per day. It is believed that for a bag 30 that in a generally flattened configuration is approximately 5 ½ inches wide by 12 inches in length, with an inner pouch 40 that is approximately 5 inches wide by 4 ½ inches in length these OTR and MVTR rates should ensure a shelf-life of at least one year. Additionally, it is expected the cost associated with using this combination of materials may be relatively low.

[0066] A further combination of materials for web 60 is illustrated in Figure 4e. In this embodiment, the web is formed from a layer of PET coated with PVDC film barrier (such as EMBLET 1215). The PET / PVDC film layer 462a, 462b is laminated using a PVDC adhesive layer 463. An example of a suitable layer 463 is Doran 8600C from Darex Division of WR Grace and which can be coated to a sealant film layer 466 at about 3.5 lbs/r of the 8600C.

[0067] With respect to the heat activated sealant layer 466, used to provide fin seal 46 and possibly end seals 48 and 49, three different heat activated seals which have been found to be effective are, namely, the FDA compliant Dow Chemical Integral 808 film (about 1 mil thickness) which would be dry bond laminated with a

PVDC adhesive at 3-4 lbs/r, Primacor 3440 (an EAA copolymer designed for extrusion coating) (about 1 mil thickness) also manufactured by Dow Chemical, and the HL9918X an extrusion grade hot melt heat seal referred to above (about 0.75-1.0 mil thickness). Both extrusion coating technologies would be extruded on a primer/barrier/tie layer of PVDC adhesive as used in the dry bonding lamination method. The sealant layer 466 can be applied in a single pass using an extrusion or dry bond lamination process. Other heat-activated sealants can be used.

[0068] It is believed that all of these particular combinations of materials in Figure 4e, for pouches 40 have what is believed to be an acceptable MVTR and OTR that would ensure a shelf-life of one year.

[0069] In each of the foregoing embodiments, with respect to the bonding of pouches 40 to the inner surface of top panel 34 of enclosure 30, it has been found that 1/16 inch beads of WB3621Y adhesive from HB Fuller applied to the outer surface on panel 44 of pouch 40 fulfilled the requirements, as would various other attachment mechanisms.

[0070] Those versed in the art would appreciate that many other combination of materials are possible for forming the inner pouches used in conjunction with the popcorn bag of the present invention.

[0071] In use, and with reference to Figures 7, 7a, 7b and 7c, the microwave popcorn bag 20 is placed in a microwave oven and subjected to microwave radiation. For a 750 watt microwave oven, approximately 60-80 grams of kernels and an associated charge heated in inner pouch 40 of bag 20 for an approximate time of about 3 minutes, will usually ensure that an acceptable number of kernels are popped. Indeed the proportion of kernels being popped would be expected to be very high.

[0072] During the heating process, the kernels located in inner pouch 40 begin to pop shortly after the temperature in the inner pouch (and indeed the bag 20 in general) has become high enough that steam is generated inside the kernels. As the pressure inside the inner pouch 40 increases, it will begin to inflate, thus expanding inner pouch 40. Concomitantly, the heat activated sealant used to seal fin seal 46 begins to heat up and soften, thus eventually causing fin seal 46 to break down. Inner pouch 40

then begins to open up as can be seen in Figure 7a. It will be appreciated that fin seal 46 begins to break down only at a point where the temperature inside the bag 20 has softened the seal to that the pressure inside the pouch will force the pouch to open, typically along the heat activated sealant used for fin seal 46. As mentioned above, the fin seal and end seals can be configured by for example width of seal and/or choice of adhesive, so that the fin seal 46 will open before any seal would break on end seals 48, 49. Therefore, until that point, none of the kernels inside pouch 40, or the popped corn, come in contact with the susceptor 22, and accordingly, none of the kernels or popped corn become scorched or charred.

[0073] It will be appreciated that other opening mechanisms for pouch 40 are possible. For example, the web 60 could be made from a selection of materials that while meeting some or all of the design criteria mentioned above at normal temperatures, will rupture when subjected to heat and increased internal pressure inside the pouch.

[0074] Typically the pouch 40 will start to release kernels into the cavity of outer enclosure 30 fairly early in the heating cycle. Once a few kernels have popped, the seal 46 will release and the pouch 40 starts to vent into outer enclosure 30. The release of seal 46 is assisted because it is closer to the bottom susceptor than end seals 48 and 49. This increases the tendency of the seal 46 to release, without release of seals 48 and 49.

[0075] As pouch 40 releases its contents, kernels, oil and other flavourings will tend to fall down onto the susceptor of panel 32. This will cause additional kernels to pop, releasing steam and increasing the pressure in the bag or enclosure 30. As the pressure increases in enclosure 30, the bag will start to inflate. This inflation of the bag will tend to cause the pouch to open up more fully allowing more kernels to escape pouch 40 and reach the susceptor. It should be noted that the process of the start of release of kernels and charge from pouch 40 will occur relatively quickly. As an aside, as is known, appropriate venting of outer enclosure 30 can be permitted so that there is not a catastrophic release of the contents from out of enclosure 30 into the environment.

[0076] Once the popping of kernels has begun, there will be a significant degree of vibration of pouch 40 and enclosure 30, which will assist in evenly distributing the kernels and oil over the susceptor.

[0077] In addition to the heat activated sealant used for fin seal 46 breaking down, thus causing fin seal 46 to be released, the heat activated sealant used for sealing seal 38a of outer enclosure 30 also begins to heat up and break down. However, since seal 38a is located far enough away and to the side of susceptor patch 22, in contrast to fin seal 46 which is located just above susceptor 22 and at a much closer distance thereto, the heat activated sealant used for seal 38a will heat up and begin to break down at a slower rate than the heat activated sealant used for fin seal 46. As a result, the break down of the heat activated sealant at seal 38a will not be completed so far that the popcorn will spill out into the microwave oven. Seal 38a may however have been configured so that it can be easily opened by a consumer to permit easy access to inside the bag.

[0078] It should also be noted that the bond between the inner pouch and the upper panel of the outer bag should hold up throughout the heating and consumption process. More heat resistance for bonding the outer bag to the pouch can be achieved, if needed, for example, by adding a cross-linker to the HB Fuller WB3621Y adhesive.

[0079] As seen in Figure 7b, showing bag 20 in cross section at the end of the microwave heating cycle, when the microwave heating cycle has come to an end most of the kernels originally placed inside inner pouch 40 have popped. The popping of the kernels will have caused inner pouch 40 to expand to a tub-shaped configuration wherein the walls of inner pouch 40 may abut gussets 28a and 28b, as shown in Figure 7b. As can further be seen from Figure 7b, and also Figure 7c, showing a side perspective view of bag 20 at the end of the microwave heating cycle, at its inflated state the bag 20 has an essentially rectangular box-like configuration near its open end (corresponding to where seal 38a was located). However, since seal 38b of outer enclosure 30 remains intact throughout the heating cycle, top panel 34 remains attached to bottom panel 34 along the width of bag 20 where seal 38b was formed. Once all of the kernels are popped into popcorn, and the bag is open, the popcorn is ready to be consumed.

[0080] It should be noted that one of the significant benefits of the specific containers disclosed herein, particularly in the context of a bag, is that a plastic over-wrap is not required for the outer enclosure to maintain freshness of the product therein. However, as mentioned above, if an outer package overwrap is used then the design requirements for pouch 40 will not be as stringent.

[0081] Although the embodiments of Figures 1-7 relate to embodiments of the invention incorporated into an expandable microwave popcorn bag, other microwave food containers can embody the invention. For example, the container may comprise a self-erecting box as is disclosed in US Application Serial No. 10/317,618 filed December 12, 2002 published June 12, 2003 as Publication No. 2003/0106899 A1, the contents of which are hereby incorporated herein by reference. Self-erecting boxes are those which can be moved from a first generally flattened configuration to a raised or erected configuration by a person applying pressure at one or more locations on the box. Optionally, the box may provide for a self-locking feature to hold the box in its erected configuration. In this regard, with reference to Figures 8, 9 and 10, a container 520 also that can be used in making microwave popcorn, is illustrated. Container 520 comprises two basic components: an outer enclosure 530 and inner enclosure 540. In this embodiment outer enclosure 530 consists of a housing that is constructed in the form of a self-erecting cardboard box. The outer enclosure 530 encloses an internal cavity 516 in which is located an inner enclosure 540 which in this embodiment is in the form of a generally flexible pouch. Examples of other self erecting containers that might be used or easily modified for such use, are disclosed in one or more of US Patent No. 3,494,536 issued to Henry on February 10, 1970, US Patent No. 4,291,828 issued September 29, 1981 to Nigro, and US Patent No. 6,155,479 issued December 5, 2000 to Wellner et al., the contents of which are hereby incorporated herein by reference.

[0082] In the embodiment of Figures 8, 9 and 10, outer enclosure 540 has a top panel 534 with a removable lid portion 517, a bottom panel 532, a first solid front wall 524 and a second solid rear wall 526. Removal of lid portion 517 is facilitated by score lines located in the cardboard in top panel 534. Completing the rectangular box 520 are identical side walls 529 and 531, which are comprised of a plurality of individual overlapping panels which have an interlocking feature, which provide for

an interference fit connection. The panels form opposed side walls 529 and 531 and complete the box and partially define the internal cavity 516, when the box is in its erect configuration shown in Figure 1. A susceptor can be attached or otherwise associated with bottom panel 532 and the panels can be made of a suitable cardboard or other rigid or semi-rigid material.

[0083] Pouch 540 can be constructed like any of the pouches described above and can be attached with a suitable heat resistant adhesive to the inner surface of top panel 534. Indeed, pouch 540 could be mounted to the underside of lid 517. After heating in a microwave oven, lid 517 can be removed by pulling on the tab shown in Figure 8. In removing lid 517, this will also remove from box 520 the emptied, but possibly somewhat still greasy, pouch 540.

[0084] In use, pouch 540 will open when pouch 520 is subjected to microwave radiation in a microwave oven. In doing so, corn kernels will be distributed onto the susceptor below. Using this design for the container, the inner pouch would be remote from the heating advantage of the susceptor. The inner pouch would open by the steam pressure created by the popcorn and a minimal seal width provided on fin seal 46. Additionally, a susceptor feature (e.g. providing metalization of part of the pouch) in the region of the longitudinal seal), could be provided to assist in the release of seal 46.

[0085] The invention can also be used with other microwave food containers, such as containers made of heat resistant plastic, and which hold food products other than popcorn, and that employ susceptors.

[0086] The foregoing described only preferred embodiments and modifications and variations will readily become apparent to those of ordinary skill in the art without departing from the scope of the invention as defined by the claims hereinafter.

WE CLAIM:

1. An expandable microwave popcorn bag comprising:

a) a generally microwave transmissible outer enclosure enclosing an outer cavity, said outer enclosure comprising a top panel, and a bottom panel positioned opposite to said top panel;

b) an inner pouch located within said outer cavity and containing a plurality of unpopped popcorn kernels enclosed in said inner pouch, wherein at least some of said plurality of kernels will be released from said inner pouch to pop when said bag is subjected to microwave radiation, and said bag will expand to accommodate said popped kernels, said inner pouch being attached to said top panel of said outer enclosure; and

c) a susceptor associated with said bottom panel of said outer enclosure, and positioned generally opposite to said inner pouch.

2. The microwave popcorn bag of claim 1, wherein said inner pouch comprises a top panel attached to the inner surface of said top panel of said outer enclosure, and a bottom panel, and wherein said bottom panel of said inner pouch has a sealed opening such that when said popcorn bag is heated in a microwave oven, said sealed opening is released to permit said unpopped corn kernels to move toward said susceptor within said outer cavity.

3. The microwave popcorn bag of claim 2, wherein said outer enclosure is formed from a web comprising:

a) an outer layer of a suitable paper material;

b) a medial layer comprising a partially vacuum metallized, polyester film attached to said paper outer layer, said metallized film providing a susceptor region; and

c) an inner layer of grease proof paper attached to said medial layer, such that said medial layer is sandwiched between said outer layer and said inner layer.

4. The popcorn bag of claim 3, wherein said susceptor is integrally formed with said inner and outer layers.

5. The popcorn bag of claim 3, wherein said inner pouch also contains a charge.

6. The popcorn bag of claim 5, wherein said charge is a non-hydrogenated oil.

7. The popcorn bag of claim 5, wherein said sealed opening is sealed with a heat activated adhesive or sealant layer.

8. The microwave popcorn bag of claim 1, wherein said inner pouch further contains a charge and said inner pouch encloses an inner cavity for holding

said popcorn kernels and said charge during storage of said bag, and said inner pouch is made from a web made from a material that provides an oil or grease resistant barrier for preventing a significant amount of said charge located inside said inner pouch from seeping out of said inner cavity of said inner pouch during storage of said bag.

9. A bag as claimed in claim 1, wherein said charge is a liquid or semi-liquid oil.

10. The popcorn bag of claim 9, wherein said charge is a non-hydrogenated oil.

11. The popcorn bag of claim 9, wherein said inner pouch is comprised of at least two layers of material attached to each other, said at least two layers of material also providing during storage of said bag, a moisture barrier for preventing loss of a significant amount of moisture out of said inner cavity of said inner pouch.

12. The popcorn bag of claim 11, wherein said at least two layers of material also provides during storage of said bag a gas barrier for preventing the intrusion of a significant amount of oxygen into said cavity of said inner pouch.

13. The popcorn bag of claim 12, wherein said moisture and gas barrier is formed at least in part from a layer of polyvinylidene chloride attached to a polyester film layer.

14. A popcorn bag according to claim 13, wherein said polyester is a suitable PET.

15. The popcorn bag of claim 12, wherein said moisture and gas barrier is formed from a 3 layer co-extrusion of a 2 mil film of XUR 970052-4 and said oil resistant barrier is formed from an (EAA) ethylene acrylic acid copolymer co-extruded on a core nylon gas barrier layer.

16. The popcorn bag of claim 12, wherein said moisture and gas barrier is formed from a 3 layer tandem extrusion of SARANEX 21, said oil resistant barrier is formed from (EVA) ethylene vinyl acetate copolymer, and said moisture and gas barrier is formed from a core layer coating of (PVDC) polyvinylidene chloride, said PVDC coating being applied to a LDPE top layer.

17. The popcorn bag of claim 12, wherein said moisture and gas barrier is formed from a 3 layer tandem extrusion of SARANEX 14, said oil resistant barrier is formed from a (LDPE) low density polyethylene sealant layer, and said moisture and gas barrier is formed from a core layer coating (PVDC) polyvinylidene chloride, said PVDC coating being applied to a LDPE top layer.

18. The popcorn bag of claim 16 further comprising an EMBLET 1215 film layer attached to the LDPE outer layer.

19. The popcorn bag of claim 17 further comprising an EMBLET 1215 film layer attached to the LDPE outer layer.

20. The popcorn bag of claim 1, wherein said inner pouch comprises:

a) a top panel; and

b) a bottom panel, said bottom panel comprising an opening adapted to open when said bag is subjected to microwave radiation, to allow the said plurality of unpopped kernels, popped kernels and charge to fall into the outer cavity of said outer enclosure of said popcorn bag, said opening having been sealed using a heat activated sealant such that said opening in said top panel is closed prior to exposure of said bag to microwave radiation.

21. A popcorn bag according to claim 20, wherein said heat activated sealant is a hot melt adhesive.

22. A popcorn bag according to claim 20, wherein said heat-activated sealant is an EAA copolymer.

23. A popcorn bag according to claim 20, wherein said outer enclosure is expandable from a first generally flattened configuration to a second generally inflated configuration and wherein when said outer enclosure is in said first configuration, said sealed opening is located proximate said susceptor,

whereby heat emitted by said susceptor will expedite the release of said sealed opening.

24. The popcorn bag of claim 12, wherein the gas, moisture and oil barrier properties of said inner pouch are selected to eliminate the need for a film outer wrap but provide at least a one year shelf life for the corn kernels and charge stored within said inner pouch.

25. The popcorn bag of claim 20, wherein said opening in said bottom panel of said inner pouch is sealed using a fin seal.

26. A popcorn bag according to claim 20, wherein said outer enclosure is expandable from a first generally flattened configuration to a second generally inflated configuration and wherein when said outer enclosure is in said first configuration, said fin seal is located proximate said susceptor, whereby heat emitted by said susceptor will expedite the release of said fin seal.

27. A popcorn bag according to claim 1, wherein said outer enclosure is expandable from a first generally flattened configuration to a second generally inflated configuration.

28. A microwave food container comprising:

a) a generally microwave transmissible outer enclosure defining a cavity and having a susceptor associated therewith; and

b) an inner enclosure enclosing a food product in an inner cavity, said inner enclosure being attached within said cavity, wherein at least some of said food product will be released out of said inner enclosure within said cavity to be heated by heat emitted from said susceptor, when said container is subjected to microwave radiation.

29. A container as claimed in claim 28, wherein said food product is a plurality of corn kernels, and at least some of said plurality of corn kernels will pop within said inner enclosure, assisting in the release of additional corn kernels from said inner enclosure.

30. A container as claimed in claim 29, wherein said inner enclosure also holds a charge.

31. A container as claimed in claim 28, wherein said inner enclosure is formed as a pouch attached to said outer enclosure within said cavity at a position spaced from said susceptor.

32. A container as claimed in claim 28, wherein said inner enclosure is positioned within said cavity at a position generally opposite to said susceptor within said cavity.

33. A container as claimed in claim 28, wherein said inner enclosure is positioned generally above said susceptor.

34. A container as claimed in claim 28, wherein said inner enclosure is a pouch made from a material having some degree of flexibility.

35. A container as claimed in claim 28, wherein said pouch has a releasable seal which releases said popcorn kernels from said inner pouch when said container is subjected to microwave radiation, such that at least some of said kernels create popcorn.

36. A container as claimed in claim 35, wherein said pouch also contains a charge.

37. A container as claimed in 36, wherein said charge is a non-hydrogenated oil.

38. A container as claimed in claim 36 wherein said charge is a liquid oil.

39. A container as claimed in claim 28, wherein said outer enclosure is expandable to accommodate an increase in volume of said food product, when said food product is subjected to microwave radiation.

40. A container as claimed in claim 28, wherein said outer enclosure is expandable from a first generally flattened configuration to a second generally erect configuration.

41. A container as claimed 28, wherein said outer enclosure is formed in part from one or more suitable paper materials, and said container is a formed as an expandable bag.

42. A container as claimed in claim 33, wherein said inner enclosure is affixed to an inner surface of said outer enclosure in said cavity.

43. A container as claimed in claim 34, wherein said pouch is affixed generally above said susceptor.

44. A container as claimed in claim 34, wherein said pouch has a sealed opening that is sealed with a heat-activated adhesive or sealant.

45. A container according to claim 24, wherein said inner pouch further contains a charge and said inner pouch encloses an inner cavity for holding said popcorn kernels and said charge during storage of said bag, and said inner pouch is made from a web made from a material that provides an oil or grease resistant barrier for preventing a significant amount of said charge located inside said inner pouch from seeping out of said inner cavity of said inner pouch during storage of said bag.

46. A container as claimed in claim 45, wherein said charge is a liquid or semi-liquid oil.

47. A container as claimed in claim 45, wherein said charge is a non-hydrogenated oil.

48. A container as claimed in claim 45, wherein inner pouch is comprised of at least two layers of material attached to each other, said at least two layers of material also providing during storage of said bag, a moisture barrier for preventing loss of a significant amount of moisture out of said inner cavity of said inner pouch.

49. A container as claimed in claim 45, wherein said at least two layers of material also provides during storage of said bag a gas barrier for preventing the intrusion of a significant amount of oxygen into said cavity of said inner pouch.

50. The container of claim 49, wherein said moisture and gas barrier is formed at least in part from a layer of polyvinylidene chloride attached to a polyester film layer.

51. The container of claim 50, wherein said polyester is a suitable PET.

52. The container of claim 49, wherein said moisture and gas barrier is formed from a 3 layer co-extrusion of a 2 mil film of XUR 970052-4 and said oil resistant barrier is formed from an (EAA) ethylene acrylic acid copolymer co-extruded on a core nylon gas barrier layer.

53. The container of claim 49, wherein said moisture and gas barrier is formed from a 3 layer tandem extrusion of SARANEX 21, said oil resistant barrier is formed from (EVA) ethylene vinyl acetate copolymer, and said moisture and gas barrier is formed from a core layer coating of (PVDC) polyvinylidene chloride, said PVDC coating being applied to a LDPE top layer.

54. The popcorn bag of claim 49, wherein said moisture and gas barrier is formed from a 3 layer tandem extrusion of SARANEX 14, said oil resistant barrier is formed from (LDPE) low density polyethylene, and said moisture and gas barrier is formed from a core layer coating of (PVDC) polyvinylidene chloride, said PVDC coating being applied to a LDPE top layer.

55. The container of claim 53 further comprising an EMBLET 1215 film layer attached to the LDPE outer layer.

56. The container of claim 54 further comprising an EMBLET 1215 film layer attached to the LDPE outer layer.

57. The container of claim 49, wherein said inner enclosure is formed as a pouch and comprises:

a) a top panel; and

b) a bottom panel, said bottom panel comprising an opening adapted to open when said bag is subjected to microwave radiation, to allow the said

plurality of unpopped kernels, popped kernels and charge to fall into the outer cavity of said outer enclosure of said popcorn bag, said opening having been sealed using a heat activated sealant such that said opening in said top panel is closed prior to exposure of said bag to microwave radiation.

58. The container of claim 57, wherein said heat activated sealant is a hot melt adhesive.

59. The container of claim 57, wherein said heat activated sealant is an EAA copolymer.

60. The container of claim 49, wherein the gas, moisture and oil barrier properties of said inner enclosure are selected to eliminate the need for a film outer wrap but provide at least a one year shelf life for the corn kernels and charge stored within said inner enclosure.

61. A container according to claim 28, wherein said outer enclosure is a box having a lower panel having said susceptor associated therewith, and a top panel positioned opposite said lower panel.

62. A container as claimed in claim 61, wherein said top panel has a removable lid, and said inner enclosure is mounted to an under side of said removable lid.

63. A container as claimed in claim 61, wherein said box is a self-erecting box.

64. A container according to claim 28, wherein said outer enclosure is a self erecting container having a lower panel having said susceptor associated therewith, and a top panel positioned opposite said lower panel.

65. A container as claimed in claim 64, wherein said top panel has a removable lid, and said inner enclosure is mounted to an under side of said removable lid.

66. A microwave food container comprising:

a) a generally microwave transmissible outer enclosure defining a cavity and having a susceptor associated therewith, said outer enclosure not providing a gas barrier preventing oxygen from penetrating into said cavity from said environment; and

b) an inner enclosure enclosing a food product in an inner cavity said inner enclosure made from a material that provides a gas barrier, said inner enclosure being attached within said cavity, wherein at least some of said food product will be released out of said inner enclosure within said cavity to be heated by heat emitted from said susceptor, when said container is subjected to microwave radiation.

67. A microwave food container comprising:

a) a generally microwave transmissible outer enclosure defining a cavity and having a susceptor associated therewith, said outer enclosure not providing an oil or grease barrier preventing oil or grease from seeping from said cavity during storage of said container; and

b) an inner enclosure enclosing a food product in an inner cavity, said inner enclosure made from a material that provides an oil or grease barrier, said inner enclosure being attached within said cavity, wherein at least some of said food product will be released out of said inner enclosure within said cavity to be heated by heat emitted from said susceptor, when said container is subjected to microwave radiation.

68. A web for use as an inner enclosure with an inner cavity, in a microwave popcorn container, said web being made from a material that provides an oil or grease resistant barrier for preventing a significant amount of a charge located inside said inner enclosure from seeping out of said inner cavity of said inner enclosure during storage of said container.

69. The web of claim 68, wherein said inner enclosure is comprised of at least two layers of semi-flexible or flexible material attached to each other, said at least two layers of material also providing during storage of said bag, a moisture barrier for preventing loss of a significant amount of moisture out of said inner cavity of said inner pouch.

70. The web of claim 69, wherein said at least two layers of material also provides during storage of said container, a gas barrier for preventing the intrusion of a significant amount of oxygen into said cavity of said inner enclosure.

71. A method of forming a container for microwave popcorn kernels comprising:

a) forming an inner enclosure with microwave popcorn kernels held inside, said inner enclosure having a releasable seal for releasing said kernels during heating of said container;

b) placing said inner enclosure in a partly formed outer enclosure; and

c) sealing said outer enclosure to enclose said inner enclosure therein.

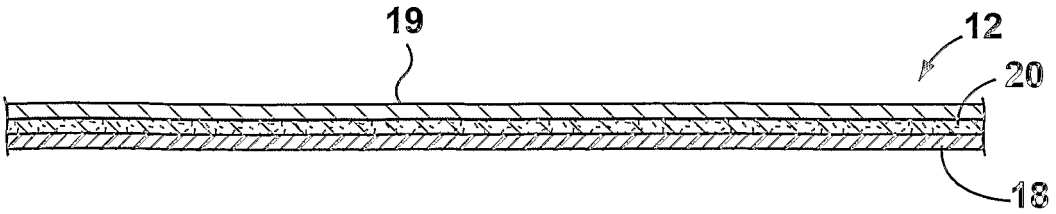

FIG. 1

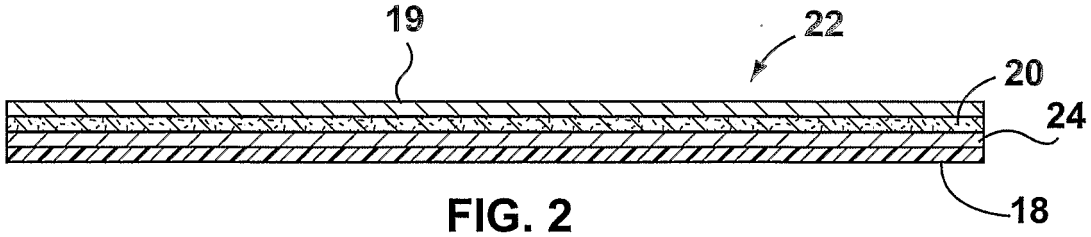

FIG. 2

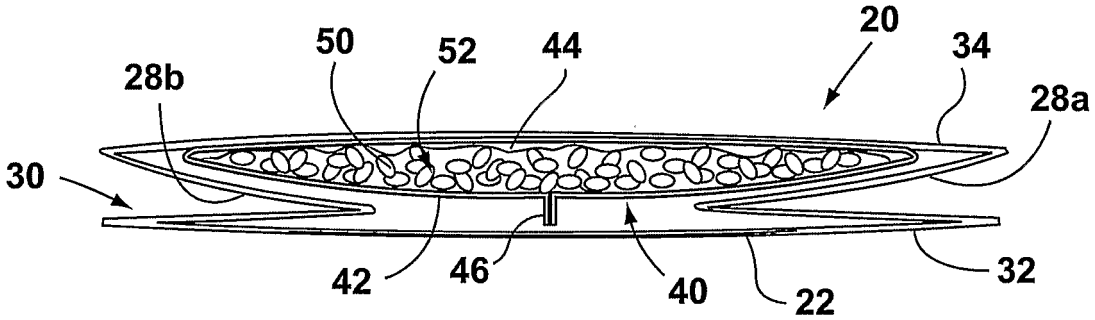

FIG. 3a

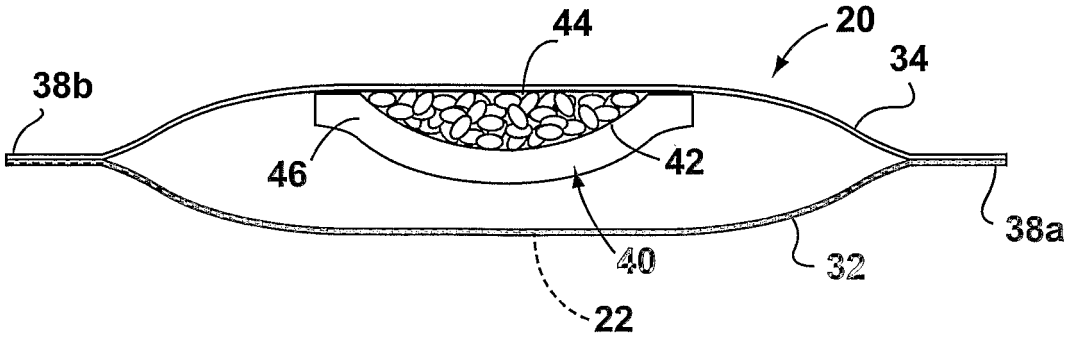

FIG. 3b

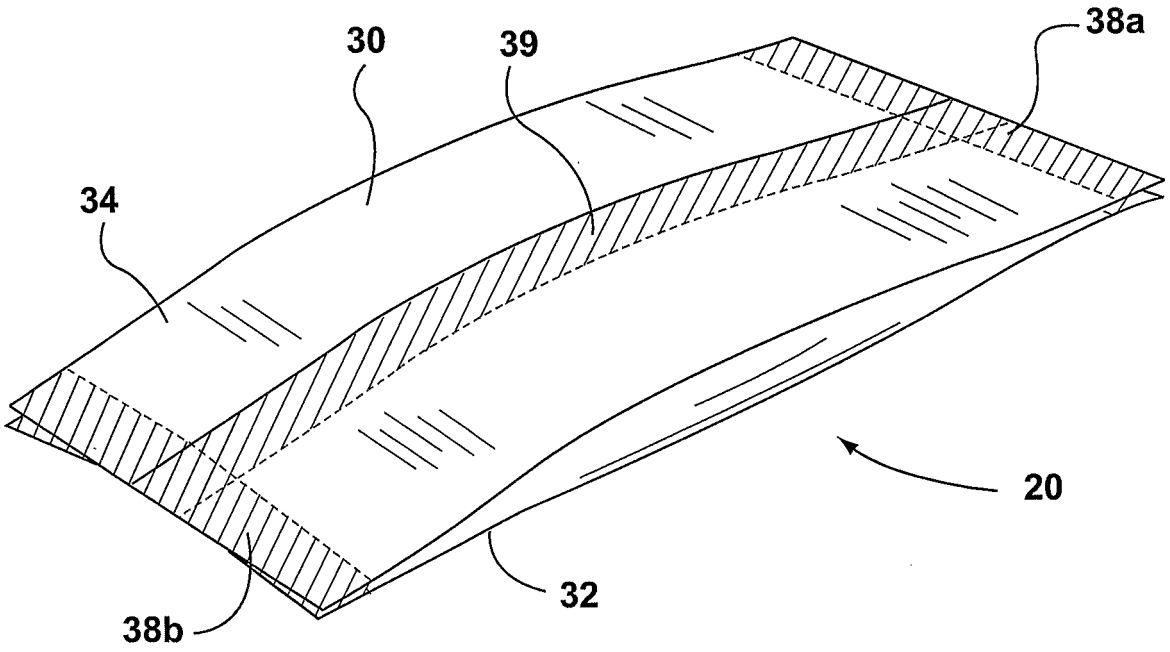

FIG. 3c

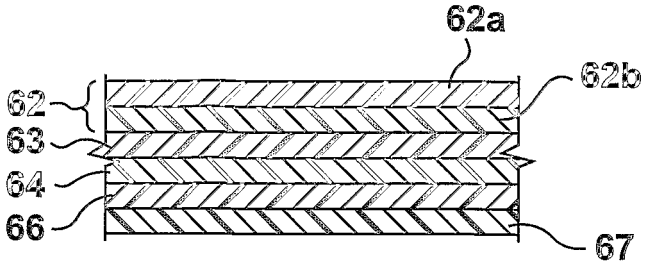

FIG. 4a

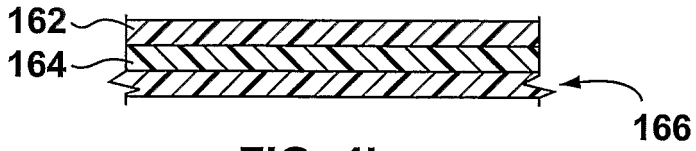

FIG. 4b

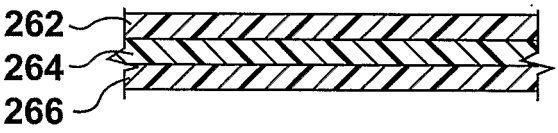

FIG. 4c

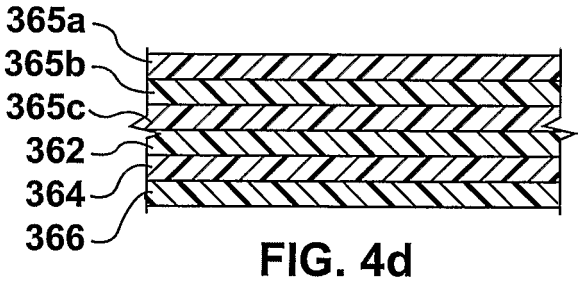

FIG. 4d

FIG. 4e

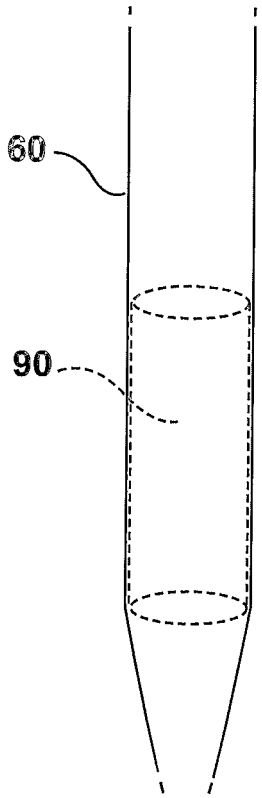

FIG. 5a

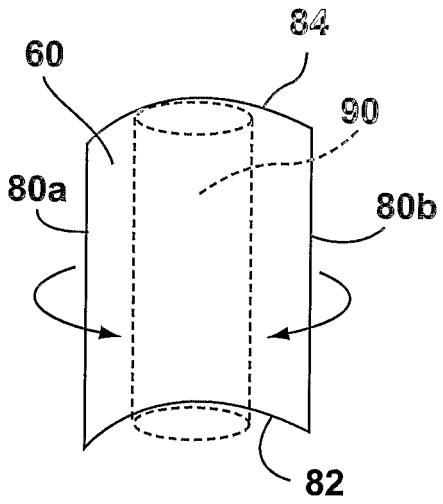

FIG. 5b

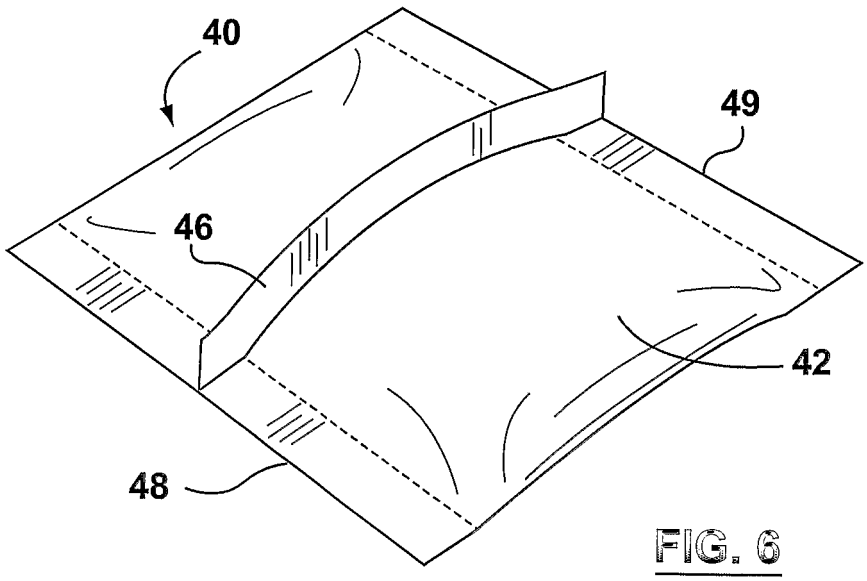

FIG. 6

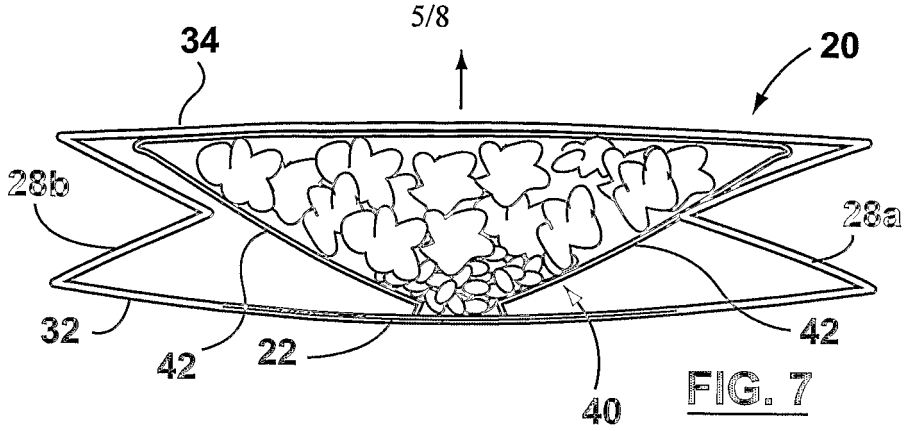

FIG. 7

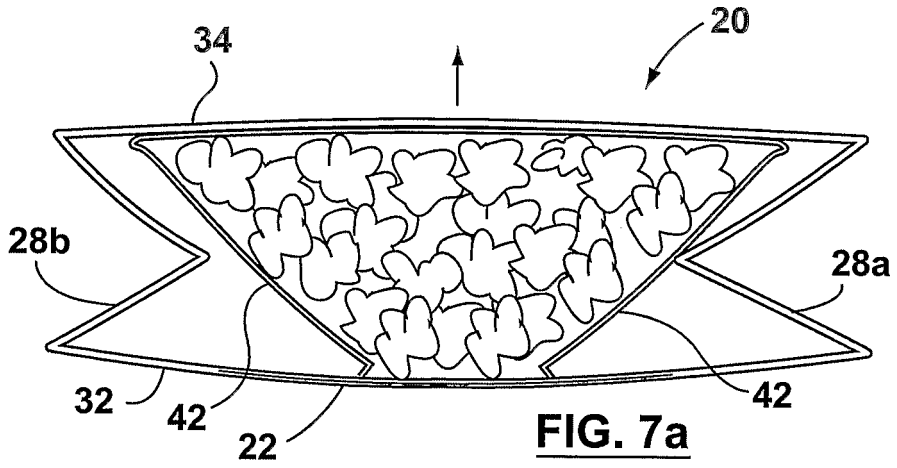

FIG. 7a

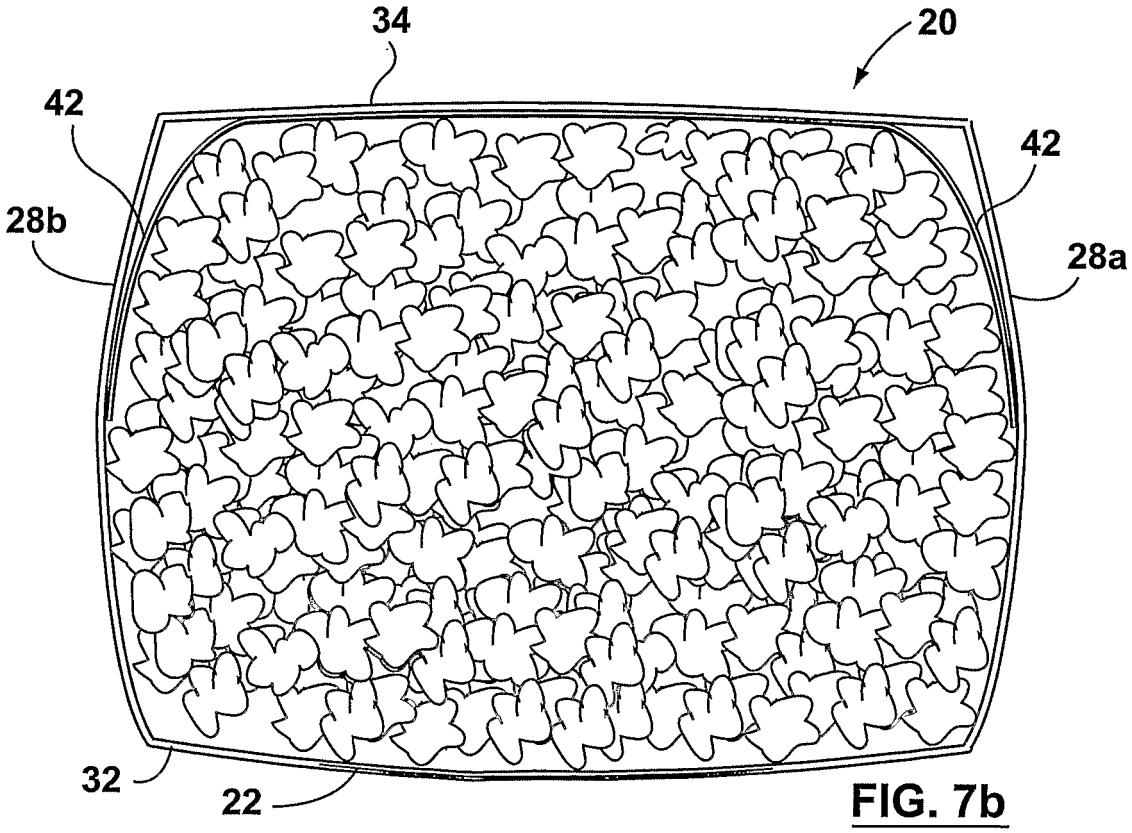

FIG. 7b

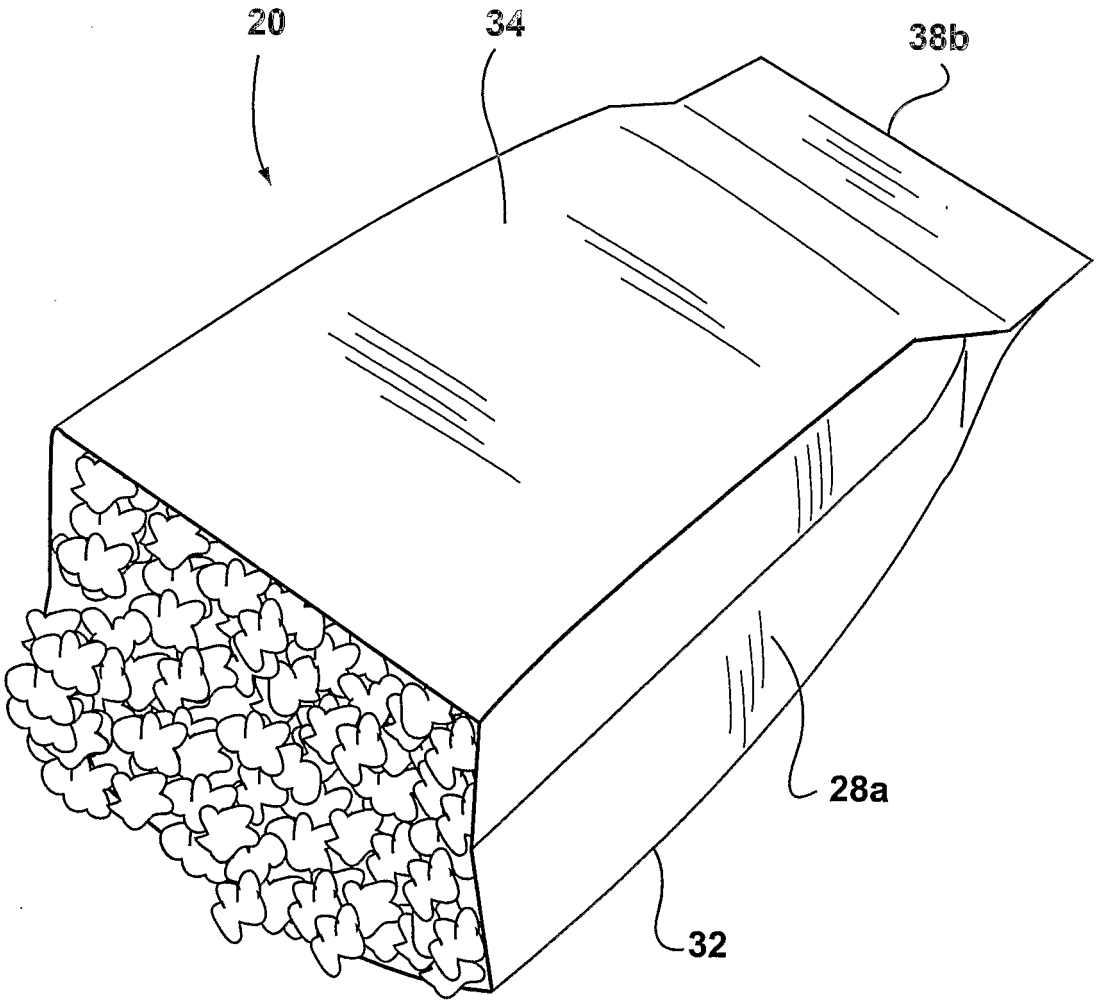

FIG. 7c

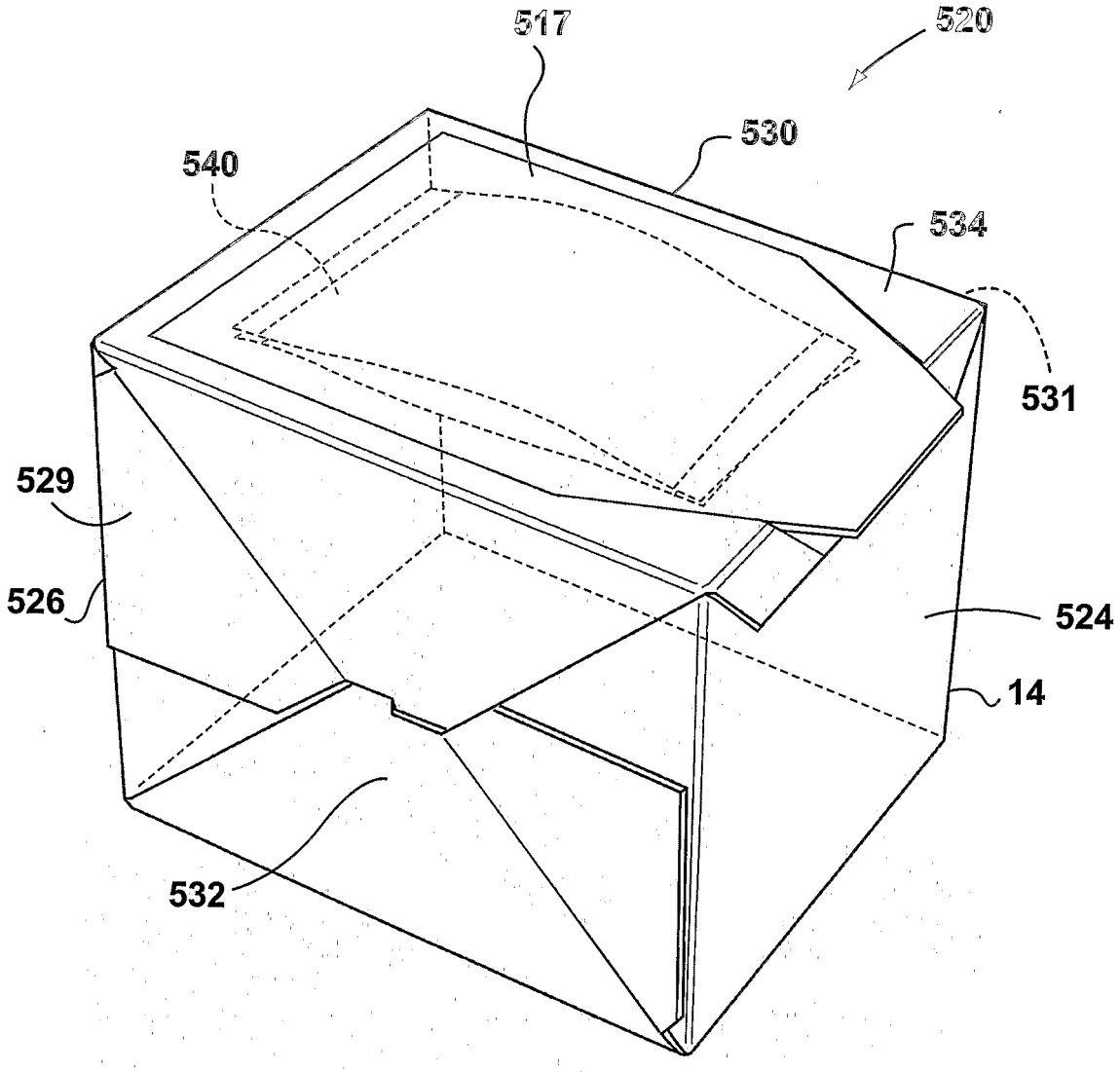

FIG. 8

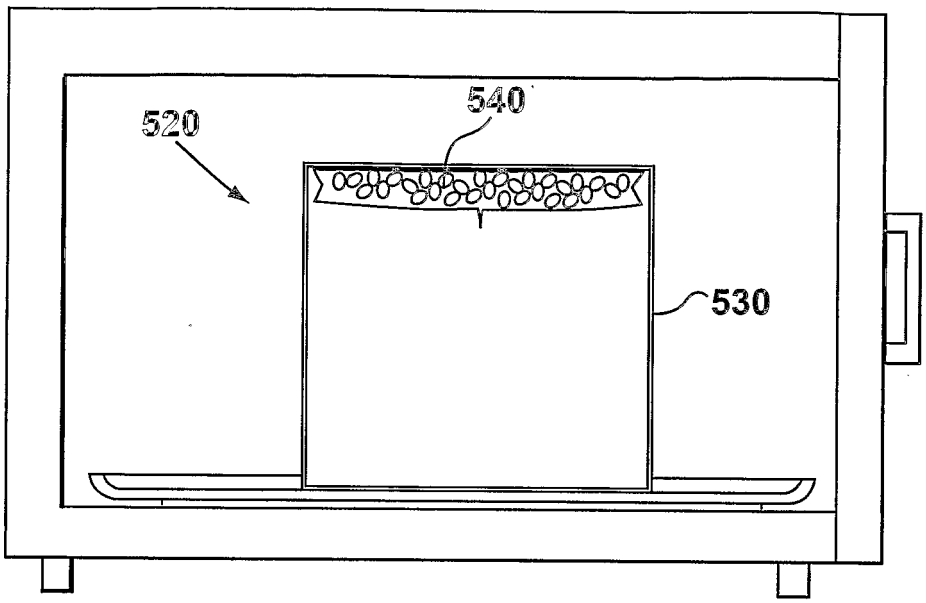

FIG. 9

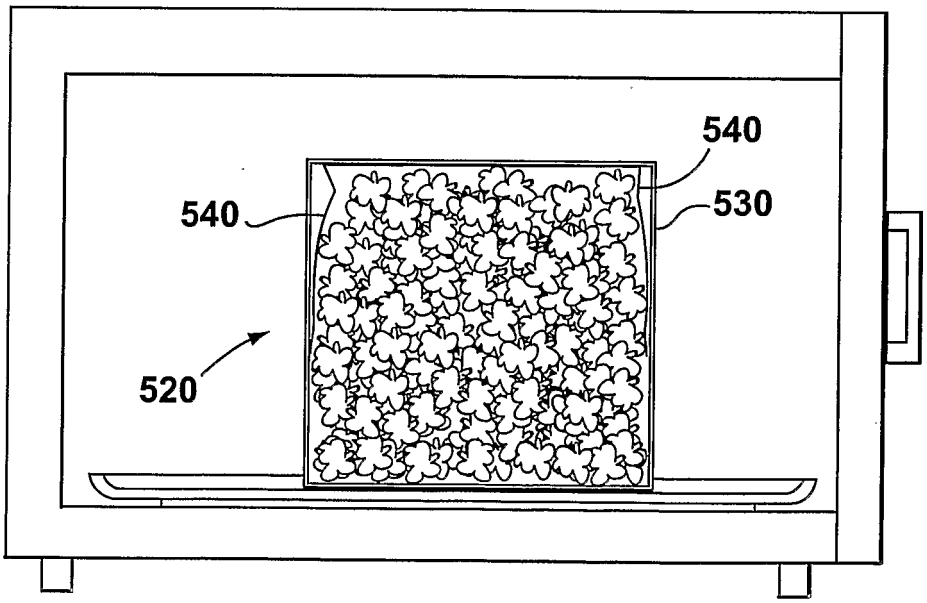

FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA2004/000485

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D81/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/61456 A (HUNT WESSON INC ; SIMON FREDERICK (US)) 19 October 2000 (2000-10-19)	1,8,9, 11,20, 23,24, 27-30, 32-36, 38-46, 48, 57-60, 67-69,71
Y	the whole document	10, 12-14, 21,25, 26,37, 47, 49-51, 61-66,70

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 August 2004	23/08/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Pernice, C

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA2004/000485

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,Y	US 2003/106899 A1 (LANGEN H J PAUL) 12 June 2003 (2003-06-12)	21,61-65
A,P	the whole document	22
Y	US 3 973 045 A (ANDREAS DAVID W ET AL) 3 August 1976 (1976-08-03)	10,37,47
A	the whole document	1-9
Y	US 4 734 288 A (FINCHAM DOUGLAS M ET AL) 29 March 1988 (1988-03-29)	12-14, 49-51, 66,70
A	the whole document	15-19, 52-56
Y	US 5 171 950 A (BRAUNER ARNE H ET AL) 15 December 1992 (1992-12-15)	25,26
A	the whole document	2-7
A	EP 1 190 960 A (MONTSERRATE GIBERNAU ANTONIO) 27 March 2002 (2002-03-27) the whole document	1-65

3

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-65

An expandable microwave popcorn bag comprising an outer enclosure having a top and bottom panel, an inner pouch containing unpooped corn kernels and located within said outer enclosure and a susceptor associated with said outer enclosure.

---

2. claim: 66

A microwave food container comprising an outer enclosure having a susceptor associated therewith and not providing a gas barrier preventing oxygen from penetrating in said enclosure, and an inner enclosure enclosing a food product, said inner enclosure being made from a material that provides a gas barrier.

---

3. claim: 67

A microwave food container comprising an outer enclosure having a susceptor associated therewith and not providing an oil or grease barrier, and an inner enclosure enclosing a food product, said inner enclosure being made from a material that provides oil or grease barrier.

---

4. claims: 68-70

A web for use as an inner enclosure in a microwave popcorn container, said web made from a material that provides oil or grease resistant barrier.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2004/000485

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/CA2004/000485

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0061456 A	19-10-2000	WO 0061456 A2	19-10-2000
		AU 3638799 A	14-11-2000
		BR 9917255 A	08-01-2002
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		EP 1190960 A2	27-03-2002
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