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(54) Vacuum or modified atmosphere package for foods which tend to release liquids

(57) There is described a vacuum or modified atmosphere package for food products which are susceptible of releasing liquids, comprising 1) a tray (1) made of plastic material having a bottom (3) and side walls (5) ending in an edge (6) and comprising at least two layers, of which an upper layer (7) consists of a foil of expanded thermoplastic material with substantially open cells, having holes or slots (10) on at least part of the its upper surface and incorporating at least one surfactant, and a lower layer (9) consists of a gas-barrier composite film made of plastic material, and wherein the portion of said layers which is situated in correspondence of said edge is folded up so that said upper layer (7) is arranged below said lower layer (9), 2) a food product (4) susceptible of releasing liquids laying down onto the bottom of said tray, 3) a cover (2) for said tray consisting of a gas-barrier composite film made of plastic material which adheres onto said lower layer in correspondence of said edge in such a way as to guarantee the vacuum inside the package or the preservation of a modified atmosphere.

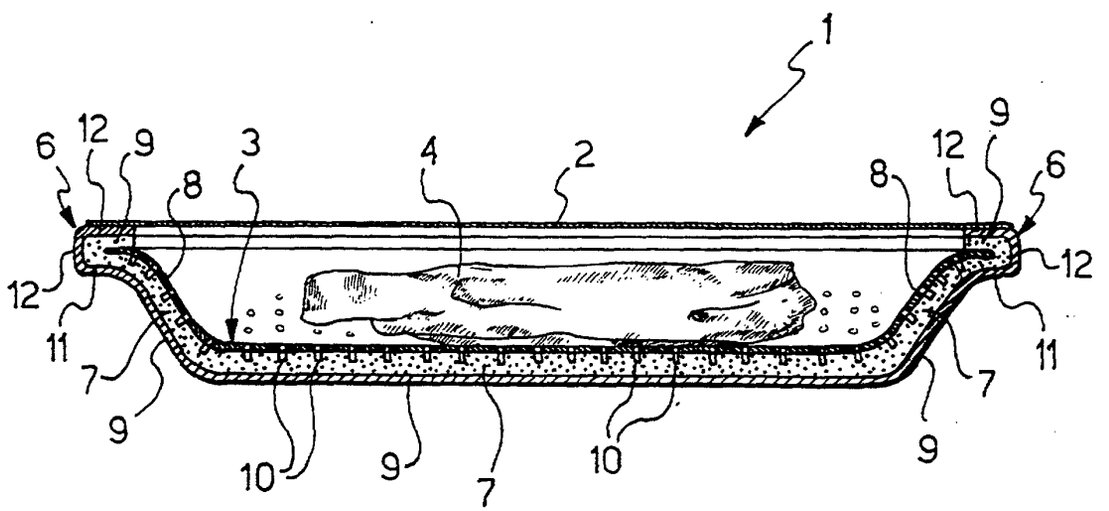

FIG. 2

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Description

Field of application

[0001] In its broader aspect, the present invention relates to the field of modified atmosphere packaging or vacuum packaging of food products by means of packages made of plastic material.

[0002] In particular, the invention relates to a package for food products comprising a tray made of thermoplastic material, having barrier properties with respect to gases and having absorbing power with respect to any liquid released by the food products, and a hermetically sealed cover for said tray.

[0003] Moreover, the present invention relates to a tray to be used in the aforesaid package and a process for the preparation of such tray.

Prior Art.

[0004] The use of containers made of plastic material for packaging food products is quite widespread, above all for the retail sale in supermarkets. In case of easily perishable food products, such as meat and fish, the problem arises of extending as much as possible the period for which the food products maintains substantially unaltered its organoleptic, nutritional and hygienic characteristics and maintains an aspect as identical as possible to that of the fresh product.

[0005] In order to solve such problem, various solutions have been proposed, among which those of vacuum packaging and modified atmosphere packaging are the most used.

[0006] Examples of application of such techniques of vacuum packaging or modified atmosphere packaging shall be found, for example, in the patents US 3 574 642, US 5 115 624 and in the international application WO 97/36504.

[0007] There essentially exist three packaging techniques, of which the first foresees the use of a tray of expanded plastic material on the bottom of which the food product is laid, whereby afterwards the tray is closed with a gas-permeable film and inserted inside a bag which is impermeable to gases. The air contained inside the bag is then replaced either by washing with a mixture of inert gases (generally nitrogen and carbon dioxide) or by applying vacuum and then introducing the aforesaid mixture of inert gases.

[0008] The second technique foresees instead the use of a tray of expanded plastic material wrapped externally by a gas-impermeable film. The food product is placed onto the bottom of the tray and this is closed by means of a plastic material film which is impermeable to gases. In this case as well, before achieving a complete sealing of the tray, a modified atmosphere is set inside it in the above mentioned way. In this respect, reference shall be made to US Patent 5 744 181.

[0009] The third technique foresees the use of a tray made of expanded plastic material which is rendered gas-impermeable through the coupling of a film provided with gas-barrier properties onto the inner face of the tray. Before sealing it with a cover of gas-barrier film, the replacement of the air of the package with a suitable gas mixture is carried out.

[0010] A drawback of the tray obtained by means of the aforesaid third technique is the impossibility of absorbing the liquids released by the food products, apart from using an absorbing pad between the food product and the bottom of the tray, which, however negatively influences the production costs and complicates the operations of disposal and recycle of the packages after use.

[0011] A problem which has been encountered with the first two above mentioned techniques is the impossibility of removing completely the oxygen from the inner atmosphere of the tray, as the closed-cell structure of the trays in expanded plastic material holds air, notwithstanding the application of vacuum, in order to release it gradually in the space above the food product.

[0012] For this reason, it has been proposed to add into the packages provided with an outer bag, chemical substances adapted to neutralise the residual oxygen ("oxygen scavengers"), such as iron and its derivatives in presence of acids (US 5 698 250).

[0013] It is clear, however, that such a solution implies relevant additional costs and eventual risk of contamination of the food products.

[0014] An improved technical solution with respect to US 5 698 250, recently proposed in the Patent Application WO 00/26113 foresees the use of a tray in open-cell plastic material, instead of the conventional trays in closed-cell plastic material, inside the packaging system with the above described outer bag. In this way, the need of adding the "oxygen scavengers" inside the packages is eliminated.

[0015] Again, in the aforesaid patent application, reference is made to the possibility of absorbing any liquid released by the food product by means of an absorbing pad arranged between the food product and the bottom of the tub.

[0016] Patent Application WO 00/46125 describes a tray having absorbing properties which is suitable for vacuum packaging or modified atmosphere packaging of food products which may release liquids. Such a tray consists of a structure made of open cell plastic material enclosed between two films of which at least one is impermeable to the gases respectively applied onto its inner and outer surface. The film applied onto the inner surface is interrupted by perforations in order to allow the liquid to penetrate into a predetermined portion of the underlying open-cell structure. According to an embodiment of the above mentioned tray, said portion is sealed by welding the two films in predetermined points in order to prevent the liquid provided inside it from migrating into the remaining open-cell structure of the tray.

[0017] As an alternative, the films may be welded or

glued in correspondence of the cutting surfaces provided at the ends of the edge in order to prevent the liquid from migrating outside of the tray.

[0018] However in the above indicated solutions, a gas migration occurs along the open-cell plastic material thus reaching an equilibrium with the atmosphere outside of the tray in correspondence of the cutting surfaces. This phenomenon achieves the undesired effect of altering the modified atmosphere originally set inside the tray.

[0019] Further on, the realisation of an open-cell plastic material structure with two barrier films implies not negligible additional costs.

[0020] The technical problem at the basis of the present invention is that of providing a package for modified atmosphere packaging or vacuum packaging of food products susceptible of releasing liquids which would be of easier and more economical manufacture and which would allow to maintain substantially unaltered the gas atmosphere set inside it or the vacuum before use.

Summary of the invention

[0021] Such a problem has been solved, according to the present invention, by a vacuum or modified atmosphere package for food products which are susceptible of releasing liquids, comprising:

- a tray made of plastic material having a bottom and side walls ending in an edge and comprising at least two layers, of which a upper layer consists of a foil of expanded thermoplastic material having substantially open cells, having holes or slots on at least part of its upper surface and incorporating at least one surfactant, and a lower layer consists of a gas-barrier composite film made of plastic material, and in which the portion of said layers which is situated in correspondence of said edge, is folded up so that said upper layer is arranged below said lower gas-barrier layer,

- a food product susceptible of releasing liquids laying down onto the bottom of said tray, and

- a cover for said tray consisting of a gas-barrier composite film made of plastic material which adheres onto said lower layer in correspondence of said edge, in such a way to allow the vacuum or a modified atmosphere to be maintained inside the package.

[0022] Preferably said tray consists of the aforesaid upper and lower layers and of a further layer arranged, at least in correspondence of the bottom, above the aforesaid upper layer and consisting of a non-expanded film or foil of plastic material, provided with through holes or slots on at least part of its upper surface.

[0023] Advantageously, such film or foil is rendered opaque, to allow the concealment of the absorbed liquid. For example, the opacification may be realised through incorporation of titanium dioxide into the plastic material.

[0024] The gas-barrier composite film defining the cover is preferably adhered to the folded-up edge of the tray by means of heat sealing.

[0025] Such film may be identical to the gas-barrier composite film which defines the lower layer of the tray and which is arranged above the upper layer of the tray in correspondence of the edge as a consequence of the folding.

[0026] Preferably, the gas-barrier composite film defining the lower layer and the cover of the tray is a multilayered film comprising at least one gas-barrier layer in plastic material and at least one layer made of a thermoplastic material. Obviously, further layers may be foreseen in order to provide the structure of the aforesaid film with the desired mechanical and thickness characteristics.

[0027] The material forming the gas-barrier layer may be chosen from the group comprising polymers and copolymers of ethylene vinyl alcohol (EVAL, EVOH), nylon, polyvinylidene chloride (PVDC), poly- or copolyamides and combination thereof. Preferably, the aforesaid material is a polymer or copolymer of ethylene vinyl alcohol or nylon.

[0028] Examples of multilayered barrier film of the above indicated type, suitable to the purposes of the present invention are those described in the US Patent 4,735,855.

[0029] Examples of particularly preferred multilayered gas-barrier films are the multilayered films produced and sold by the Firm B-PACK having a thickness of 50-60 micron and comprising a gas-barrier layer consisting of EVOH and two layers consisting of polyethylene (PE) and polystyrene (PS), respectively.

[0030] The plastic material which forms the expanded foil having substantially open cells and the non-expanded film or foil of the tray is preferably chosen from the group comprising polystyrene, polypropylene, polyethylene, polyethylene terephtalate, polyvinyl chloride and their copolymers. Polystyrene is particularly preferred.

[0031] The grams per square meter of the foil of open-cell thermoplastic material are preferably comprised in the range from 150 to 350 g/m^2.

[0032] The surfactant provides the capacity of absorbing aqueous liquids by the foil of open-cells thermoplastic material.

[0033] It can be chosen among the conventional anionic, cationic and nonionic surfactants and is preferably a salt of a sulphonic acid having the formula R-SO_3H or of a sulphonic ester having the formula R-OSO_3H, wherein R is chosen from the group comprising alkyl and alkylaryl, with an alkaline metal or an alkaline-earth metal.

[0034] A surfactant which is particularly useful for the purposes of the present invention is the aliphatic sulpho-

nate sold by the firm NOVACROME with the name HOSTASTAT SYSTEM E 3904®.

[0035] In case the food product to be packed should be susceptible of releasing even smelly volatile substances (for example fish, food products containing eggs, etc..) the layer of expanded open-cells plastic material advantageously contains a finely-divided solid material able to absorb the aforesaid smelly substances.

[0036] A material like this is preferably chosen from the group comprising aluminium oxide, bentonite, kaolin, activated carbon, zeolites, synthetic polymers having a high melting point such as polyphenyloxide and polyimmides, graphite, mica, diatomaceous earth, pumice and clay.

[0037] The packaging according to the present invention allows preserving perishable food products, such as meat and fish, for several days without any remarkable deterioration in their organoleptic and microbiological properties, concealing the exudate and absorbing possible smelly volatile substances into the layer of open-cells expanded plastic material.

[0038] Further on, the packaging according to the present invention has the advantage of maintaining constant the atmosphere originally set inside it without any gas transportation taking place towards the outside or the inside of the package through the upper layer of open-cells thermoplastic material and the cutting surfaces of the tray provided in correspondence of the ends of the edge.

[0039] In fact, it shall be noted that in the package according to the invention, the aforesaid cutting surfaces are turned towards the inside of the tray through the edge folding and are arranged below the gas-barrier composite film which forms the cover, preventing in such a way any exchange of gas with the outside.

[0040] Further on, in the package according to the invention, the air inside the tray may be completely removed by virtue of the open-cells structure of the layer of expanded plastic material and eventually replaced with the gaseous atmosphere of desired composition chosen as a function of the food product to be packaged.

[0041] All that is obtained at remarkably lower material and equipment cost than those implied by the use of the technology which employs the external gas-impermeable bag (WO 00/26113).

[0042] Further on, the absorption of the liquids released by the food products is not provided by the interposition of an absorbing pad between the food product and the bottom of the tray, but rather by exploiting the absorbing properties of the layer of expanded open-cells plastic material containing a surfactant.

[0043] The use of a material different from the plastic material of which the tray consists is thus avoided, i.e. a cellulosic material such as paper or paperboard, thus facilitating the disposal or recycle operations of the packages after their use.

[0044] Further on, an effective absorption of the liquids is achieved, even in conditions of inclined position of the tray, by perforating the entire upper surface of the foil of open-cells expanded thermoplastic material.

[0045] According to an embodiment of the present invention, the tray of the aforesaid package comprises two layers and is obtained through a process according to any one of the claims 15 to 18.

[0046] According to a preferred embodiment of the present invention, the tray of the aforesaid package comprises three layers and is obtained through a process according to any one of the claims 19 to 24.

[0047] The way of obtaining the foils or leaves of open-cell expanded thermoplastic material is well known in technical literature; see for example Klempner and Frisch "Handbook of Polymeric Foams and Foam Technology", Carl Hanser Verlag, 1991. Specific processes are for example described in EP-A-0 090 507, US-A-3 610 509, EP-A-0 642 907 and EP 0 849 309.

[0048] The coupling of the foil of open-cells thermoplastic material with the gas-barrier composite film and with the non-expanded foil may be realised by means of hot rolling, use of adhesives or any other method conventionally used for this purpose.

[0049] The coupling by means of hot rolling is particularly preferred. For instance, the foil of open-cells thermoplastic material, obtained through the conventional techniques of annular or flat-head extrusion with injection of expanding gases, may be initially hot-rolled with a non-expanded film or foil obtained through coextrusion or subsequently extruded through the techniques known as "extrusion coating", obtaining a first composite leaf.

[0050] Such first composite leaf is perforated and rolled, in-line or out-of-line, with a gas-barrier composite film. This latter rolling operation is preferably carried out at a temperature comprised in the range 185-210 °C whereas the rolling of the foil of open-cells thermoplastic material with a non-expanded film or foil is preferably carried out at a temperature of 160-180°C.

[0051] The holes or slots in the non-expanded film and in the foil of open-cells thermoplastic material may be made in a conventional way, for example by means of punching machines. Such perforations allow the passage of the liquid released by the food product contained in the tray into the foil of open-cells thermoplastic material.

[0052] The forming of the semifinished tray and the folding of the respective edge are carried out in a conventional way, preferably by thermoforming in a dedicated mould at a temperature comprised in the range 160-220°C. In particular, said thermoforming operations may be carried out in sequence in a single mould or in different moulds using suitable conventional methods, such as vacuum suction, compressed air injection, mechanical methods, etc.

[0053] The package according to the present invention is obtained by means of procedures already known in the art, for example from the US Patent 5,744,181.

[0054] According to such procedures, the food prod-

uct to be packed is placed onto the bottom of the above described tray and the tray is sealed under vacuum or under modified atmosphere by adhering a gas-barrier composite film onto the lower layer of the tray in correspondence of the folded edge.

[0055] Preferably, the aforesaid gas-barrier film is adhered onto the lower layer of the tray in correspondence of the folded edge through thermoforming.

[0056] The package according to the invention may be under vacuum or under modified atmosphere. In the latter case, the modified atmosphere is obtained through application of vacuum and subsequent injection of inert gases, such as nitrogen and carbon dioxide, or of mixture containing oxygen according to the kind of food product to be packed and preserved.

[0057] The features and advantages of the present invention will be more evident from the description hereinbelow of a preferred embodiment of the package for food products and of an example of packaging of food products which are susceptible of releasing liquids, said description being given as a non-limiting indication with reference to the attached drawings.

Brief description of the drawings.

[0058] In the drawings:

- figure 1 shows a perspective view of a package according to the invention,
- figure 2 shows a sectioned view of the package of figure 1.

Detailed description

[0059] With reference to the figures, a package according to the invention comprises a tray 1 and a cover 2.

[0060] The tray 1 has a bottom 3 onto which a food product 4 is placed before its packaging and side walls 5 which end up in a folded edge 6.

[0061] The structure of the tray 1 consists of a foil 7 made of expanded polystyrene having substantially open cells, whose upper surface is coated by a non-expanded polystyrene film 8 and whose lower surface is coated by a multilayered film 9 comprising a gas-barrier layer made of EVOH or nylon.

[0062] The film 8 has a plurality of holes 10 of predetermined diameter that extend into the thickness of the underlying expanded polystyrene foil 7 by a predetermined amount so as to allow the liquid released by the food product 4, in this specific instance meat, to penetrate into the substantially open cells of the foil 7 passing through such holes 10.

[0063] In particular, the open cell structure of the foil 7 has a close network of capillary void channels which put the single cells in communication and allow them to receive and keep the liquid penetrated through the aforesaid holes 10.

[0064] In this way, the liquid is kept like by a sponge, and, because of the strong capillary interactions between the void channels and the liquid, it cannot return onto the upper surface of the bottom 3 of the tray 1 by passing through the holes 10, even if this is inclined or even turned upside down.

[0065] The penetration of the liquid is also enhanced by the presence of a surfactant in the foil 7; the surfactant, in fact, remarkably reduces the natural water repellency of the plastic material, increasing the adhesion forces between the solid (plastic material) and the liquid until these overcome the cohesion forces between the molecules of the liquid, thus allowing the liquid to penetrate into the structure provided with substantially open cells of the foil 7 through the holes 10.

[0066] The folded edge 6 has a substantially U-shaped cross-section and comprises a first portion 11 protruding from the side walls 5 linked to a second folded portion 12.

[0067] As a result of the folding, in correspondence of the second folded portion 12, the multilayered barrier film 9 is arranged above the corresponding portion of the foil of expanded polystyrene 7.

[0068] The cover 2 consists of a multilayered barrier film and is applied onto the tray 1 through heat welding in correspondence of the second portion 12 of the folded edge 6. Such a cover 2 is applied at the end of the packaging procedure, after having created the vacuum or modified the atmosphere inside the tray 1 in which the food product 4 has been placed.

[0069] Beside the advantages mentioned above, the package according to the invention has the advantage that the liquid released by the food products may be absorbed onto the entire inner surface of the tray because of its structural features which foresee an intermediate absorbing layer consisting of a foil of thermoplastic material with substantially open cells. Further on, any smelly volatile substances released by the food product (for example fish) may be absorbed by the active substances included into the porous open-cells foil.

[0070] A further advantage of the package according to the present invention is the high effectiveness of the heat welding of the cover with the folded edge of the tray because, as a result of such folding, the materials which are welded together may be identical to each other or extremely compatible.

Example

[0071] With a procedure analogous to that described in the Patent Application EP 0 849 309, a foil made of expanded polystyrene with substantially open cells (a percentage higher than 80 %), having a weight (grams per square meter) of 300 g/m^2, a thickness of 4,5 mm and a density of 60 g/l, was prepared by extrusion of a suitable mixture.

[0072] The foil so produced was immediately sent to

a hot rolling station in which a OPS-type opacified non-expanded polystyrene film, having a thickness of 25 micron, was applied in correspondence of a surface of such foil by rolling at a temperature of 160°C. The composite leaf thus obtained was perforated in correspondence of the free surface of the non-expanded polystyrene film by means of a plurality of metal nails.

[0073] Thereafter, a multilayered barrier film of the PE//EVOH//PS type, produced by B-pack and having a thickness of 60 micron was applied in correspondence of the free surface of the aforesaid foil, thus obtaining a perforated composite leaf. This last rolling was carried out at a temperature of 170°C and a conveying speed of 15 m/min.

[0074] Finally, the perforated composite leaf was sent into a thermoforming machine wherein it was taken to an average temperature of 200 °C and then thermoformed in a suitable mould obtaining a tray according to the present invention.

[0075] Thereafter, the tray was sent to a packaging machine comprising a chamber equipped with a suitable mould and with apertures for the air intake and/or the inlet of a gaseous mixture.

[0076] After having put the food product to be packed into the aforesaid tray, the tray placed inside the aforesaid chamber together with a cover hold above it. The cover consisted of a multilayered barrier film of the PE/EVOH/PE type and had a thickness of 50 micron.

[0077] The chamber was then closed, the air contained therein was evacuated by applying a reduced pressure of 1-4 millibar and afterwards a gaseous mixture consisting of 70 % oxygen and 30 % carbon dioxide was introduced into the chamber.

[0078] As soon as the introduction of the aforesaid gas into the chamber had been completed, the aforesaid cover was heat welded onto the folded edge of the tray obtaining a package according to the invention.

Claims

1. Vacuum or modified atmosphere package for food products which are susceptible of releasing liquids, comprising:

- a tray made of plastic material having a bottom and side walls ending in an edge and comprising at least two layers, of which an upper layer consists of a foil of expanded thermoplastic material with substantially open cells, having holes or slots on at least part of the its upper surface and incorporating at least one surfactant, and a lower layer consists of a gas-barrier composite film made of plastic material, and wherein the portion of said layers which is situated in correspondence of said edge is folded up so that said upper layer is arranged below said lower layer,
- a food product susceptible of releasing liquids laying down onto the bottom of said tray,
- a cover for said tray consisting of a gas-barrier composite film made of plastic material which adheres onto said lower layer in correspondence of said edge in such a way as to guarantee the vacuum inside the package or the preservation of a modified atmosphere.

2. Package according to claim 1, further comprising a layer arranged, at least in correspondence of the bottom, above the aforesaid upper layer and consisting of a non-expanded film or foil made of plastic material, having holes or slots on at least part of its upper surface.

3. Package according to claim 2, wherein said non-expanded film or foil is opacified.

4. Package according to claim 1, wherein the plastic material which forms said foil of expanded thermoplastic material with substantially open cells is chosen from the group comprising polystyrene, polypropylene, polyethylene, polyethylene terephtalate, polyvinyl chloride and copolymers thereof.

5. Package according to claim 2 or 3, wherein the plastic material forming said foil of expanded thermoplastic material with substantially open cells and said non-expanded film or foil is chosen from the group comprising polystyrene, polypropylene, polyethylene, polyethylene terephtalate, polyvinyl chloride and copolymers thereof.

6. Package according to claim 5, wherein said plastic material is polystyrene.

7. Package according to any one of the preceding claims, wherein said gas-barrier composite film which defines the lower layer of the tray and the cover consists of a multilayered film comprising at least one gas-barrier layer made of plastic material and at least one layer consisting of a thermoplastic material.

8. Package according to claim 7, wherein the plastic material forming said gas-barrier layer is chosen from the group comprising polymers and copolymers of ethylene vinyl alcohol (EVAL, EVOH), nylon, polyvinylidene chloride (PVDC) poly- o copolyamides and combinations thereof.

9. Package according to claim 8, wherein said plastic material is a polymer or copolymer of ethylene vinyl alcohol or nylon.

10. Package according to any one of the preceding

claims from 7 to 9, wherein said gas-barrier films which define the lower layer of the tray and the cover are made of the same plastic material.

11. Package according to any one of the preceding claims, wherein said upper layer of expanded thermoplastic material with open cells contains a finely divided solid material able to absorb smelly volatile substance eventually released by said food product.

12. Package according to claim 11, wherein said finely divided solid material is chosen from the group comprising aluminium oxide, bentonite, kaolin, activated carbon, zeolites, synthetic polymers having a high melting point such as polyphenyloxide and polyimmides, graphite, mica, diatomaceous earth, pumice and clay.

13. Tray suitable to be used in the package for food products according to any one of the preceding claims, the tray having a bottom and side walls ending in an edge and comprising at least two layers, of which an upper layer consists of a foil of expanded thermoplastic material with substantially open cells, having holes or slots on at least part of the its upper surface and incorporating at least one surfactant, and a lower layer consists of a gas-barrier composite film made of plastic material, and wherein the portion of said layers which is situated in correspondence of said edge is folded up so that said upper layer is arranged below said lower layer.

14. Tray according to claim 13 further comprising a layer arranged, at least in correspondence of the bottom, above the aforesaid upper layer and consisting of a non-expanded film or foil made of plastic material, having holes or slots on at least part of its upper surface.

15. Process for the preparation of a tray according to claim 13, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,
- coupling a gas-barrier composite film onto a surface of said foil of expanded thermoplastic material,
- making a series of holes or slots in said foil of expanded thermoplastic material in correspondence of at least part of its uncoupled surface, said holes or slots extending into at least part of the thickness of said foil of expanded thermoplastic material, obtaining a perforated composite leaf
- forming the perforated composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,
- folding up the edge of the semifinished tray so as to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray.

16. Process for the preparation of a tray according to claim 13, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,
- coupling a gas-barrier composite film onto a surface of said foil of expanded thermoplastic material, thus obtaining a composite leaf,
- forming said composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,
- making a series of holes or slots on the bottom of said semifinished tray in correspondence of at least part of the uncoupled surface of said foil of expanded thermoplastic material, said holes or slots extending into at least part of the thickness of said foil of expanded thermoplastic material,
- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray.

17. Process for the preparation of a tray according to claim 13, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,
- coupling a gas-barrier composite film onto a surface of said foil of expanded thermoplastic material, thus obtaining a composite leaf,
- forming said composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower

layer of said semifinished tray,

- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray,

- making a series of holes or slots on the bottom of said tray in correspondence of at least part of the uncoupled surface of said foil of expanded thermoplastic material, said holes or slots extending into at least part of the thickness of said foil of expanded thermoplastic material.

18. Process according to any one of the claims 15 to 17, wherein said coupling step is carried out through hot rolling of said foil of expanded thermoplastic material with said gas-barrier composite film.

19. Process for the preparation of a tray made of plastic material according to claim 14, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,

- coupling a non-expanded film or foil of plastic material onto a surface of said foil of expanded thermoplastic material, thus obtaining a first composite leaf,

- making a series of holes or slots in said first composite leaf in correspondence of at least part of the uncoupled surface of said non-expanded film or foil, said holes or slots extending into at least part of the thickness of said foil of expanded thermoplastic material, obtaining a first perforated composite leaf

- coupling a gas-barrier composite film made of plastic material onto the first perforated composite leaf in correspondence of the free surface of said foil of expanded thermoplastic material, thus obtaining a second perforated composite leaf,

- forming the second perforated composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,

- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray.

20. Process according to claim 19, wherein said steps of coupling are respectively carried out through a first hot rolling of said foil of expanded thermoplastic material with said non-expanded film or foil and a second hot rolling of the first perforated composite leaf with said gas-barrier composite film.

21. Process for the preparation of a tray made of plastic material according to claim 14, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,

- coupling a non-expanded film or foil of plastic material onto a surface of said foil of expanded thermoplastic material, thus obtaining a first composite leaf,

- coupling a gas-barrier composite film made of plastic material onto the first composite leaf in correspondence of the free surface of said foil of expanded thermoplastic material, thus obtaining a second composite leaf,

- making a series of holes or slots in said second composite leaf in correspondence of at least part of the uncoupled surface of said non-expanded film or foil, said holes or slots extending into at least part of the thickness of said foil of expanded thermoplastic material, obtaining a second perforated composite leaf

- forming the second perforated composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,

- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray.

22. Process for the preparation of a tray made of plastic material according to claim 14, comprising the step of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,

- coupling a non-expanded film or foil of plastic material onto a surface of said foil of expanded thermoplastic material, thus obtaining a first composite leaf,

- coupling a gas-barrier composite film made of plastic material onto the first composite leaf in correspondence of the free surface of said foil of expanded thermoplastic material, thus obtaining a second composite leaf,

- forming the second composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,

- making a series of holes or slots on the bottom of said semifinished tray in correspondence of at least part of the uncoupled surface of said non-expanded film or foil, said holes extending into at least part of the thickness of said foil of expanded thermoplastic material,

- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray.

23. Process for the preparation of a tray made of plastic material according to claim 14, comprising the steps of:

- providing a foil of expanded thermoplastic material with substantially open cells containing at least one surfactant,

- coupling a non-expanded film or foil of plastic material onto a surface of said foil of expanded thermoplastic material, thus obtaining a first composite leaf,

- coupling a gas-barrier composite film made of plastic material onto the first composite leaf in correspondence of the free surface of said foil of expanded thermoplastic material, thus obtaining a second composite leaf,

- forming the second composite leaf in such a way as to obtain a semifinished tray having a bottom and side walls ending in an edge and wherein said gas-barrier composite film defines the lower layer of said semifinished tray,

- folding up the edge of the semifinished tray so to arrange in correspondence thereof said gas-barrier composite film above said foil of expanded thermoplastic material, thus obtaining said tray,

- making a series of holes or slots on the bottom of said tray in correspondence of at least part of the uncoupled surface of said non-expanded film or foil, said holes extending into at least part of the thickness of said foil of expanded thermoplastic material.

24. Process according to any one of the claims 21 to 23, wherein said steps of coupling are respectively carried out through a first hot rolling of said foil of expanded thermoplastic material with said non-expanded film or foil and a second hot rolling of the first composite leaf with said gas-barrier composite film.

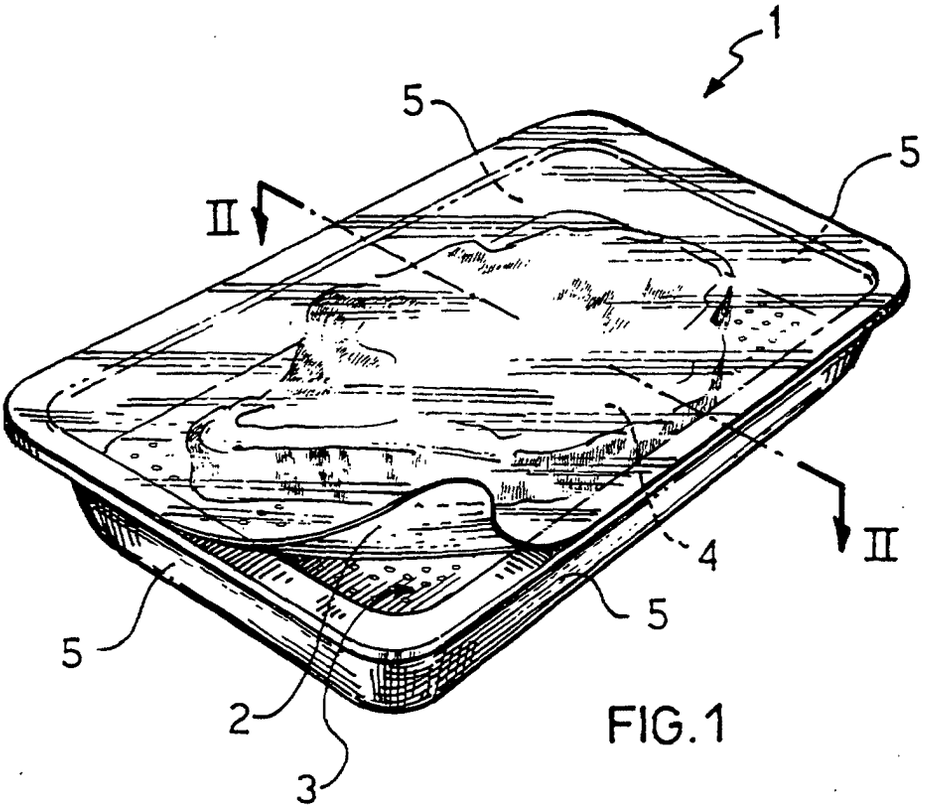

FIG. 1

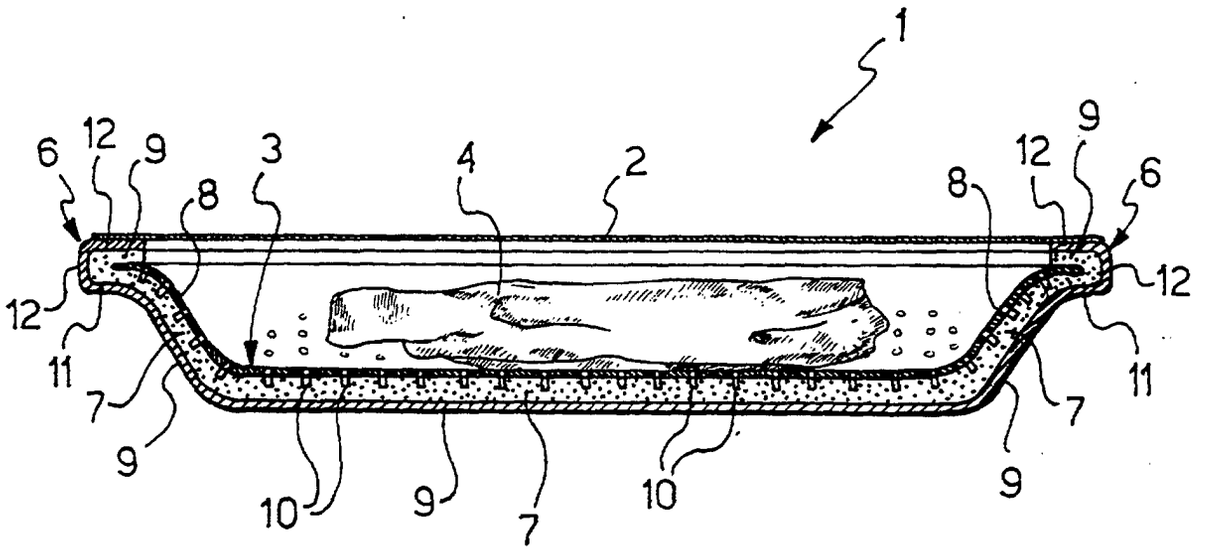

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0794

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 May 2001	Martens, L

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