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GB 1199998 A WO 90/01005 A1 WO 88/01592 A1

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(54) **"Packaging and preserving food"**

(57) A process for preserving a food product 8 comprises introducing the food product into a tray 1 having side walls 3 stepped to form a first support surface 4 extending round the tray. The side walls 3 also provide a second support surface 6 extending round the tray 1, the first support surface 4 being nearer to the base 2 of the tray than the second support surface. A microporous inner lid 5 is affixed to the first support surface 4, the food product 8 is heated in the tray 1 and then allowed to cool, and the tray is sealed by affixing an outer lid 7 to the second support surface.

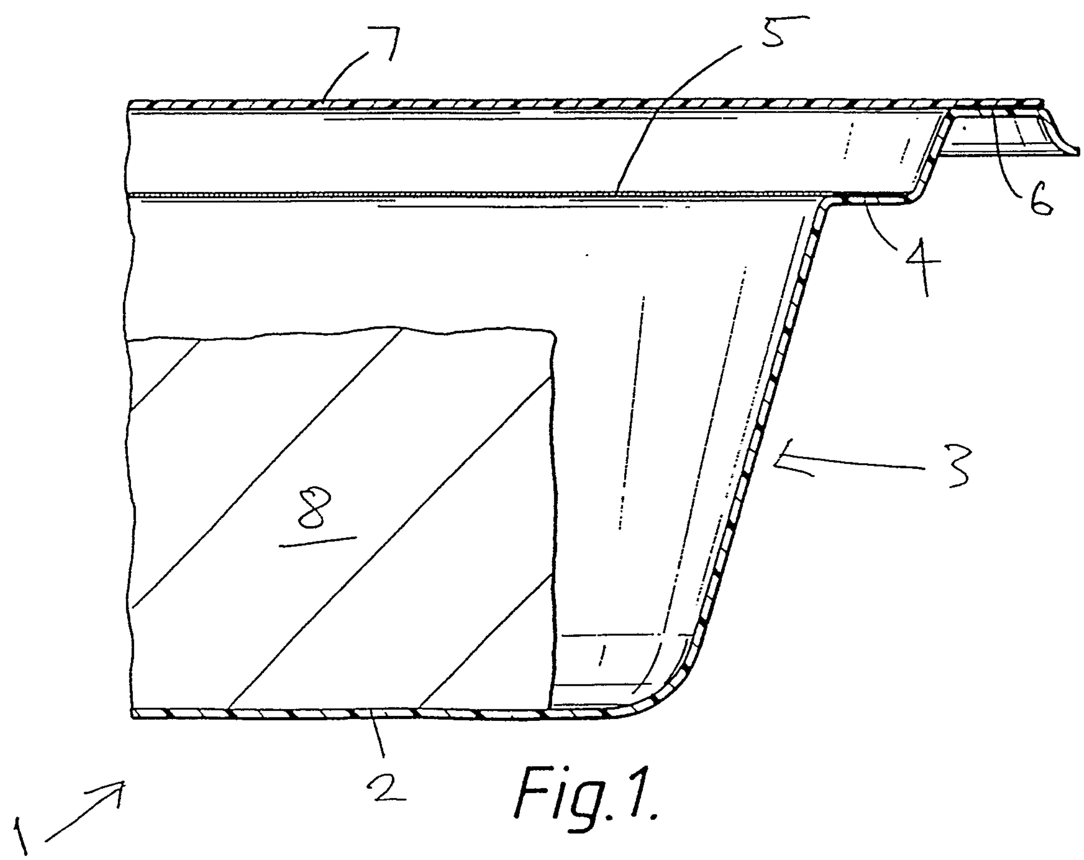

Fig.1.

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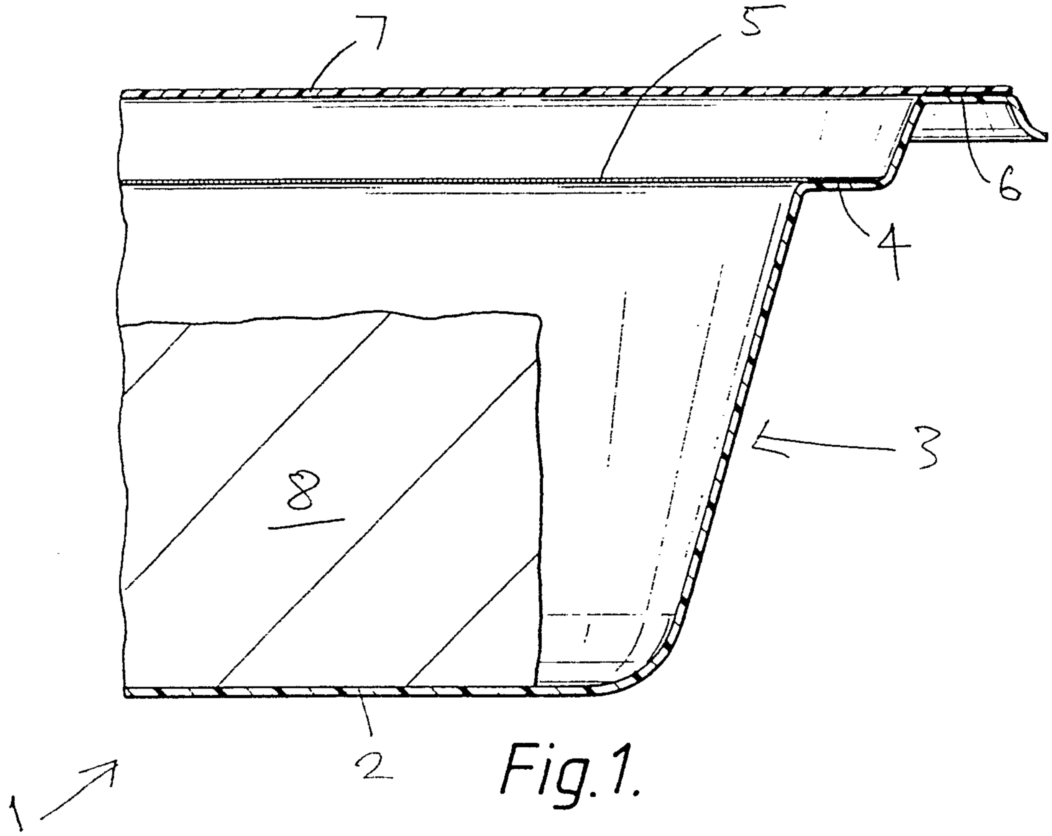

Fig.1.

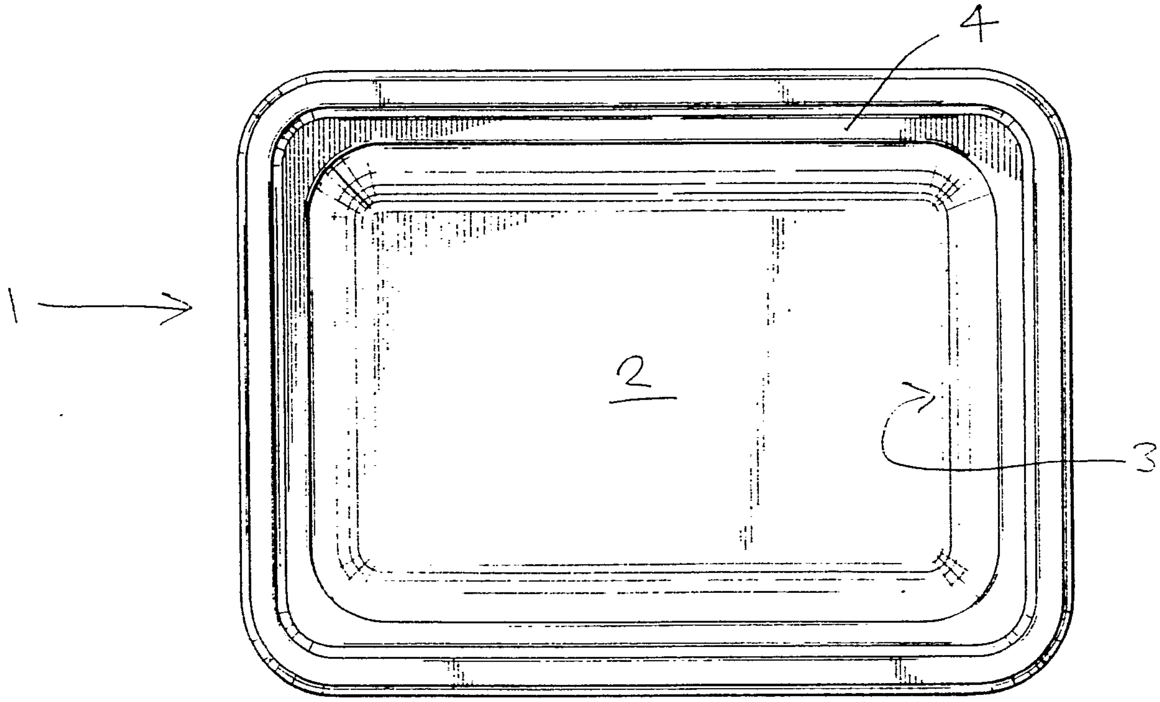

Fig.2.

STEPPED TRAY

Improvements in and relating to preserving food products.

This invention relates to preserving food products and to the resulting food products themselves.

The term "preserving" is used throughout the specification to mean so treating a food product as to increase the period of time for which that food product will remain substantially unimpaired by vegetative micro-organisms as compared with the period of time for which it would have remained so unimpaired under the same storage conditions had it not been so treated.

The preserving of moist baked foods, for example, bread and cake, gives rise to particular problems. Baking itself suffices to preserve the food products to some extent in addition to effecting cooking. That is because baking brings the temperature of the food ingredients, and of the cooked product, to a level at which vegetative micro-organisms are destroyed. The destruction of vegetative micro-organisms that are responsible for most food spoilage begins when the temperature rises above 65°C.

Many products that have simply been formed by baking appropriate ingredients, however, do not remain unspoilt for very long unless further steps are taken. There are several reasons for that: the moisture content of the product may change undesirably, the product may become re-infected by vegetative micro-organisms, and there are two groups of bacteria that produce heat-resistant spores that survive the heat treatment inherent in baking.

Undesired changes in moisture content can be avoided by enclosing the product in a sealed package. For various reasons, however, the product usually has to be allowed to cool before packaging. For example, the product may be fragile while it is hot and condensation may occur within the package if it is sealed before cooling of the product. During cooling, the product is liable to re-contamination unless steps are taken to prevent it.

Spoilage resulting from the heat resistant spores can, as is known, be controlled in various ways, for example, by restricting the water activity of the product and by maintaining a high acidity of the product, both of which can be applied to only a restricted range of products. Also, spoilage can be controlled by storing the product under a suitable atmosphere, for example, an atmosphere containing only a small proportion of free oxygen and especially an atmosphere containing a high proportion of carbon dioxide. Further, spoilage can be controlled by storing the product at temperatures lower than the ambient temperature.

It has previously been proposed (see European Patent Application No. 368 601 A2) to prevent re-contamination of the product during cooling by closing the mouth of a tray in which the product is located, before heating, with a layer of a microporous material, which may be a paper or a plastics material and which, while permitting the egress of gas (for example, air and water vapour) and the ingress of gas (for example, carbon dioxide), prevents the ingress of micro-organisms. When the product has been cooled, the tray is enclosed within a gas-proof envelope. The resulting pack is, however, somewhat cumbersome and unattractive.

The invention provides a process for preserving a food product, which comprises introducing the food product into a tray having side walls stepped to form a first support surface extending round the tray for an inner lid, the side walls also providing a second support surface extending round the tray for an outer lid, the first support surface being nearer to the base of the tray than the second support surface, affixing to the first support surface a microporous inner lid, thereafter heating the food product in the tray to effect pasteurisation and, if desired, cooking, allowing the food product to cool and then sealing the tray by affixing an outer lid to the second support surface.

The inner, microporous lid serves to prevent, or at least substantially reduce, the ingress of micro-organisms, and to prevent contamination of the food product during the handling processes to which the tray is subjected after the inner lid has been affixed and before the tray is sealed by the outer lid. At the same time, the porous nature of the inner lid prevents an unacceptable pressure difference across it (that could result in rupture of the lid) from developing both when the food product is treated to effect pasteurisation and when the food product is allowed to cool before the tray is sealed. The use of a tray with stepped side walls that provide separate support surfaces for the inner and outer lids enables the lids to perform their respective functions with a compact construction.

Depending on the particular baked food product, the process of the invention makes it possible to obtain a sealed tray containing a food product that is ambient-stable or that has enhanced shelf life when stored at temperatures lower than the ambient temperature.

Advantageously, the side walls terminate, away from the base, in an outwardly extending flange, which forms the second support surface. Except where the context requires otherwise, the term "side walls" is used throughout the Specification to include a single wall extending right round the base of the tray.

The configuration of the tray is advantageously such that the separation between the planes of the inner and outer lids, as defined by the first and second support surfaces, is not less than 0.5 mm, and, preferably, is not greater than one quarter of the depth of the tray. In certain circumtances as, for example, when the food products are cakes and it is not desired to affix the outer lid to the tray in an atmosphere of an inert gas (as described below), the separation between the planes of the inner and outer lids, as defined by the first and second support surfaces, is advantageously not greater than 1 mm. With such an arrangement, when the outer lid is affixed to the tray, it may also be affixed to the inner lid, preferably, in the region where the inner lid is affixed to the first support surface, so that the lids can be removed from the tray together. In other cases, especially when the outer lid is to be affixed to the tray in an atmosphere of an inert gas, then the separation between the inner and outer lids is, advantageously, greater than 1 mm, preferably, greater than 3 mm. A separation of substantially 5 mm will generally then be found to be suitable.

The tray may be made of a crystalline polyester, in which case the tray may have, on the surface to which the lids are affixed, a coating of an amorphous polyester, at least one of the lids being affixed to the tray by heat-sealing. The tray may, instead, be made of a plastics material comprising a polyether imide and a polycarbonate, or of a thermosetting plastics material. In other options, the tray may be made of a fibrous material lined with an amorphous polyester to which at least one of the lids is affixed by heat sealing, or the tray may be made of aluminium foil having a lacquer coating to which at least one of the lids is so affixed.

The inner lid may be made of medical paper or of a microporous plastics material, for example, microporous polyester.

The outer lid may be made of an oriented polyester. It may be of laminated construction, the innermost layer being made of a material that can be adhesively united with the side walls of the tray by heat-sealing to effect the required sealing of the tray. In such a case, the outer lid may be made by co-extruding an oriented polyester and a heat-sealable, amorphous polyester, the latter material forming the inner surface of the lid. The outer lid may, however, also comprise three layers, an outer layer of oriented polyester, a middle barrier layer in the form of a layer of polyvinylidene chloride or a metallic layer, and an inner layer of amorphous polyester. Instead, the outer lid may be made of metal foil laminated to a sealing medium or it may be made of board with at least the surface of the board that forms the inner surface of the lid being coated with a heat-sealable polyester.

The heating of the food product in the tray after the inner lid has been affixed and before the tray is sealed by affixing the outer lid, may be effected by placing the tray in an oven at a temperature within the range of from 180°C to 240°C. Alternatively, the heating may be effected by irradiation with microwaves.

When (in order to control the effect of the spore-forming bacteria) the outer lid is affixed to the tray in an atmosphere of an inert gas, that is to say, a gas that is substantially inert with respect to the food product under the prevailing conditions, the inert gas may be nitrogen or carbon dioxide. The primary function of such an inert gas is to balance the ambient pressure, thus ensuring that there is no substantial pressure drop tending to cause ambient air to diffuse into the tray. If, as in the case of nitrogen, the inert gas has no preservative effect on the food product, even a relatively small partial pressure of oxygen within the sealed tray would cause significant degradation of the food product. Accordingly, it is necessary to ensure that the partial pressure of such an inert gas within the sealed tray remains close to the ambient pressure, which will typically be about 10^5Pa (absolute).

When the outer lid is affixed to the tray in an atmosphere of carbon dioxide, the carbon dioxide not only serves to balance the ambient pressure, but also has a preservative effect on the food product by inhibiting the growth of micro-organisms. Because the carbon dioxide has a preservative effect, the partial pressure of carbon dioxide within the sealed tray does not need to be maintained so close to the ambient pressure as when, say, nitrogen, is used, but it is undesirable to allow it to fall below 50% of the ambient pressure, which will typically be about $5x10^4$Pa (absolute).

The rate at which carbon dioxide diffuses through at least most of the materials of which the tray and the outer lid will usually be made is greater than the rate at which many other gases, including nitrogen, diffuse through such materials. Accordingly, despite the less stringent condition for minimum partial pressure within the sealed tray when carbon dioxide is used, the requirement that the tray and the outer lid have a high degree of impermeability is no less strict when carbon dioxide is used rather than when, say, nitrogen is used.

Advantageously, the nature and thickness of the materials used to form the tray and the outer lid, and the effectiveness of sealing between the outer lid and the tray are such that, if the sealing is effected in an atmosphere of an inert gas of which at most a minor proportion is carbon dioxide and the sealed tray is thereafter maintained in an atmosphere of air at a pressure of substantially $1x10^5$Pa (absolute) and the temperature of the tray, of the food product it contains and of the ambient air is 20°C, then the partial pressure of the inert gas, including the partial pressure of any carbon dioxide present in the tray, does not fall below

$5x10^4$Pa (absolute) within thirty days of the sealing of the tray.

Similarly, it is advantageous that the nature and thickness of the materials used to form the tray and the outer lid, and the effectiveness of sealing between the outer lid and the tray are such that, if the sealing is effected in an atmosphere of carbon dioxide and the sealed tray is thereafter maintained in an atmosphere of air at a pressure of substantially $1x10^5$Pa (absolute) and the temperature of the tray, of the food product it contains and of the ambient air is 20°C, then the partial pressure of carbon dioxide in the tray does not fall below $9x10^4$Pa (absolute) within thirty days of the sealing of the tray.

The invention also provides a sealed tray containing a food product, which has been produced by a process in accordance with the invention.

The invention further provides a sealed tray containing a food product, the tray having side walls stepped to form a first support surface extending round the tray, to which an inner microporous lid is affixed, the side walls also providing a second support surface extending round the tray, to which an outer lid is affixed to seal the tray, the first support surface being nearer to the base of the tray than the second support surface but above the food product.

A process for preserving a food product, and a sealed tray, each in accordance with the invention, will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic vertical axial section taken through a part of the sealed tray and on a larger scale than Fig. 2; and

Fig. 2 is a plan view of the tray before filling and sealing.

Referring to the accompanying drawings, the tray, which is indicated generally by the reference numeral 1, is (as seen in plan) of generally rectangular form but with corners which are rounded (although, of course, that need not be the case). Thus, the tray has a flat base 2 and side walls which are indicated generally by the reference numeral 3.

The side walls 3 are stepped towards their upper edges to form a shoulder 4 which extends right round the tray, is substantially planar, and serves as a support for a peripheral portion of an inner, microporous lid 5. At their upper edges, the side walls terminate in an outwardly extending flange 6 which extends right round the tray, is substantially planar, has a down turned lip on its free end and forms a support for a peripheral portion of an outer lid 7, which serves to seal the tray. In a particular example of the invention the separation of the inner lid support surface provided by the shoulder 4 and the outer lid support surface provided by the flange 6 is 5mm.

The food product is indicated diagrammatically at 8.

The tray itself is formed of crystalline polyester having a layer on its inner surface (by which is to be understood the entire surface of the tray visible in Fig. 2) of amorphous (that is to say, unnucleated) polyester. The tray is produced by co-extruding two layers of amorphous polyester, one of the layers containing a nucleating agent and then crystallising that part of the resulting polyester sheet material that contains the nucleating agent. The thickness of the sheet material before forming is at least 900 microns. In that way, it will be found possible to ensure that, with typical tray dimensions, the wall thickness of the formed tray is nowhere less than 400 microns, which is desirable when the food product is to be stored under an atmosphere consisting largely of carbon dioxide, to which many plastics materials are relatively permeable.

The inner lid 4 is made of a microporous plastics material or of a microporous paper, while the outer lid 6 is made of a laminated material, it having a layer of oriented polyester on the upper or outer side a poly-vinylidene chloride, or metallic, middle layer, and, on its lower or inner side, a layer of amorphous polyester.

An uncooked food product 8 is placed in the tray 1, and the inner, microporous lid 5 is then placed in position and a peripheral portion of the inner lid is heat-sealed to the shoulder 4. The tray 1 containing the food product 8 and fitted with the inner lid 5 is then placed in an oven at a temperature of, say, 220°C to effect baking and pasteurisation, the term "pasteurisation" being used throughout the specification in the sense in which it is commonly used and understood in the food industry, so that it does not necessarily imply the removal of all forms of viable micro-organisms. For example, it does not necessarily imply the removal of thermophillic spores.

The porosity of the inner lid 5 allows air to pass outwardly through it during heating, thus preventing the build-up across it of a large pressure drop which would be liable to rupture it. Similarly, air can enter the tray 1 during the cooling of the food product 8 following pasteurisation

When the food product 8 has cooled to ambient temperature, carbon dioxide is introduced into the tray 1 containing the food product. Thus, carbon dioxide may be caused to flow over the top of the tray at a sufficient rate and for a sufficient time. Alternatively, solid carbon dioxide ("dry ice") may be introduced into the tray (so that it rests on the inner lid 5). With the tray 1 still in an atmosphere of carbon dioxide, the outer lid 7 is placed in position and a peripheral portion of it is heat-sealed to the flange 6, thereby sealing the tray.

It will be understood that, where the atmosphere in the tray does not consist largely of carbon dioxide, the requirements for the material or materials of which the base 2 and side walls 3 of the tray are constructed, the minimum thickness of the base and side walls, and the nature of the material or materials of which the outer lid is constructed, are subject to less stringent conditions. Thus, for example, where the product is to be stored at temperatures lower than the ambient temperature, the aforesaid conditions will normally be less stringent. In addition, in certain circumstances, the separation of the inner lid support surface and the outer lid support surface may be significantly less than 5 mm, say, within the range of from 0.5 mm to 1 mm. With such a separation, the outer lid may be affixed to the inner lid so that the inner and outer lids can be removed from the tray in a single operation. That can be achieved by arranging for the inner surface of the outer lid to be heat-sealed to the outer surface of the inner lid in the region where the inner lid is affixed to (and hence firmly supported by) the tray, and a heat-sealing tool so shaped as to heat-seal the outer lid to the tray and the outer lid to the inner lid at the same time can be used. Such an arrangement is especially suitable when the food products are cakes.

More generally, the stepped construction of the tray considerably facilitates the final sealing, because the affixing to the tray of the outer lid 7 is not interfered with in any way by the presence of the inner, microporous lid 5.

Claims

1. A process for preserving a food product, which comprises introducing the food product into a tray having side walls stepped to form a first support surface extending round the tray for an inner lid, the side walls also providing a second support surface extending round the tray for an outer lid, the first support surface being nearer to the base of the tray than the second support surface, affixing to the first support surface a microporous inner lid, thereafter heating the food product in the tray to effect pasteurisation and, if desired, cooking, allowing the food product to cool and then sealing the tray by affixing an outer lid to the second support surface.

2. A process as claimed in claim 1, wherein the side walls terminate, away from the base, in an outwardly extending flange, which forms the second support surface.

3. A process as claimed in claim 1 or claim 2, wherein the configuration of the tray is such that the separation between the planes of the inner and outer lids, as defined by the first and second support surfaces, is not less than 0.5 mm.

4. A process as claimed in claim 3, wherein the separation between the planes of the inner and outer lids is not greater than one quarter of the depth of the tray.

5. A process as claimed in claim 3 or claim 4, wherein the separation between the planes of the inner

and outer lids is not greater than 1 mm, and the outer lid is affixed to the inner lid in the region where the inner lid is affixed to the first support surface.

6. A process as claimed in claim 3 or claim 4, wherein the separation between the planes of the inner and outer lids, as defined by the first and second support surfaces is greater than 3 mm.

7. A process as claimed in claim 6, wherein the separation between the planes of the inner and outer lids is substantially 5 mm.

8. A process as claimed in any one of claims 1 to 7, wherein the tray is made of a crystalline polyester.

9. A process as claimed in claim 8, wherein the tray has, on the surface to which the lids are affixed, a coating of an amorphous polyester, and at least one of the lids is affixed to the tray by heat-sealing.

10. A process as claimed in any one of claims 1 to 7, wherein the tray is made of a plastics material comprising a polyether imide and a polycarbonate.

11. A process as claimed in any one of claims 1 to 7, wherein the tray is made of a thermosetting plastics material.

12. A process as claimed in any one of claims 1 to 7, wherein the tray is made of a fibrous material lined with an amorphous polyester to which at least one of the lids is affixed by heat-sealing.

13. A process as claimed in any one of claims 1 to

7, wherein the tray is made of aluminium foil having a lacquer coating to which at least one of the lids is affixed by heat-sealing.

14. A process as claimed in any one of claims 1 to 13, wherein the inner lid is made of medical paper.

15. A process as claimed in any one of claims 1 to 13, wherein the inner lid is made of a microporous plastics material.

16. A process as claimed in claim 15, wherein the microporous plastics material is a microporous polyester.

17. A process as claimed in any one of claims 1 to 16, wherein the outer lid is made of an oriented polyester.

18. A process as claimed in any one of claims 1 to 16, wherein the outer lid is of laminated construction, the innermost layer being made of a material that can be adhesively united with the side walls of the tray by heat-sealing to effect the required sealing of the tray.

19. A process as claimed in claim 18, wherein the outer lid is made by co-extruding an oriented polyester and a heat-sealable, amorphous polyester, the latter material forming the inner surface of the lid.

20. A process as claimed in claim 18, wherein the outer lid comprises three layers, an outer layer of oriented polyester, a middle, barrier layer in the form of a layer of polyvinylidene chloride, or a metallic layer, and an inner layer of amorphous polyester.

21. A process as claimed in any one of claims 1 to 16, wherein the outer lid is made of a metal foil laminated to a sealing medium.

22. A process as claimed in any one of claims 1 to 16, wherein the outer lid is made of board with at least the surface that forms the inner surface of the lid being coated with a heat-sealable polyester.

23. A process as claimed in any one of claims 1 to 22, wherein the heating of the food product in the tray, after the inner lid has been affixed and before the tray is sealed by affixing the outer lid, is effected by placing the tray in an oven at a temperature within the range of from 180°C to 240°C.

24. A process as claimed in any one of claims 1 to 22, wherein the heating of the food product in the tray, after the inner lid has been affixed and before the tray is sealed by affixing the outer lid, is effected by irradiating it with microwaves.

25. A process as claimed in any one of claims 1 to 24, wherein the nature and thickness of the materials used to form the tray and the outer lid, and the effectiveness of sealing between the outer lid and the tray are such that, if the sealing is effected in an atmosphere of an inert gas of which at most a minor proportion is carbon dioxide and the sealed tray is thereafter maintained in an atmosphere of air at a pressure of substantially $1x10^5$Pa (absolute) and the

temperature of the tray, of the food product it contains and of the ambient air is 20°C, then the partial pressure of the inert gas, including the partial pressure of any carbon dioxide present in the tray, does not fall below $5x10^4$Pa (absolute) within thirty days of the sealing of the tray.

26. A process as claimed in any one of claims 1 to 24, wherein the nature and thickness of the materials used to form the outer tray and the outer lid, and the effectiveness of sealing between the outer lid and the tray are such that, if the sealing is effected in an atmosphere of carbon dioxide and the sealed tray is thereafter maintained in an atmosphere of air at a pressure of substantially $1x10^5$Pa (absolute) and the temperature of the tray, of the food product it contains and of the ambient air is 20°C, then the partial pressure of carbon dioxide in the tray does not fall below $9x10^4$Pa (absolute) within thirty days of the sealing of the tray.

27. A sealed tray containing a food product, which has been produced by a process as claimed in any one of claims 1 to 26.

28. A sealed tray containing a food product as claimed in claim 27 and substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

29. A sealed tray containing a food product, the tray having side walls stepped to form a first support

surface extending round the tray, to which an inner microporous lid is affixed, the side walls also providing a second support surface extending round the tray, to which an outer lid is affixed to seal the tray, the first support surface being nearer to the base of the tray than the second support surface but above the food product.

30. A sealed tray containing a food product as claimed in claim 29 and substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

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Relevant Technical fields

(i) UK Cl (Edition K) A2D (DSA,DSB,DSX,DX2,DX3)
B8C (CWP3,CPA,CF12)
B8D (DCA1, DCE)

(ii) Int Cl (Edition 5) A23L; B65B; B65D

Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

K MacDONALD

Date of Search

21.02.91.

Documents considered relevant following a search in respect of claims 1-30

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1199998 (UNILEVER) Figure 3	at least Claim 29
X	WO A1 90/01005 (GARWOOD) Figure 3	" "
X	WO A1 88/01592 (GARWOOD) Figure 3	" "

SF2(p)

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Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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