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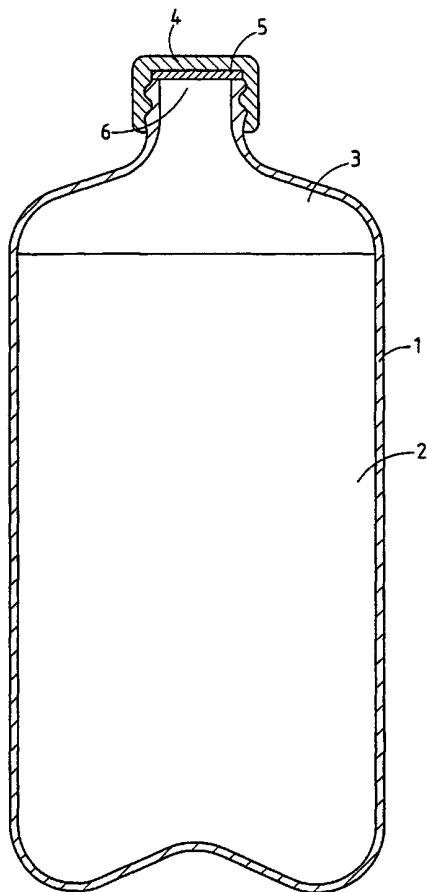
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(54) Title: BOTTLE FOR LIGHT-SENSITIVE DAIRY PRODUCTS



(57) Abstract: Bottle made of plastic having a transparent, substantially oxygen-tight wall, said bottle enclosing a sterilized dairy product, the wall of the bottle having the following properties: substantially no transmission of light of a wavelength shorter than 350 nm, less than 30 % transmission of light of a wavelength of from 350 to 450 nm, 30 % or more transmission of light of a wavelength of 450 - 650 nm. The dairy product has a very long shelf life at room temperature, taste and nutritional value being all but maintained.



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BOTTLE FOR LIGHT-SENSITIVE DAIRY PRODUCTS

5 The present invention relates to a bottle made of plastic for a sterilized dairy product.

 In the prior art, many types of plastic bottles are known, including so-called PP, polycarbonate, PE and PET bottles. These bottles are used for various applications and are
10 suitable, inter alia, for holding beverages, including dairy products.

 For example, WO-A-97/30122 discloses a plastic bottle for beverages whose gas-tightness and resistance to leaching of chemical compounds from the wall into the contents of the bottle
15 is enhanced by the incorporation of cyclodextrins into the wall. The wall of this bottle is not lightproof.

 Furthermore, NL-A-8104678 teaches a container whose wall consists of a plurality of layers of the same polymer, PE being the only example mentioned. This container is lightproof and
20 suitable for packaging sterilized milk, inter alia. In this bottle, the wall is permeable to gases.

 Finally, "Canning + Filling" of April 1999, pp. 43-46 reports the idea of aseptically bottling "extended shelf-life" milk into PET bottles. It is stated that in that case materials
25 having a UV- and oxygen-barrier effect should be incorporated into the PET material. No examples are mentioned, nor is anything said about barrier characteristics with respect to visible light. It is noted in this context that "extended shelf-life" milk is milk which should be stored under refrigeration
30 and will keep there for at most one month. This does not, therefore, relate to sterilized milk.

 A major problem with packaged sterilized dairy products is the considerable sensitivity of these sterilized dairy products to external influences such as bacterial contamination,
35 light, oxygen etc. Given the desired long storage time without refrigeration, generally up to rather more than 6 months, the dairy product should be suitably protected by the container both against UV radiation and visible light. This radiation, particularly the radiation of a wavelength shorter than 500 nm,

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causes chemical degradation of, inter alia, vitamin B2, reaction products (free radicals) being formed in the process which in turn can react with other constituents within the dairy product. This produces the so-called light-induced off-flavour. The shelf
5 life of the dairy product is also reduced thereby.

It is an object of the present invention to provide a solution to the abovementioned problem and to provide a generally improved bottle of the type specified in the introduction. The invention provides a bottle made of plastic
10 having a transparent, substantially oxygen-tight wall, said bottle enclosing a sterilized dairy product, the wall of the bottle having the following properties:

- substantially no transmission of light of a wavelength shorter than 350 nm,
- 15 - less than 30% transmission of light of a wavelength of from 350 to 450 nm,
- 30% or more transmission of light of a wavelength of 450-650 nm.

A bottle according to the invention allows sterilized
20 dairy products to be kept therein at room temperature for a very long time.

Per se, US-A-4535901 discloses a transparent plastic bottle having good oxygen barrier properties and UV barrier properties, but the specific light transmission characteristics
25 as pertain to the bottle according to the invention are not disclosed, nor is there any mention of the bottle being used to hold sterilized dairy products.

In addition, GB-A-2086342 discloses a bottle made of plastic for sterilized milk. This bottle comprises two layers,
30 the first layer screening out light of a wavelength greater than or equal to 800 nm, and the second layer screening out light of a wavelength of less than 800 nm. In other words, this bottle is therefore not transparent.

It has been found that transparency is an important
35 requirement for bottles in which dairy products are present, so that the user is able to get a good view of the product from outside.

In the context of the present invention, "completely transparent" is meant to indicate that the wall of the bottle

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will therefore have substantially perfect image transmittivity. In other words, the wall may have a colour, but the contents can at all times be perceived in focus.

According to the invention, bottles having different
5 colours can be fabricated, ranging from green, yellow-green, orange, orange-red to red. Preference is given to yellow-green and orange-red bottles.

In particular, the wall of the bottle has the property:
40% or more, preferably 50% or more transmission of light of a
10 wavelength of 450-650 nm.

Advantageously, the wall of the bottle has the following properties:

- substantially no transmission of light of a wavelength shorter than 350 nm,
- 15 - less than 30% transmission of light of a wavelength of from 350 to 500 nm,
- substantially complete transmission of light of a wavelength of 500-650 nm.

Preference is given to yellow-green and orange-red
20 bottles.

In particular, the wall of the bottle has the property:
40% or more, preferably 50% or more transmission of light of a
wavelength of 500-650 nm.

Fabrication of a transparent plastic bottle is possible
25 with many materials such as eg. PP containing a so-called "clarifying agent". Preferably, however, the wall of the bottle at least comprises polyethylene terephthalate (PET). Compared with the use of other plastics such as eg. PE, the use of PET for bottles for sterilized dairy products offers many advantages
30 apart from transparency:

- PET has better wear resistance and higher breaking strength. Consequently, PET is more suitable as a material for refillable bottles.
- In the case of PET, a thread on the bottle for the purpose
35 of fastening eg. a cap can be defined much more precisely than in the case of PE. Thus gas-tightness at the cap and resealability of the bottle can be ensured more effectively without additional measures being taken.

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- PET has a classier appearance, which comes very close to that of glass, so that PET is more suitable for so-called "premium quality products".

For convenience's sake, the following will refer solely to sterilized milk, although it will be obvious that the invention is by no means limited thereto. Apart from sterilized milk (beverages), sterilized dairy products also include sterilized yoghurt (beverages), cream, coffee cream etc.

The term "sterilized dairy product" refers to a commercial sterile dairy product which can be obtained, for example, via the so-called UHT process. Other conceivable ways of sterilizing dairy products are high-pressure sterilization, irradiation, electropulse sterilization, microfiltration etc.

For the purpose of the present invention, a bottle is any bottle suitable for holding a sterilized dairy product. In other words, neither the shape nor the dimensions of the bottle are essential. The shape can vary from a standard milk bottle to a milk carton, nor are smaller packaging types such as small beverage bottles and beverage cartons excluded.

Moreover, the bottle according to the invention can comprise any suitable seal ranging from caps to rupturable membranes.

The bottle according to the invention can comprise a single- or multilayer wall. Preferably, the wall of the bottle successively comprises a layer of PET, a layer made of EVOH and PA, and a layer of PET. This combination of layers provides an excellent possibility of fabricating a bottle according to the invention which is transparent and oxygen-tight and additionally has the desired transmission properties.

In order to impart light barrier and oxygen barrier characteristics to the wall of the bottle according to the invention, suitable materials having light barrier and oxygen barrier characteristics can be incorporated into the material of the wall or be laminated thereonto. Advantageously, however, the materials having light barrier and oxygen barrier characteristics are incorporated in the plastic of the wall of the bottle.

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In order to confer the required light transmission properties to the bottle, the plastic material of the wall of the bottle can be admixed with suitable colorants.

The oxygen barrier characteristics are obtained, for example, by the wall of the bottle having ethylvinyl alcohol (EVOH), polyamide (PA) or poly(vinylidene) chloride (PVDC) incorporated therein as a material having oxygen barrier characteristics.

Preferably, the bottle is filled with the sterilized dairy product by means of an aseptic bottling method. Any bacterial contamination can thus be avoided.

Advantageously, the air in the void space of the bottle is replaced by a gas which is inert with respect to the dairy product, for example sterilized nitrogen, Ar, CO₂, He, N₂O (nitrous oxide), SO₂ or mixtures of these. Thus oxygen from the void space in the bottle is prevented from penetrating the sterilized dairy product and adversely affecting it.

Advantageously, the bottle comprises a substance that is able to scavenge oxygen from the bottle ("oxygen scavenger") and can also be used with foodstuffs. Thus, any remaining oxygen is removed from the void space in the bottle and indirectly also from the dairy product itself. This substance can be chosen, for example, from an alkali metal sulphite, eg. sodium sulphite, an alkali metal ascorbate, eg. sodium ascorbate, or metal ions in such an oxidation state that they can react with oxygen, or mixtures of these substances.

The location of the oxygen scavenger in the bottle is not critical. Advantageously, however, it is present in the headspace of the bottle. If the bottle comprises a cap or similar closure means, the oxygen scavenger can be attached thereto or be incorporated therein.

In a specific embodiment, the bottle comprises a seal. A seal provides quality assurance, as the user in that case is at all times able to ascertain whether the bottle has already been opened. There are no particular limitations to the seal which, for example, can comprise a rupture ring for the cap, but can equally comprise a sealing strip glued to the cap and the bottle.

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Advantageously, the rupture edge on the cap is a so-called d-strip. This permits very effective cleaning of the bottle, with a smaller risk of rinse water and chemical and/or bacterial contamination's remaining behind at the rupture edge, this being in contrast to the so-called J-strip.

Particularly preferably, the sterilized dairy product is sterilized milk. Particularly in the case of sterilized milk, the properties of the bottle according to the invention are of essential importance.

The invention further provides a bottle made of plastic having a transparent, substantially oxygen-tight wall, the wall of the bottle having the following properties:

- substantially no transmission of light of a wavelength shorter than 350 nm,
- 15 - less than 30% transmission of light of a wavelength of from 350 to 450 nm,
- 30% or more transmission of light of a wavelength of 450-650 nm.

In particular, the wall of the bottle has the property: 40% or more, preferably 50% or more transmission of light of a wavelength of 450-650 nm.

Preferably, the bottle according to the invention has the following properties:

- 25 - substantially no transmission of light of a wavelength shorter than 350 nm,
- less than 30% transmission of light of a wavelength of from 350 to 500 nm,
- 30% or more transmission of light of a wavelength of 500-650 nm.

In particular, the wall of the bottle has the property: 40% or more, preferably 50% or more transmission of light of a wavelength of 500-650 nm.

In particular, the bottle is designed for holding a sterilized dairy product, preferably a sterilized dairy product.

35 The invention will be explained below in more detail with reference to an example. A bottle was fabricated as shown in Figure 1, by injection moulding a parison, followed by blow moulding.

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The bottle wall is composed of multilayer material comprising an inner layer of PET (thickness approximately 120 μm), a core layer of polyamide (thickness approximately 60 μm) and an outer layer of PET (thickness approximately 120 μm). The barrier core layer can also consist of EVOH. To obtain the desired transmission properties, a mixture of colorants was added to both PET layers. The option of restricting the colorant or the mixture of colorants to one PET layer or possibly to the barrier core layer is not excluded.

10 The bottle had a transmission spectrum as shown in Figure 2 and a green-yellow colour.

In the figure, 1 denotes the bottle which is fabricated from PET/PA/PET as stated in the example. The bottle 1 is filled with sterilized milk 2.

15 Another example of a suitable multilayer material for fabrication of a bottle 1 according to the invention comprises an inner layer of PET, an interlayer of PET or polyamide with colorants, a core layer of PET, an interlayer of polyamide and an outer layer of PET including colorants. All the layers in this structure have a thickness of 60 μm . The option of all the PET layers containing colorants is not excluded, the important point being that the transmission spectrum of the bottle wall is comparable with the spectrum according to the invention.

25 The void space 3 in the bottle is mainly filled with sterilized nitrogen. 4 denotes a cap, and 5 denotes a seal. This seal 5 comprises a plastic sealing membrane which seals the outlet orifice 6 of the bottle 1 underneath the cap 4. Prior to initial use, the membrane needs to be perforated or removed.

30 On its side facing the milk, the membrane comprises a thin layer of sodium ascorbate which is able to scavenge any remaining oxygen from the headspace of the bottle. Equally, it will scavenge oxygen entering the headspace from the milk while the bottle is stored.

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CLAIMS

1. Bottle made of plastic having a transparent, substantially oxygen-tight wall, said bottle enclosing a sterilized dairy
5 product, the wall of the bottle having the following properties:
 - substantially no transmission of light of a wavelength shorter than 350 nm,
 - less than 30% transmission of light of a wavelength of from 350 to 450 nm,
 - 10 - 30% or more transmission of light of a wavelength of 450-650 nm.
2. Bottle according to claim 1, **characterized** in that the wall of the bottle has the following properties:
 - substantially no transmission of light of a wavelength
15 shorter than 350 nm,
 - less than 30% transmission of light of a wavelength of from 350 to 500 nm,
 - 30% or more transmission of light of a wavelength of 500-650 nm.
- 20 3. Bottle according to claim 1 or 2, **characterized** in that the wall of the bottle at least comprises polyethylene terephthalate (PET).
4. Bottle according to claim 3, **characterized** in that the wall of the bottle successively comprises a layer of PET, a layer
25 made of EVOH and PA, and a layer of PET.
5. Bottle according to one or more of the preceding claims, **characterized** in that the void space (3) of the bottle (1) holds a gas which is inert with respect to dairy products (2).
6. Bottle according to one or more of the preceding claims,
30 **characterized** in that bottle (1) on its inside comprises a substance which is able to scavenge oxygen from the bottle (1).
7. Bottle according to claim 6, **characterized** in that the substance which is able to scavenge oxygen from the bottle (1) is selected from an alkali metal sulphite, an alkali metal
35 ascorbate, (metal ions) or mixtures thereof.
8. Bottle according to one or more of the preceding claims, **characterized** in that the bottle (1) comprises a seal (5).

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9. Bottle according to one or more of the preceding claims, **characterized** in that the sterilized dairy product is sterilized milk.

10. Bottle made of plastic having a transparent, substantially oxygen-tight wall, the wall of the bottle having the following properties:

- substantially no transmission of light of a wavelength shorter than 350 nm,
- less than 30% transmission of light of a wavelength of from 350 to 450 nm,
- 30% or more transmission of light of a wavelength of 450-650 nm.

11. Bottle according to claim 10, **characterized** in that the wall of the bottle has the following properties:

- substantially no transmission of light of a wavelength shorter than 350 nm,
- less than 30% transmission of light of a wavelength of from 350 to 500 nm,
- 30% or more transmission of light of a wavelength of 500-650 nm.

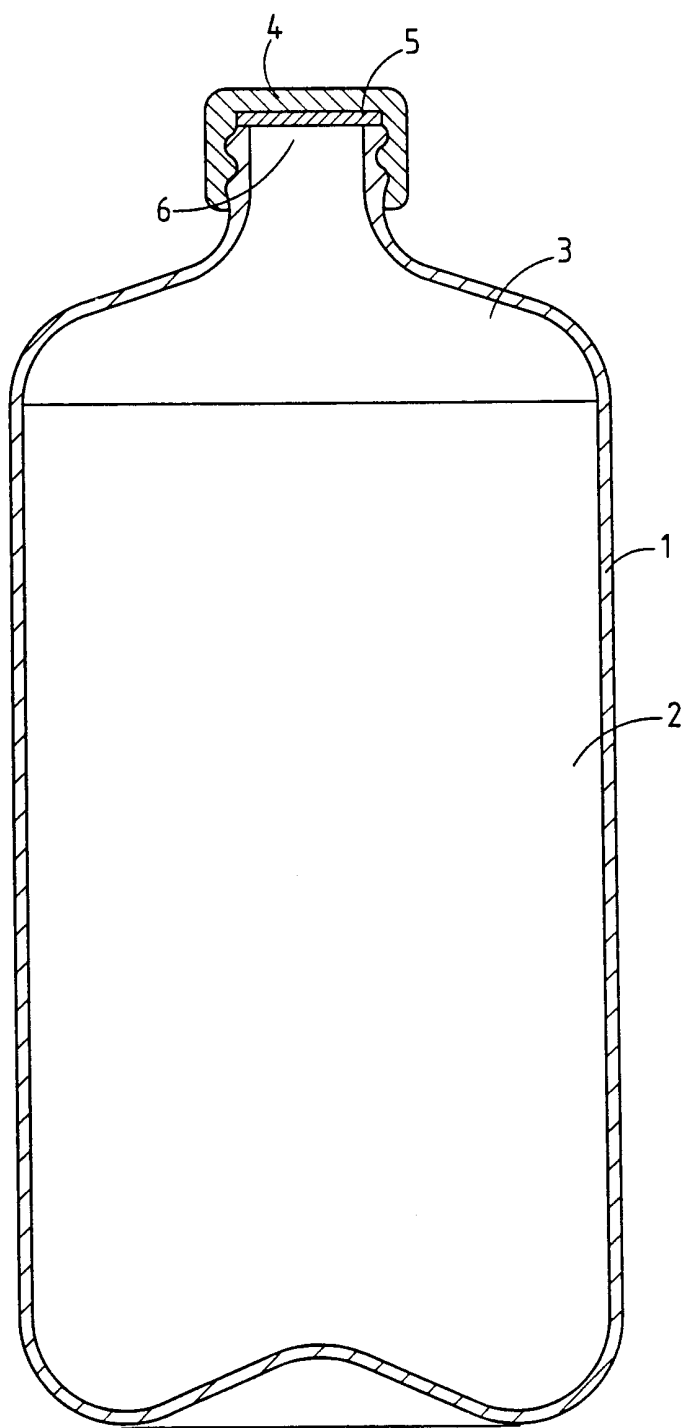


FIG. 1.

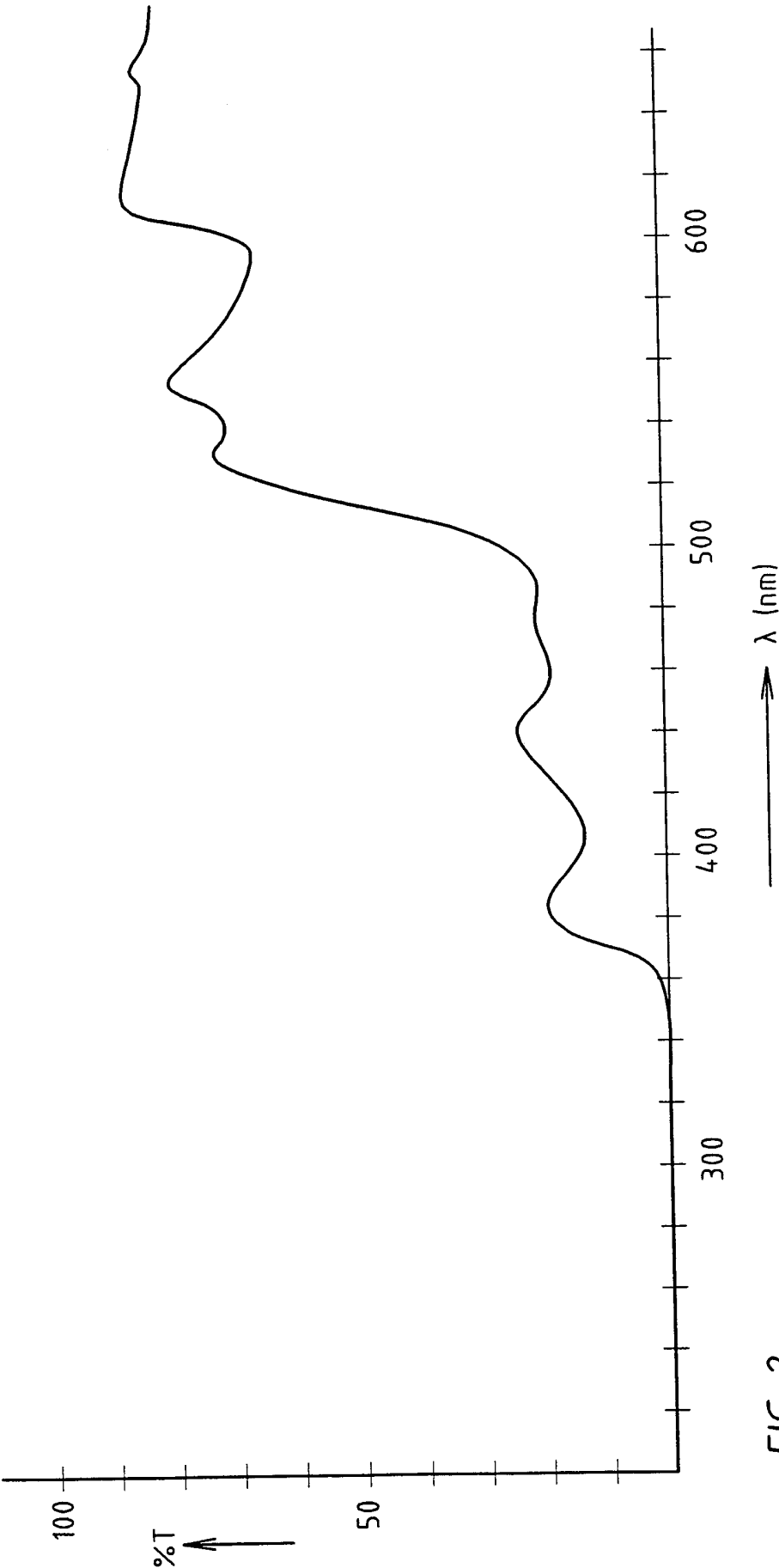


FIG. 2.

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

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

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Y	US 5 804 236 A (FRISK PETER) 8 September 1998 (1998-09-08) claims 1-4 ---	6,7
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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