Title: A CLOSURE SYSTEM FOR CLOSING A CONTAINER

Abstract: The invention relates to a closure system for closing a container, wherein the lid comprises an inner lid and an outer lid. The outer lid comprises a top and an annular side, wherein the sides of the lid have means for that cooperate with projections on the container. The inner lid may form a face whose shape is adapted to the internal configuration of the outer lid and the edge of the container, wherein the inner lid comprises at least first and second polymer layers, and wherein a first polymer layer cooperates with the edge of the container, and where the first polymer layer has a flexibility to accommodate the irregularities of a container edge, and wherein the second polymer layer has a low friction against the outer lid which allows a relative movement between the outer lid and the inner lid, and wherein the second polymer layer has a great flexural rigidity.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
A closure system for closing a container

The invention relates to a closure system for closing a container, wherein the lid comprises an inner lid and an outer lid, wherein the container has a neck with an edge, and wherein the lid comprises a top and an annular side, wherein the sides of the lid have means for attachment to the container, and wherein the container has projections which cooperate with the means of the lid for attachment and sealing.

Screw lids of this type are known inter alia from EP-B-411385. This document describes a screw lid which ensures a tight sealing of a container with a negative pressure. However, to open the lid, a great force is required for rotating the lid sufficiently to achieve pressure equalization in the package container. Only after pressure equalization can the lid be removed. To facilitate opening of screw lids, tools for opening screw lids are provided in many kitchens.

GB 2 122 178 A discloses a plastics lid equipped with a plurality of projections which, when being screwed off, engage an inner lid which is thereby lifted out of contact with a container. A large number of projections is provided, or there is one annular projection which serves to lift off an inner lid. The external plastics lid itself is open at the centre so that just the inner lid provides the actual covering of the internal volume of the container. Between the inner lid and the container there is a gasket which serves to accommodate the irregularities of the container edge, and which also ensures sealing along the upper rim of the container. The use of
a gasket may involve an unnecessary environmental pollution upon disposal.

GB 1 231 208 concerns a lid which is formed by a metal foil which is coated with a thermoplastic material on the container side, said thermoplastic material being heated, following application of the lid, by the use of radio frequencies which supply energy to the thermoplastic material.

As a result, good adhesion between lid and container can be achieved, but if a negative pressure prevails in the container, the lid will deflect downwards and also be very difficult to open. In the disposal of the lid, the thermoplastic material may involve an unnecessary environmental pollution.

US 3 933 267 concerns a container closure consisting of an outer cap which is generally cup-shaped and has a top and a skirt, which is connected to the outer rim of the top, where the invention has means for securing the closure unit above the opening of the container. A disc-shaped component of an elastic material is provided between the outer lid and the outer edge of the container, said elastic material being arranged in a shell whose surface is in contact with the inner side of the top of the outer lid, and the inner side of the shell provides a closure toward the closing faces of the container.

As the elastic material may be rubber, disposal of a lid of this type will involve an unfortunate environmental pollution.
Also, a lid of this type with an elastic material encapsulated in another material will be relatively expensive to manufacture relative to other types of lids.

US 4,473,163 also concerns a screw lid which consists of an outer lid which is connected with the external side of a container by securing means, wherein an inner lid forms the direct seal against the upper edge of the container, and wherein the inner lid and the container edge have interposed between them a sealing layer which is arranged in an annular upwardly bent hollow in the inner lid. This results in a good seal between the container edge and the sealing material, while the inner lid contains several bends, and in several embodiments the inner lid is the only seal against the surroundings. This might cause the bends to have weaknesses that may enable the oxygen of the air to penetrate through the inner lid and thereby create contamination of the inner volume of the container.

Another drawback of the invention as described here is the sealing layer which is present between the upper edge of the container and the inner lid, since the disposal of this might perhaps give rise to unnecessary pollution.

It is unfortunate that the outer lid is open in the centre if the container is to have a considerable negative pressure. Hereby, the pressure difference will prevail on the surface of the entire inner lid. Further, the inner lid can easily be broken if it is subjected to mechanical impacts, and there will be direct access from the external atmosphere to the interior of the container. During opening of the lid, the large number of projections will try to lift the inner lid on its entire cir-
cumference. Then a great force is to be applied in order to lift off the inner lid. This is just possible in a situation where the internal volume in the container is subjected to a modest negative pressure. In particular if the containers have a large diameter, the method will be directly unfortunate.

US 4 637 519 discloses an inner lid consisting of a metal layer with a layer of heat-activated adhesive polymer facing toward a container edge.

The object of the invention is to provide an effective closure system for a container, which is simultaneously easy to open, wherein an inner lid may be used without further sealing material, and wherein the closure system may be disposed of with a minimum of environmental pollution.

This may be achieved with a closure system like the one described in the opening paragraph, if the inner lid forms a face whose shape is adapted to the internal configuration of the outer lid and the edge of the container, wherein the inner lid comprises at least first and second polymer layers, and wherein a first polymer layer cooperates with the edge of the container, and wherein the first polymer layer has a flexibility for accommodating the irregularities of a container edge, and wherein the second polymer layer has a low friction against the outer lid which allows a relative movement between the outer lid and the inner lid, and wherein the second polymer layer has a great flexural rigidity, and wherein at least one of the polymer layers has barrier properties against gas. The two plastics layers are
joined by gluing, heat welding, lamination or optionally mechanical locking.

This results in an effective closure of a container which will be closed by two independent lids. The outer lid ensures the first covering of the container, said outer lid protecting against all larger particles. Gas atoms can penetrate through cracks between an ordinary outer lid and the uneven edge of the container and thereby contaminate a container over a long period of time. The inner lid provides an additional sealing for the container, said inner lid providing a barrier against the gas atoms that penetrate through the outer lid. By depression of an inner lid, a negative pressure in the container can create a negative pressure in a volume between the outer lid and the inner lid. Hereby, a pressure difference above the outer lid may be reduced relatively to what it would be if the outer lid is the only cover for the container. The smaller pressure difference per se results in reduced diffusion through the outer lid. An outer lid will be easy to screw loose, because the outer lid can be rotated relatively to the inner lid which remains in position on the container edge during an initial unscrewing of the outer lid.

The first polymer layer may comprise a heat-activatable adhesive polymer layer facing toward a container edge. The polymer layer may hereby be fused to the container edge by heat action, whereby adhesion may be achieved, while the polymer layer may accommodate container edge irregularities, if any. The tightness along the container edge is hereby optimum. Heating and fusing of the polymer layer may take place by mounting the lid on a preheated
container, or by heating after the lid has been screwed on.

Instead, the inner lid may comprise a first polymer layer for closing against the edge of the container, wherein the first polymer layer contains soft thermoplastics, a soft elastomer or a soft polymer, and wherein the inner lid also comprises a second polymer layer having good gas barrier properties. As a result sealing against the container edge may be achieved without melting of the polymer layer, so that opening of the container will be easy.

The inner lid may advantageously comprise a third polymer layer between the other two layers containing a barrier material. The inner lid may hereby achieve a better barrier against diffusion of gas. Examples of such barrier materials that may be used include polyvinyl alcohol or Blox® from Dow Chemicals.

Alternatively, the third layer may contain aluminium as a gas barrier. It is known that a thin layer of aluminium forms an effective barrier against oxygen.

The first polymer layer may advantageously contain a low-crystalline polyolefin. This allows a simple and inexpensive seal against a container edge to be formed, since such materials are soft and flexible.

As an example of this, the first polymer layer may contain low density polyethylene. An alternative simple and inexpensive seal against a container edge may be achieved hereby.
The second polymer layer may contain polyolefin. Hereby, the uppermost layer toward the inner lid may have such a low friction that movement of the outer lid takes place with a low torque.

As an example of a polyolefin, the second polymer layer may contain polyethylene, preferably high density polyethylene, or polypropylene. As a result, the inner lid may be used at high temperatures, while ensuring low friction against the outer lid.

As an alternative, the second polymer layer may contain polypropylene, ethylene vinyl acetate plastics or polyester. The uppermost layer toward the outer lid may hereby have such a low friction that movement of the outer lid takes place with a low torque. This is particularly advantageous if the outer lid is made as a lacquered metal lid.

In a preferred embodiment, the diameter of the inner lid is larger than the external diameter of the container neck, but at the same time smaller than the internal diameter of the outer lid. The inner lid hereby fits in an outer lid, and the inner lid has an edge which protrudes beyond the container edge. The protruding edge may advantageously be used as an engagement face for an opening means which can press the inner lid out of contact with the container edge.

In a special embodiment, the centre of the inner lid is secured to the outer lid with a rotatable securing means, wherein a negative pressure in the container through the inner lid pulls the centre of the outer lid downwards, thereby deflecting a central part of the surface of the
outer lid downwards. As a result, monitoring of a negative pressure in the container may be achieved. In the production, the downward deflection of the centre of the outer lid may be checked by technical measuring systems. Further, a consumer can check whether a container has a negative pressure.

The annular side of the outer lid may contain at least one projection which points radially toward the centre, and which extends from the inner side of the annular side, said projection pressing the edge of the inner lid out of contact with the upper edge of the container neck at least at one point when the lid is screwed off. The outer lid may hereby affect the inner lid with a point pressure force which leads to the formation of a channel between the inner lid and the container edge, thereby venting the container.

The inner lid may advantageously have a rigidity that causes an open channel, which vents the container, to be formed as soon as the projection begins to move the edge of the inner lid upwards. The necessary rigidity of the inner lid may be achieved either in that the inner lid consists of metal, as mentioned, or in that it may be made of relatively rigid plastics. Various composite materials may be used to advantage.

Moreover, it will be an advantage to compose the lid of layers of several different materials, where one of the layers may be of metal. The use of layers of different materials may result in the achievement of a low friction against the screw lid, which may thus be rotated without the inner lid being rotated at the same time, and, optionally, good adhesion may be intended between the inner
lid and the uppermost edge of the container to achieve an optimum sealing.

The invention ensures that sealing against ingress of e.g. oxygen or other gases must take place below the inner lid along the uppermost edge of the container. This provides a relatively thin sealing face with a long path of diffusion.

The invention will be explained more fully below with reference to the accompanying drawing, in which:

Fig. 1 shows a possible embodiment of a screw lid according to the invention seen in section along the line I-I,

Fig. 2 shows a possible embodiment of a screw lid according to the invention seen from the bottom of the lid,

Fig. 3 shows a second embodiment of a screw lid according to the invention seen in section,

Fig. 4 shows a third embodiment of a screw lid according to the invention seen in section along the line IV-IV, and

Fig. 5 shows the third embodiment of a screw lid according to the invention seen from the bottom,

Fig. 6 shows a section through a possible embodiment of an inner lid,

Fig. 7 shows a section through another possible embodiment of an inner lid.
Fig. 1 shows a screw lid 1 in relation to a neck 2 of a container 15, and this neck 2 of the container 15 comprises means for securing the screw lid 1 in the form of outer convolutions/threads 12. The screw lid 1 is shown in section and comprises a cylindrical side 3 having on its inner face an annular bead/screw part 4 (fig. 2) which protrudes radially from said side, and preferably extends from the lower termination face of the side 3. The opposite end of the side 3 terminates in a top part 6, which is essentially shaped as a plane sheet in integral connection with the side 3. In the lid there is a loose, circular sheet called the inner lid 5 whose diameter essentially corresponds to the diameter of the side 3 and is larger than the external diameter of the container neck. A projection 13 in the form of a cylindrical or box-shaped pin protrudes from the inner face of the side 3, said projection 13 having an extent so as to engage with the peripheral part of the inner lid 5, i.e. from the edge and a small distance therefrom, preferably 1-3 mm, at which the free end 7 of the projection ends. The projection 13 may be shaped as a cylinder or as a decided plane face, the essential point being that it has a small extent so that when the lid is removed, and the venting function is released, the force applied must be distributed over as small an area as possible, so as to achieve partly a great torque, partly a great pressure at the location concerned. Further projections 14 may be arranged in the screw lid, and these further projections 14 are all arranged at a greater distance from the inner lid 5 than the active projections 13, said further projections exclusively serving to ensure that the inner lid does not drop out. The further projections 14 are essentially shaped like the projections 13.
Fig. 2 shows the position of the projections (13, 14) seen from the bottom, said projections being offset 120°.

Fig. 3 shows the screw lid 1 shown in fig. 1, but here these further projections 14 do not form part of the structure.

Fig. 4 shows a third embodiment of the invention, where the position of the projection 13 is the same as stated before, but where the inner lid 5 itself may be formed with a circular hole 10 whose centre coincides with that of the inner lid 5. In order to still ensure a tightly sealed screw lid 1 and container, a sealing ring 9 is arranged between the upper side of the inner lid 5 and the underside of the top part 6, and this sealing ring 9 is positioned radially relative to the hole so as to provide a tight connection between the inner lid 5 and the top part 6.

Fig. 6 shows a section through a possible embodiment of an inner lid having at least first and second polymer layers. A first polymer layer 21 cooperates with the edge of the container, and the first polymer layer 21 is flexible so as to accommodate the irregularities of a container edge, and the second polymer layer 22 has a low friction against an outer lid 6 which allows a relative movement between the outer lid and the inner lid 6. The second polymer layer 22 may have a great flexural rigidity, where at least one of the polymer layers 21, 22 may advantageously have barrier properties against gas.

Fig. 7 shows a possible alternative embodiment of an inner lid which differs from fig. 6 in that between the
first polymer layer 21 and the second polymer layer 22 there is a third layer 23 which is arranged between the two other layers, at least the third layer of the polymer layers having barrier properties against gas.
PATENT CLAIMS

1. A closure system for closing a container, wherein the lid comprises an inner lid and an outer lid, wherein the container has a neck with an edge, and wherein the lid comprises a top and an annular side, wherein the sides of the lid have means for attachment to the container, and wherein the container has projections which cooperate with the means of the lid for attachment and sealing, characterized in that the inner lid constitutes a face whose shape is adapted to the internal configuration of the outer lid and the edge of the container, wherein the inner lid comprises at least first and second polymer layers, and wherein a first polymer layer cooperates with the edge of the container, and wherein the first polymer layer has a flexibility for accommodating the irregularities of a container edge, and wherein the second polymer layer has a low friction against the outer lid which allows a relative movement between the outer lid and the inner lid, and wherein the second polymer layer has a great flexural rigidity.

2. A closure system for closing a container according to claim 1, characterized in that the first polymer layer comprises a heat-activatable adhesive polymer layer facing toward a container edge.

3. A closure system for closing a container according to claim 1, characterized in that the inner lid comprises a first polymer layer for closing against the edge of the container, wherein the first polymer layer contains soft thermoplastics, a soft elastomer or a soft polymer, and wherein the inner lid also comprises a third polymer having good gas barrier properties.
4. A closure system for closing a container according to one of claims 1 to 3, characterized in that the inner lid comprises a second polymer layer containing thermoplastics which covers the third polymer layer, said second polymer layer being in contact with the outer lid.

5. A closure system for closing a container according to one of claims 1 - 4, characterized in that a third layer between the two polymer layers contains aluminium.

6. A closure system for closing a container according to one of claims 1 - 5, characterized in that the first polymer layer contains a low-crystalline polyolefin.

7. A closure system for closing a container according to one of claims 1 - 6, characterized in that the first polymer layer contains a low density polyethylene.

8. A closure system for closing a container according to one of claims 1 - 7, characterized in that the second polymer layer contains polyolefin.

9. A closure system for closing a container according to one of claims 1 - 8, characterized in that the second polymer layer contains polyethylene.

10. A closure system for closing a container according to one of claims 1 - 9, characterized in that the second polymer layer contains polypropylene.

11. A closure system for closing a container according to one of claims 1 - 10, characterized in that the second polymer layer contains ethylene vinyl acetate copolymer.
12. A closure system for closing a container according to one of claims 1 - 11, characterized in that the second polymer layer contains polyester.

13. A closure system for closing a container according to one of claims 1 - 12, characterized in that the diameter of the inner lid is larger than the external diameter of the container neck, but at the same time smaller than the internal diameter of the outer lid.

14. A closure system for closing a container according to one of claims 1 - 13, characterized in that the centre of the inner lid is secured to the outer lid by a rotatable securing means, wherein a negative pressure in the container through the inner lid pulls the centre of the outer lid downwards, thereby deflecting a central part of the surface of the outer lid downwards.

15. A closure system for closing a container according to one of claims 1 - 13, characterized in that the annular side of the outer lid has at least one projection which points radially toward the centre, and which extends from the inner side of the annular side, said projection pressing the edge of the inner lid out of contact with the upper edge of the container neck at least at one point when the lid is screwed off.


**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7  B65D51/20  B65D51/22

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**

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

**Date of the actual completion of the international search**

12 December 2001

**Date of mailing of the international search report**

08:02 02

**Name and mailing address of the ISA**

European Patent Office, P.B. 5318 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 540-5000, Tx. 31 651 apn nl, Fax: (+31-70) 340-3016

Authorized officer

Anette Hall

Form: PCT/ISA/10 (second sheet) (July 1992)
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INTERNATIONAL SEARCH REPORT

Box I  Observations where certain claims were found unsearchable (Continuation of item 1 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.: 14 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:

   see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 8.4(a).

Box II  Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

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.
Continuation of Box I.2

Claims Nos.: 14

Present claim 14 relates to an extremely large number of possible devices. Support within the meaning of Article 6 PCT and disclosure within the meaning of Article 5 PCT is not to be found. In the present case, the claim so lack support and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, claim 14 also lacks clarity. An attempt is made to define the device by reference to results to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out only for the alleged result within the scope of claim 1.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.
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