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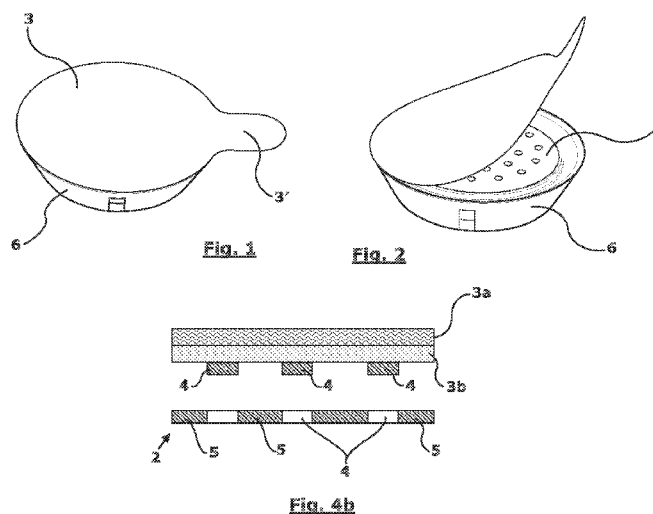
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(54) Title: DIFFUSER OF ACTIVE AGENTS SUCH AS INSECTICIDES, PERFUMES, DETERGENTS OR DISINFECTANTS,
AND MANUFACTURING PROCESS THEREOF



(57) Abstract: Diffuser of an active liquid agent, for the treatment of a fluid environment, be it at the gaseous or liquid state, of the type comprising a container (1) of the active agent, closed by grid means apt to maintain in position said active agent and to allow the emanation of fluids of the same, said grid means being covered by a barrier film, peelable at the time of the first use to make operative said grid means, wherein said container (1) is closed by a single multilayer film (2, 3a, 3b) comprising at least one external barrier layer (3a) and at least another inner sealing layer (2) apt to maintain in position said active agent and to form said grid means, at the time of the first use of the container, following the simultaneous removal of said barrier film and of predefined portions (4) of said sealing layer (2).

DIFFUSER OF ACTIVE AGENTS SUCH AS INSECTICIDES, PERFUMES, DETERGENTS OR DISINFECTANTS, AND MANUFACTURING PROCESS THEREOF

DESCRIPTION

FIELD OF THE INVENTION

5 The present invention relates to a diffuser of active liquid agents - such as for example insecticides, perfumes, detergents or disinfectants - for the treatment of a surrounding fluid environment, be it at the gaseous or liquid state, that are imbued in a solid or gel-like support. Such a diffuser is of
10 the type having at least one wall closed by a containment grid of the solid or gel-like support of the active agent and by a removable barrier film, impermeable to fluids, which covers the active agent and the grid during the diffuser storage and
15 process of such a diffuser.

PRIOR STATE OF THE ART

 Devices consisting of a box-shaped container of the above indicated type are well known in the art; they are used to make up a large supply of active agents which - as it happens for
20 many products treating a liquid or gaseous environment - are sufficiently soluble or evaporable in the fluid of which said environment consist, to cause a slow release of the active agent towards the environment, through said grid. Said emission may possibly be accelerated with the aid of an additional heating of
25 the fluid flowing around the device.

 In known diffusers, the grid has the following functions:

- retaining the active agent support in a correct and stable position inside the diffuser;
- avoiding the contact between the active agent and the
30 hands or other parts of the user's body;
- allowing the emission of the active agent towards the surrounding environment, once the external barrier layer has been removed;

 and is made of a solid material, preferably an injection-moulded
35 plastic material.

 As already said, in order to prevent the diffusion of the

active agent from starting before the first use of the diffuser by the user, a barrier film impermeable to fluids is applied on-
to the external side of the grid. A stable adhesion between the
grid material and the barrier film is obtained by means of an
5 adhesive or by thermal welding. The adhesion strength between
these two elements must be sufficiently high to prevent the ac-
tive agent from leaking between the grid and the barrier film or
the barrier film from accidentally detaching during transport,
storage and sale, and yet still sufficiently low to allow the
10 user to remove the barrier film at the time of use without ex-
cessive effort.

Normally, the remaining surface of the diffuser body con-
sists of continuous walls of plastic material, which the active
agent cannot pass through; it is possible to provide a second
15 grid also on the opposite side of the diffuser body, in order to
have a higher overall emission rate of the active agent.

The following are mentioned among the drawbacks of the
existing solutions of this type:

- as said above, the grids are usually made of injection-
20 moulded plastic material; this involves the production of
a separate element in addition to the container, which
has its own cost of production and an additional cost for
assembling it on of the diffuser body, before the appli-
cation of the barrier film;
- 25 - the application process of the barrier film on the grid
has a certain complexity (label positioning, non-flatness
of the injection-moulded piece, positioning differences
between pieces, etc.) possibly resulting in an impairment
of the final quality of the manufactured item;
- 30 - the active substance may interact with the adhesive layer
during its application or hinder the thermal welding pro-
cess thus leading to an early separation of the barrier
film from the grid.

SUMMARY OF THE INVENTION

35 The object of the invention is therefore to provide a
structure for a diffuser that:

- overcomes the above mentioned drawbacks in the manufacturing process of the known-type diffusers, by reducing the number of pieces to be manufactured and consequently simplifying the assembly step;
- 5 - provides better performances with reference to the adhesion stability of the barrier film and, consequently, to any possible active agent leaking;
- allows the user an easier start-up operation of the activation function of the diffuser; and, finally,
- 10 - exhibits a reduced manufacturing cost compared to diffusers of the known art.

This multiple object is fully achieved by a diffuser of an active liquid agent, for the treatment of a fluid environment, be it at the gaseous or liquid state, of the type comprising a container (1) of the active agent, closed by grid means apt to retaining in position said active agent and to allow the emanation of fluids of the same, said grid means being covered by a barrier film, peelable at the time of the first use to make operative said grid means, wherein said container (1) is closed by a single multilayer film (2, 3a, 3b) comprising at least one external barrier layer (3a) and at least another inner sealing layer (2) apt to retaining in position said active agent and to form said grid means, at the time of the first use of the container, following the removal of said barrier film and of predefined portions (4) of said sealing layer (2).

Other preferred features of the invention are disclosed in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the invention will anyhow be more evident from the following detailed description of some preferred embodiments of the same, provided as a mere and non-limiting example and illustrated in the attached drawings, wherein:

Fig. 1 is a perspective view of a diffuser according to a first embodiment of the invention, in the closed configuration prior to use;

Fig. 2 is a view similar to Fig. 1, taken while removing, by peeling it, part of the multilayer film which closes the diffuser;

Fig. 3 is a perspective view similar to Fig. 2, with part of said closing film completely removed;

Figs. 4a and 4b are schematic, greatly enlarged, cross-sectional views, of the whole closing film (Fig. 1) and of the portion of said film that remains adhering to the container after the opening of the diffuser device (Fig. 3), respectively;

Fig. 5 is an exploded perspective view of a second embodiment of the diffuser of the present invention;

Fig. 6 is a view similar to Fig. 5, after the sealing film removal;

Fig. 7 is an exploded perspective view of a third embodiment of the diffuser of the present invention; and

Fig. 8 is a view similar to Fig. 7, after the sealing film removal.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

As outlined in Figures 1 to 3, a diffuser according to the present invention consists of a container body 1 for the active liquid agent, and a multilayer sealing film 3, which is welded to the body 1. The active liquid agent can be totally imbued in a solid or gel-like support, or it can be contained in a reservoir which is separated from the multilayer sealing film by a solid support apt to be imbued with the active liquid agent and which therefore acts as a wick. In any case, thus, the multilayer sealing film 3 is in contact with a solid internally, and in contact with the environmental fluid, in the gaseous or liquid state, , externally.

According to the present invention, the multilayer sealing film 3 is directly applied on the edge of the container 1 and is able to serve both as a grid and a barrier layer, which functions, in known diffusers, were performed by two separate components. In order to achieve this innovative and striking result, the closing multilayer film consists of the following coupled layers:

- an inner sealing layer 2, apt to maintain in stable position the solid or gel-like support of the active agent, which has an inner structure of incisions which run through the entire thickness of said layer, according to a predefined pattern;

5 - an external barrier layer 3a, apt to prevent the active agent from leaking outwards;

 - an intermediate release layer 3b, apt to facilitate the detachment by peeling between said intermediate release layer 3b and the inner layer 2, when a sufficient traction effort is imparted to the external layer 3a of barrier material through its projecting tab 3'.

10 Optionally, a further layer (not shown in the figures) can be applied on the external layer 3a of barrier material, the whole to confer to the same additional chemical and/or mechanical protection.

15 The inner layer 2 of the closing multilayer film of the present invention can be defined as a layer "provided with an inner structure of incisions" or more briefly as a "structured" layer, because this layer is cut throughout its depth according to one or more closed lines of a desired shape, which delimit the perimeter of incision areas 4 which are therefore no longer laterally connected to the remaining part of the film 2. Thus, when the peelable part of the closing multilayer film 3 - i.e. both the layers 3a and 3b - are removed, through the tearing action on tab 3', the incision areas 4 of layer 2 remain adhering to the overlying layer 3b and they are removed with it, while on the free surface of the container 1 remains only the part 5 of the sealing layer 2, freed from the incision areas 4, therefore having a plurality of orifices 6. In this way, this part 5 of the sealing layer 2 is therefore able to perform the same functions as seen above for the grid of the known-art diffusers, i.e. keeping the solid or gel-like active agent support in position, while allowing the emission of the agent to the surrounding fluid environment, be it at a gaseous or liquid state, in the form of vapours or solution, respectively.

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In order to obtain that the incision areas 4 of the sealing layer 2 remain adhering to the layer 3b while the portion 5 of layer 2 remains adhering to the edge of the container, it is sufficient to operate as follows: on one hand, care is taken to secure the contour of the closing multilayer film, and therefore of its inner sealing layer 2, to the upper flange edge of the container 1 in a particularly accurate manner, for example by thermal welding, so that this fixing offers a great mechanical strength in terms of detachment from the container 1. On the other hand, a structure of incision areas is formed in the sealing layer 2 with the following conformation: the incision areas are delimited by a closed perimeter; the incisions go through the entire thickness of the sealing layer 2; the incision areas preferably do not intersect; and, preferably, the incision areas do not extend in the perimeter area of the layer 2, so that the remaining part 5 of this layer, after removal of said incision areas 4, still has a sufficient mechanical strength.

In this way, when the barrier portion 3a and 3b of the closing multilayer film is removed by peeling, by pulling the tab 3', the perimeter edge of the sealing layer 2 - which, as said, is firmly fixed to the flange edge of the container 1 - together with the remaining portion 5 of the same layer, remains adhering to the container 1; while the incision areas 4 - which, as a result of said incisions, are no longer joined laterally to the remaining part of the sealing film 2 - will be removed thanks to their adhesion to the release layer 3b.

The depth of said closed-perimeter incision lines is not necessarily strictly limited to the layer 2, but it can extend further within the release layer 3b and possibly also affect the entire thickness of this release layer 3b, thus making the adjustment of the cutting depth during the manufacturing process less critical. Obviously, it is preferable that the cutting action not to reach the barrier layer 3a, typically of aluminium, so as not to risk damaging the integrity of this layer, which action could reduce the overall barrier properties of the closing multilayer film of the present invention.

A cutting process for manufacturing such a closing multi-layer film according to the invention is the one which provides for the use of a standard Form Fill Seal machine type, commonly used in the flexible packaging industry, and to perform the cutting operation of the sealing layer 2 in a stage preceding the sealing closure of the container 1. In this way, it is possible to obtain more easily a good positioning of the different incision areas 4 with respect to the inside of the cavity of the container 1.

The incision can be done mechanically, with blades designed to reach a certain depth inside the sealing layer 2, and optionally the release layer 3b. Alternatively, the cut can be made using a thermal-action knife (thermocutter) which can dissolve the plastic material layer 2. Preferably, the cut will be rather performed using laser cutting technology, where the applied power control can be performed in a very precise way, so as to achieve a certain desired cutting depth. This latter process is particularly preferred because it does not involve specific mechanical equipment according to the cutting pattern, so that different patterns of incision areas 4 may be obtained with the same cutting machine, thus allowing to manufacture products with different features and performances just by appropriately programming said cutting machine. It is quite clear that the distribution and the geometry of the incision areas 4 will be defined from time to time according to the specific application requirements.

In the following, the diffuser of active agents of the present invention will be described with reference to some specific examples of application.

Example 1 - Container of active agents on a solid support (Figs. 1-3)

The container 1 is made from a PE plastic material, 1.5 mm thick, injection moulded in the shape of a circular cup with a diameter of 50 mm.

Inside this container 1 a cellulose pad is placed, impregnated with an active liquid substance (perfume, disinfect-

ant, insecticide, etc.) having similar dimensions to the inner diameter of the circular cup, so as to find a stable position within the container.

5 A closing multilayer film according to the invention is positioned on top of the container and heat-sealed on the contour flange of the cup of the container 1.

The closing multilayer film consists of, from inside outwards, a PE sealing layer 2, a PP release layer 3b, an aluminium barrier foil 3a, which acts as a barrier layer, and by a further
10 external PET protection layer.

The PE sealing layer 2 is cut according to multiple incision areas 4, having a circular geometrical shape with a diameter of about 2 mm. Their position is distributed in a regular manner in correspondence with the central area of the container
15 1.

When the aluminium barrier layer 3a is removed, together with the PP release layer 3b, the PE material corresponding to the above multiple incision areas 4, formed in the sealing layer 2, is simultaneously removed, creating round holes 6 in said PE
20 sealing layer 2. Through these holes 6, the active substance imbued in the pad - in the form of vapour or solution, depending on whether the container 1 is positioned in a gaseous or liquid environment - can be emanated, while the pad itself is kept in position and inhibited from contact with the user from the remaining portion 5 of the inner PE sealing layer 2.
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Example 2 - Container of active liquid agents with wick (Figs. 5-6)

The container 1 in this case consists of a sheet of PET/EVOH/PE, having a thickness of 450 microns, thermoformed so
30 as to have a flat perimeter flange and a central cavity that comprises two different depth zones; more precisely, an area with greater depth of about 20 mm, for containing the active liquid agent 8, and an area elongating upward having a much lower depth of about 2 mm.

35 A porous cellulose element 7 having a Y-shape and thickness of about 2 mm, which acts as a wick, is disposed between

the container 1 and the closing multilayer film 3, inhibiting a direct contact between said multilayer film 3 and the active liquid agent 8. The elongated portion of the wick 7 is disposed in the cavity of lesser depth of the thermoformed container 1, while the two diverging ends of the Y shape are placed in respective low-thickness cavities formed in the perimeter flange.

The closing multilayer film consists, as in the previous Example, of a PE sealing layer 2, a PP release layer 3b, an aluminium barrier foil 3a and a further PET external protection layer.

The PE sealing layer 2 is cut according to a circular incision area, so as to create in the same - after peeling of the barrier layer 3a and of the release layer 3b, by acting on tab 3'- a single circular orifice 6 of the diameter of 10 mm in an area facing the central part of the wick. Preferably, in the process of application of the multilayer film to the container 1, the edge of such circular orifice 6 is welded to the wick 7, so as to avoid any possible leaking of active liquid agent between the wick and the multilayer film.

The container thus formed can then be directly associated with a heating device to obtain the emanation of the active agent at a controlled temperature above room temperature.

Example 3- Container of active liquid agents with wick (Figs. 7-8)

A container 1 is formed in the same manner described in Example 2 and a similar wick 7 is disposed in the same. The closing multilayer film consists, as in the previous Example, of a PE sealing layer 2, a PP release layer 3b, an aluminium barrier foil 3a and a further PET external protection layer, in which a circular orifice 6 is cut as in Example 2.

Unlike the previous example, the PE sealing layer of the multilayer film is, however, permeable only to vapours of the active agent. In addition, a guide 9 and an incision line 10 are formed on the barrier layer 3a in the manner described in detail in the Italian patent application no. 102015000022867, in the name of the same Applicant.

In this combined solution, when the user activates the device by means of peeling the barrier layer 3a, the barrier layer is removed only in its upper portion while it remains intact in the lower part which covers the portion of the active agent reservoir 8 having a greater depth.

Thanks to this construction, it is therefore possible to use the diffuser of the invention either in the same way described in the above-mentioned patent, i.e., by exploiting only the natural evaporation rate of the active substance, or by combining the diffuser with a heating device, to obtain an increased active agent emanation, through the wick 7 and the orifice 6.

It is understood, however, that the invention is not to be considered as limited by the particular arrangements illustrated above, which represent only exemplary implementations of the same, but different variants are possible, all within the reach of a person skilled in the art, without departing from the scope of the invention itself, as defined by the following claims.

CLAIMS

1) Diffuser of an active liquid agent, for the treatment of a fluid environment, be it at the gaseous or liquid state, of the type comprising a container (1) of the active agent, closed by grid means apt to maintain in position said active agent and to allow the emanation of fluids of the same, said grid means being covered by a barrier film, peelable at the time of the first use to make operative said grid means, **characterised in that** said container (1) is closed by a single multilayer film (3) comprising at least an external barrier layer (3a) and at least another inner sealing layer (2) **and in that** said inner sealing layer (2) is apt to maintain in position said active agent and to form said grid means, at the time of the first use of the container, following the simultaneous removal of said barrier film and of predefined portions (4) of said sealing layer (2).

2) Diffuser as in claim 1, wherein said multilayer film (3) furthermore comprises an intermediate release layer (3b) between said barrier layer (3a) and said sealing layer (2).

3) Diffuser as in claim 2, wherein said multilayer film (3) comprises:

- an inner sealing layer (2), apt to maintain in stable position the active agent support, internally structured with incisions which run through the entire thickness of said layer according to a predefined pattern;
- an external barrier layer (3a), apt to prevent the outward leaking of the active agent;
- an intermediate release layer (3b), apt to facilitate the detachment by peeling between said intermediate release layer (3b) and the inner sealing layer (2), when a sufficient traction effort is imparted to the external barrier layer (3a).

4) Diffuser as in claim 3, wherein said multilayer film (3) comprises an inner sealing layer (2) of PE plastic material, an intermediate release layer (3b) of PP plastic material and an

external barrier layer (3a) of aluminium.

5) Diffuser as in claim 3, wherein said multilayer film (3) furthermore comprises, outside said external barrier layer (3a), a further layer of PET plastic material for additional chemical and/or mechanical protection,.

6) Diffuser as in any one of the preceding claims, wherein the peripheral inner edge of said multilayer film of sealing material (2) is thermally welded onto the flange edge of said container (1).

10 7) Diffuser as in any one of the preceding claims, wherein said inner sealing layer (2) has an inner structure of incisions which extend at least across the entire depth thereof, according to one or more closed lines which delimit the perimeter of removable areas (4), no longer laterally connected to the remaining part of said inner sealing layer (2).

15 8) Diffuser as in claim 7, wherein said removable areas (4) of the inner sealing layer (2) remain adherent to said external barrier layer (3a), leaving corresponding cavities in said sealing layer (2), following the removal of said external barrier layer (3a).

20 9) Diffuser as in any one of claims from 1 to 8, wherein said active liquid agent is imbued in a solid or gel-like support.

10 11) Diffuser as in any one of claims from 1 to 8, wherein said active liquid agent is separated from said multilayer film (3) by a porous solid support (7) acting as wick.

11) Diffuser as in claim 10, wherein said inner sealing layer (2) is permeable to the vapours of said active liquid agent.

30 12) Diffuser as in claims 10 or 11, wherein said inner sealing layer (2) is welded to said porous solid support (7) acting as wick, in correspondence of the edges of said orifices 6 formed in the same.

35 13) Manufacturing process of a diffuser as in any one of the preceding claims, characterised in that it comprises the

steps of:

- forming a multilayer film, with at least an inner sealing layer (2) and at least an external barrier layer (3a), with a release layer (3b) arranged in between;
- 5 - cutting at least said sealing layer (2) according to closed-perimeter incision lines which run through the entire thickness of said layer, according to a predefined pattern which defines removable areas (4) no longer laterally connected with the remaining part of said inner sealing layer (2);
- 10 - applying and accurately welding the inner edge of said multilayer film onto the flange edge of said container (1).

14) Process as in claim 13, wherein said incision lines
15 extend at least partly into said intermediate release layer (3b).

15) Process as in any one of claims 13 and 14, wherein said incision lines are performed mechanically, with cutting blades at a controlled cutting depth.

20 16) Process as in any one of claims 13 and 14, wherein said incision lines are performed thermo-mechanically, with thermal-action knives with controlled cutting depth.

17) Process as in any one of claims 13 and 14, wherein said incision lines are performed with a laser cut, adjusting
25 the cutting depth by controlling the applied power.

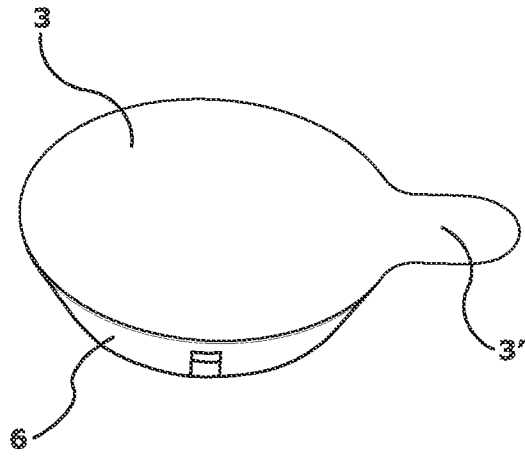


Fig. 1

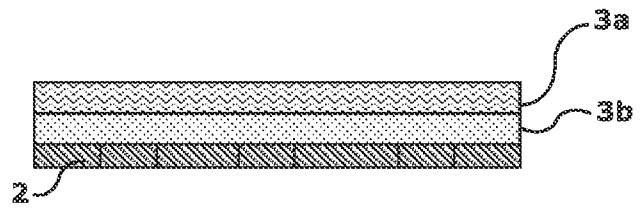


Fig. 4a

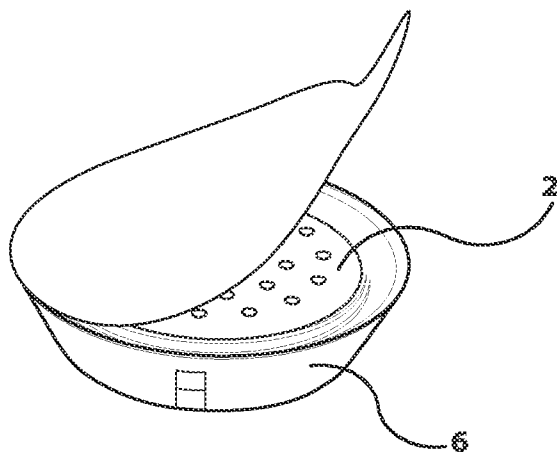


Fig. 2

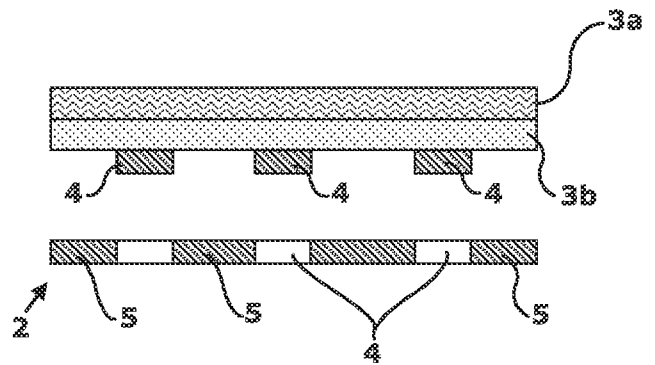


Fig. 4b

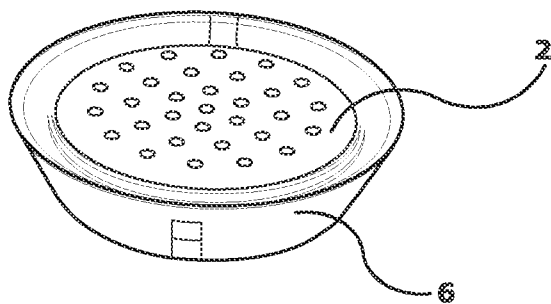


Fig. 3

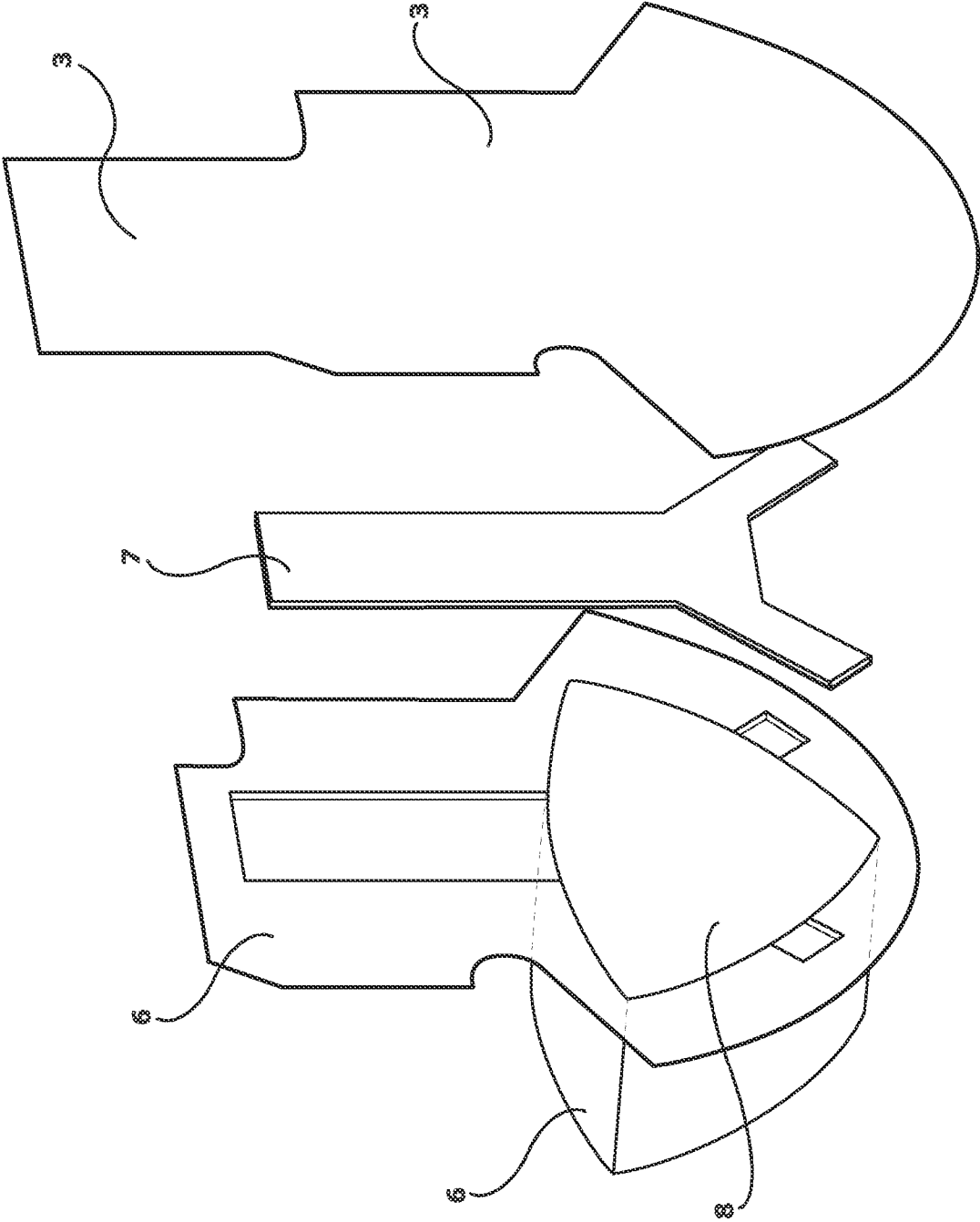


Fig. 5

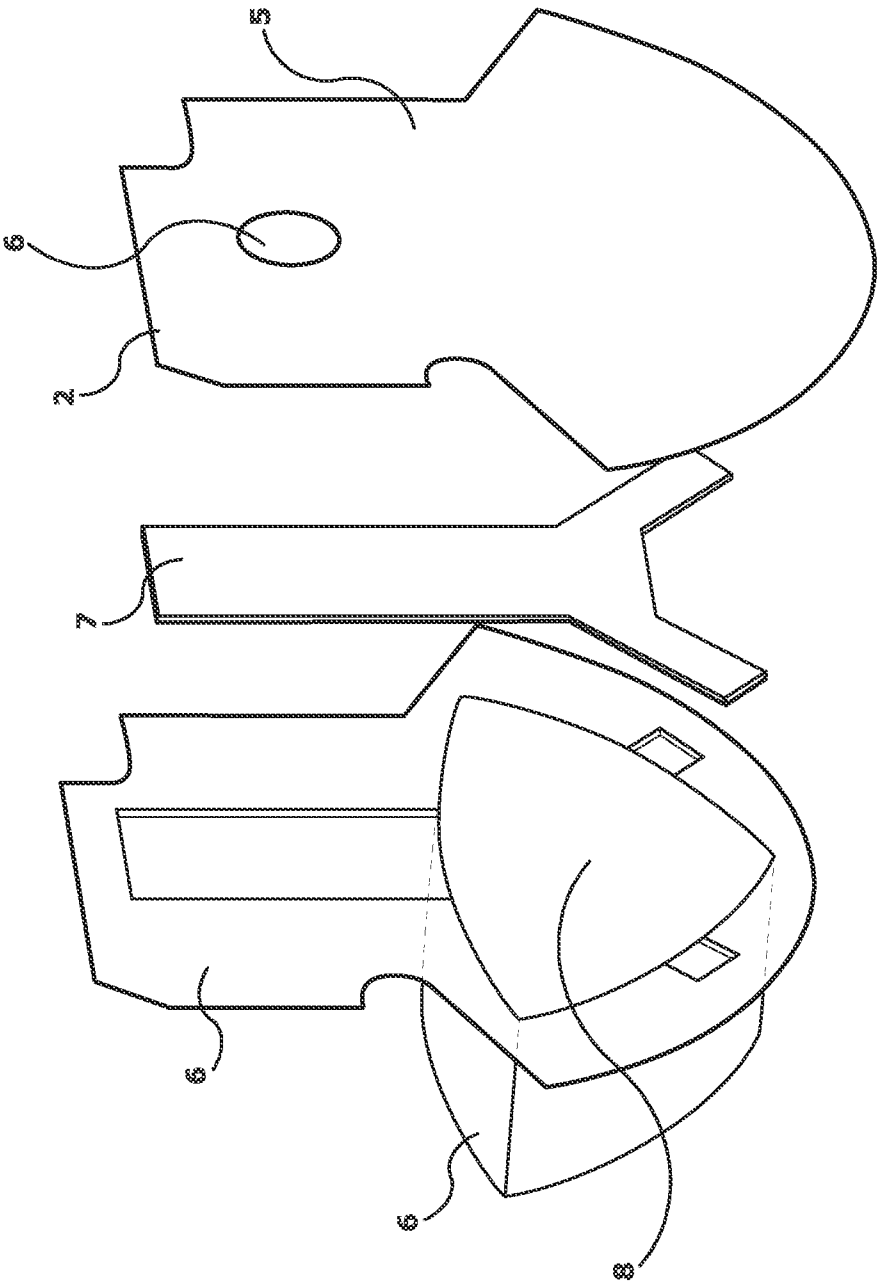


Fig. 6

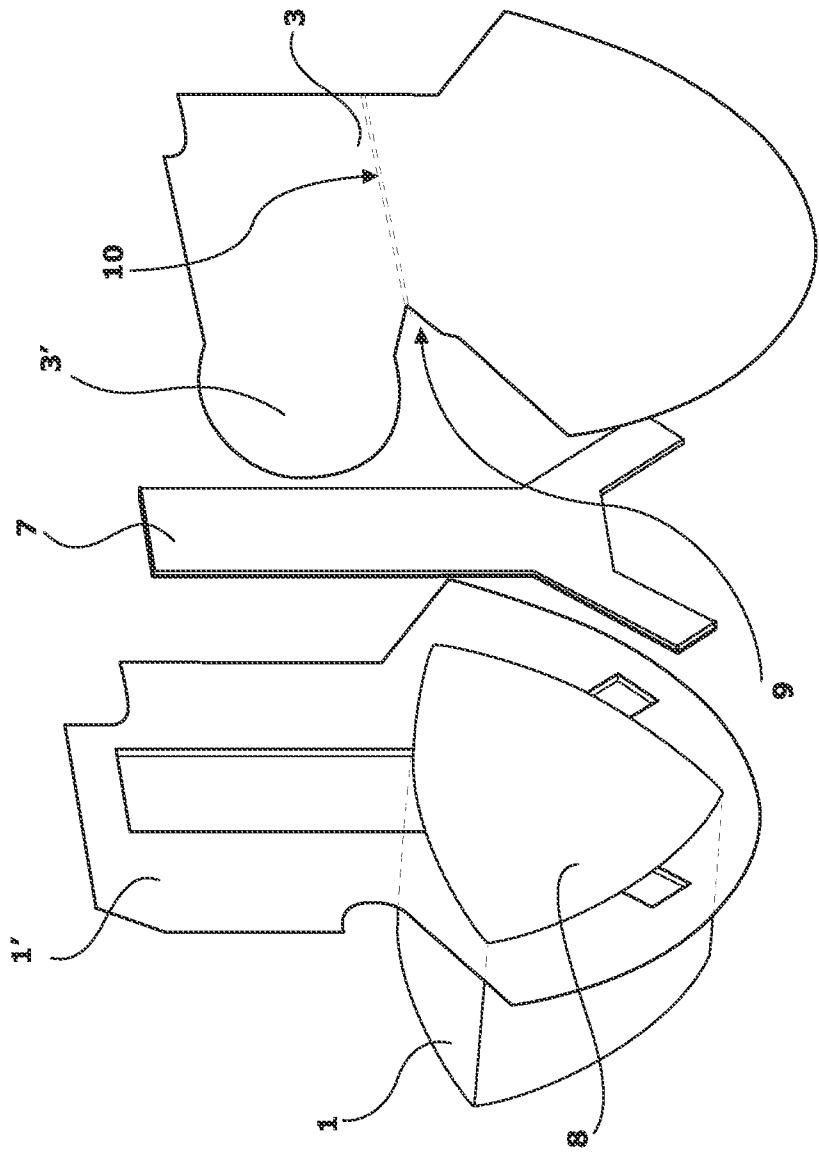


Fig. 7

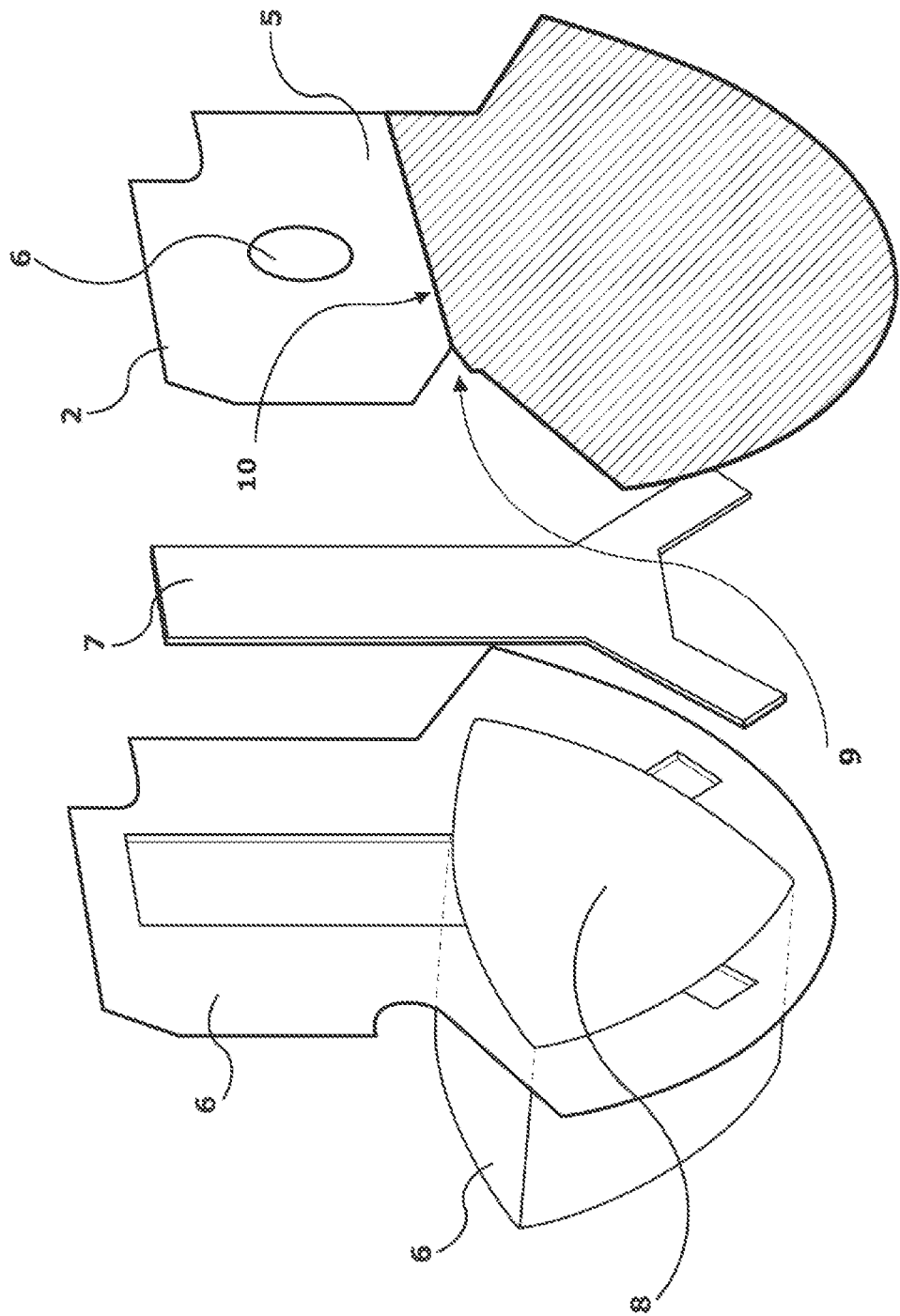


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/058034

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61L9/12 B32B7/06 B32B3/30 B65D75/58
ADD.

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)

A61L B32B 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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94/27646 A1 (MINNESOTA MINING & MFG [US]) 8 December 1994 (1994-12-08) page 14, lines 14-25; figures 1-2	1-17
A	US 4 767 016 A (COOK JR HAROLD [US] ET AL) 30 August 1988 (1988-08-30) figures 1, 3-5	1-17

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date		Patent family member(s)		Publication date
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