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(54) **SEALING STRUCTURE FOR PACKAGING BOX, PRODUCTION PROCESS FOR SEALING STRUCTURE, AND PACKAGING BOX**

(57) Disclosed are a sealing structure for a packaging box, a production process for the sealing structure, and a packaging box. The sealing structure includes: a pull piece (1), an inner membrane (5), and a plug sheet (2), the pull piece covers an outer side of an opening in a packaging box, an area of the pull piece is greater than that of the opening, and the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than

that of the opening; the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening. By providing the sealing structure on the packaging box, the opening of the packaging box is able to be repeatedly opened and closed, thereby effectively reducing the usage amount of plastic, which is more environmentally friendly, and reducing the manufacturing cost.

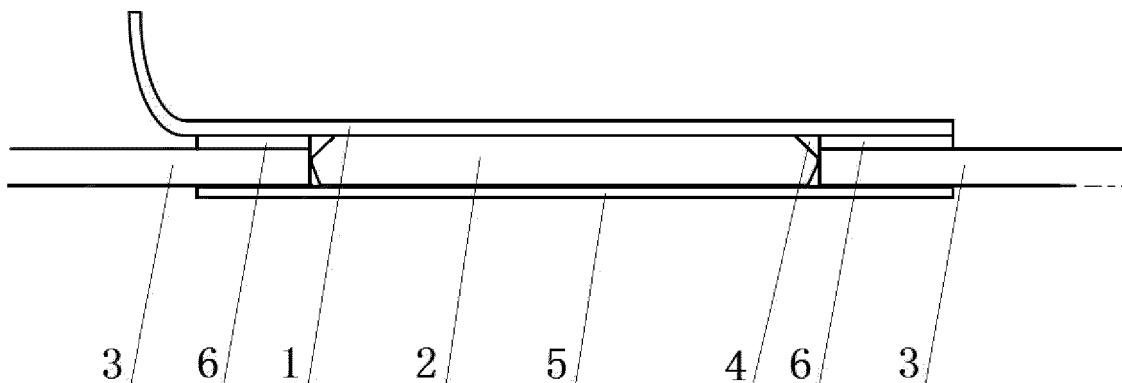


Fig. 1

Description

Cross-Reference to Related Application

[0001] The present invention claims priority to and the benefit of Chinese Patent Application No. 202111348620.0, filed to the China National Intellectual Property Administration (CNIPA) on November 15 2021 and entitled "Sealing Structure for Packaging Box, Production Process for Sealing Structure, and Packaging Box", which is hereby incorporated by reference in its entirety.

Technical Field

[0002] The present invention relates to the technical field of product packaging, and particularly relates to a sealing structure for a packaging box, a production process for the sealing structure, and a packaging box.

Background

[0003] Non-carbonated liquid foods, such as drinking water, milk, and yogurt, as well as semi-liquid foods, such as juice, are widely packaged and sold in three-dimensional packaging boxes. Packaging boxes for liquid or semi-liquid foods are usually made of a paper-based composite packaging material, formed by compounding multi-layer structures, such as a paper base layer, a barrier layer (such as an aluminum foil), a waterproof layer, and an innermost layer. The waterproof layer covers an outermost side of the composite packaging material, which can provide waterproof and dustproof performance. The paper base layer may provide stiffness for the composite packaging material. The barrier layer may block oxygen, thereby prolonging the shelf life of the liquid foods, such as liquid milk or juice. When being configured for filling of drinking water, such as mineral water or pure water, the composite packaging material may also not include the barrier layer. After the production of the composite packaging material is completed, the composite packaging material is delivered from a packaging material enterprise to a food filling enterprise, and forms a liquid food packaging box on a filling machine of the filling enterprise through the processes, such as filling, sealing, and shaping.

[0004] The liquid food packaging box is usually sealed by using a disposable seal, or a plastic packaging cover. The plastic packaging cover is not only high in production cost, but also produces a large amount of plastic waste that is difficult to degrade, which brings a heavy burden to the environment. The disposable seal used in the liquid food packaging box, such as an easy-to-pull sticker, has the advantages of being easily opened and low in cost, and is very suitable for liquid food packaging, especially small-capacity liquid food packaging. However, the easy-to-pull sticker on the conventional liquid food packaging box can only be opened once, cannot close the opening

again after being opened, and cannot be repeatedly used, so that the liquid food packaging box with the easy-to-pull sticker cannot achieve a ready-to-drink effect, and is inconvenient to carry.

Summary

[0005] In view of the above problems, the present invention provides a sealing structure for a packaging box, a production process for the sealing structure, and a packaging box, so as to overcome the above problems or at least partially solve the above problems.

[0006] In order to achieve the above object, the present invention adopts the following technical solutions.

[0007] Some embodiments of the present invention provide a sealing structure for a packaging box, the packaging box is made of a composite packaging material, the composite packaging material includes a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure includes a pull piece, an inner membrane, and a plug sheet;

the pull piece covers an outer side of an opening of the packaging box, an area of the pull piece is greater than that of the opening, and the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening;

the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and

the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening.

[0008] In some embodiments, the plug sheet is located on an inner side surface of the pull piece, and the inner membrane is fixedly connected to the plug sheet.

[0009] In some embodiments, the plug sheet is located on an outer side surface of the pull piece, and the inner membrane is fixedly connected to the pull piece.

[0010] In some embodiments, the plug sheet is located on an inner side surface of the inner membrane, and the pull piece is fixedly connected to the inner membrane.

[0011] In some embodiments, the sealing structure further includes an outer membrane. The outer membrane is arranged on the outer side of the opening, and the pull piece is arranged on an outer side of the outer membrane.

[0012] In some embodiments, an area of the outer membrane is smaller than that of the pull piece or a length of the outer membrane is smaller than that of the pull piece, and the pull piece is partially fixedly connected to the outer membrane.

[0013] In some embodiments, the plug sheet is made of plastic, paper, a paper-plastic composite material, or

a degradable biological material.

[0014] In some embodiments, the pull piece is a composite material including a barrier material and a fusible material, the barrier material is at least one of an aluminum foil or barrier paper, and the fusible material is at least one selected from plastic, Polylactic Acid (PLA) or Butyleneadipate-co-terephthalate (PBAT).

[0015] In some embodiments, the inner membrane is a Polyethylene (PE) membrane or a composite membrane.

[0016] In some embodiments, an edge of the plug sheet is provided with a chamfer or an inclined surface.

[0017] In some embodiments, the inclined surface is provided with a plurality of arc-shaped protrusions or arc-shaped grooves in a horizontal direction.

[0018] In some embodiments, a thickness of the plug sheet is 1/8 to 8 times a thickness of the base layer of the composite packaging material.

[0019] In some embodiments, the thickness of the plug sheet is 2 to 4 times the thickness of the base layer of the composite packaging material.

[0020] In some embodiments, a thickness of one side of the plug sheet is smaller than that of the other side of the plug sheet, and the pull piece is pulled from the side with a smaller thickness of the plug sheet.

[0021] In some embodiments, the sealing structure further includes a connecting component, the connecting component connects the composite packaging material with the pull piece or the plug sheet.

[0022] In some embodiments, the sealing structure further includes a connecting component, the connecting component is an end of the pull piece, and the end of the pull piece is connected to the composite packaging material.

[0023] In some embodiments, the sealing structure further includes a connecting component, one end of the connecting component is fixedly connected to the inner membrane or the innermost layer near the inner side of the opening, while the other end thereof is fixedly connected to the plug sheet.

[0024] In some embodiments, the plug sheet is of a hollow structure and/or a middle part of the plug sheet is provided with an open hole.

[0025] In some embodiments, the plug sheet is recessed towards the opening to form a recess.

[0026] In some embodiments, the recess of the plug sheet is provided with an open hole.

[0027] Some other embodiments of the present invention provide a production process for a sealing structure for a packaging box, the production process includes the following steps:

S1, perforating a composite packaging material to form an opening;

S2, respectively arranging an inner membrane and a pull piece on an inner side and an outer side of the opening, and areas of the inner membrane and the

pull piece are both greater than an area of the opening;

S3, arranging a plug sheet on the pull piece or the inner membrane, and the plug sheet matches a shape of the opening and corresponds to a position of the opening;

S4, fixedly connecting the inner membrane, the plug sheet, and the pull piece by means of a heat sealing process or an adhesive bonding process, so that the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and in a case that the plug sheet is pressed, enabling the plug sheet to be embedded in the opening, so as to close the opening.

[0028] In some embodiments, the production process further includes the following steps:

arranging an outer membrane on the outer side of the opening; or

arranging an outer membrane on an outer side of the composite packaging material, and perforating an area covered by the outer membrane to form the opening.

[0029] Still some other embodiments of the present invention provide a sealing structure for a packaging box, the packaging box is made of a composite packaging material, the composite packaging material includes a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure includes an inner membrane and a plug sheet, the inner membrane is fixedly connected to the plug sheet;

the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening;

the plug sheet enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening;

the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening.

[0030] In some embodiments, the plug sheet is recessed towards the opening to form a recess, and is provided with an edge greater than the opening and parallel to the opening, and the edge is configured to cover an outer side of the opening of the packaging box.

[0031] Still some other embodiments of the present invention provide a sealing structure for a packaging box,

the packaging box is made of a composite packaging material, the composite packaging material includes a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure includes an inner membrane and a plug sheet, the inner membrane is fixedly connected to the plug sheet;

the plug sheet matches a shape of the opening and corresponds to a position of the opening, the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening;

the plug sheet enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening;

the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening;

the plug sheet is recessed towards the opening to form a recess, and is provided with an edge greater than the opening and parallel to the opening, the edge is configured to cover an outer side of the opening of the packaging box, and the recess is provided with an open hole.

[0032] Still some other embodiments of the present invention provide a packaging box, including the above sealing structure.

[0033] The present invention has the following advantages and beneficial effects.

[0034] In the sealing structure of the present invention, the plug sheet matching the shape of the opening is provided on the position of the opening of the composite packaging material, and the pull piece or the plug sheet arranged on the outer side of the opening enables the inner membrane on the inner side of the position of the opening to be broken at the opening of the packaging box under the action of an external force, so as to open the opening; the plug sheet is able to be embedded in the opening under the action of an external force, the opening is closed by the plug sheet and/or the pull piece, and then the opening of the packaging box is able to be repeatedly opened and closed, compared with a relatively conventional opening manner, the plug sheet effectively reduces the usage amount of plastic, which is more environmentally friendly, and reduces the manufacturing cost.

Brief Description of the Drawings

[0035] Various other advantages and benefits will become apparent to those of ordinary skill in the art upon reading the following detailed description of the embodiments. The drawings are only for the purpose of illustrating the embodiments and are not to be considered as

limiting the present invention. Moreover, the same reference signs are used to refer to the same components throughout the drawings. In the drawings:

5 Fig. 1 is a longitudinal sectional view of a sealing structure in Embodiment 1 of the present invention.

10 Fig. 2 is a longitudinal sectional view of another sealing structure in Embodiment 1 of the present invention.

Fig. 3 is a longitudinal sectional view of a sealing structure in Embodiment 2 of the present invention.

15 Fig. 4 is a longitudinal sectional view of a sealing structure in Embodiment 3 of the present invention.

20 Fig. 5 is a longitudinal sectional view of another sealing structure in Embodiment 3 of the present invention.

25 Fig. 6 is a longitudinal sectional view and a top view of still another sealing structure in Embodiment 3 of the present invention.

Fig. 7 is a longitudinal sectional view and a top view of yet another sealing structure in Embodiment 3 of the present invention.

30 Fig. 8 is a longitudinal sectional view of a sealing structure provided with inclined surfaces on upper and lower edges of a plug sheet in Embodiment 4 of the present invention.

35 Fig. 9 is a longitudinal sectional view of a sealing structure provided with chambers on upper and lower edges of a plug sheet in Embodiment 4 of the present invention.

40 Fig. 10 is a longitudinal sectional view of a sealing structure provided with an inclined surface on an upper edge of a plug sheet in Embodiment 4 of the present invention.

45 Fig. 11 is a longitudinal sectional view of another sealing structure provided with an inclined surface on an upper edge of a plug sheet in Embodiment 4 of the present invention.

50 Fig. 12 is a longitudinal sectional view of a sealing structure provided with a connecting component on a plug sheet in Embodiment 4 of the present invention.

55 Fig. 13 is a flowchart of a production process for a sealing structure for a packaging box in Embodiment 5 of the present invention.

Fig. 14 is a flowchart of another production process for a sealing structure for a packaging box in Embodiment 5 of the present invention.

Fig. 15 is a flowchart of still another production process for a sealing structure for a packaging box in Embodiment 5 of the present invention.

Fig. 16 is a longitudinal sectional view of a sealing structure in Embodiment 6 of the present invention.

Fig. 17 is a longitudinal sectional view and a top view of another sealing structure in Embodiment 6 of the present invention.

[0036] In the figures: 1. Pull piece; 2. Plug sheet; 3. Composite packaging material; 4. Opening; 5. Inner membrane; 6. Outer membrane; 7. Arc-shaped groove; 8. Connecting component.

Detailed Description of the Embodiments

[0037] In order to make the purposes, technical solutions and advantages of the present invention clearer, the technical solutions of the present invention will be clearly and completely described below in combination with the specific embodiments of the present invention and corresponding drawings. It is apparent that the described embodiments are only a part of the embodiments of the present invention, and not all of them. All other embodiments obtained by those of ordinary skill in the art based on the embodiments of the present invention without creative efforts are within the scope of protection of the present invention.

[0038] The technical solutions provided by the embodiments of the present invention will be described in detail below in combination with the drawings.

Embodiment 1

[0039] The embodiment provides a sealing structure for a packaging box, the packaging box is made of a composite packaging material, the composite packaging material includes a base layer, a barrier layer, a waterproof layer, and an innermost layer. The base layer of the composite packaging material generally uses raw paper, such as white base paper or kraft base paper, and the base layer is able to provide the necessary stiffness for the composite packaging material, so that the packaging box maintains a stable appearance. The barrier layer is crucial for the composite packaging material for liquid food packaging, which plays a key role in the shelf life of a liquid food, oxygen permeation is the main reason for deterioration of a packaged content of a food package, the barrier layer prevents oxygen from permeating into a packaging container to prolong the shelf life of the food, and an aluminum foil is usually used as the barrier layer in the composite packaging material. The waterproof layer

is generally a thermoplastic resin. In an embodiment, the thermoplastic resin is polyolefin, including, but is not limited to, Low Density Polyethylene (LDPE), Metallocene Polyethylene (m-PE), or a mixture thereof. The waterproof layer is located on the outermost side of the composite packaging material, and is able to provide waterproof and dustproof performance, and protects the printed image-text of the composite packaging material from being worn. The innermost layer of the composite packaging material is in direct contact with the packaged content. The innermost layer is generally a thermoplastic resin. In an embodiment, the thermoplastic resin includes polyolefin, such as Polyethylene (PE), including, but is not limited to, Linear Low Density Polyethylene (LLDPE), ultra-low density polyethylene, LDPE, m-PE, or mixtures thereof. A bonding layer is generally further arranged between the base layer and the barrier layer and between the barrier layer and the innermost layer, and the bonding layer plays a role of bonding between two adjacent layers, and generally uses an adhesive polymer layer, such as a modified polypropylene-based thermoplastic adhesive polymer. The packaging box is provided with an opening as an outlet for flowing or drinking of the packaged content, the opening is perforated on the composite packaging material by a perforating device, and the sealing structure for closing the opening is correspondingly arranged at the position of the opening.

[0040] As shown in Fig. 1, the sealing structure in the embodiment includes a pull piece 1, an inner membrane 5, and a plug sheet 2.

[0041] The pull piece 1 covers an outer side of an opening 4 in a composite packaging material 3. Unless otherwise specified in the present invention, the outer side refers to the side facing the outside air, and an inner side refers to the side facing the packaged content. An area of the pull piece 1 is greater than that of the opening 4. The pull piece 1 is generally prepared by a composite material, which is a composite material including a barrier material and a fusible material, the barrier material is at least one of an aluminum foil or barrier paper, and the fusible material is at least one selected from plastic, PLA or PBAT. For example, the pull piece 1 is compounded by the barrier paper (such as nanocellulose paper) and PE or the aluminum foil and PE. The barrier paper or the aluminum foil is also replaced with a material, such as LDPE, High Density Polyethylene (HDPE), Polypropylene (PP), Polyamide (PA), PLA or PBAT, and paper. The pull piece 1 prepared by the aluminum foil is able to be fixed by means of electric heating, and during electric heating, PE in the pull piece 1 is melted by means of electric heating, so that the pull piece 1 is fixedly bonded to the composite packaging material 3, and PE is also replaced with PP, PA, PLA or PBAT. The pull piece 1 not including the aluminum foil in the preparation material is able to be fixed to the composite packaging material 3 by gluing.

[0042] The inner membrane 5 covers an inner side of the opening 4, and an area of the inner membrane 5 is

greater than that of the opening 4. The inner membrane 5 is a PE membrane or a composite membrane, for example, PE is laminated on both sides of an Ethylene vinyl alcohol copolymer (EVOH) material, and EVOH and PE are bonded with a binder to form a PE/binder/EVOH/binder/PE composite material. EVOH is also replaced with an evaporation coating of Polyvinyl Alcohol (PVOH), Polyvinylidene Chloride (PVDC), PA or a metal oxide, such as Al_2O_3 , so that the inner membrane 5 prepared by the composite material has a certain barrier property, which is able to prolong the shelf life of the packaged content.

[0043] In the embodiment, as shown in Fig. 1, the plug sheet 2 is located on an inner side of the pull piece 1, a part of the inner membrane 5 outside the opening 4 is attached to the innermost layer of the composite packaging material 3, the inner membrane 5 at the opening 4 is fixedly connected to the plug sheet 2, that is, the plug sheet 2 is located between the pull piece 1 and the inner membrane 5, an open hole is provided in the middle of the plug sheet, a size of the open hole is not limited, the plug sheet is able to be embedded in the opening under an action of an external force, and the plug sheet and the pull piece jointly close the opening.

[0044] The plug sheet 2 is made of plastic, paper, a paper-plastic composite material, or a degradable biological material. The plug sheet 2 is prepared by an injection molding material, such as plastic. In an embodiment, the plastic is any one or a combination of PE, or PP, PA, PLA or PBAT, such as a combination of PE/PLA, and PE is selected as LDPE, HDPE. The prepared plug sheet 2 is of a solid or hollow structure, as long as a shape of the plug sheet 2 matches the opening 4, and the material strength thereof is sufficient to close the opening 4. The hollow plug sheet not only further reduces plastic, but also has better telescopic elasticity, and better closes the opening after being embedded. The plug sheet 2 is also prepared by paper or a composite of paper and plastic. Of course, the plug sheet 2 is also made of other materials, such as wood and bamboo, which are also within the scope of protection of the present invention. The plug sheet 2 is formed and then fixed to the pull piece 1. When the plug sheet 2 is an injection molding material, such as plastic, the plug sheet 2 is able to be formed and then fixed to the inner side of the pull piece 1, the plug sheet 2 is also able to be directly injection-molded on the inner side of the pull piece 1, and then the pull piece 1 having the plug sheet 2 is fixed to the composite packaging material 3. During the production, the pull piece 1, the plug sheet 2, and the inner membrane are able to be respectively prepared by different materials and then be combined together by means of heat sealing or adhesive bonding. The pull piece 1, the plug sheet 2, and the inner membrane 5 are also able to be prepared by the same material, and in this case, the pull piece 1 and the plug sheet 2 are also integrally prepared and formed in the embodiment.

[0045] Specifically, the plug sheet 2 is fixed to the pull piece 1, the plug sheet 2 matches the shape of the open-

ing 4 and corresponds to the position of the opening 4, one surface of the plug sheet 2 is fixedly connected to the pull piece 1, the other surface of the plug sheet 2 is fixedly connected to the inner membrane 5, and under the action of an external force, such as lifting the pull piece 1 or pressing the pull piece 1, a bonding force between the plug sheet 2 and the pull piece 1 and a bonding force between the plug sheet 2 and the inner membrane 5 are both greater than a tear strength of the inner membrane 5, so that the inner membrane 5 at the position of the opening 4 is torn, so as to open the opening 4, and at this time, liquid is able to be poured out from the opening 4. The tear strength refers to a force required to tear the inner membrane 5. After opening, the plug sheet 2 is able to be pulled out and/or pressed back from the opening 4, for example, the plug sheet 2 is pressed to be embedded in the opening 4, so as to close the opening 4. In order to enable the plug sheet 2 to better close the opening 4, an overall size of the plug sheet 2 is slightly greater than the opening 4, or a local size of the plug sheet 2 is slightly greater than the opening 4, so that the plug sheet 2 is in contact with an edge of the opening 4 more tightly, thereby effectively preventing the liquid in the packaging box from flowing out. The middle part of the plug sheet 2 is provided with the open hole, and the open hole is able to further reduce a usage amount of plastic of the plug sheet 2, so as to better meet the requirements for environmental protection and plastic reduction. If the plug sheet 2 is provided with the open hole, before the opening 4 is opened or after the opening 4 is closed again, the plug sheet 2 mainly closes the opening 4 through tight closing between an outer edge thereof and an inner edge of the opening 4, and a part with the open hole is closed by means of a fixed connection between the plug sheet 2 and the pull piece 1. The plug sheet 2 is also of the hollow structure, and the middle part of the plug sheet 2 is provided with the open hole. The hollow structure of the plug sheet 2 and the open hole in the middle part thereof are able to further reduce the usage amount of plastic of the plug sheet 2, enable the plug sheet to have better telescopic elasticity, and the plug sheet is combined with the edge of the opening more tightly after being embedded, so as to better close the opening.

[0046] As shown in Fig. 1, the sealing structure further includes an outer membrane 6. The outer membrane 6 is provided on the outer side of the opening 4, and the pull piece 1 is provided on an outer side of the outer membrane 6. The outer membrane 6 is PE, and the outer membrane 6 is also prepared by a composite material of Oriented Polypropylene (OPP) and PE. OPP is also replaced with a polyester material, such as HDPE, PP, and PET/PBT. Before perforation, the outer membrane 6 is pre-provided at the pre-perforating position of the composite packaging material 3, perforation is performed in an area covered by the outer membrane 6 to form the opening 4, and the area of the opening 4 is smaller than that of the outer membrane 6. Or, the composite pack-

aging material 3 is perforated first, the outer membrane 6 is provided on the outer side of the composite packaging material 3 at the perforating position, and the area of the outer membrane 6 is greater than that of the opening 4, so that the outer membrane 6 completely covers the opening 4, and the specific structure thereof is shown in Fig. 2. When the pull piece 1 includes an aluminum foil, the pull piece 1 is heated by means of electric heating, so that the pull piece 1 and the outer membrane 6 are attached and fixed to the composite packaging material 3. The outer membrane 6 is able to avoid damage to the composite packaging material 3 when the pull piece 1 is pulled up due to a strong bonding force between the pull piece 1 and the composite packaging material 3 during opening. If an outermost layer of the composite packaging material 3 is a material, such as OPP, due to the fact that the composite packaging material 3 is not torn by a force that separates the pull piece 1 from the material, after bonding, the outer membrane is not needed. In addition, considering a positioning error in the process, a width of the pull piece 1 is set to be slightly narrower than that of the outer membrane 6.

[0047] In an embodiment, the pull piece 1 is only partially attached to the outer membrane 6, and at this time, at least a part of the pull piece 1 is not fixed to the composite packaging material 3, so that an area of the outer membrane 6 is smaller than that of the pull piece 1, or a length of the outer membrane 6 is smaller than that of the pull piece 1, and the part of the pull piece 1 that is not fixed facilitates lifting the pull piece 1 during opening.

[0048] Further, the sealing structure further includes a connecting component, the connecting component is configured to prevent the pull piece 1 from being completely separated from the packaging box after opening. The connecting component is a connecting band or a connecting strip, for example, the connecting component is integrally injection-molded with the plug sheet 2 by using an injection molding material, the plug sheet 2 is fixed to the pull piece 1, and the connecting component is fixed to the composite packaging material 3. The plug sheet 2 and the connecting component are also respectively prepared, and then one end of the connecting component is fixed to the pull piece 1 or the plug sheet 2 by means of adhesive bonding or hot melting, and the other end of the connecting component is fixed to the composite packaging material 3.

[0049] An end of the pull piece 1 is also configured as the connecting component, one end of the pull piece 1 is bonded or fixed to the composite packaging material 3, and after being lifted from the other end, the pull piece 1 remains connected to the packaging box, so as to prevent the pull piece 1 from being completely separated from the packaging box, so that the opened plug sheet 2 is more conveniently stored and installed back on the opening 4.

[0050] The connecting component is also a part of the composite packaging material 3, for example, when the composite packaging material 3 is perforated to form the

opening 4, the composite packaging material 3 at the perforating position is not completely cut off, the cut composite packaging material 3 is lifted towards the outer side of the opening and connected to the pull piece 1, for example, connected to the outer side of the pull piece 1, the plug sheet 2 on the inner side of the pull piece 1 is bonded to the inner membrane 5 to close the opening 4, and after opening, the pull piece 1 is able to still be connected to the packaging box through the cut composite packaging material 3. In addition, the connecting component is also a limiting or buckling mechanism injection-molded on the composite packaging material 3, and the connecting component enables the opened pull piece 1 to remain directly or indirectly connected to the packaging box, thereby more facilitating repeated opening of the opening 4 by the plug sheet 2.

Embodiment 2

[0051] The embodiment discloses a sealing structure for a packaging box, which is different from Embodiment 1, as shown in Fig. 3, a plug sheet 2 is located on an outer side of a pull piece 1, an inner membrane 5 is fixedly connected to the pull piece 1, and then an opening 4 is closed.

[0052] The pull piece 1 is attached to an outer side of the opening 4 of a composite packaging material 3, so that the pull piece 1 is attached to a waterproof layer of the composite packaging material 3 on the outer side of the opening 4. If an outer membrane 6 is further provided at the opening 4, the pull piece 1 is attached to the outer membrane 6 on the outer side of the opening 4. If the prepared pull piece 1 includes an aluminum foil, the pull piece 1 is heated by means of electric heating, so that the inner membrane 5 is attached to the pull piece 1 at the position of the opening 4, and the part of the inner membrane 5 outside the opening 4 is attached to an innermost layer of the composite packaging material 3 on the inner side of the opening 4, so as to close the opening 4.

[0053] The plug sheet 2 is made of plastic, paper, a paper-plastic composite material, or a degradable biological material. The plug sheet 2 is prepared by an injection molding material, such as plastic. In an embodiment, the plastic is any one or a combination of PE, or PP, PA, PLA or PBAT, such as a combination of PE/PLA, and PE is selected as LDPE, HDPE. After the pull piece 1 is fixed to the outer side of the opening 4, then the plug sheet 2 is injection-molded on the pull piece 1 or a pre-prepared plug sheet 2 is bonded. Or, the plug sheet 2 is pre-fixed to an outer side surface of the pull piece 1 by means of injection molding or bonding, and then an inner side of the pull piece 1 is attached to the outer side of the opening 4 of the composite packaging material 3. The prepared plug sheet 2 is of a solid or hollow structure, as long as the shape of the plug sheet 2 matches the opening 4, and the material strength thereof is sufficient to close the opening 4. During the production, the pull

piece 1, the plug sheet 2, and the inner membrane 5 are able to be respectively prepared by different materials and then be combined together by means of heat sealing or adhesive bonding. The pull piece 1, the plug sheet 2, and the inner membrane 5 are also able to be prepared by the same material, and in this case, the pull piece 1 and the plug sheet 2 are also integrally prepared in the embodiment. The middle part of the plug sheet 2 is provided with an open hole, and the open hole further reduces the usage amount of plastic of the plug sheet 2, so as to better meet the requirements for environmental protection and plastic reduction. If the plug sheet 2 is provided with the open hole, before the opening 4 is opened or after the opening 4 is closed again, the plug sheet 2 mainly closes the opening 4 through tight closing between an outer edge thereof and an inner edge of the opening 4, and the open hole part is closed by means of a fixed connection between the plug sheet 2 and the pull piece 1. The plug sheet 2 is also of the hollow structure, and the middle part of the plug sheet 2 is provided with the open hole. The hollow structure of the plug sheet 2 and the open hole in the middle part thereof are able to further reduce the usage amount of plastic of the plug sheet 2, enable the plug sheet to have better telescopic elasticity, and the plug sheet is combined with the edge of the opening more tightly after being embedded, so as to better close the opening.

[0054] Under the action of an external force, such as lifting the pull piece 1 or pressing the pull piece 1, the inner membrane 5 is broken at the opening 4, so as to open the opening 4. During opening, the bonding force between the plug sheet 2 and the pull piece 1, and the bonding force between the pull piece 1 and the inner membrane 5 are both greater than the tear strength of the inner membrane 5, so that the inner membrane 5 at the opening 4 is torn. After opening, the plug sheet 2 is able to be pulled out and/or pressed back from the opening 4, and the plug sheet 2 is pressed to be embedded in the opening 4, so as to close the opening 4.

[0055] In an embodiment, as shown in Fig. 3, the sealing structure further includes an outer membrane 6. The outer membrane 6 is provided on the outer side of the opening 4, and the pull piece 1 is provided on an outer side of the outer membrane 6. The outer membrane 6 is PE, and the outer membrane 6 is also prepared by a composite material of OPP and PE. OPP is also replaced with a polyester material such as HDPE, PP, and PET/PBT. Before perforation, the outer membrane 6 is pre-provided at the pre-perforating position of the composite packaging material 3, perforation is performed in the area covered by the outer membrane 6 to form the opening 4, and the area of the opening 4 is smaller than that of the outer membrane 6. Or, the composite packaging material 3 is perforated first, the outer membrane 6 is provided on the outer side of the composite packaging material 3 at the perforating position, and the area of the outer membrane 6 is greater than that of the opening 4, so that the outer membrane 6 completely covers the

opening 4. When the pull piece 1 includes an aluminum foil, the pull piece 1 is heated by means of electric heating, so that the pull piece 1 and the outer membrane 6 are attached and fixed to the composite packaging material 3. The outer membrane 6 is able to avoid damage to the composite packaging material 3 when the pull piece 1 is pulled up due to a strong bonding force between the pull piece 1 and the composite packaging material 3 during opening. In addition, considering a positioning error in the process, the width of the pull piece 1 is set to be slightly narrower than that of the outer membrane 6.

[0056] In an embodiment, the pull piece 1 is only partially attached to the outer membrane 6, and at this time, at least a part of the pull piece 1 is not fixed to the composite packaging material 3, so that the area of the outer membrane 6 is smaller than that of the pull piece 1, or the length of the outer membrane 6 is smaller than that of the pull piece 1, and the part of the pull piece 1 that is not fixed facilitates lifting the pull piece 1 during opening.

[0057] Further, the sealing structure further includes a connecting component. The connecting component is configured to prevent the pull piece 1 from being completely separated from the packaging box after opening. The connecting component is a connecting band or a connecting strip, for example, the connecting component is integrally injection-molded with the plug sheet 2 by using an injection molding material, the plug sheet 2 is fixed to the pull piece 1, and the connecting component is fixed to the composite packaging material 3. The pull piece 1 is also attached to the composite packaging material 3 or the outer membrane 6, then the plug sheet 2 and the connecting component are injection-molded on the pull piece 1, and the connecting component is fixed to the composite packaging material 3. The plug sheet 2 and the connecting component are also respectively prepared, and then one end of the connecting component is fixed to the pull piece 1 or the plug sheet 2 by means of adhesive bonding or hot melting, and the other end of the connecting component is fixed to the composite packaging material 3.

[0058] An end of the pull piece 1 is also configured as the connecting component, one end of the pull piece 1 is bonded or fixed to the composite packaging material 3, and after being lifted from the other end which is not bonded or fixed to the composite packaging material 3, the pull piece 1 remains connected to the packaging box, so as to prevent the pull piece 1 from being completely separated from the packaging box, so that the opened plug sheet 2 is conveniently stored and installed back on the opening 4.

[0059] The connecting component is also a part of the composite packaging material 3, for example, when the composite packaging material 3 is perforated to form the opening 4, the composite packaging material 3 at the perforating position is not completely cut off and separated, the cut composite packaging material 3 is lifted towards the outer side of the opening and connected to the pull piece 1 or the plug sheet 2, the pull piece 1 at

the opening 4 is attached to the inner membrane 5 to close the opening 4, and after opening, the pull piece 1 or the plug sheet 2 is connected to the packaging box through the cut composite packaging material 3. In addition, the connecting component is also in the form of a limiting or buckling mechanism injection-molded on the composite packaging material 3, and the structure enabling the opened pull piece 1 to remain directly or indirectly connected to the packaging box is considered as the connecting component.

[0060] In conclusion, in the sealing structure in the foregoing embodiment, the pull piece 1 is provided on the outer side of the opening 4 in the composite packaging material 3, and the plug sheet 2 matching the shape of the opening 4 is provided on the inner side surface or the outer side surface of the pull piece 1, so that the inner membrane 5 is broken at the opening 4 under the action of an external force, so as to open the opening 4, the plug sheet 2 is able to be pulled out and/or pressed back from the opening 4 under the action of an external force, and then the opening 4 of the packaging box is repeatedly opened and closed, thereby effectively reducing the usage amount of plastic, which is more environmentally friendly, and reducing the manufacturing cost.

Embodiment 3

[0061] In the embodiment, an area of a plug sheet 2 is greater than an opening 4, the plug sheet 2 completely covers the opening 4 and is inwardly recessed at the opening 4 to form a recess, and is provided with an edge greater than the opening 4 and parallel to the opening 4, and the edge is configured to cover an outer side of the opening 4 of a packaging box. Fig. 4 shows that the plug sheet 2 located on an inner side of a pull piece 1 is provided with an inwardly recessed recess at the opening 4, and Fig. 5 shows that the plug sheet 2 located on an outer side of the pull piece 1 is provided with an inwardly recessed recess at the opening 4. The recess of the plug sheet 2 is able to reduce a volume of the plug sheet 2, thereby greatly reducing the usage amount of plastic required for forming the plug sheet 2, so as to better meet the requirements for environmental protection and plastic reduction. Further, an open hole is also formed in the plug sheet 2 by means of perforation or injection molding, Fig. 6 shows that the plug sheet 2 located on the inner side of the pull piece 1 is provided with an inwardly recessed recess having the open hole at the opening 4, and Fig. 7 shows that the plug sheet 2 located on the outer side of the pull piece 1 is provided with an inwardly recessed recess having the open hole at the opening 4. The open hole in the plug sheet 2 is used as a straw hole, and a straw is able to directly extend into the packaging box from the open hole in the plug sheet 2. When the straw is not used, the opening 4 is opened directly through the pull piece 1, and the plug sheet 2 is pressed back after opening, so that the recess of the plug sheet 2 is embedded in and closes the opening 4. The open

hole in the plug sheet 2 provides a more flexible opening manner, and further reduces the usage amount of plastic of the plug sheet 2, and a size of the open hole is not limited. If the plug sheet 2 is provided with the open hole, before the opening 4 is opened or after the opening 4 is closed again, a part with the open hole is closed by means of a fixed connection between the plug sheet 2 and the pull piece 1. The sealing structure further includes an outer membrane 6. The outer membrane 6 is provided on the outer side of the opening 4, and the inner side of the pull piece 1.

[0062] The prepared plug sheet 2 is of a solid or hollow structure, as long as the shape of the plug sheet 2 matches the opening 4, and the material strength thereof is sufficient to close the opening 4. The plug sheet 2 is made of plastic, paper, a paper-plastic composite material, or a degradable biological material. During the production, the pull piece 1, the plug sheet 2, and the inner membrane 5 are able to be respectively prepared by different materials and then be combined together by means of heat sealing or adhesive bonding. Of course, the pull piece 1, the plug sheet 2, and the inner membrane 5 are also able to be prepared by the same material, and in this case, the pull piece 1 and the plug sheet 2 are also integrally prepared.

Embodiment 4

[0063] The embodiment provides a sealing structure for a packaging box, which is different from the foregoing three embodiments, as shown in Figs. 8-12, a plug sheet 2 is located on an inner side of an inner membrane 5, and the inner side of the inner membrane 5 is the side facing a packaged content.

[0064] The inner membrane 5 is provided on an inner side of an opening 4 of a composite packaging material 3, and the inner membrane 5 is heated, so that the inner membrane 5 is attached to an innermost layer of an inner side of the composite packaging material 3 at a position outside the opening 4. A pre-formed plug sheet 2 is fixed to a position, corresponding to the opening 4, of the inner side of the inner membrane 5, or the plug sheet 2 is injection-molded at the position, corresponding to the opening 4, of the inner side of the inner membrane 5.

[0065] The plug sheet 2 is also able to be first fixed to the inner membrane 5, and then the inner membrane 5 is attached to the inner side of the opening 4 of the composite packaging material 3, for example, the plug sheet 2 is injection-molded on one side of the inner membrane 5 or the pre-formed plug sheet 2 is fixed to one side of the inner membrane 5, the inner membrane 5 is heated, and the other side of the inner membrane 5 is sealed against the inner side of the opening 4 of the composite packaging material 3.

[0066] The plug sheet 2 is made of plastic, paper, a paper-plastic composite material, or a degradable biological material. The plug sheet 2 is of a solid or hollow structure, as long as the shape of the plug sheet 2 match-

es the opening 4, and the material strength thereof is sufficient to close the opening 4. During the production, the pull piece 1, the plug sheet 2, and the inner membrane 5 are able to be respectively prepared by different materials and then be combined together by means of heat sealing or adhesive bonding. Of course, the pull piece 1, the plug sheet 2, and the inner membrane 5 are also able to be prepared by the same material, for example, the plug sheet 2 and the inner membrane 5 are integrally prepared in the embodiment.

[0067] During opening, the inner membrane 5 is broken, and the pull piece 1, the broken part of the inner membrane 5, and the plug sheet 2 are used as a whole to leave the opening 4. An open hole is also provided in the middle of the plug sheet 2, and a size of the open hole is not limited. If the plug sheet 2 is provided with the open hole, before the opening 4 is opened, a part with the open hole is closed by means of a fixed connection between the inner membrane 5 and the pull piece 1. After opening, the plug sheet 2 is still fixedly connected to the pull piece 1 through the inner membrane 5, the plug sheet 2 is able to be embedded in the opening 4 again after being pulled out from the opening 4, and the part with the open hole is closed by the pull piece 1 and the torn inner membrane 5.

[0068] As shown in Figs. 8-12, the sealing structure further includes an outer membrane 6. The outer membrane 6 is provided on the outer side of the opening 4, and the pull piece 1 is provided on an outer side of the outer membrane 6. The outer membrane 6 is PE, and the outer membrane 6 is also prepared by a composite material of OPP and PE. OPP is also replaced with a polyester material such as HDPE, PP, and PET/PBT. During the production process, the outer membrane 6 is first bonded to the composite packaging material 3, and then perforation is performed in the area covered by the outer membrane 6 to form the opening 4. Or, the composite packaging material 3 is perforated first to form the opening 4, the outer membrane 6 is provided on the outer side of the opening 4, and the area of the outer membrane 6 is greater than that of the opening 4, so that the outer membrane 6 completely covers the opening 4.

[0069] In an embodiment, the pull piece 1 is only partially attached to the outer membrane 6, and at this time, at least a part of the pull piece 1 is not fixed to the composite packaging material 3, so that the area of the outer membrane 6 is smaller than that of the pull piece 1, or the length of the outer membrane 6 is smaller than that of the pull piece 1, so as to facilitate lifting the pull piece 1. The inner membrane 5 and the plug sheet 2, the inner membrane 5 and the pull piece 1, and the outer membrane 6 and the pull piece 1 are fixedly connected by means of heat sealing, adhesive bonding, ultrasound or inductance.

[0070] Further, the sealing structure further includes a connecting component. The connecting component is configured to prevent the pull piece 1 from being completely separated from the packaging box after opening.

Specifically, as shown in Fig. 12, one end of the connecting component 8 is connected to the inner membrane 5 at the periphery of the opening 4, one end of the connecting component 8 is also connected to the innermost layer of the composite packaging material 3 near the opening 4, and the other end of the connecting component 8 is fixedly connected to the plug sheet 2. After the pull piece 1 is lifted, the plug sheet 2 is still connected to the packaging box through the connecting component 8, so as to further prevent the plug sheet 2 from being separated from the packaging box. For example, the connecting component 8 is a connecting band or a connecting strip, and the connecting component 8 is integrally injection-molded with the plug sheet 2 by using an injection molding material.

[0071] As shown in Fig. 8 to Fig. 12, an edge of the plug sheet 2 is provided with a chamfer or an inclined surface, so that the plug sheet 2 is more easily embedded in the opening 4 under the action of an external force, or the plug sheet 2 is not liable to be separated from the opening 4 after being embedded in the opening 4, thereby ensuring a firmness of closing the opening 4.

[0072] In an embodiment, as shown in Fig. 11, the inclined surface is provided with a plurality of arc-shaped protrusions or arc-shaped grooves 7 in a horizontal direction. When the plug sheet 2 is embedded in the opening 4, the edge of the opening 4 is exactly at a connection of the two arc-shaped protrusions or in the arc-shaped grooves 7, thereby achieving relative fixation between the plug sheet 2 and the packaging box, effectively preventing the plug sheet 2 from being separated from the opening 4, and also preventing liquid in the packaging box from flowing out.

[0073] The composite packaging material 3 is formed by compounding multi-layer structures, such as a paper base layer, a barrier layer (such as an aluminum foil), a waterproof layer, an innermost layer and a bonding layer. A thickness of the plug sheet 2 is 1/8 to 8 times a thickness of the base layer of the composite packaging material 3. In an embodiment, the thickness of the plug sheet 2 is 2 to 4 times the thickness of the base layer of the composite packaging material 3. In an embodiment, as shown in Fig. 12, a thickness of one side of the plug sheet 2 is smaller than that of the other side of the plug sheet 2. When the connecting component is provided on the side with a smaller thickness of the plug sheet 2 or when the connecting component is not provided on the plug sheet 2, the pull piece 1 is pulled from the side with a greater thickness of the plug sheet 2. In an embodiment, when the connecting component 8 is provided on the side with the greater thickness of the plug sheet 2, the pull piece 1 is pulled from the side with the smaller thickness of the plug sheet 2.

Embodiment 5

[0074] The embodiment of the present invention provides a production process for a sealing structure for a

packaging box. As shown in Fig. 13, the production process includes the following steps:

S1, perforating a composite packaging material to form an opening;

S2, respectively arranging an inner membrane and a pull piece on an inner side and an outer side of the opening, and areas of the inner membrane and the pull piece are both greater than an area of the opening;

S3, arranging a plug sheet on the pull piece or the inner membrane, and the plug sheet matches a shape of the opening and corresponds to a position of the opening;

S4, fixedly connecting the inner membrane, the plug sheet, and the pull piece by means of a heat sealing process or an adhesive bonding process, so that the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and in a case that the plug sheet is pressed, enabling the plug sheet to be embedded in the opening, so as to close the opening.

[0075] In an embodiment, as shown in Fig. 14, the production process for the sealing structure for the packaging box further includes the following step: arranging an outer membrane on the outer side of the opening.

[0076] In another embodiment, as shown in Fig. 15, the production process for the sealing structure for the packaging box further includes the following step: arranging an outer membrane on an outer side of the composite packaging material, and perforating an area covered by the outer membrane to form the opening.

[0077] The pull piece is provided above the outer membrane, the pull piece is partially bonded to the outer membrane, and at this time, at least a part of the pull piece is not fixed to the composite packaging material, so that the area of the outer membrane is smaller than that of the pull piece, or the length of the outer membrane is smaller than that of the pull piece, and the part of the pull piece that is not bonded facilitates lifting the pull piece when opening. The pull piece is generally prepared by using a composite material, such as a composite of paper and PE or a composite of an aluminum foil and PE. The paper is barrier paper, such as nanocellulose paper. The paper or the aluminum foil is also replaced with a material, such as LDPE, HDPE, PP, PA, PLA or PBAT.

[0078] In an embodiment, the plug sheet is fixed to the inner side of the pull piece, and the inner membrane at the position of the opening of the composite packaging material is fixedly connected to the plug sheet to close the opening. Specifically, one of the manners is as follows: the composite packaging material is perforated by a perforating device to form an opening; the inner mem-

brane is bonded to the inner side of the opening; the plug sheet is provided on the pull piece, the plug sheet matches the shape of the opening, and if the plug sheet is a plastic material, such as plastic, the plug sheet is injection-molded on an inner side surface of the pull piece by an injection molding device through an injection molding process. Or, the plug sheet is first formed, and then the plug sheet is fixed to the inner side of the pull piece. One surface, which is not fixed to the pull piece, of the plug sheet is correspondingly provided at the position of the opening, so that the plug sheet and the inner membrane at the opening are fixedly connected together by means of a heat sealing process or an adhesive bonding process, so as to close the opening.

[0079] Further, the sealing structure further includes a connecting component. The connecting component is configured to prevent the pull piece from being completely separated from the packaging box after opening. Specifically, the connecting component is integrally injection-molded with the plug sheet by using an injection molding material, for example, the plug sheet having the connecting component is simultaneously injection-molded on one surface of the pull piece by an injection molding device, or, the plug sheet having the connecting component is injection-molded first, and then the plug sheet is fixed to the pull piece. When the plug sheet and the inner membrane are fixedly connected by means of heat sealing or adhesive bonding, the other end of the connecting component is fixed to the composite packaging material by means of heat-sealing or adhesive bonding.

[0080] An end of the pull piece is also configured as the connecting component, one end of the pull piece is bonded or fixed to the composite packaging material, and after being lifted from the other end which is not bonded or fixed to the composite packaging material, the pull piece remains connected to the packaging box, so that the pull piece is prevented from being completely separated from the packaging box, and the opened plug sheet is conveniently stored and installed back on the opening.

[0081] The connecting component is also a part of the composite packaging material, that is, when the composite packaging material is perforated to form the opening, the composite packaging material at the perforating position is not completely cut off; one surface of the pull piece is fixedly connected to the plug sheet, and the cut composite packaging material is also connected to the pull piece; the plug sheet is bonded to the inner membrane to close the opening, and the pull piece and the packaging box are able to still be connected together through the cut composite packaging material after opening.

[0082] In another embodiment, the plug sheet is fixed to an outer side surface of the pull piece, and the inner membrane at the position of the opening of the composite packaging material is fixedly connected to the pull piece to close the opening.

[0083] Specifically, one of the manners is as follows: an outer membrane is provided at a pre-perforating po-

sition of the composite packaging material, and the perforating device performs perforation within the coverage range of the outer membrane to form the opening, or an outer membrane is provided on the opening formed in the composite packaging material; the inner membrane is bonded to the inner side of the opening; the plug sheet is provided on the pull piece, the plug sheet matches the shape of the opening, and if the plug sheet is a plastic material, such as plastic, the plug sheet is injection-molded on the outer side of the pull piece by the injection molding device through the injection molding process. Or, the plug sheet is formed first, and then the plug sheet is fixed to the outer side of the pull sheet; and one surface, which is not provided with the plug sheet, of the pull piece and the inner membrane at the opening are fixedly connected together by means of a heat sealing process or an adhesive bonding process, so as to close the opening, and the closed plug sheet corresponds to the position of the opening.

[0084] Further, the sealing structure further includes a connecting component. The connecting component is configured to prevent the pull piece from being completely separated from the packaging box after opening. Specifically, the connecting component is integrally injection-molded with the plug sheet by using an injection molding material, for example, the plug sheet having the connecting component is simultaneously injection-molded on one surface of the pull piece by an injection molding device, or, the plug sheet having the connecting component is injection-molded first, and then the plug sheet is fixed to the pull piece. When the pull piece and the inner membrane are fixedly connected by means of heat sealing or adhesive bonding, the other end of the connecting component is simultaneously fixed to the composite packaging material by means of heat-sealing or adhesive bonding.

[0085] An end of the pull piece is also configured as the connecting component, one end of the pull piece is bonded or fixed to the composite packaging material, and after being lifted from the other end which is not bonded or fixed to the composite packaging material, the pull piece remains connected to the packaging box, so as to prevent the pull piece from being completely separated from the packaging box, so that the opened plug sheet is more conveniently stored and installed back on the opening.

[0086] The connecting component is also a part of the composite packaging material, that is, when the composite packaging material is perforated to form the opening, the composite packaging material at the perforating position is not completely cut off; one surface of the pull piece is fixedly connected to the plug sheet, and the cut composite packaging material forming the opening part is connected to the plug sheet or the pull piece; the pull piece is bonded to the inner membrane to close the opening, and the pull piece and the packaging box are able to still be connected together through the composite packaging material forming the opening part after open-

ing.

[0087] In still another embodiment, the plug sheet is fixed to the inner side of the inner membrane, and is fixedly connected to the inner membrane, and at the position of the opening of the composite packaging material, the inner membrane is bonded to the pull piece to close the opening.

[0088] Specifically, one of the manners is as follows: an outer membrane is provided at a preset position of the composite packaging material, and the perforating device performs perforation within the coverage range of the outer membrane to form the opening, or an outer membrane is provided on the opening formed in the composite packaging material; the inner membrane is bonded to the inner side of the opening, and then the plug sheet is provided on the inner side surface of the inner membrane; or, the plug sheet is provided on one surface of the inner membrane first, and then the inner membrane with the plug sheet is provided on the inner side of the opening. The plug sheet matches the shape of the opening and corresponds to the position of the opening. The pull piece and the inner membrane at the opening are fixedly connected together by means of a heat sealing process or an adhesive bonding process, so as to close the opening.

[0089] Further, the sealing structure further includes a connecting component. The connecting component is configured to prevent the pull piece from being completely separated from the packaging box after opening. Specifically, the connecting component is integrally injection-molded with the plug sheet by using an injection molding material, for example, the plug sheet having the connecting component is simultaneously injection-molded on the inner membrane by an injection molding device, or, the plug sheet having the connecting component is injection-molded first, and then the plug sheet is fixed to the inner membrane. When the inner membrane is fixed to the position of the opening by means of heat sealing or adhesive bonding, the other end of the connecting component is fixed to an innermost layer of the composite packaging material or the inner membrane near the opening.

[0090] An end of the pull piece is also configured as the connecting component, one end of the pull piece is bonded or fixed to the composite packaging material, and after being lifted from the other end which is not bonded or fixed to the composite packaging material, the pull piece remains connected to the packaging box, so that the pull piece is prevented from being completely separated from the packaging box, and the opened plug sheet is conveniently stored and installed back on the opening.

[0091] In an embodiment, an edge of the plug sheet is provided with a chamfer or an inclined surface.

[0092] Further, the inclined surface is provided with a plurality of arc-shaped protrusions or arc-shaped grooves in a horizontal direction.

[0093] The composite packaging material includes a base layer, a barrier layer, a waterproof layer, the innermost layer, and a bonding layer. The base layer of the

composite packaging material generally uses raw paper, such as white base paper or kraft base paper.

[0094] In an embodiment, a thickness of the plug sheet is manufactured to be 1/8 to 8 times a thickness of the base layer of the composite packaging material.

[0095] In an embodiment, the thickness of the plug sheet is manufactured to be 2 to 4 times the thickness of the base layer of the composite packaging material.

[0096] In an embodiment, when the plug sheet is manufactured, a thickness of one side of the plug sheet is smaller than that of the other side of the plug sheet, and the pull piece is pulled from the side with the smaller thickness of the plug sheet.

Embodiment 6

[0097] The embodiment provides a sealing structure for a packaging box, which is different from Embodiment 1, the sealing structure in the embodiment includes an inner membrane 5 and a plug sheet 2, but does not include a pull piece. The packaging box is made of a composite packaging material 3. The composite packaging material 3 includes a base layer, a barrier layer, a water-proof layer, and an innermost layer. The sealing structure includes the inner membrane 5 and the plug sheet 2. The plug sheet 2 matches a shape of the opening 4 and corresponds to a position of the opening 4. The inner membrane 5 covers an inner side of the opening 4, and an area of the inner membrane 5 is greater than that of the opening 4. The plug sheet 2 enables the inner membrane 5 to be broken at the opening 4 under an action of an external force, so as to open the opening 4. The plug sheet 2 is able to be embedded in the opening 4 under an action of an external force, so as to close the opening 4.

[0098] The sealing structure further includes an outer membrane 6. The outer membrane 6 is provided on an outer side of the opening 4. The plug sheet 2 is connected to the composite packaging material 3 through the outer membrane 6, an area of the plug sheet 2 is slightly greater than that of the outer membrane 6, and an external force acts on a part of the plug sheet 2 that exceeds the outer membrane 6 to open the opening 4.

[0099] As shown in Fig. 16, the area of the plug sheet 2 is greater than the opening 4, the plug sheet 2 completely covers the opening 4 and is inwardly recessed at the opening 4 to form a recess, and is provided with an edge greater than the opening 4 and parallel to the opening 4, and the edge is configured to cover the outer side of the opening 4 in the packaging box. In addition, as shown in Fig. 17, an open hole is formed in a recess of the plug sheet 2 by means of perforation or injection molding, and a size of the open hole is not limited. The open hole in the recess of the plug sheet 2 is used as a straw hole, and a straw is able to directly extend into the packaging box from the open hole in the plug sheet 2. When the straw is not used, the opening 4 is opened directly through the plug sheet 2, and the plug sheet 2 is pressed

back after opening, so that the recess of the plug sheet 2 is embedded in and closes the opening 4. If the plug sheet 2 is provided with the open hole, the opening 4 is closed through the inner membrane 5 before the opening 4 is opened, but after opening, the inner membrane 5 is broken and is not able to close the opening 4 again. The open hole in the plug sheet 2 provides a more flexible opening manner, and further reduces the usage amount of plastic of the plug sheet 2.

Embodiment 7

[0100] The embodiment of the present invention provides a production process for a sealing structure for a packaging box, which includes the following steps:

performing a composite packaging material to form an opening;

arranging an inner membrane on an inner side of the opening, and an area of the inner membrane is greater than that of the opening;

arranging a plug sheet on an outer side of the inner membrane, and the plug sheet matches a shape of the opening and corresponds to a position of the opening;

fixedly connecting the inner membrane and the plug sheet by means of a heat sealing process or an adhesive bonding process, so that the plug sheet enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and in a case that the plug sheet is pressed, the plug sheet is able to be embedded in the opening, so as to close the opening.

[0101] Those skilled in the art will understand that, similar to Embodiment 5, the order and the adjacent relationship of the above steps are not limited. For example, an outer membrane is provided on an outer side of the opening before the opening is formed by perforating, that is, the outer membrane is provided on an outer side of the composite packaging material, and then perforation is performed in the area covered by the outer membrane to form the opening. The outer membrane is provided on the outer side of the opening after the opening is formed by perforating and before the inner membrane is provided on the inner side of the opening. After the inner membrane is provided on the inner side of the opening, the outer membrane is provided on the outer side of the opening. In addition, the plug sheet is also arranged on the inner membrane, and then a combination of the inner membrane and the plug sheet is provided on the opening.

[0102] The adhesive bonding manner between the adjacent parts is similar to Embodiment 5. If the outer membrane is provided, the plug sheet is provided on the outer side of the outer membrane, and the plug sheet is partially

bonded to the outer membrane. In an embodiment, the area of the plug sheet is set to be greater than the opening, the plug sheet completely covers the opening and is inwardly recessed at the opening to form a recess, and is provided with an edge greater than the opening and parallel to the opening, the edge is configured to cover the outer side of the opening in the packaging box, and the edge is bonded to an outermost layer of the composite packaging material or the outer membrane.

[0103] One embodiment of the present invention discloses a packaging box. The packaging box includes the sealing structure as described in any of the above embodiments. The packaging box is able to repeatedly open and close the opening of the packaging box, and is convenient to carry and more environmentally friendly.

[0104] The above is only specific embodiments of the present invention, and other modifications or variations may be made based on the above embodiments by those skilled in the art in light of the above teachings of the present invention. Those skilled in the art should understand that the above specific description is only for the purpose of better explaining the present invention, and that the scope of protection of the present invention shall be subject to the scope of protection of the claims.

Claims

1. A sealing structure for a packaging box, the packaging box being made of a composite packaging material, the composite packaging material comprising a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure comprises: a pull piece, an inner membrane, and a plug sheet;

the pull piece covers an outer side of an opening of the packaging box, an area of the pull piece is greater than that of the opening, and the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening; the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening.

2. The sealing structure as claimed in claim 1, wherein the plug sheet is located on an inner side surface of the pull piece, and the inner membrane is fixedly connected to the plug sheet.
3. The sealing structure as claimed in claim 1, wherein the plug sheet is located on an outer side surface of the pull piece, and the inner membrane is fixedly

connected to the pull piece.

4. The sealing structure as claimed in claim 1, wherein the plug sheet is located on an inner side surface of the inner membrane, and the pull piece is fixedly connected to the inner membrane.
5. The sealing structure as claimed in claim 1, wherein further comprising an outer membrane, the outer membrane is arranged on the outer side of the opening, and the pull piece is arranged on an outer side of the outer membrane.
6. The sealing structure as claimed in claim 5, wherein an area of the outer membrane is smaller than that of the pull piece or a length of the outer membrane is smaller than that of the pull piece, and the pull piece is partially fixedly connected to the outer membrane.
7. The sealing structure as claimed in claim 1, wherein the plug sheet is made of plastic, paper, a paper-plastic composite material, or a degradable biological material.
8. The sealing structure as claimed in claim 1, wherein the pull piece is a composite material comprising a barrier material and a fusible material, the barrier material is at least one of an aluminum foil or barrier paper, and the fusible material is at least one selected from plastic, Polylactic Acid (PLA) or Butylene-adipate-co-terephthalate (PBAT).
9. The sealing structure as claimed in claim 1, wherein the inner membrane is a Polyethylene (PE) membrane or a composite membrane.
10. The sealing structure as claimed in claim 1, wherein an edge of the plug sheet is provided with a chamfer or an inclined surface.
11. The sealing structure as claimed in claim 10, wherein the inclined surface is provided with a plurality of arc-shaped protrusions or arc-shaped grooves in a horizontal direction.
12. The sealing structure as claimed in claim 1, wherein a thickness of the plug sheet is 1/8 to 8 times a thickness of the base layer of the composite packaging material.
13. The sealing structure as claimed in claim 12, wherein the thickness of the plug sheet is 2 to 4 times the thickness of the base layer of the composite packaging material.
14. The sealing structure as claimed in any one of claims 1 to 13, wherein a thickness of one side of the plug

sheet is smaller than that of the other side of the plug sheet, and the pull piece is pulled from the side with a smaller thickness of the plug sheet.

15. The sealing structure as claimed in any one of claims 1 to 13, wherein further comprising a connecting component, the connecting component connects the composite packaging material with the pull piece or the plug sheet. 5
 16. The sealing structure as claimed in any one of claims 1 to 13, wherein further comprising a connecting component, the connecting component is an end of the pull piece, and the end of the pull piece is connected to the composite packaging material. 10
 17. The sealing structure as claimed in claim 4, wherein further comprising a connecting component, one end of the connecting component is fixedly connected to the inner membrane or the innermost layer near the inner side of the opening, while the other end thereof is fixedly connected to the plug sheet. 15
 18. The sealing structure as claimed in any one of claims 1 to 13, wherein the plug sheet is of a hollow structure and/or a middle part of the plug sheet is provided with an open hole. 20
 19. The sealing structure as claimed in claim 2 or 3, wherein the plug sheet is recessed towards the opening to form a recess. 25
 20. The sealing structure as claimed in claim 19, wherein the recess is provided with an open hole. 30
 21. A production process for a sealing structure for a packaging box, comprising the following steps: 35
- S1, perforating a composite packaging material to form an opening; 40
- S2, respectively arranging an inner membrane and a pull piece on an inner side and an outer side of the opening, areas of the inner membrane and the pull piece are both greater than an area of the opening; 45
- S3, arranging a plug sheet on the pull piece or the inner membrane, the plug sheet matches a shape of the opening and corresponds to a position of the opening; and
- S4, fixedly connecting the inner membrane, the plug sheet, and the pull piece by means of a heat sealing process or an adhesive bonding process, so that the pull piece enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and in a case that the plug sheet is pressed, enabling the plug sheet to be embedded in the opening, so as to close the opening. 50
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22. The production process as claimed in claim 21, wherein further comprising:

arranging an outer membrane on the outer side of the opening; or,
arranging the outer membrane on an outer side of the composite packaging material, and perforating an area covered by the outer membrane to form the opening.

23. A sealing structure for a packaging box, the packaging box being made of a composite packaging material, the composite packaging material comprising a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure comprises an inner membrane and a plug sheet, the inner membrane being fixedly connected to the plug sheet;

the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening;
the plug sheet enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; and the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening.

24. The sealing structure as claimed in claim 23, wherein the plug sheet is recessed towards the opening to form a recess, and is provided with an edge greater than the opening and parallel to the opening, and the edge is configured to cover an outer side of the opening of the packaging box.

25. A sealing structure for a packaging box, the packaging box being made of a composite packaging material, the composite packaging material comprising a base layer, a barrier layer, a waterproof layer, and an innermost layer, the sealing structure comprises an inner membrane and a plug sheet, the inner membrane being fixedly connected to the plug sheet;

the plug sheet matches a shape of the opening and corresponds to a position of the opening; the inner membrane covers an inner side of the opening, and an area of the inner membrane is greater than that of the opening;
the plug sheet enables the inner membrane to be broken at the opening under an action of an external force, so as to open the opening; the plug sheet is able to be embedded in the opening under an action of an external force, so as to close the opening; and
the plug sheet is recessed towards the opening to form a recess, and is provided with an edge

greater than the opening and parallel to the opening, the edge is configured to cover an outer side of the opening of the packaging box, and the recess is provided with an open hole.

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- 26.** A packaging box, comprising the sealing structure as claimed in any one of claims 1 to 20, and 23 to 25.

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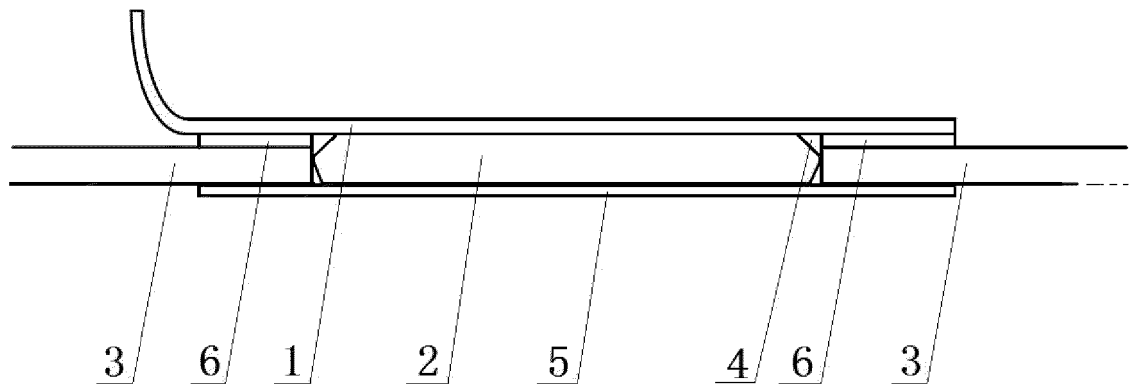


Fig. 1

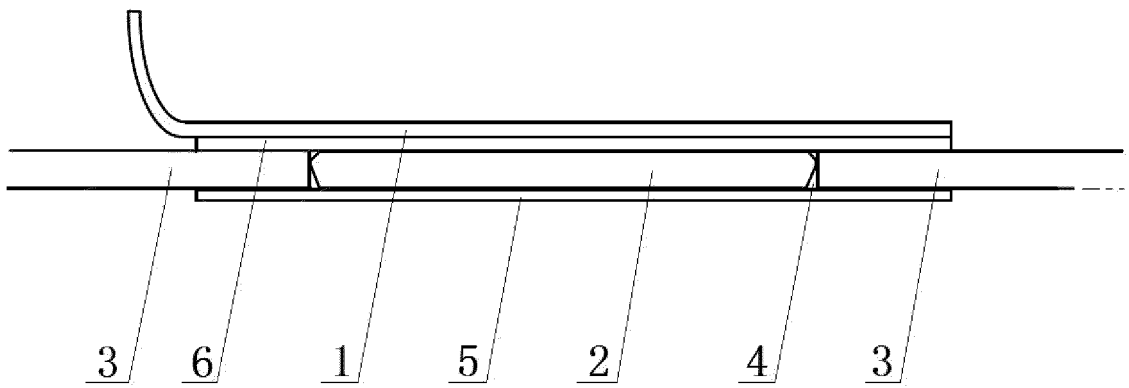


Fig. 2

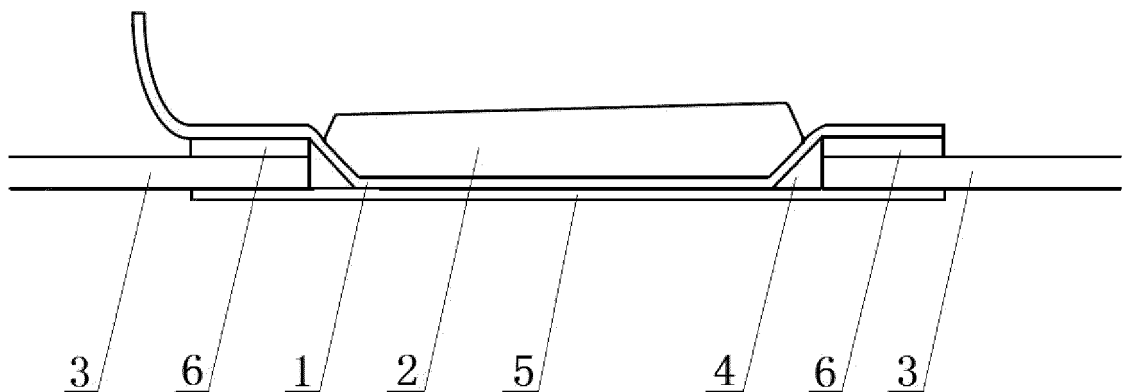


Fig. 3

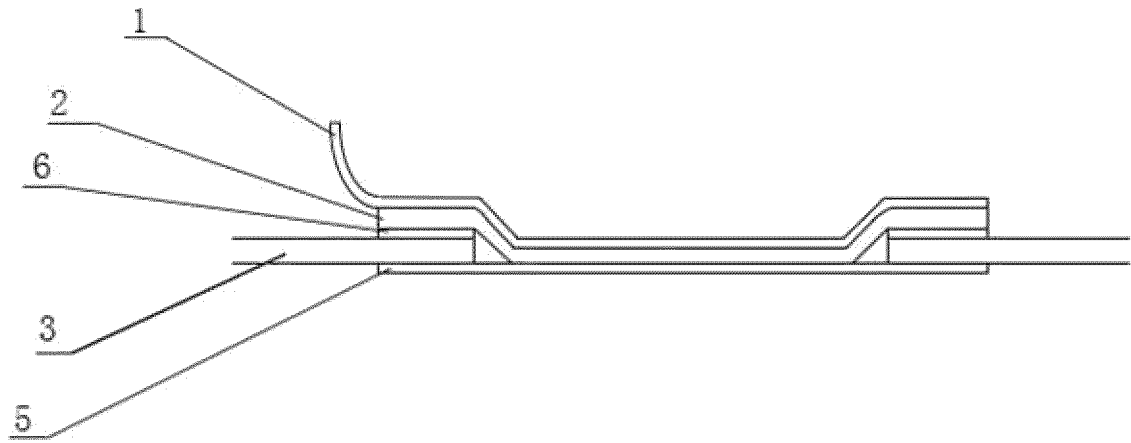


Fig. 4

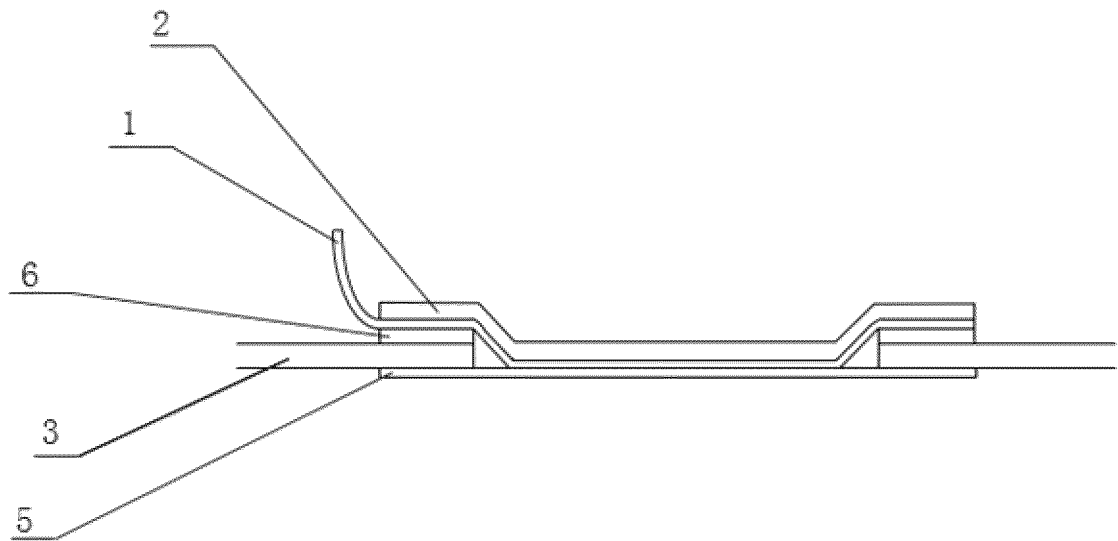


Fig. 5

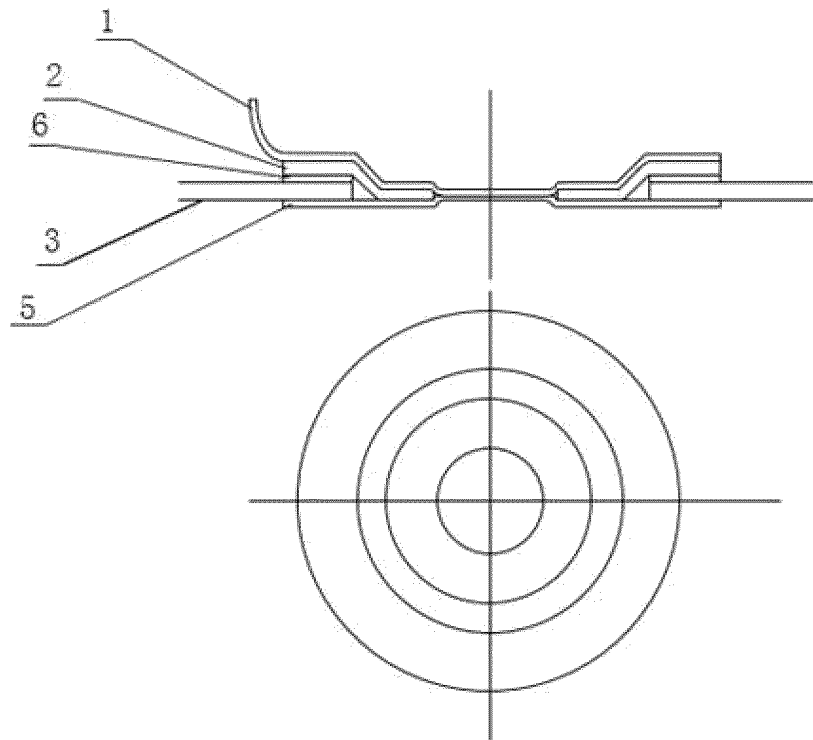


Fig. 6

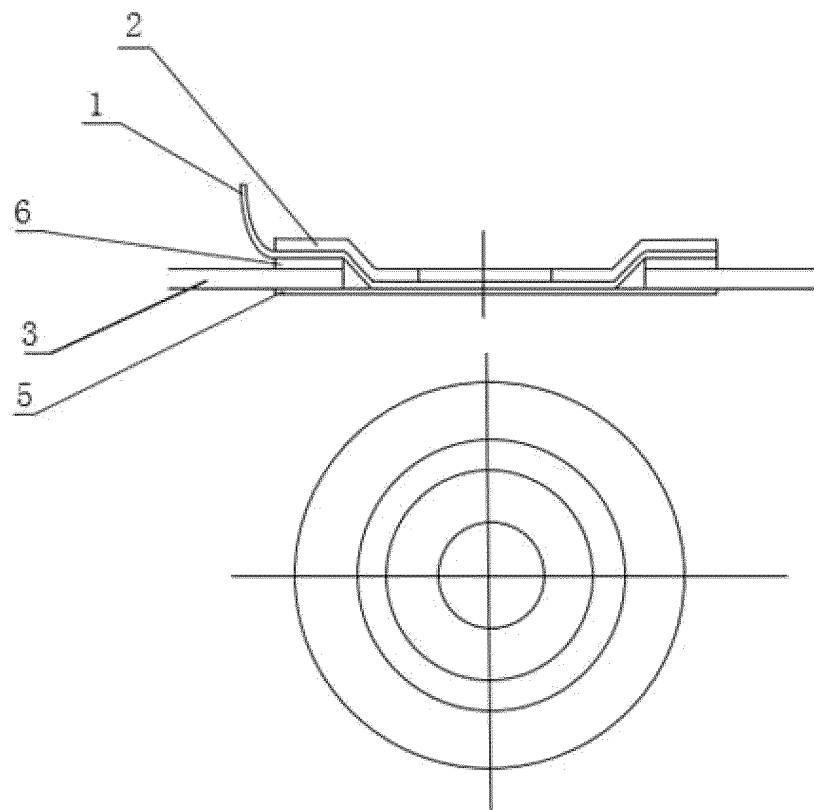


Fig. 7

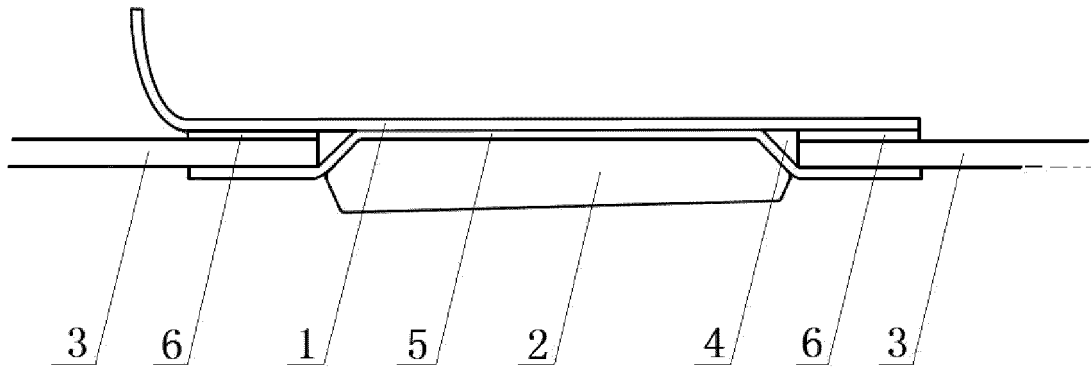


Fig. 8

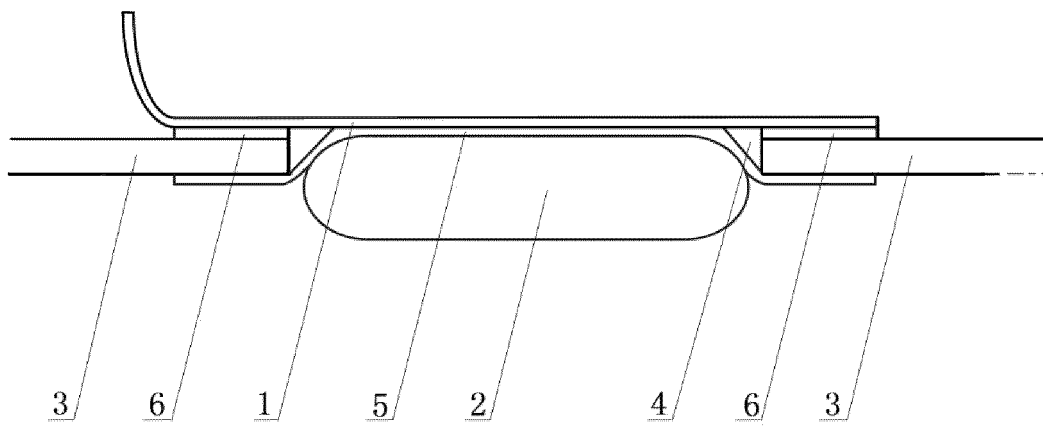


Fig. 9

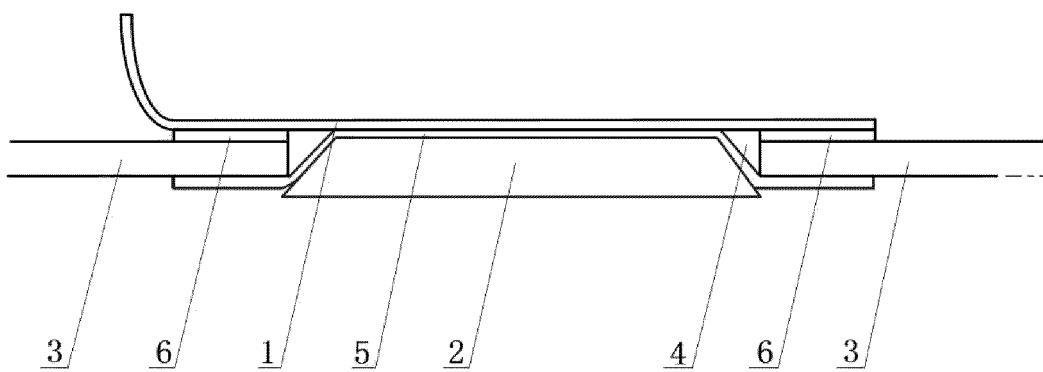


Fig. 10

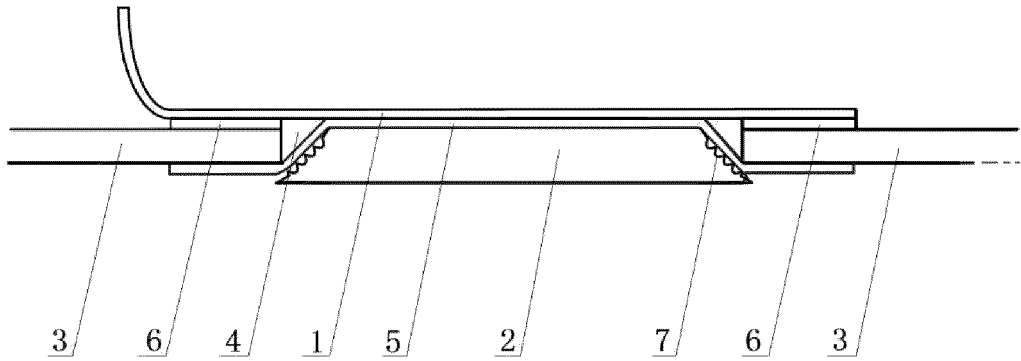


Fig. 11

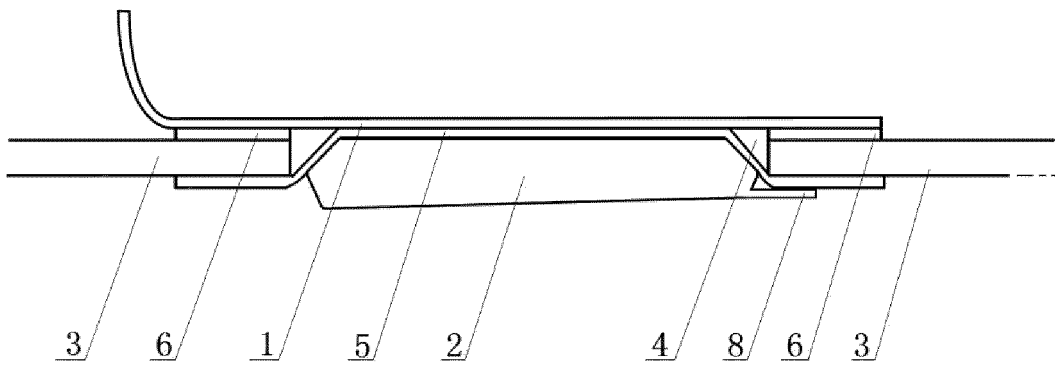


Fig. 12

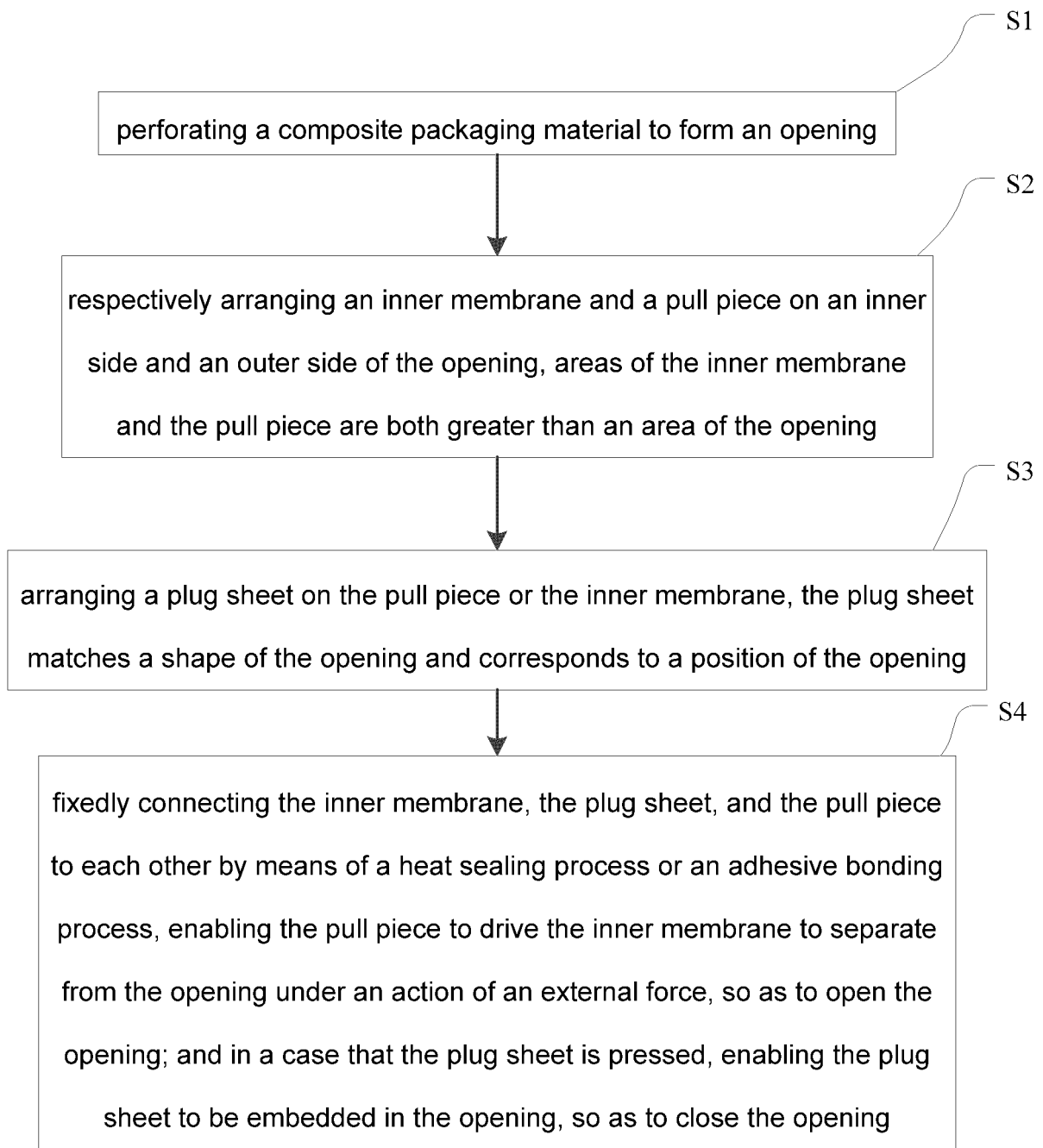


Fig. 13

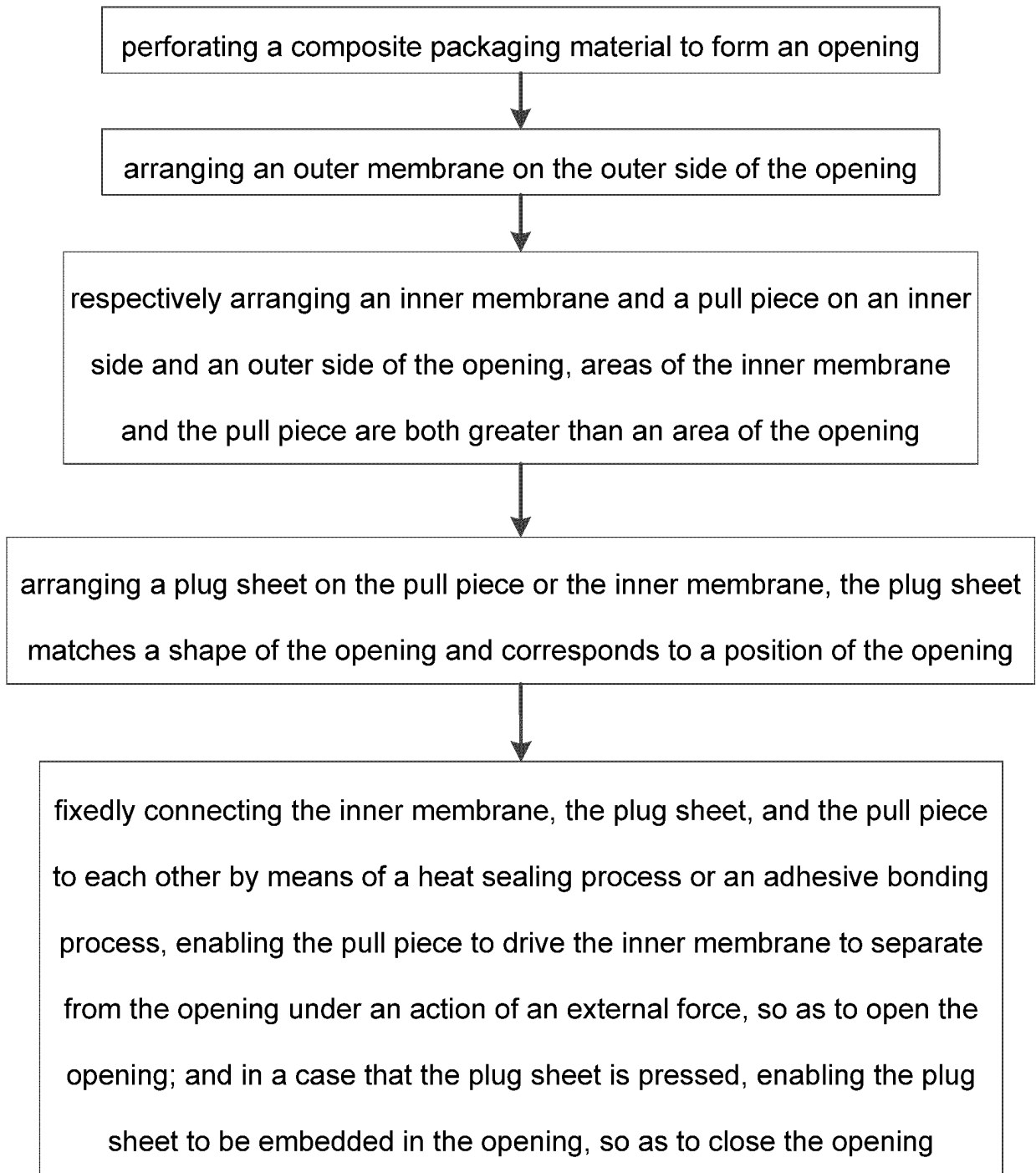


Fig. 14

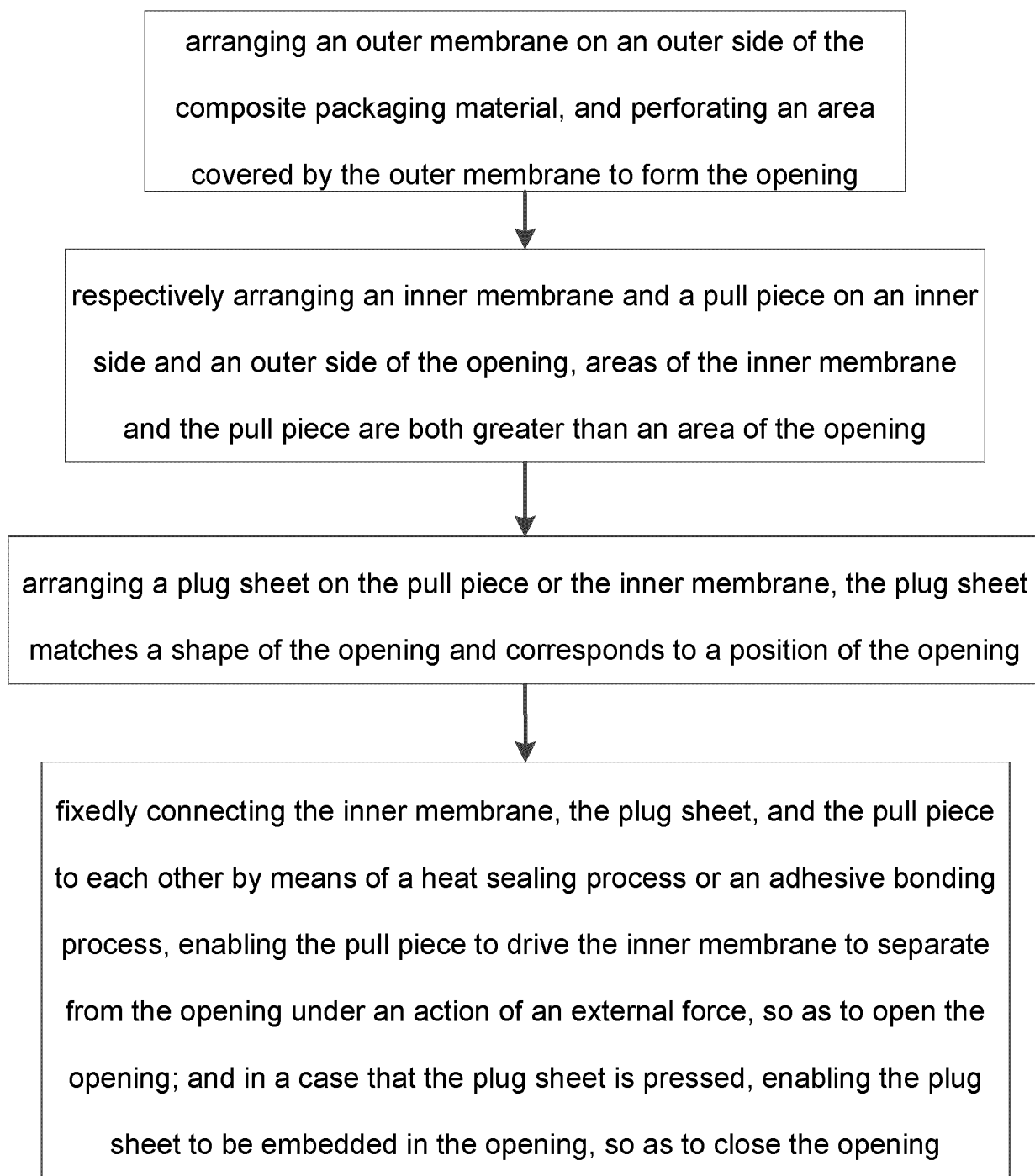


Fig. 15

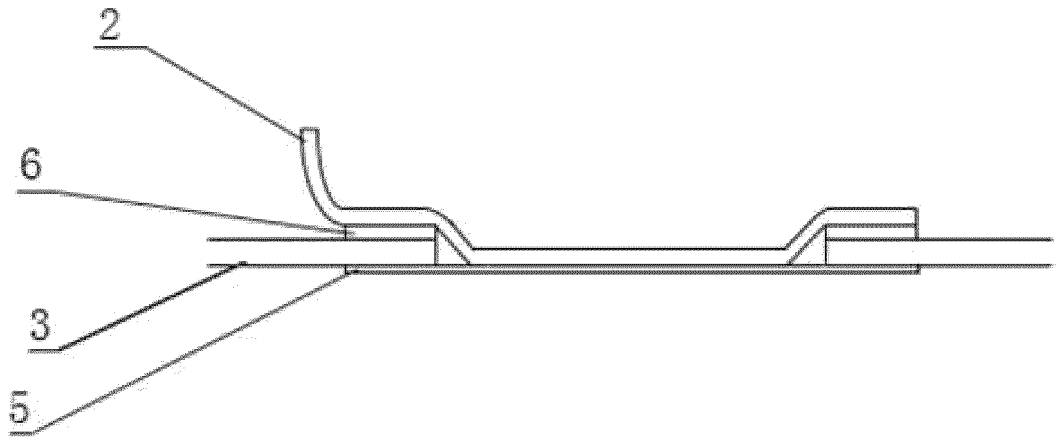


Fig. 16

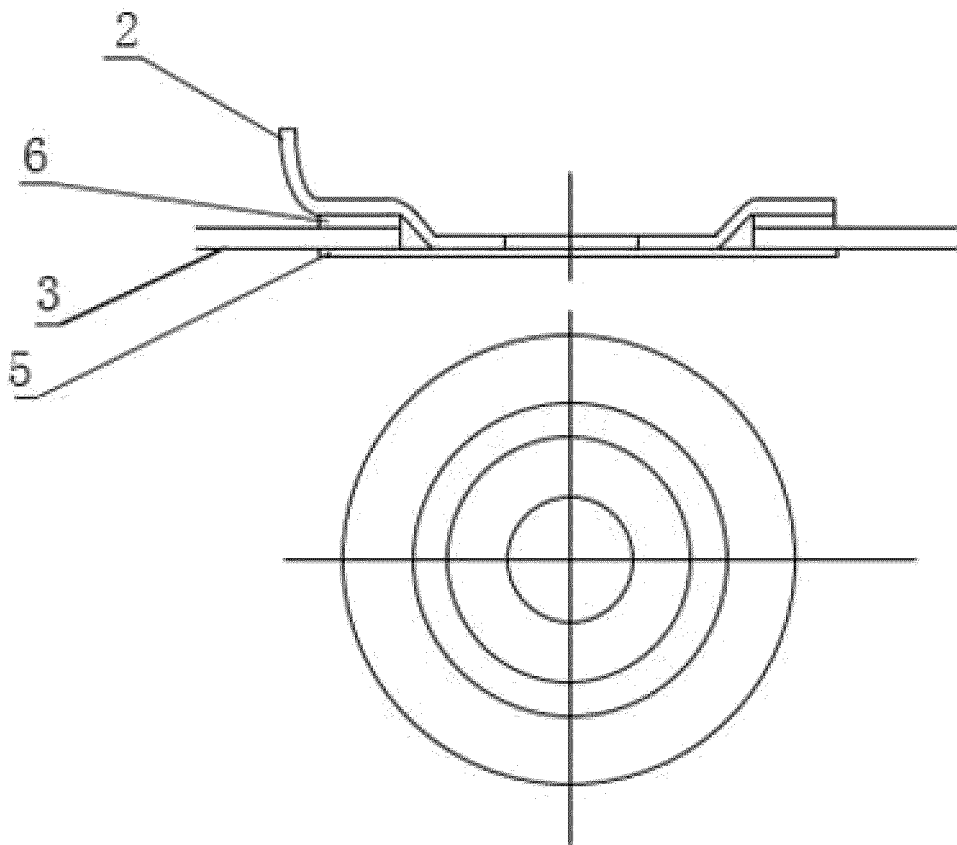


Fig. 17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/129131

A. CLASSIFICATION OF SUBJECT MATTER

B65D 51/22(2006.01)i

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)

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)

CNTXT; ENTXT; VEN; CJFD; CNKI: 开启, 封闭, 闭合, 再, 反复, 拉片, 薄片, opened, clos+, repeat+, again, draw+, sheet, slab, chip

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114030762 A (HANSEN HENGYE (BEIJING) COMMERCIAL CO., LTD.) 11 February 2022 (2022-02-11) description, paragraphs [0067]-[0147], and figures 1-17	1-26
PX	CN 216233879 U (HANSEN HENGYE (BEIJING) COMMERCIAL CO., LTD.) 08 April 2022 (2022-04-08) description, paragraphs [0059]-[0139], and figures 1-17	1-26
X	CN 1248952 A (TETRA LAVAL HOLDING & FINANCE S. A.) 29 March 2000 (2000-03-29) description, page 3, line 21 to page 7, line 22, and figures 1-5	1-26
X	CN 101687567 A (XOLUTION GMBH) 31 March 2010 (2010-03-31) description, page 6, line 17 to page 8, line 5, and figures 1-20	1-26
X	US 3441167 A (AMERICAN CAN COMPANY) 29 April 1969 (1969-04-29) description, column 2, line 46 to column 5, line 57, and figures 1-4	1-26
A	CN 113557200 A (CCL PACKAGE LABEL SNC) 26 October 2021 (2021-10-26) entire document	1-26
A	US 4880137 A (WELLS, R. A.) 14 November 1989 (1989-11-14) entire document	1-26

☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

26 December 2022

Date of mailing of the international search report

18 January 2023

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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100088, China

Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/129131

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0433502 A1 (CHEN JIN XIE) 26 June 1991 (1991-06-26) entire document	1-26

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/129131

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 114030762 A	11 February 2022	None	
CN 216233879 U	08 April 2022	None	
CN 1248952 A	29 March 2000	None	
CN 101687567 A	31 March 2010	DE 112008001021 A5	21 January 2010
		DE 102007007372 A1	14 August 2008
		MX 2009008593 A	25 January 2010
		IN 5308DELNP2009 A	23 April 2010
		AT 505404 T	15 April 2011
		JP 2010517884 A	27 May 2010
		PT 2117943 E	25 May 2011
		CA 2677981 A1	21 August 2008
		US 2010038372 A1	18 February 2010
		ES 2365102 T3	22 September 2011
		WO 2008098558 A1	21 August 2008
		EP 2117943 A1	18 November 2009
		KR 20090112753 A	28 October 2009
		BR PI0807582 A2	01 July 2014
		RU 2009134173 A	20 March 2011
		AU 2008214978 A1	21 August 2008
		DE 502008003165 D1	26 May 2011
US 3441167 A	29 April 1969	NL 6813340 A	22 April 1969
		BE 722538 A	18 April 1969
		GB 1195619 A	17 June 1970
		FR 1579371 A	22 August 1969
		DE 1802920 A1	14 August 1969
CN 113557200 A	26 October 2021	WO 2020177906 A1	10 September 2020
		DE 202019101267 U1	09 June 2020
US 4880137 A	14 November 1989	None	
EP 0433502 A1	26 June 1991	None	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202111348620 [0001]