(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 907 153 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.11.2021 Bulletin 2021/45

(51) Int Cl.:
B65D 75/58 *(2006.01)*

(21) Application number: **21172322.6**

(22) Date of filing: **05.05.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **05.05.2020 IT 202000009913**

(71) Applicant: **Easysnap Technology S.r.l.**
41123 Modena (IT)

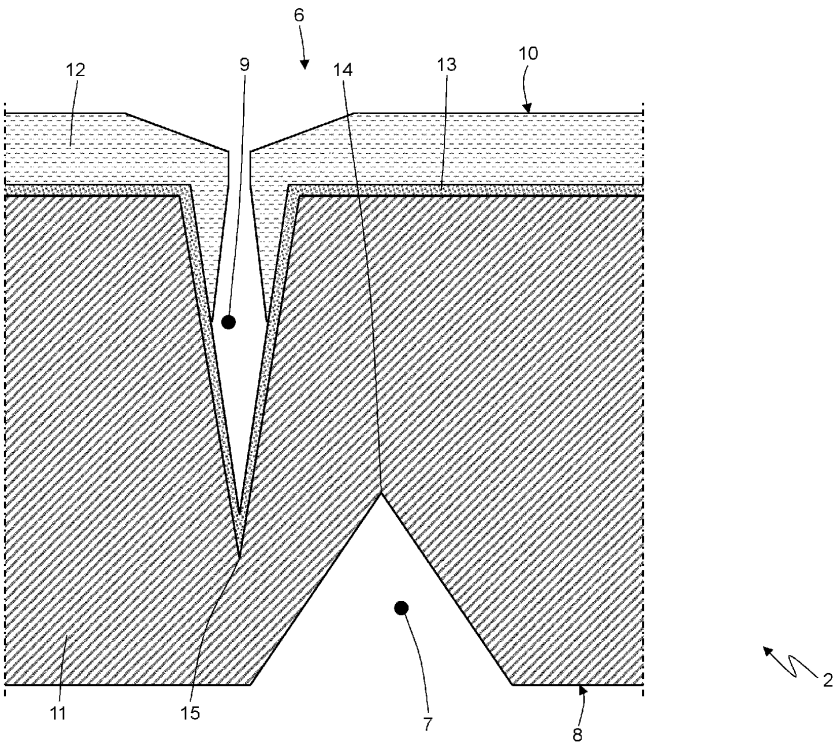
(72) Inventor: **TAGLINI, Andrea**
41123 Modena (IT)

(74) Representative: **Maccagnan, Matteo et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(54) **SEALED BREAK-OPEN PACKAGE**

(57) A sealed break-open package (1) having: a sheet (2) of semirigid plastic material; a sealed pocket (4), which contains a dose of a product (5) and is delimited on one side by the sheet (2); and a pre-weakened area (6), which is made in a central area of the sheet (2) for guiding, following a folding of the sheet (2), a controlled breakage of the sheet (2) in the pre-weakened area (6). The pre-weakened area (6) has an outer incision (7), which is obtained through an outer surface (8) of the sheet (2) and an inner incision (9), which is parallel and staggered with respect to the outer incision (7) and is obtained through an inner surface (10) of the sheet (2), which is opposite to the outer surface (8). A bottom (14) of the outer incision (7) is farther from the outer surface (8) of the sheet (2) than a bottom (15) of the inner incision (9), i.e., the bottom (14) of the outer incision (7) is closer to the inner surface (10) of the sheet (2) than the bottom (15) of the inner incision (9).

Fig. 4



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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102020000009913 filed on 05/05/2020.

TECHNICAL FIELD

[0002] The present invention relates to a sealed break-open package.

PRIOR ART

[0003] The patent application WO2009040629A2 describes a single-dose sealed break-open package; the sealed package comprises a sheet of semi-rigid plastic material and a sheet of flexible plastic material, which is superimposed and welded to the sheet of semi-rigid plastic material to define a sealed pocket which contains a dose of a fluid product. The sheet of semi-rigid plastic material has a central pre-weakened area which guides a controlled breakage in order to cause the formation of an outlet opening for the product. In other words, in use to open the sealed package, a user must grasp the sealed package with the fingers of one hand and fold the sealed package in a "V" shape until the sheet of semi-rigid plastic material breaks in the pre-weakened area. The pre-weakened area comprises an inner incision which is obtained through an inner surface (i.e., facing towards the pocket) of the sheet of semi-rigid plastic material and an outer incision which is obtained through an outer surface of the sheet of semi-rigid plastic material and is aligned with the inner incision.

[0004] According to a preferred embodiment, the inner incision is aligned with the outer incision (i.e., the inner incision is superimposed on the outer incision); according to an alternative embodiment, the inner incision is misaligned with respect to the outer incision (i.e., the inner incision is not superimposed on the outer incision). According to a further embodiment, a single outer incision and a pair of inner incisions are provided which are misaligned with respect to the outer incision and are arranged on opposite sides of the outer incision.

[0005] The patent application WO2015166453A1 also describes a single-dose sealed break-open package in which the inner incision is misaligned with respect to the outer incision (i.e., the inner incision is not superimposed on the outer incision).

[0006] The single-dose sealed package described in patent applications WO2009040629A2 and WO2015166453A1 has an optimal operation; however, its production is relatively complex (i.e., it requires the use of a very precise and perfectly adjusted incision unit) as the two incisions (inner and outer incisions) must be made with great precision to avoid, at the same time, damaging the barrier layer and to allow immediate breakage of the semi-rigid plastic sheet when the sealed package is folded in a "V" shape.

[0007] The patent application DE3810319A1 describes a blister package in which a lower panel is provided with incision lines on the two mutually opposite surfaces; in particular, two adjacent incision lines, staggered with respect to one another transversely to their extension, form a tear point intended for the opening by tearing (breakage) of the lower panel.

DESCRIPTION OF THE INVENTION

[0008] The object of the present invention is to provide a sealed break-open package which can be produced in a simple and inexpensive way.

[0009] According to the present invention, a sealed break-open package is provided, as stated in the attached claims.

The claims describe preferred embodiments of the present invention forming an integral part of the present description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will now be described with reference to the attached drawings, which illustrate a non-limiting example of embodiment, wherein:

- Figure 1 is a top perspective view of a single-dose sealed break-open package made according to the present invention;
- Figure 2 is a bottom perspective view of the sealed package of Figure 1;
- Figure 3 is a bottom view of the sealed package of Figure 1;
- Figures 4 and 5 are two schematic and sectional views along the line of section IV-IV of a sheet of semi-rigid plastic material of the sealed package of Figure 1;
- Figures 6, 7 and 8 schematically illustrate the sheet of semi-rigid plastic material of Figures 4 and 5 during execution of an inner incision and of an outer incision; and
- Figures 9 and 10 are two schematic and sectional views along the line of section IV-IV of respective variants of the sheet of semi-rigid plastic material of the sealed package of Figure 1.

PREFERRED EMBODIMENTS OF THE INVENTION

[0011] In Figures 1, 2 and 3, number 1 denotes, as a whole, a single-dose sealed break-open package The single-dose sealed package 1 comprises a sheet 2 of semi-rigid plastic material having a substantially rectangular shape and a sheet 3 of flexible plastic material having a substantially rectangular shape (shown only in Figure 1), which is superimposed and welded to the sheet 2 of semi-rigid plastic material to define a sealed pocket

4 which contains a dose of a fluid product 5 (liquid, cream or powder).

[0012] The sheet 2 of semi-rigid plastic material has a central pre-weakened area 6 (shown in Figures 2 and 3), which is made in a central area of the sheet 2 of semi-rigid plastic material (in particular in a longitudinally cantered area), developed transversely (i.e. parallel to the shorter sides of the sheet 2 of semi-rigid plastic material), and guides a controlled breakage of the sheet 2 of semi-rigid plastic material in order to cause the formation of an outlet opening for the product 5 through the sheet 2 of semi-rigid plastic material. In other words, in use, to open the single-dose sealed package 1 a user must grasp the single-dose sealed package 1 with the fingers of one hand and fold the single-dose sealed package 1 in a "V" shape until breaking the sheet 2 of semi-rigid plastic material in the pre-weakened area 6. By breaking the sheet 2 of semi-rigid plastic material in the pre-weakened area 6, the product 5 (preferably liquid) can be poured out of the sealed single-dose package 1 in a simple and hygienic way.

[0013] According to what is illustrated in Figures 3 and 4, the pre-weakened area 6 comprises an outer incision 7 which is oriented transversely (i.e., parallel to the shorter sides of the sheet 2 of semi-rigid plastic material), and is obtained through an outer surface 8 (i.e., opposite to the pocket 4) of the sheet 2 of semi-rigid plastic material. The outer incision 7 extends at the pocket 4 (i.e., the outer incision 7 is superimposed on the pocket 4).

[0014] Furthermore, the pre-weakened area 6 comprises an inner incision 9 which is oriented transversely, is parallel to the outer incision 7, and is obtained through an inner surface 10 (i.e., facing the pocket 4) of the sheet 2 of semi-rigid plastic material opposite to the outer surface 8. The inner incision 9 extends only at the pocket 4 (i.e., the inner incision 9 is entirely superimposed on the pocket 4) and only in the vicinity of the outer incision 7 (i.e., the inner incision 9 is arranged near the outer incision 7). In other words, the inner incision 9 extends only at the area in which the pocket 4 (from the side of the inner surface 10 of the sheet 2 of semi-rigid plastic material) and the outer incision 7 (from the side of the outer surface 8 of the sheet 2 of semi-rigid plastic material) are arranged at the same time. According to the embodiment illustrated in Figures 4 and 5, the sheet 2 of semi-rigid plastic material is formed by a laminate comprising an externally arranged supporting layer 11 (i.e., on the side opposite the pocket 4 and at the outer surface 8) and of an internally arranged heat-sealable layer 12 (i.e., on the same side of the pocket 4, at the inner surface 10, and in contact with the sheet 3 of flexible plastic material). Between the supporting layer 11 and the heat-sealable layer 12 an insulating or barrier layer 13 is provided, with the purpose of ensuring impermeability to air and/or light.

[0015] By way of non-limiting example, the sheet 2 of semi-rigid plastic material could be formed by a supporting layer 11 of white polystyrene (PS) having a thickness T1 of 350-400 microns (± 8%), by a barrier layer 13 of by "Evoh" or by aluminium having a thickness T2 of 6-10 microns (± 8%), and by a heat-sealable layer 12 of polyethylene (PE) having a thickness T3 of 40-50 microns (± 8%).

[0016] According to a different embodiment, all three layers 11, 12 and 13 are composed of the same family of plastic material and in particular are composed of polyolefins. Polyolefins are a class of macromolecules (i.e., polymers) composed of monomers of olefins (also called alkenes, based on the C_nH_{2n} structure) derived from the polymerization of petroleum or natural gas; the most common polyolefins are polypropylene (PP), polyethylene (PE) and polyisobutylene (PIB).

[0017] The polyolefin mixture that forms the supporting layer 11 is different from the polyolefin mixture that forms the heat-sealable layer 12; mainly the polyolefin mixture that forms the heat-sealable layer 12 must have a melting temperature lower than a melting temperature of the polyolefin mixture that forms the supporting layer 11 so as to allow heat-sealing of the sheet 2 of semi-rigid plastic material to the sheet 3 of flexible plastic material without damaging (melting) the sheet 2 of semi-rigid plastic material. Also the polyolefin mixture that forms the barrier layer 13 is different from the polyolefin mixture that forms the heat-sealable layer 12 and from the polyolefin mixture that forms the supporting layer 11; mainly the polyolefin mixture that forms the barrier layer 13 must have a melting temperature higher than a melting temperature of the polyolefin mixture that forms the heat-sealable layer 12 and the polyolefin mixture that forms the barrier layer 13 must have greater insulating properties than the polyolefin mixture that forms the heat-sealable layer 12 and above all than the polyolefin mixture that forms the supporting layer 11.

[0018] Each layer 11, 12 or 13 can be formed by a polyolefin mixture which can generally be composed of at least one polyolefin or of two or more polyolefins mixed together.

[0019] Using a single family of plastic material for the entire sealed package 1 (i.e., for the three layers 11, 12 and 13 of the sheet 2 of semi-rigid plastic material and for sheet 3 of flexible plastic material) allows the sealed package 1 to be recycled after use without having to separate the various components; therefore, the sealed package 1 is easily and quickly recyclable without requiring complex mechanical operations for separating the various parts of the sealed package 1. In particular, it is possible to obtain the entire sealed package 1 by using mixtures of polyolefins (mainly polypropylene and polyethylene) differentiated from one another as described above. Among other things, it is relatively simple to make sure that a sealed package 1 made entirely of mixtures of polyolefins has a total specific weight of less than one (i.e., it can float on water); in this way, it is possible to recycle the sealed package 1 with separation techniques that involve the use of water floatation.

[0020] The outer incision 7 is obtained through the outer surface 8 of the sheet 2 of semi-rigid plastic material,

has a "V" shape (but could also have a different shape), and is made by locally deforming the sheet 2 of semi-rigid plastic material; in particular, the outer incision 7 is made by deforming only the supporting layer 11 of the sheet 2 of semi-rigid plastic material, i.e., the outer incision 7 affects only the supporting layer 11 of the sheet 2 of semi-rigid plastic material. Preferably, the outer incision 7 has a depth P1 (i.e., a distance between the outer surface 8 and a bottom 14 of the outer incision 7) comprised between 120 and 160 microns.

[0021] The inner incision 9 is obtained through the inner surface 10 of the sheet 2 of semi-rigid plastic material, has a "V" shape (but it could also have a different shape), and is made by locally deforming the sheet 2 of semi-rigid plastic material as well; in particular, the inner incision 9 is made by deforming all three, supporting 11, heat-sealable 12 and barrier 13 layers of the sheet 2 of semi-rigid plastic material. Preferably, the inner incision 9 has a depth p2 (i.e., a distance between the inner surface 10 and a bottom 15 of the inner incision 9) comprised between 260 and 380 microns.

[0022] As illustrated in Figures 4 and 5, the inner incision 9 is parallel and staggered, i.e., not superimposed, with respect to the outer incision 7. Consequently, a central plane of symmetry 16 of the outer incision 7 (arranged transversely or parallel to the shorter sides of the sheet 2 of semi-rigid plastic material) is parallel to, and spaced from, a central plane of symmetry 17 of the inner incision 9 (transversely arranged or parallel to the shorter sides of the sheet 2 of semi-rigid plastic material); in other words, the two central planes of symmetry 16 and 17 are parallel to one another and spaced apart by a distance D1 which is preferably comprised between 70 and 130 microns, i.e., is preferably comprised between 50% and 90% of the depth P1 of the outer incision 7.

[0023] The bottom 14 of the outer incision 7 is farther from the outer surface 8 of the sheet 2 than the bottom 15 of the inner incision 9, i.e., the bottom 14 of the outer incision 7 is closer to the inner surface 10 of the sheet 2 than the bottom 15 of the inner incision 9. Consequently, the tip (i.e., the end part) of the outer incision 7 is arranged alongside the tip (i.e., the end part) of the inner incision 9.

[0024] According to a preferred embodiment, the difference Δ between a distance P1 of the bottom 14 of the outer incision 7 from the outer surface 8 of the sheet 2 (i.e., the depth P1 of the outer incision 7) and a distance D2 of the bottom 15 of the inner incision 9 from outer surface 8 of the sheet 2 is comprised between 15 and 100 microns, is comprised between 5% and 25% of a thickness T1 of the supporting layer 11, and/or is comprised between 10% and 70% of a depth P1 of the outer incision 7. From a different point of view, the difference Δ can be calculated as the difference between a distance D3 of the bottom 14 of the outer incision 7 from the inner surface 10 of the sheet 2 and a distance D2 of the bottom 15 of the inner incision 9 from the inner surface 10 of the sheet 2 (i.e., the depth P2 of the inner incision 9).

[0025] The outer incision 7 only affects (crosses) the supporting layer 11 while the inner incision 9 affects the heat-sealable layer 12, the barrier layer 13 and the supporting layer 11. According to a preferred embodiment illustrated in Figures 4 and 5, the inner incision 9 completely passes through the heat-sealable layer 12 causing a local interruption of the heat-sealable layer 12, while the inner incision 9 locally deforms the barrier layer 13 without compromising the continuity of the barrier layer 13; consequently, outside the inner incision 9 the barrier layer 13 is perfectly flat and has a constant thickness whereas, at the inner incision 9, the barrier layer 13 is deformed to assume a "V" shape in cross-section with the tip of the "V" facing the bottom 15 of the inner incision 9 and has a variable thickness.

[0026] It is important to underline that in correspondence with the inner incision 9 the barrier layer 13 the sheet 2 of semi-rigid plastic material is locally deformed plastically (even in an irregular manner), but is not torn, i.e., it maintains its integrity. Thanks to the substantial integrity of the barrier layer 13 of the sheet 2 of semi-rigid plastic material, also at the inner incision 9 obtained through the inner surface 10 of the sheet 2 of semi-rigid plastic material, it is possible to ensure perfect insulation of the pocket 4 which is therefore designed to also contain perishable and/or controlled bacterial load products such as food, medicines or cosmetics.

[0027] Obviously, during the break-opening of the single-dose sealed package 1 obtained by folding the single-dose sealed package 1 in a "V" shape, it is necessary to break all three, supporting 11, heat-sealable 12 and barrier 13 layers in the pre-weakened area 6 of the sheet 2 of semi-rigid plastic material.

[0028] As previously mentioned, the inner incision 9 extends only at the area in which the pocket 4 is located and therefore at the inner incision 9 there are no welds between the sheet 2 of semi-rigid plastic material and the sheet 3 of flexible plastic material; consequently, any local tearing of the heat-sealable layer 12 of the sheet 2 of semi-rigid plastic material at the inner incision 9 does not have any kind of negative consequence.

[0029] Generally, polyolefins have a greater insulating capacity than polystyrene (which is normally used to obtain the supporting layer 11) but on the other hand, polyolefins are more resistant to breakage than polystyrene and therefore when the supporting layer 11 is formed by a polyolefin mixture it is necessary to achieve, to be the same as other dimensions, a greater degree of weakening of the pre-weakened area 6 (i.e., a greater depth of the incisions 7 and 9). Consequently, the embodiment illustrated in the attached figures in which the two incisions 7 and 9 are staggered between one another (i.e., not superimposed) and partially side by side (i.e., the bottom 14 of the outer incision 7 is farther from the outer surface 8 than the bottom 15 of the inner incision 9) are particularly suitable for being used when the supporting layer 11 is formed by a polyolefin mixture as it allows to ensure the breakage of the supporting layer 11 even when the supporting layer 11 is particularly resistant (as

happens by using a polyolefin mixture). In other words, the combination of the embodiment illustrated in the attached figures, in which the two incisions 7 and 9 are staggered between one another and partially side by side with the use of a polyolefin mixture to form the supporting layer 11 allows to obtain a synergistic effect which maximizes the advantages of the two solutions while reducing the drawbacks thereof.

[0030] With reference to Figures 6, 7 and 8, the production process used to make the outer incision 7 and the inner incision 9 in the sheet 2 of semi-rigid plastic material is described in the following.

[0031] Staring from sheet 2 of semi-rigid plastic material without the incisions 7 and 9 as illustrated in Figure 6.

[0032] Initially and as illustrated in Figure 7, only the outer incision 7 is made (i.e., not the inner incision 9) by means of a wedge-shaped tool 18 which is pushed inside the sheet 2 of semi-rigid plastic material (in particular inside the supporting layer 11) through the outer surface 8 and by means of a contrast element 19 which rests on the inner surface 10 of the sheet 2 of semi-rigid plastic material (therefore on the opposite side of the tool 14).

[0033] According to a possible embodiment, the contrast element 19 does not initially make contact with the inner surface 10, but remains spaced apart from the inner surface 10 (for example by 1-4 mm also depending on the overall dimensions of the sealed package 1); consequently, when the tool 18 comes into contact with the outer surface 8, initially the sheet 2 of semi-rigid plastic material folds slightly in a "V" shape until it rests on the contrast element 17 and only at this point the tool 14 begins to penetrate into the sheet 2 of semi-rigid plastic material (which is slightly folded in a "V" shape) through the outer surface 8.

[0034] Once the execution of the outer incision 7 is completed, the inner incision 9 is subsequently (and at a later time) made. As illustrated in Figure 8, only the inner incision 9 is made (the outer incision 7 has been made previously and therefore is already present) by means of a wedge-shaped tool 20 which is pushed inside the sheet 2 of semi-rigid plastic material (in particular inside the three layers 11, 12 and 13) through the inner surface 10 and by means of a contrast element 21 which rests on the outer surface 8 of the sheet 2 of semi-rigid plastic material (therefore on the opposite side of the tool 16).

[0035] According to a possible embodiment, the contrast element 21 does not initially make contact with the outer surface 8, but remains spaced apart from the outer surface 8 (for example by 1-4 mm also depending on the overall dimensions of the sealed package 1); consequently, when the tool 20 comes into contact with the inner surface 10, initially the sheet 2 of semi-rigid plastic material folds slightly in a "V" shape until it rests on the contrast element 21 and only at this point the tool 20 begins to penetrate into the sheet 2 of semi-rigid plastic material (which is slightly folded in a "V" shape) through the inner surface 10.

[0036] According to the embodiment illustrated in Figures 7 and 8, the tools 18 and 20 are wedge-shaped, while the contrast elements 19 and 21 are flat. The tools 18 and 20 can have a pointed (more or less sharp), flat (or blunt), or round (or rounded) end part. It is also possible that the end part of the tool 18 is different from the end part of the tool 20 (for example the end part of the tool 18 could be pointed while the end part of the tool 20 could be blunt or rounded or vice versa) .

[0037] According to the embodiment illustrated in Figures 1-8, the barrier layer 13 of the sheet 2 of semi-rigid plastic material is locally deformed plastically (even in an irregular way), but is not torn, i.e., it maintains its integrity. According to a different embodiment illustrated in Figure 9, this is the result also for the barrier layer 13 of the sheet 2 of semi-rigid plastic material which is locally torn at the inner incision 9; however, the limited tearing of the barrier layer 13 only at the inner incision 9 can be accepted above all when the supporting layer 11 is formed by a polyolefin mixtures which have a greater insulating capacity than polystyrene (which is normally used to form the supporting layer 11). In other words, when the supporting layer 11 is formed by a polyolefin mixtures, it has a relatively high insulating capacity and therefore can allow a limited tearing of the barrier layer 13 only at the inner incision 9. It is important to underline that the limited tearing of the barrier layer 13 at the inner incision 9 is never a sought-after result (i.e., it is never done on purpose) but can be an undesirable and inevitable consequence of the formation of the inner incision 9; one always tries as far as possible not to tear the barrier layer 13 during the formation of the inner incision 9, but it must be accepted that with a given frequency (more or less high) the barrier layer 13 is torn during the formation of the inner incision 9.

[0038] According to a further embodiment illustrated in Figure 10, the sheet 2 of plastic material is without the barrier layer 13, i.e., it is formed solely of the supporting layer 11 and of the heat-sealable layer 12.

[0039] This embodiment can be used only when the supporting layer 11 is formed by a polyolefin mixture and therefore has a relatively high insulating capacity such as not to require the presence of the barrier layer 13 (particularly when the product 5 contained in the pocket 4 is more resistant to perishability, i.e., it is less subject to oxidation or other similar processes that over time can compromise its integrity).

[0040] According to a possible embodiment, the two incisions 7 and 9 have the same extension, i.e., where the outer incision 7 is present, the inner incision 9 is also present and vice versa. According to an alternative and equivalent embodiment, the outer incision 7 has a greater extension than the inner incision 9 (in this case the outer incision 7 could also extend outside the pocket 4), i.e., where the inner incision 9 is present also the outer incision 7 is present but not vice versa. In fact, the outer incision 7 (in the portion superimposed on the inner incision 9) and the inner incision 9 serve to generate, when

the single-dose sealed package 1 is folded in a "V" shape, a controlled breakage of the sheet 2 of semi-rigid plastic material to allow the product 5 contained in the pocket 4 to come out. The outer incision 7 (also in the possible portion not superimposed on the inner incision 9) also serves for guiding the folding in a "V" shape of the sheet 2 of semi-rigid plastic material so that the vertex of the "V" shaped fold of the sheet 2 of semi-rigid plastic material coincides with the incisions 7 and 9.

[0041] In the embodiment illustrated in the attached figures, the incisions 7 and 9 are continuous, i.e., without interruptions; according to an alternative and perfectly equivalent embodiment not illustrated, the incisions 7 and 9 can be discontinuous, or have one or more interruptions (in this case we can speak of two discontinuous incisions 7 and 9 or of a series of incisions 7 and 9 aligned and spaced apart from one another).

[0042] The inner incision 9 could have a variable depth along its length; this feature is preferable (but not strictly necessary) to improve the opening of the single-dose sealed package 1 when the single-dose sealed package 1 is folded in a "V" shape. In other words, the fact that the inner incision 9 has a variable depth along its length allows to obtain a progressive breakage of the sheet 2 of semi-rigid plastic material when the single-dose sealed package 1 is folded in a "V" shape. Similarly, the outer incision 7 could also have a variable depth along its length. In other words, both incisions 7 and 9 could have a variable depth along their length, only one of the two incisions 7 and 9 could have a variable depth along its length, or both incisions 7 and 9 could have a constant depth along their own length.

[0043] In the embodiment illustrated in the attached figures, the single-dose sealed package 1 has a rectangular shape; obviously for aesthetic reasons the single-dose sealed package 1 could have any other shape: round, elliptical, in the shape of a *"bottle",* rhomboid, pentagonal, hexagonal, triangular, square, in the shape of a *"bone".* Obviously, the outer surface 8 of the sheet 2 of semi-rigid plastic material and/or the outer surface of the sheet 3 of flexible plastic material can be printed both to show information about the product 5 and to achieve a greater aesthetic decoration.

[0044] In the embodiment illustrated in the attached figures, the sealed package 1 is a single-dose type (i.e., it contains a single dose of the product 5); according to other embodiments not illustrated, the sealed package 1 contains several doses of the product 5 which are extracted from the sealed package 1 at different times (by folding the sealed package 1 in a "V" shape, the product 5 can come out of the sealed package 1 through a breakage of the sheet 2 of semi-rigid plastic material while by bringing the sealed package 1 back to *"flat",* the breakage of the sheet 2 of semi-rigid plastic material is recomposed, substantially preventing further exiting of the product 5).

[0045] In the embodiment illustrated in the attached figures, the pocket 4 (containing the product 5) is defined between the sheet 2 of semi-rigid plastic material and sheet 3 of flexible plastic material (which is superimposed and welded to the sheet 2 of semi-rigid plastic material).

[0046] According to other embodiments not illustrated, the pocket 4 (containing the product 5) is defined between the sheet 2 of semi-rigid plastic material and a more or less rigid box-shaped element (i.e. the sheet 2 of semi-rigid plastic material forms a wall having a box-like structure inside which the pocket 4 containing the product 5 is defined); in this case, for the product 5 to come out of the pocket 4, the entire sealed package 1 is not folded, but only the sheet 2 of semi-rigid plastic material is folded. For example, in this embodiment, the sheet 2 of semi-rigid plastic material could be part of a larger blank which is folded to assume a closed shape which delimits the pocket 4 containing the product 5 on the inside thereof.

[0047] The embodiments described here can be combined with one another without departing from the scope of the present invention.

[0048] The single-dose sealed package 1 described above has numerous advantages.

[0049] Firstly, the single-dose sealed package 1 described above has a relatively simple production as it does not require the use of a very precise and perfectly adjusted incision unit for making the incisions 7 and 9. This result is obtained due to the fact that the bottom 14 of the outer incision 7 is staggered and side by side the bottom 15 of the outer incision 9 as illustrated for example in Figures 4 and 5; therefore an imprecision (within given relatively wide limits) in the formation of the incisions 7 and 9 does not make the pre-weakened area 6 too weak (therefore subject to accidental breakages even during production, transport and storage), or too resistant (therefore subject to not opening when the sealed package 1 is folded in a "V" shape by the end user).

[0050] Furthermore, the sealed package 1 described above is simple and inexpensive to produce since the construction thereof is entirely similar to the production of a similar standard single-dose sealed package; that is, the sealed package 1 described above can be made in an existing packaging machine which produces standard sealed packages simply by adapting the incision unit alone.

LIST OF REFERENCE NUMBERS OF THE FIGURES

[0051]

1	package
2	semi-rigid sheet
3	flexible sheet
4	pocket
5	product
6	pre-weakened area
7	outer incision
8	outer surface
9	inner incision
10	inner surface

11	supporting layer
12	heat-sealable layer
13	barrier layer
14	bottom
15	bottom
16	central plane of symmetry
17	central plane of symmetry
18	tool
19	contrast element
20	tool
21	contrast element
T1	thickness
T2	thickness
T3	thickness
P1	depth
P2	depth
D1	distance
Δ	difference
D2	distance
D3	distance

Claims

1. A sealed break-open package (1); the sealed package (1) comprises:

a sheet (2) of semi-rigid plastic material;
a sealed pocket (4), which contains a dose of a product (5) and is delimited on one side by the sheet (2); and
a pre-weakened area (6), which is made in a central area of the sheet (2) for guiding, following a "V" shape folding of the sheet (2), a controlled breakage of the sheet (2) in the pre-weakened area (6) in order to cause the formation of an outlet opening for the product (5) through the sheet (2);
wherein the pre-weakened area (6) comprises an outer incision (7), which is obtained through an outer surface (8) of the sheet (2) and at least partially extends at the pocket (4), and an inner incision (9), which is parallel to and staggered, i.e., not superimposed, with respect to the outer incision (7) and is obtained through an inner surface (10) of the sheet (2), which is opposite to the outer surface (10);
the sealed package (1) is **characterized in that:**

a bottom (14) of the outer incision (7) is farther from the outer surface (8) of the sheet (2) than a bottom (15) of the inner incision (9), i.e., the bottom (14) of the outer incision (7) is closer to the inner surface (10) of the sheet (2) than to the bottom (15) of the inner incision (9); and
the difference (Δ) between a distance (D1) of the bottom (14) of the outer incision (7) from the outer surface (8) of the sheet (2) and a distance (D2) of the bottom (15) of the inner incision (9) from the outer surface (8) of the sheet (2) is comprised between 15 and 100 microns.

2. The sealed package (1) according to claim 1, wherein the difference (Δ) between a distance (D1) of the bottom (14) of the outer incision (7) from the outer surface (8) of the sheet (2) and a distance (D2) of the bottom (15) of the inner incision (9) from the outer surface (8) of the sheet (2) is comprised between 5% and 25% of a thickness (T1) of a supporting layer (11).

3. The sealed package (1) according to claim 1 or 2, wherein the difference (Δ) between a distance (D1) of the bottom (14) of the outer incision (7) from the outer surface (8) of the sheet (2) and a distance (D2) of the bottom (15) of the inner incision (9) from the outer surface (8) of the sheet (2) is comprised between 10% and 70% of a depth (P1) of the outer incision (7).

4. The sealed package (1) according to claim 1, 2 or 3, wherein:

a depth (P1) of the outer incision (7) is comprised between 120 and 160 microns; and
a depth (P1) of the inner incision (9) is comprised between 260 and 380 microns.

5. The sealed package (1) according to one of the claims from 1 to 4, wherein a distance (D1) between a central plane of symmetry (16) of the outer incision (7) and a central plane of symmetry (17) of the inner incision (9) is comprised between 70 and 130 microns.

6. The sealed package (1) according to one of the claims from 1 to 5, wherein a distance (D1) between a central plane of symmetry (16) of the outer incision (7) and a central plane of symmetry (17) of the inner incision (9) is comprised between 50% and 90% of a depth (P1) of the outer incision (7).

7. The sealed package (1) according to one of the claims from 1 to 6, wherein:

the sheet (2) is formed by a laminate comprising: an externally arranged supporting layer (11), an internally arranged heat-sealable layer (12), and a barrier layer (13) interposed between the supporting layer (11) and the heat-sealable layer (12);
the outer incision (7) only affects the supporting layer (11); and
the inner incision (9) affects the heat-sealable

layer (12),
the barrier layer (13) and the supporting layer (11).

8. The sealed package (1) according to claim 7, wherein the inner incision (9) completely passes through the heat-sealable layer (12) causing a local interruption of the heat-sealable layer (12).

9. The sealed package (1) according to claim 7 or 8, wherein the inner incision (9) locally deforms the barrier layer (13) without compromising the continuity of the barrier layer (13).

10. The sealed package (1) according to claim 9, wherein outside the inner incision (9) the barrier layer (13) is perfectly flat and has a constant thickness; and
the barrier layer (13) is deformed at the inner incision (9) to assume a "V" shape in cross-section with the tip of the "V" facing the bottom (15) of the inner incision (9) and has a variable thickness.

11. The sealed package (1) according to claim 7 or 8, wherein the inner incision (9) completely passes through the barrier layer (13) causing a local interruption of the barrier layer (13) .

12. The sealed package (1) according to one of the claims from 1 to 11, wherein the sheet (2) is formed by a laminate comprising: a supporting layer (11) arranged externally and composed of polyolefins and a heat-sealable layer (12) arranged internally.

13. The sealed package (1) according to claim 12, wherein the heat-sealable layer (12) is composed of polyolefins and has a melting temperature lower than a melting temperature of the supporting layer (11).

14. The sealed break-open package (1); the sealed package (1) comprises:

a sheet (2) of semi-rigid plastic material;
a sealed pocket (4), which contains a dose of a product (5) and is delimited on one side by the sheet (2); and
a pre-weakened area (6), which is made in a central area of the sheet (2) for guiding, following a "V" shape folding of the sheet (2), a controlled breakage of the sheet (2) in the pre-weakened area (6) in order to cause the formation of an outlet opening for the product (5) through the sheet (2);
wherein the pre-weakened area (6) comprises an outer incision (7), which is obtained through an outer surface (8) of the sheet (2) and at least partially extends at the pocket (4), and an inner incision (9), which is parallel to and staggered, i.e., not superimposed, with respect to the outer incision (7) and is obtained through an inner surface (10) of the sheet (2), which is opposite to the outer surface (10);
the sealed package (1) is **characterized in that** a bottom (14) of the outer incision (7) is farther from the outer surface (8) of the sheet (2) than a bottom (15) of the inner incision (9), i.e., the bottom (14) of the outer incision (7) is closer to the inner surface (10) of the sheet (2) than to the bottom (15) of the inner incision (9).

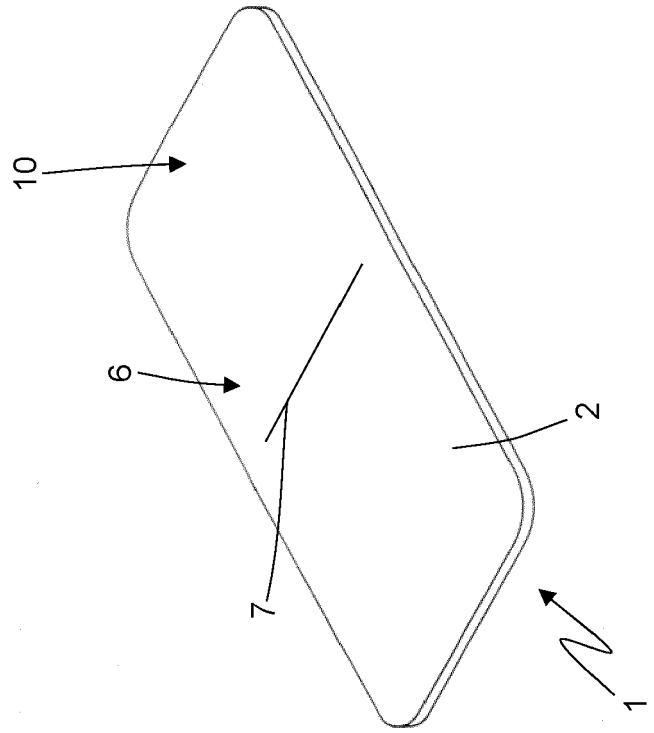


Fig. 2

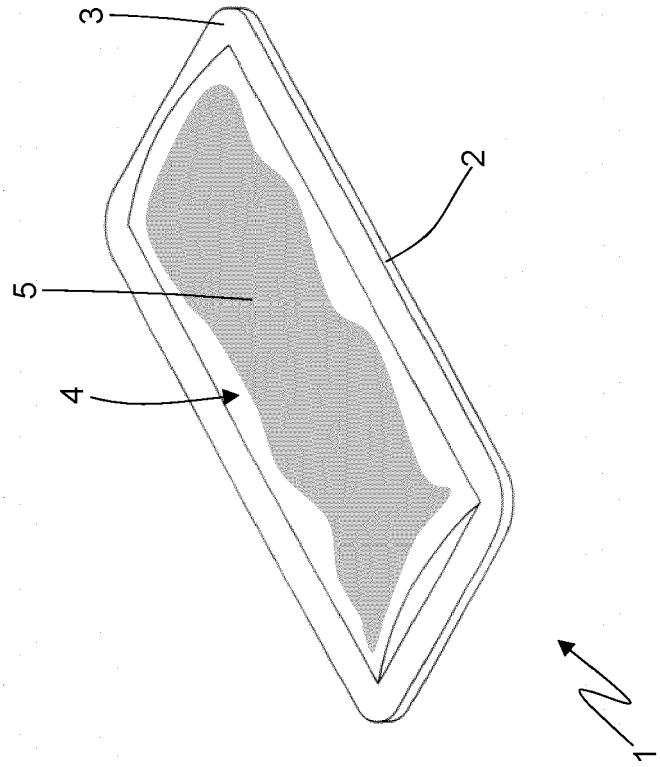


Fig. 1

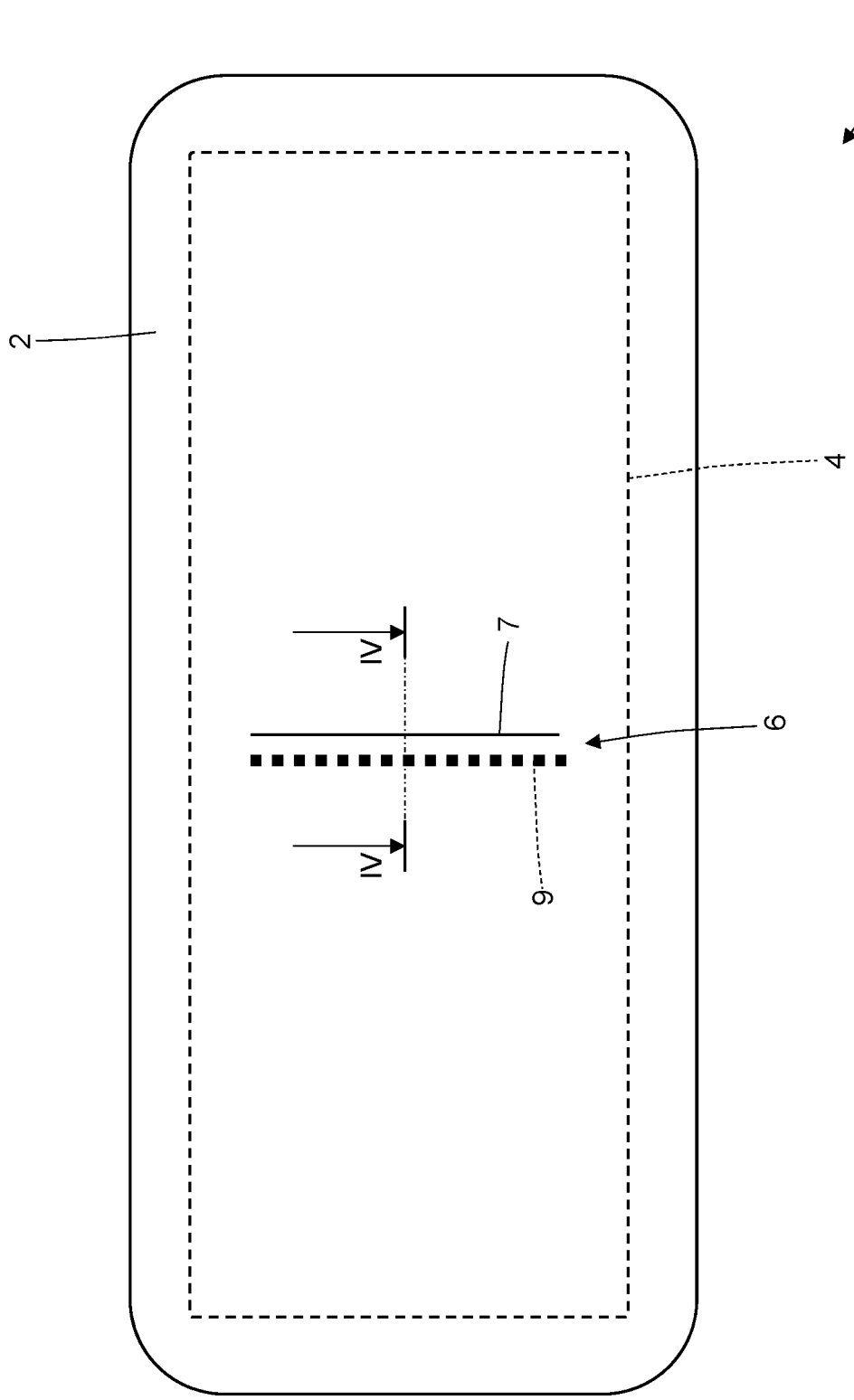


Fig. 3

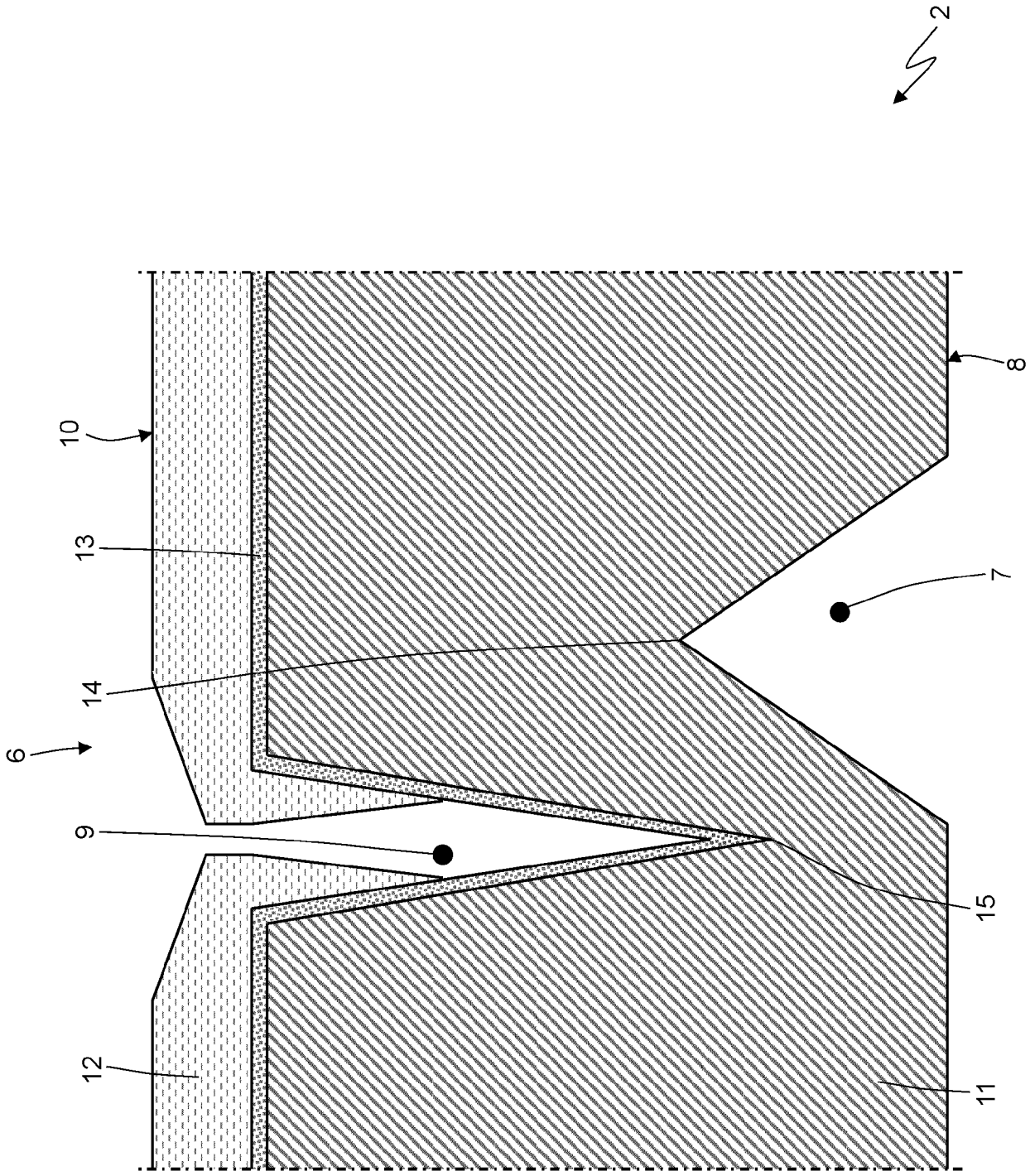


Fig. 4

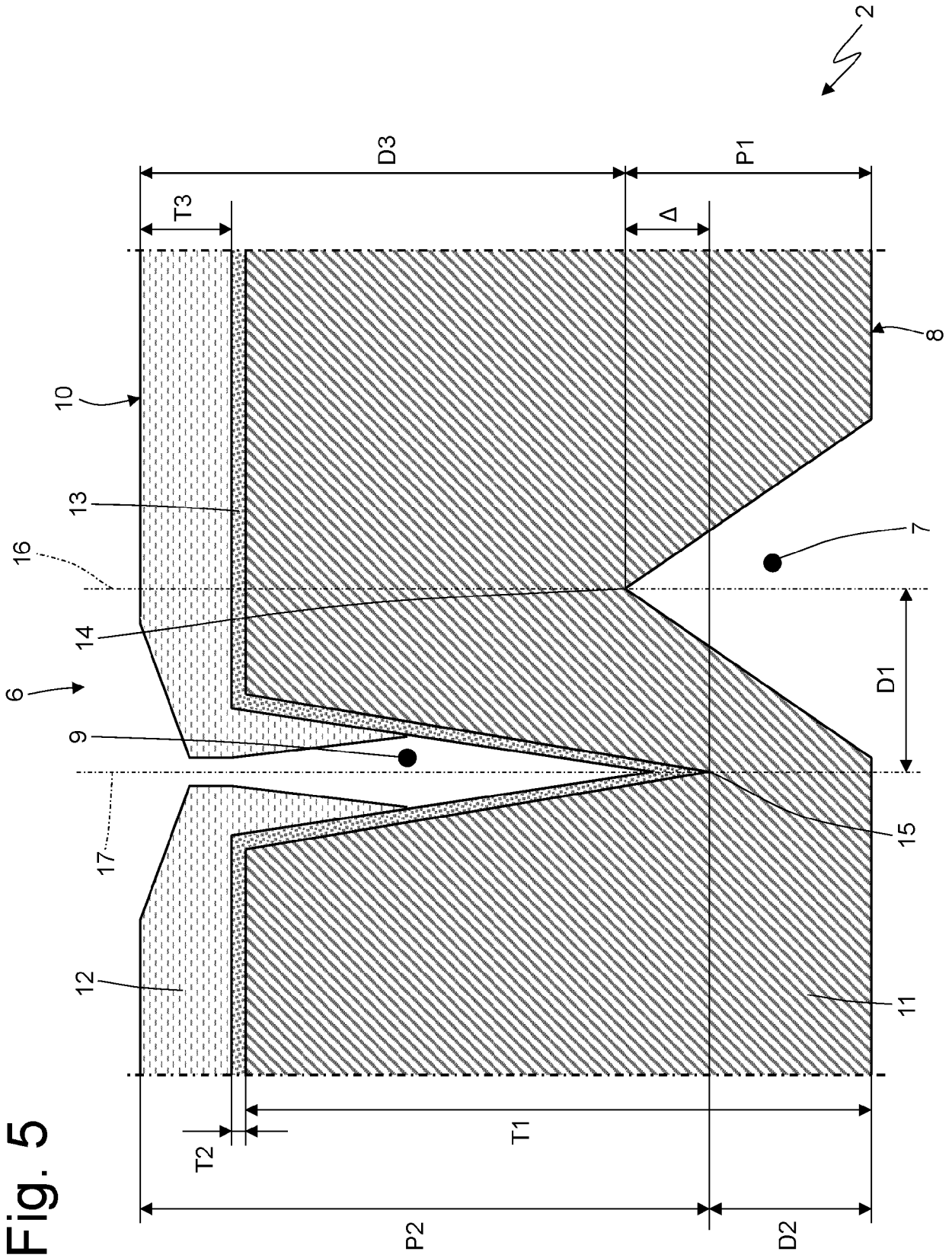


Fig. 5

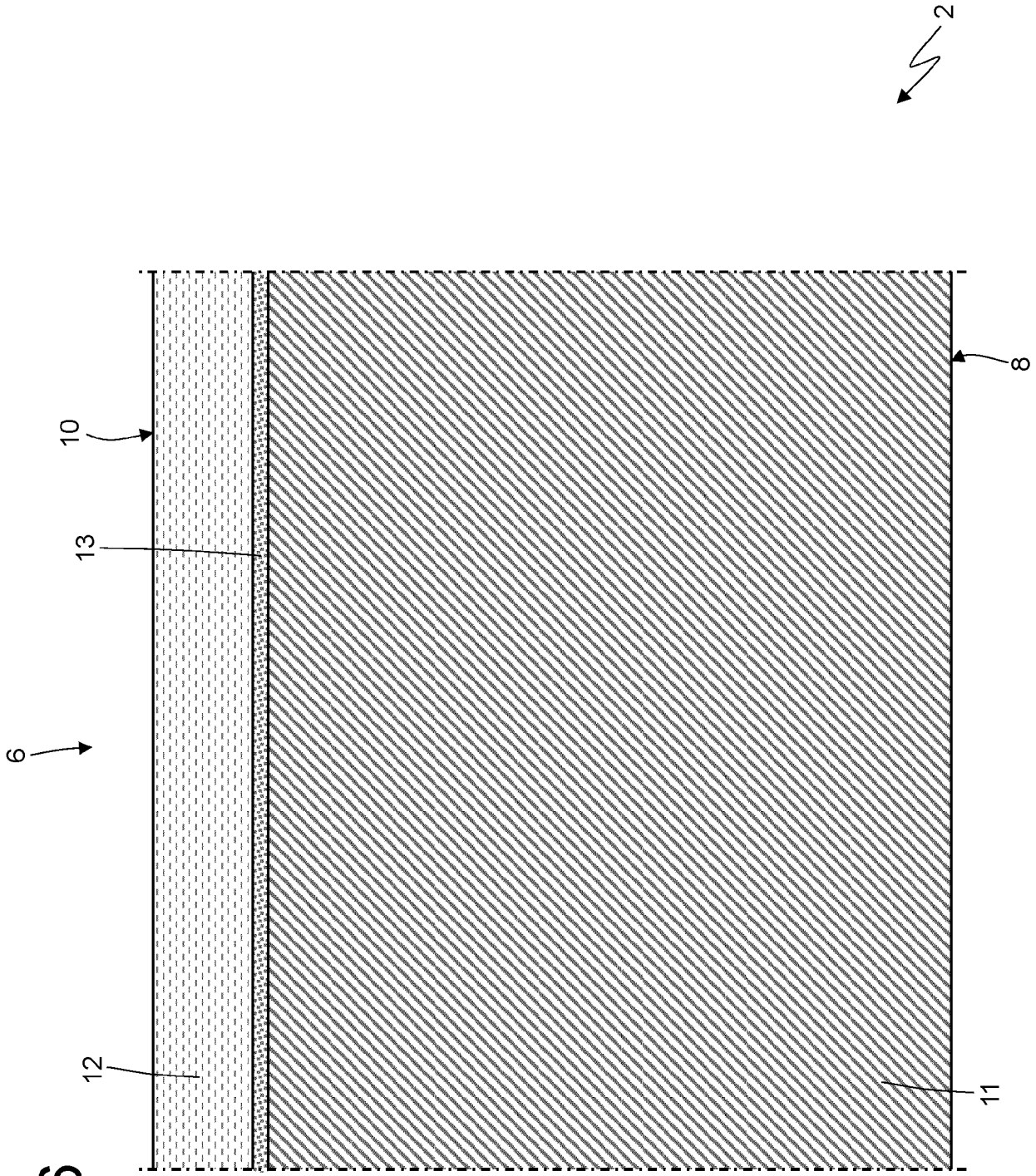


Fig. 6

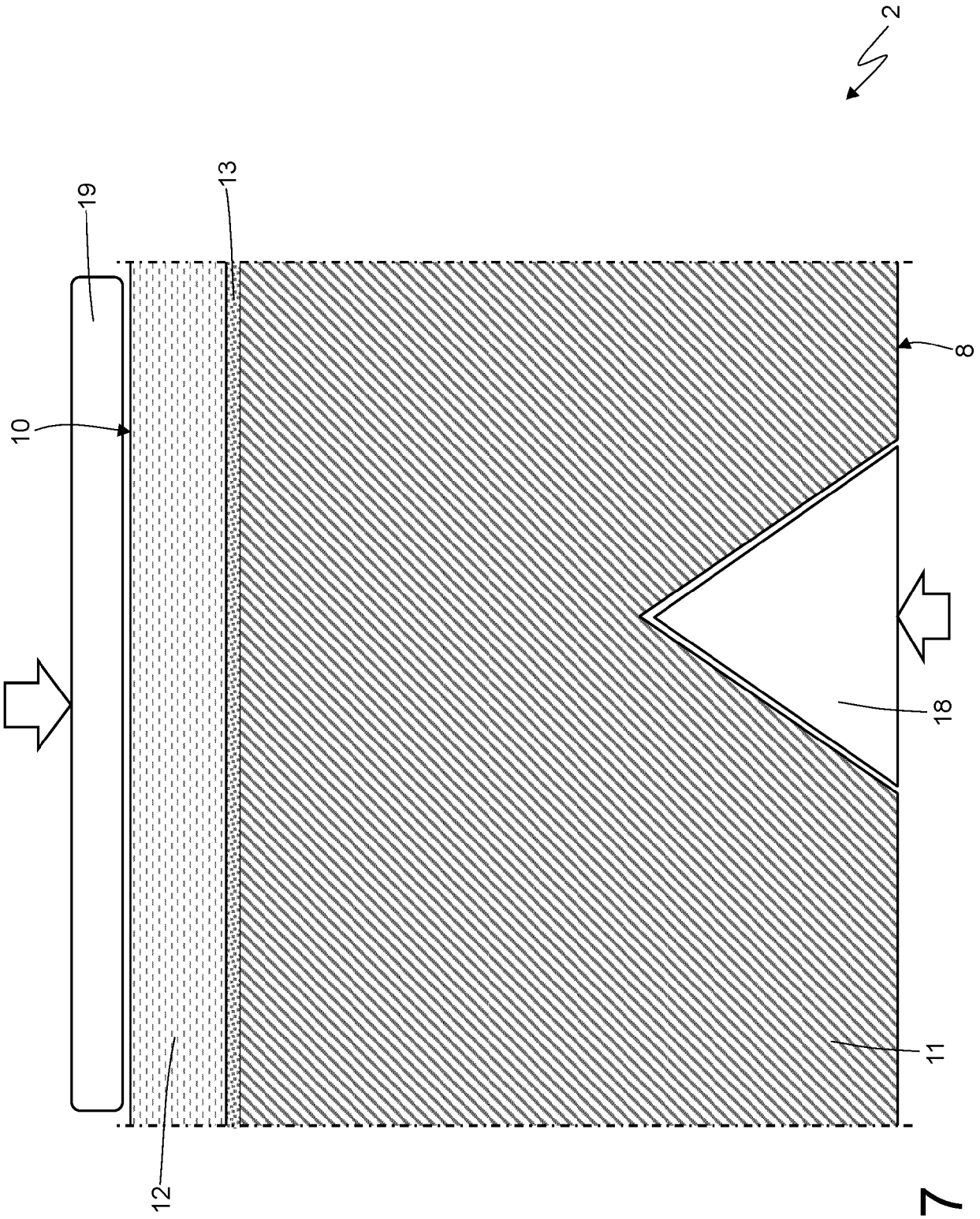
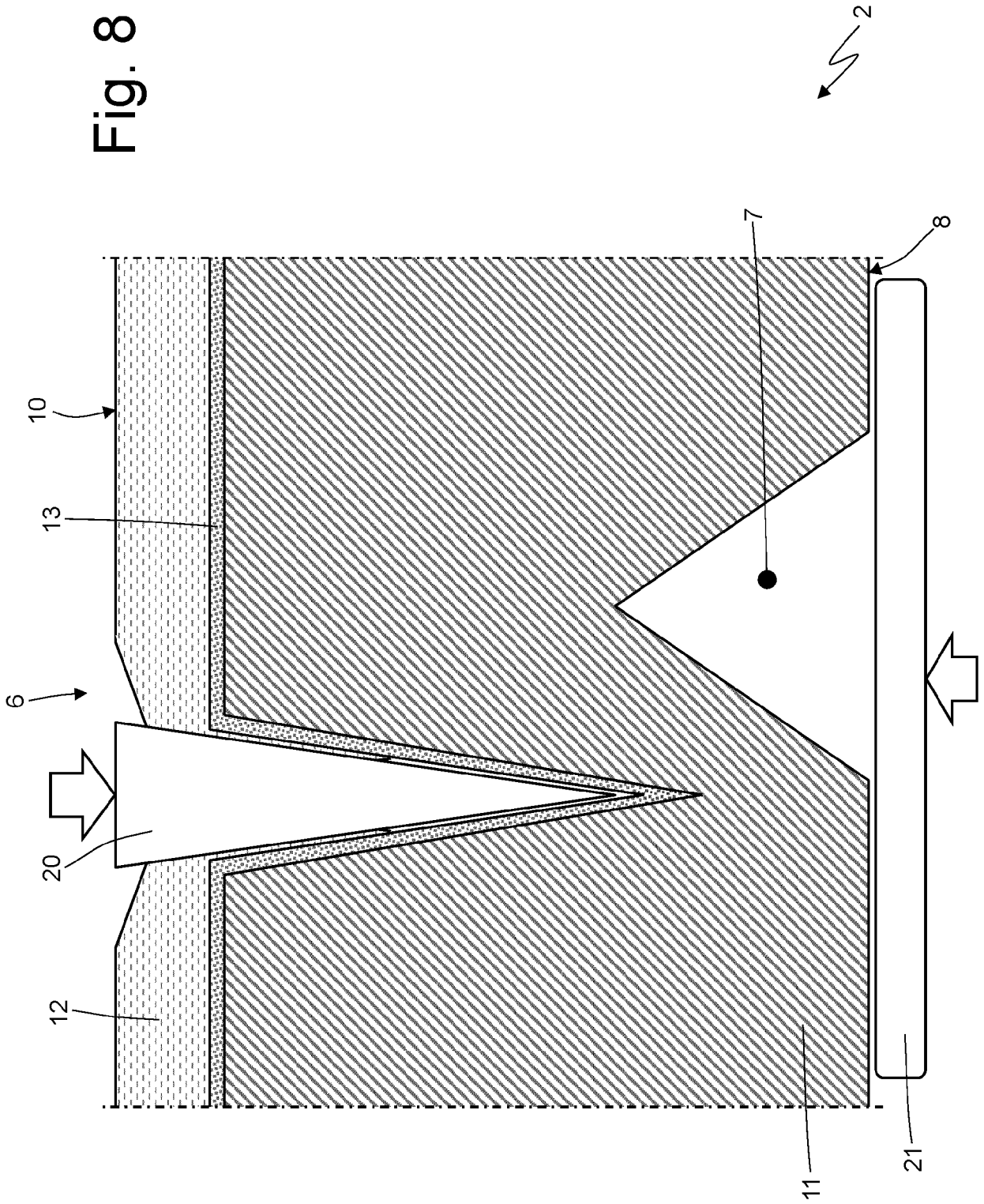


Fig. 7

Fig. 8



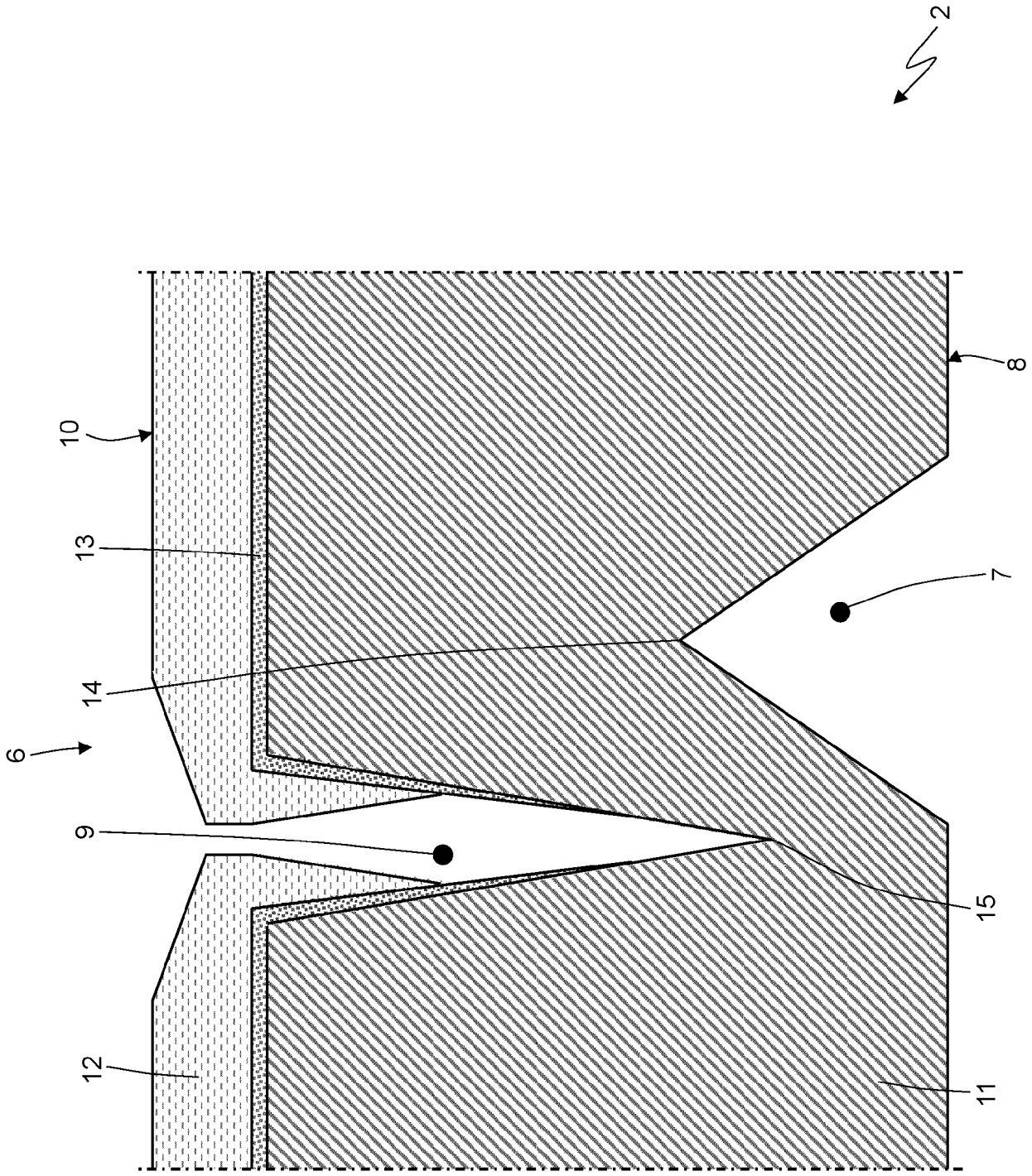


Fig. 9

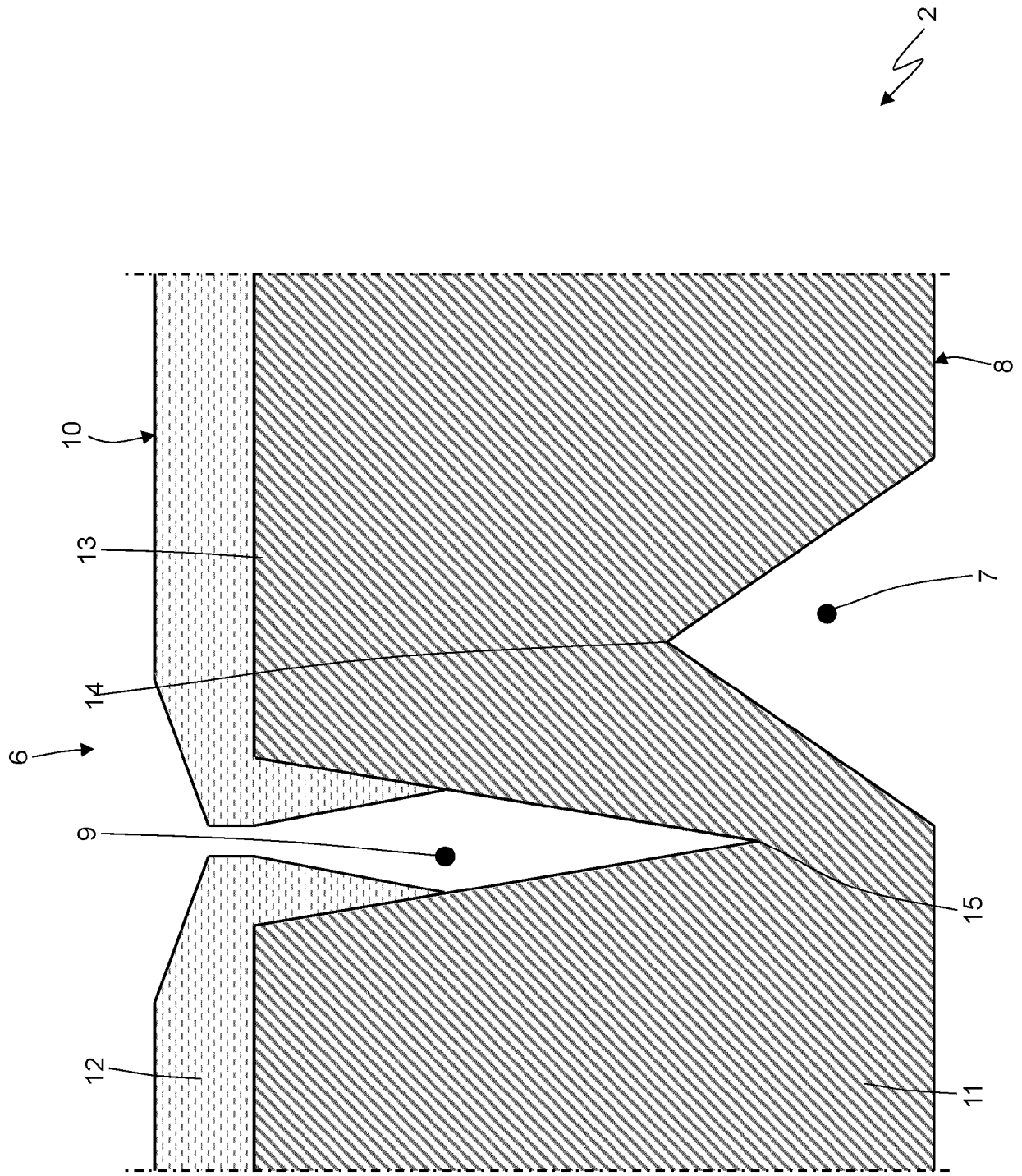


Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 2322

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Y	WO 2009/040629 A2 (DIAPACK LTD [GB]; BURATTINI CHRISTIAN [IT]) 2 April 2009 (2009-04-02) * claim 22; figure 13 *	1,3, 7-10,12, 14	INV. B65D75/58
Y	DE 38 10 319 A1 (MIGROS [CH]) 10 November 1988 (1988-11-10) * column 1, line 54 - column 3, line 19; figure 1 *	1,3, 7-10,12, 14	
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B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 September 2021	Balz, Oliver

CATEGORY OF CITED DOCUMENTS

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27-09-2021

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