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

(11) **EP 4 124 583 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.02.2023 Bulletin 2023/05

(21) Application number: **22177459.9**

(22) Date of filing: **07.06.2022**

(51) International Patent Classification (IPC):
B65D 5/02 *(2006.01)* ***B65D 5/10*** *(2006.01)*
B65D 5/66 *(2006.01)* ***B65D 55/02*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B65D 5/6661; B65D 5/0254; B65D 5/106; B65D 55/026; B65D 2211/00; B65D 2401/00; B65D 2401/10; B65D 2401/55

(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: **30.07.2021 IT 202100020438**

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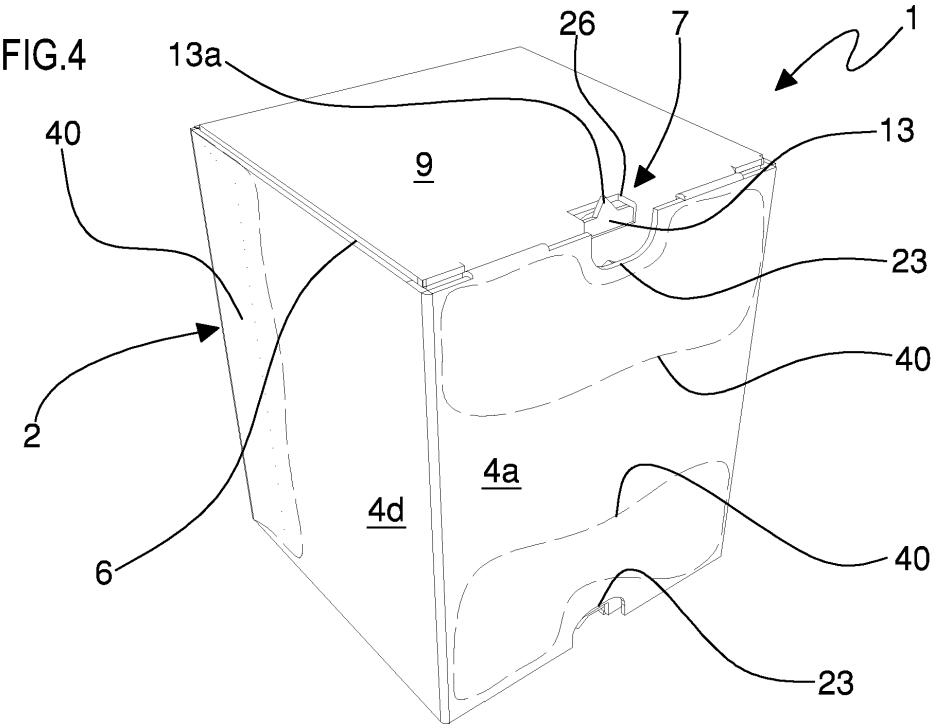
(54) **TAMPER-EVIDENT CONTAINER AND PROCESS OF MAKING THE SAME**

(57) The present invention relates to a tamper-evident container (1) comprising: a store (2) for housing at least one product, a closure system (7) placed at a passage opening (5) of the store (2) and configured for obstructing said passage opening to define a closed condition of the container (1). The store (2) has at least one glued portion at which a layer (40) made of heat-sensitive material is arranged, configured for irreversibly varying, following a heating of said layer (40), an optical and/or physical property of the same layer to provide evidence of an attempted tampering of the container (1).

FIG.4



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Description

FIELD OF THE INVENTION

[0001] The present invention regards a tamper-evident container and a process of making the same. The container may have application in the fields that provide for the packaging of products, in which safety is required which allows providing evidence of a possible tampering of the pack. For example, the container may be employed in the fields of packaging, of communication (e.g., for postal services), food, transport and logistics.

STATE OF THE ART

[0002] It is known to use containers made of paper material provided with anti-tampering systems whose object is to provide evidence of a first opening of the container, in a manner such to be able to signal a possible tampering of the product.

[0003] For example, such tamper-evident system may comprise adhesive labels positioned on the closure of the container and configured for preventing the opening of the latter without the preceding removal of the label. The known adhesive labels nevertheless do not allow effectively rendering the containers tamper-proof; the labels may be easily removed without such operation damaging the package in an evident manner: following the opening of the container, it is possible to tamper with the contents and reposition the removed label - or place a new label - on the closure of the container without the user having evidence of the product tampering that took place.

[0004] Given the poor effectiveness of the above-described labels, tamper-evident containers were made that do not require the application of supplementary seals for closing the container itself.

[0005] A first example, described in the patent applications No. WO 2015/170203 A1 and EP 3 453 637 A1, regards a tamper-evident container having a store made by folding and gluing of a single sheet, which is associated with a closure system. The container also comprises a first coupling portion associated with the closure system and a second coupling portion arranged in the store; the first and the second coupling portions are configured for being engaged during a first closed condition of the container. The second coupling portion defines a removable portion configured for being separated from the container during a first opening condition of the latter, after the first closed condition. On the store, a through opening is present which allows viewing the removable portion. The container described in the abovementioned applications is improved with respect to the preceding solutions since, in addition to allowing an effective closure of the container without the aid of supplementary seals, it provides clear evidence of container tampering that occurred, due to the presence of the through opening on the store through which it is possible to identify the lack of the removable portion.

[0006] The Applicant has however detected that the known containers described in the abovementioned applications have auxiliary access points that could allow bypassing the safety closures of the container. A person could in fact heat the glued lateral walls of the store to allow the opening thereof without stressing the closure system; in this manner, a person could open the container without causing the breakage of the removable portion, tampering/picking up the products and reclosing the container, once again gluing the portions of the store that were previously unglued.

[0007] A second example, described in the patent application No. IT AR 930 009 U1, also regards a tamper-evident container having a store made by folding and gluing of a single sheet, which is associated with a closure system. The closure system is constituted by two overlapped tabs that are glued on each other: the tabs have weakened portions configured for causing the breakage of the tabs themselves during a container opening attempt. On the external surface of the closure system, a heat-sensitive paint is applied that is configured for varying its own color in case of heating of the container.

[0008] The Applicant has detected that also the container of the Italian patent application does not lack limitations. Such container has a closure system that does not allow, once open, the subsequent closure of the container. Furthermore, the Applicant has also detected that the container of the Italian patent application also has auxiliary access points on the store that could allow a person to bypass the safety closure of the container by means of heating the store.

[0009] A third example, described in the patent application No. EP 0 617 950 A1, describes a container provided with a store made by folding and gluing of a single sheet closable by means of a closure system constituted by a folded tab. The closure of the container occurs by means of the gluing of the tabs in the store. The container is further provided with a heat-sensitive paint applied outside the store, at the portion in which the folded tab is glued: the heat-sensitive paint is configured to provide evidence of an attempted tampering of the container by means of the heating thereof. The Applicant has however detected that also the container of the patent application No. EP 0 617 950 A1 does not lack limitations. Such container has a complex closure system, difficult to activate since it requires the gluing of the folded tab in the store; in addition, the container does not allow, once open, the subsequent closing of the container; furthermore, also such container has auxiliary access points on the store that could allow a person to bypass the safety closure of the container by means of heating the store.

[0010] Further noted from the patent application No. GB 2 327 933 A are multilayer bags that maybe torn open and are provided with a heat-sensitive paint.

[0011] Even if such above-described known containers are employed today to define tamper-evident container solutions, the Applicant has detected that these

latter may be improved with regard to several aspects.

OBJECT OF THE INVENTION

[0012] Object of the present invention is therefore that of substantially resolving at least one of the drawbacks and/or limitations of the preceding solutions.

[0013] A first objective of the invention is to provide a container that may be easily manufactured by means of the existing fold-glue plants and provided with a reduced number of glued portions, and simultaneously that may easily provide evidence of an attempted tampering at a first opening of the same. In particular, one object of the invention is to provide a tamper-evident container that does not require the modification of the already-existing plants employed for making containers of standard type in order to adapt them for making the container, object of the present invention. A further object of the invention is to provide a container having a simple and compact structure; another object of the present invention is to provide a tamper-evident container capable of ensuring, once open, the easy reclosure of the container.

[0014] One or more of the above-described objects, which will be clearer in the course of the following description, are substantially reached by a tamper-evident container and a process of making the same in accordance with one or more of the enclosed claims and/or of the following aspects.

SUMMARY

[0015] In one aspect, a tamper-evident container is provided comprising:

- a store (2) defining an internal volume (3) configured for housing at least one product, the store (2) having a predetermined number of lateral walls defining at least one passage opening (5) delimited by a free edge (6), said passage opening (5) being configured for placing the internal volume (3) in communication with the outside environment,
- at least one closure system (7) placed at the passage opening (5) of the store and configured for obstructing said passage opening to define a closed condition of the container (1).

[0016] In one aspect according to the preceding aspect at least one between the store (2) and the closure system (7) has at least one glued portion. In one aspect according to the preceding aspect the glued portion has a softening point defined at a predetermined temperature, optionally higher than 50°C, still more optionally comprised between 65°C and 90°C. In one aspect according to the preceding aspect the softening point is defined at a predetermined temperature substantially equal to the melting temperature of the glued portion.

[0017] In one aspect according to any one of the preceding three aspects the container (1) comprises, at said glued portion, at least one layer (40) made of heat-sensitive material. In one aspect according to the preceding aspect the heat-sensitive layer (40) is configured for irreversibly varying at least one between an optical and physical property of the same layer to provide evidence of an attempted tampering of the container (1). In one aspect according to the preceding aspect the layer (40) is configured for varying at least one between an optical and physical property following a heating of said layer (40). In one aspect according to the preceding aspect the layer (40) made of heat-sensitive material is configured for varying the optical or physical property at a predetermined reference temperature. In one aspect according to the preceding aspect, the ratio between the predetermined reference temperature and the softening point is comprised between 0.8 and 1.2.

[0018] In one aspect according to any one of the preceding aspects the passage opening (5) of the store (2) is configured to allow the passage of said at least one product. In one aspect according to any one of the preceding aspects said at least one passage opening (5) is the only opening of the store allowing the passage of said at least one product. In one aspect according to any one of the preceding aspects said at least one passage opening (5) is the only one, in use condition of the container, allowing the passage of the at least one product.

[0019] In one aspect according to any one of the preceding aspects the heat-sensitive material of the layer (40) is configured for varying, following a heating of said layer (40), at least one optical property thereof. In one aspect according to any one of the preceding aspects the heat-sensitive material of the layer (40) is configured for at least partly varying, following a heating of said layer (40), at least one of the following optical properties: color, opacity, transparency, transmittance, refraction, brightness. In one aspect according to any one of the preceding aspects the heat-sensitive material of the layer (40) is configured for varying, following a heating of said layer (40), at least one physical property thereof. In one aspect according to any one of the preceding aspects the heat-sensitive material of the layer (40) is configured for at least partly varying, following a heating of said layer (40), at least one of the following physical properties: consistency, roughness. In one aspect according to any one of the preceding aspects the layer (40) defines at least one external covering of the container (1). In one aspect according to any one of the preceding aspects the layer (40) comprises at least one of: a heat-sensitive paint, a heat-sensitive film.

[0020] In one aspect according to any one of the preceding aspects the layer (40) defines at least one part of an external surface of the container (1). In one aspect according to any one of the preceding aspects the layer (40) is opposite the at least one glued portion.

[0021] In one aspect according to any one of the preceding aspects the store (2) is made of sheet material. In one aspect according to any one of the preceding aspects the store is made of sheet paper material. In one

aspect according to any one of the preceding aspects the store (2) is made by folding and gluing of a single sheet blank of sheet paper material. In one aspect according to any one of the preceding aspects the store (2) has an overlap zone which comprises at least one first and at least one second constraint portions engaged with each other by means of a/the glued portion. In one aspect according to the preceding aspect the sheet material of the store is at least partly enclosed on itself to form said overlap zone. In one aspect according to any one of the preceding aspects the predetermined number of lateral walls of the store (2) have an overlap zone which comprises at least one first and at least one second constraint portions at least partly overlapped and engaged each other by a/the glued portion.

[0022] In one aspect according to any one of the preceding aspects the first constraint portion defines at least part of an internal wall of the store (2) delimiting said internal volume (3) while the second constraint portion delimits at least part of an external wall of the store (2), wherein said layer (40), made of heat-sensitive material, covers the surface of at least part of the second constraint portion to define at least part of an external surface of the container. In one aspect according to any one of the preceding aspects the layer (40) defines at least one part of an external surface of the container (1), substantially overlapped to the glued portion of the store. In one aspect according to any one of the preceding aspects the layer (40) defines a portion of an external surface of the container placed in proximity to the glued portion, optionally the glued portion of the store.

[0023] In one aspect according to any one of the preceding aspects the predetermined number of lateral walls of the store (2) is at least partly enclosed on itself around a longitudinal axis to define a tubular body, having said overlap zone, which is extended longitudinally along said longitudinal axis, wherein the layer (40), made of heat-sensitive material, covers at least partly an external surface of said overlap zone placed outside the internal volume of the store (2). In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, covers the surface of a main part of an external surface of the overlap zone, optionally overlapped to the glued portion.

[0024] In one aspect according to any one of the preceding aspects the store (2) is made of sheet material, optionally paper, at least partly wound on itself to essentially form a tubular body defined by the predetermined number of lateral walls which delimits two opposite longitudinal passage openings (5), wherein at least one enclosed portion of the predetermined number of lateral walls is overlapped and is engaged by means of glue to define said overlap zone. In one aspect according to the preceding aspect the overlap zone extends between the two opposite passage openings (5). In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, is only arranged on the store (2) in proximity to the glued overlap zone. In one aspect according to any one of the preceding aspects the container (1) comprises, at the glued portion of the overlap zone of the store, said layer (40) made of heat-sensitive material.

[0025] In one aspect according to any one of the preceding aspects the predetermined number of lateral walls comprises a front wall (4a) and a rear wall (4b) facing and parallel to each other, the front wall and the rear wall being connected to each other by a first and a second connection wall (4c, 4d), also facing and parallel to each other. In one aspect according to the preceding aspect the front wall (4a) is spaced from the rear wall (4b) by said first and second connection wall (4c, 4d). In one aspect according to any one of the preceding aspects the first and the second connection wall are spaced from each other by means of the front wall and rear wall. In one aspect according to any one of the preceding aspects at least the second connection wall (4d) of the store (2) comprises said overlap zone. In one aspect according to the preceding aspect the layer (40), made of heat-sensitive material, at least partly externally covers said second connection wall (4d), at least in proximity to the glued portion of the overlap zone. In one aspect according to any one of the preceding aspects the overlap zone is defined only on said second connection wall (4d) of the store (2). In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, externally covers a main part of said second connection wall (4d).

[0026] In one aspect according to any one of the preceding aspects the glued portion comprises at least one of:

- one or more portions of glue (80), optionally cold glue,
- one or more portions of adhesive material (80), optionally adhesive material strips.

[0027] In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, is defined at the second constraint portion directly engaged, optionally directly glued and/or made adhesive, with the first constraint portion. In one aspect according to any one of the preceding aspects the predetermined number of lateral walls of the store (2) has, according to a section orthogonal to said longitudinal axis, a tubular section with closed profile, said predetermined number of lateral walls of the store (2) defining, at opposite longitudinal end edges, respective free edges (6) each of which delimiting a passage opening (5) configured for placing in communication the internal volume (3) of the store (2) with the outside environment, wherein the container comprises, for each passage opening, a respective closure system (7).

[0028] In one aspect according to any one of the preceding aspects the closure system (7) is at least partly made of sheet material. In one aspect according to any one of the preceding aspects the closure system (7) com-

prises a tab (8) engaged at said free edge (6) and movable, optionally via rotation, relative to the store (2), the tab (8) of the closure system (7) being configured to define at least:

- a closed condition in which the tab (8) itself prevents the communication between the internal volume (3) of the store (2) and the outside environment,
- an open condition in which the tab (8) itself allows the communication between the internal volume (3) and the outside environment.

[0029] In one aspect according to the preceding aspect the tab (8), in the closed condition, is configured for preventing the passage of the at least one product from the passage opening (5). In one aspect according to any one of the two preceding aspects the tab (8), in the open condition, is configured to allow the passage of the at least one product from the passage opening (5). In one aspect according to any one of the preceding aspects the closure system (7) also comprises:

- at least one first coupling portion (12) carried by the tab (8),
- at least one second coupling portion (13),

wherein said first and second coupling portions (12, 13), in the closed condition of the container (1), are configured for being stably engaged with each other. In one aspect according to the preceding aspect the first and second coupling portions (12, 13) when engaged to each other define an activation condition of the container. In one aspect according to the preceding aspect at least one part of the second coupling portion (13) is engaged with the store (2) by a glued portion. In one aspect according to the preceding aspect at least one of said first and second coupling portion (12, 13) comprises at least one removable portion (15) configured for being separated by at least one between said closure system (7) and store (2) following a first opening of the closure system (7), subsequent to said activation condition, to provide evidence of a tampering of the container (1).

[0030] In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, is placed on the store (2) at the second coupling portion (13). In one aspect according to any one of the preceding aspects the tab (8) of the closure system lacks glued portions. In one aspect according to any one of the preceding aspects the tab (8) of the closure system (7) is adapted to obstruct a passage opening (5) of the store, wherein said tab (8) lacks glued portions. In one aspect according to any one of the preceding aspects the tab (8) and the first coupling portion (12) lack glued portions.

[0031] In one aspect according to any one of the preceding aspects the closure system (7) lacks said layer (40), made of heat-sensitive material. In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, defines at least partly an external surface of a lateral wall of the store (2) directly glued to the second coupling portion (13).

[0032] In one aspect according to any one of the preceding aspects the tab (8) of the closure system (7) comprises a closure portion (9) engaged with the free edge (6) of the store (2) and movable, optionally by rotation, relative to the latter, the tab (8) also having at least one inserting portion (10) configured for being inserted, in the closed condition of the closure system (7), within the volume (3) of the store (2), wherein the first coupling portion (12) emerges from the inserting portion (10) while the second coupling portion (13) is constrained to a lateral wall of the store. In one aspect according to the preceding aspect the layer (40), made of heat-sensitive material, is placed at the second coupling portion (13), optionally to define a part of an external surface of the store (2).

[0033] In one aspect according to any one of the preceding aspects the second coupling portion (13) is housed at least partly in the internal volume (3) of the store. In one aspect according to any one of the preceding aspects the second coupling portion (13) is directly engaged with the store (2) entirely in the internal volume (3). In one aspect according to any one of the preceding aspects the second coupling portion (13) is directly engaged with a lateral wall of the store. In one aspect according to any one of the preceding aspects the second coupling portion is engaged with a front lateral wall (4a) of the store (2). In one aspect according to any one of the preceding aspects the second coupling portion (13) defines at least one undercut (16) configured for stably engaging the first coupling portion (12), in the closed condition of the container to define said activation condition. In one aspect according to any one of the preceding aspects the second coupling portion (13) defines at least partly said removable portion (15). In one aspect according to any one of the preceding aspects the removable portion (15), in the activation condition, is entirely arranged in the internal volume of the store, optionally spaced from the free edge (6). In one aspect according to any one of the preceding aspects the second coupling portion (13) comprises at least one undercut (16) defining at least one hook (16a) configured for stably engaging said first coupling portion (12).

[0034] In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) has a grip edge delimiting said undercut (16). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) comprises a tab having a substantially "C" or "U" shape, the hook (16a) of the second coupling portion (13) being directed according to a direction entering the store (2).

[0035] In one aspect according to any one of the preceding aspects the second coupling portion (13) comprises at least one base (25) fixed by glue to the store (2), optionally to the front wall (4a) of the store (2), the hook (16a) of the second coupling portion (13) being directly carried by the base (25), wherein the hook (16a) is constrained to the base (25) by of (optionally only) at

least one weakened portion to define said removable portion. In one aspect according to the preceding aspect the layer (40) made of heat-sensitive material defines at least one part of an external surface of the store (2) opposite the base (25). In one aspect according to any one of the preceding aspects the layer (40) externally covers at least one part of an external surface of the front wall (4a). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) is only constrained directly to the base (25). In one aspect according to any one of the preceding aspects the base (25) is integrally joined with the hook (16a) of the second coupling portion (13). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) is hinged to the base (25). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) lacks glued portions. In one aspect according to any one of the preceding aspects the base (25) is the only part of the second coupling portion (13) constrained to the store (2), optionally to the front lateral wall of the store. In one aspect according to any one of the preceding aspects the base (25) of the second coupling portion (13) is engaged in proximity to the free edge (6) of the store (2). In one aspect according to any one of the preceding aspects the base (25) is joined to a section of the free edge (6) of the store (2). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) and the base (25) delimit in cooperation with each other a through opening configured for insertingly receiving at least one part of the first coupling portion (12) to allow the engagement thereof with the second coupling portion (13) to define said activation condition. In one aspect according to the preceding aspect the through opening is on the upper part delimited by the grip edge of the hook (16a) of the second coupling portion (13). In one aspect according to any one of the preceding aspects the undercut (16) is entirely placed within the store (2), distinct and spaced from the free edge (6). In one aspect according to any one of the preceding aspects the hook (16a) of the second coupling portion (13) is entirely housed in the internal volume (3) of the store (2). In one aspect according to any one of the preceding aspects the grip edge delimited by the hook (16a) of the second coupling portion (13) has a substantially "V" shape. In one aspect according to any one of the preceding aspects the second coupling portion (13) is made of sheet material, optionally paper. In one aspect according to any one of the preceding aspects the second coupling portion (13) comprises a single folded sheet, optionally of paper material. In one aspect according to any one of the preceding aspects the single folded sheet of the second coupling portion (13) is directly constrained to the free edge (6) of the store (2) and defines the base (25) and the hook (16a).

[0036] In one aspect according to any one of the preceding aspects the container comprises:

- the layer (40) of heat-sensitive material which at least partly covers the surface of the wall of the second constraint portion of the store (2) to define at least part of an external surface of the container,
- the layer (40) of heat-sensitive material which at least partly covers the surface of the wall of the store with which the base (25) of the second coupling portion (13) is directly constrained, said layer being arranged outside the store (2).

[0037] In one aspect according to any one of the preceding aspects the inserting portion (10) is configured for being arranged, in the closed condition of the container, at least partly in the internal volume of the store (2), wherein the container comprises a glue portion (80) configured for stably constraining, in the closed condition, the inserting portion (10) to the store (2), wherein the layer (40) made of heat-sensitive material, covers at least part of an external surface of the store (2) directly glued to the inserting portion (10).

[0038] In one aspect according to any one of the preceding aspects the closure system (7) is made of sheet material, optionally paper, and is integrally joined with the store (2).

[0039] In one aspect according to any one of the preceding aspects the closure portion (9) is configured for obstructing at least partly, in the closed condition, the at least one passage opening (5) of the store (2). In one aspect according to any one of the preceding aspects the closure portion (9) is at least partly countershaped with respect to the free edge (6) of said at least one passage opening (5). In one aspect according to any one of the preceding aspects the closure portion (9) is hinged to the free edge (6) of the store (2). In one aspect according to any one of the preceding aspects the inserting portion (10) is engaged with the closure portion (9) at a fold edge (9a), optionally opposite the free edge (6) of the store (2), said inserting portion (10) being configured for being inserted at least partly (optionally entirely), in the closed condition, in the internal volume (3) of the store (2). In one aspect according to any one of the preceding aspects the closure portion (9) is hinged to the rear wall (4b) of the store (2), the inserting portion (10), in the activation condition, being at least partly inserted in the store (2) and facing the front wall (4a) of the store (2). In one aspect according to any one of the preceding aspects the first coupling portion (12) is integrally joined with the tab (8) of the closure system (7). In one aspect according to any one of the preceding aspects the first coupling portion (12) is directly carried by the inserting portion (10). In one aspect according to any one of the preceding aspects the first coupling portion (12) emerges from the inserting portion (10) on the opposite side with respect to the closure portion (9). In one aspect according to any one of the preceding aspects the first coupling portion (12) is in a single piece with the inserting portion (10).

[0040] In one aspect according to any one of the preceding aspects the first coupling portion (12), in the ac-

tivation condition, is stably engaged with the undercut (16) of the second coupling portion (13), optionally at least partly in the internal volume (3) of the store (2). In one aspect according to any one of the preceding aspects the first coupling portion (12), in the activation condition, is stably engaged with the hook (16a) of the second coupling portion (13). In one aspect according to any one of the preceding aspects the first coupling portion (12) comprises at least one respective undercut (17) configured for being stably engaged, in the activation condition, with the undercut (16) of the second coupling portion (13). In one aspect according to any one of the preceding aspects the undercut (17) of the first coupling portion (12) comprises at least one hook (17a) configured for being constrained to the undercut (16) of the second coupling portion (13). In one aspect according to any one of the preceding aspects the hook (17a) of the first coupling portion (12), in the activation condition, is completely arranged in the internal volume of the store. In one aspect according to any one of the preceding aspects the hook (17a) of the first coupling portion (12), in the activation condition, is spaced from the free edge (6) of the store. In one aspect according to any one of the preceding aspects the at least one hook (17a) of the first coupling portion (12) comprises a first and a second hooks opposite each other with respect to a central portion of the first coupling portion (12) itself. In one aspect according to any one of the preceding aspects the first coupling portion (12) has a substantially arrow shape or substantially "T" shape or substantially "V" shape. In one aspect according to any one of the preceding aspects the first coupling portion (12) comprises a tab of sheet material, optionally paper, emerging from the inserting portion (10). In one aspect according to any one of the preceding aspects the first coupling portion (12) is integrally joined with the connection portion. In one aspect according to any one of the preceding aspects the tab (8) of the closure system lacks glued portions. In one aspect according to any one of the preceding aspects the first coupling portion (12) lacks glued portions.

[0041] In one aspect according to any one of the preceding aspects the second coupling portion (13) comprises at least one support portion (19) at least partly overlapped to the removable portion (15). In one aspect according to the preceding aspect the support portion being configured for supporting said removable portion during the activation condition of the container. In one aspect according to the two preceding aspects the support portion (19) is directly constrained by glue to the base (25) of the second coupling portion (13), optionally it is only constrained to said base (25). In one aspect according to the three preceding aspects the removable portion (15) of the second coupling portion (13) is interposed between said support portion (19) and the lateral wall of the store (2) directly carrying said second coupling portion (13). In one aspect according to the four preceding aspects the removable portion (15) of the second coupling portion (13) is interposed between said support portion (19) and the front wall (4a) of the store (2).

[0042] In one aspect according to any one of the preceding aspects the closure system (7) comprises at least one label (90) configured for locking the container in the closed condition. In one aspect according to the preceding aspect the layer (40) is placed at the label (90). In one aspect according to any one of the preceding aspects the layer is placed at least partly around the label (90). In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, is arranged outside the container at least on a part of the store (2) and/or of the closure system (7), at the label (90). In one aspect according to any one of the preceding aspects the label (90) is placed outside the container and engages the store (2) and the closure portion (9) of the closure system, wherein the layer (40), made of heat-sensitive material, is arranged outside the container at least on a part of the store (2) and/or of the closure portion (9), at the label (90), optionally at least on the side of the label (90). In one aspect according to any one of the preceding aspects the label is of the type that is tamper-evident. In one aspect according to any one of the preceding aspects the label (90) is placed outside the container (1), and stably constrains the tab (8) of the closure system (7) to the store (2). In one aspect according to any one of the preceding aspects the label (90) is configured for stably maintaining the tab (8) of the closure system (7) in the closed condition, optionally in stable engagement with the store (2). In one aspect according to any one of the preceding aspects the layer (40), made of heat-sensitive material, is arranged outside the container at least on a part of the store (2) and/or of the tab (8), at the label (90), optionally at least on the side of the label (90).

[0043] In one aspect a process is provided of making a container (1) according with any one of the preceding aspects. In one aspect according to the preceding aspect said process comprising at least the following steps:

- providing the store (2),
- providing the closure system (7).

wherein the step of providing the store (2) comprises at least the following substeps:

- providing a first sheet (51) comprising at least one first and a second portion (52, 54) interconnected by a central connection portion (53), the first sheet (51) also comprising at least one first and at least one second lateral connection portions (55, 56), the second portion (54) being interposed between the first lateral connecting portion (55) and the central connection portion (53), while the second lateral connection portion (56) may be connected to the first lateral connection portion (55) or to the first portion (52), each of said portions (52, 53, 54, 55, 56) comprising at least two opposite longitudinal edges and two opposite end edges, said portions (52, 54), cen-

tral connection portion (53) and said first and second lateral connection portions (55, 56) being joined along the longitudinal edges and aligned along a single connection direction,

- folding the first sheet (51) along said longitudinal edges so as to arrange the lateral connection portion at the first portion (52),

wherein the step of providing the closure system (7) comprises the substep of providing at least one second sheet (57) connected to an end edge of the first portion (52), the second sheet (57) comprising a first and a second portions (58, 59) integrally joined with each other, the first portion (58) of the second sheet (57) being interposed between the first portion (52) of the first sheet (51) and the second portion (59) of the second sheet (57).

[0044] In one aspect according to the preceding aspect the process comprises at least one step of providing, on at least one part of the first sheet and/or of the second sheet, a covering (70) of heat-sensitive material. In one aspect according to the preceding aspect the covering (70), following the arrangement of the store and of the closure system, defines at least part of the layer (40), made of heat-sensitive material, of the container.

[0045] In one aspect according to the three preceding aspects the step of arranging the store (2) also comprises the substep of joining, by gluing, the second lateral connection portion (56) with said first portion (52) or said first lateral connection portion inserting portion (55) to define said store. In one aspect according to any one of the preceding process aspects the covering (70) is arranged on the surface on at least one of: the first portion (52) of the first sheet, the second portion (54) of the first sheet, the first lateral connection portion (55) of the first sheet, the first portion (58) of the second sheet. In one aspect according to any one of the preceding process aspects the covering (70) comprises at least one of: a heat-sensitive paint, a heat-sensitive film. In one aspect according to any one of the preceding process aspects the first and the second sheet (51, 52) are integrally joined to form a single body. In one aspect according to any one of the preceding process aspects the first and second sheet (51, 57) are obtained via die cutting of a single flat sheet, optionally of paper material.

[0046] In one aspect according to any one of the preceding process aspects said process also comprises the arrangement of at least one third and fourth sheet (62, 63), wherein the third sheet (62) is integrally joined and laterally emerges from the second portion (54) of the first sheet (51), said third sheet (62) comprising:

- at least one first portion (62a) directly integrally joined with the second portion (54) of the first sheet (51) and laterally emerging from the latter,
- at least one second portion (62c) directly carried by the first portion (62a) of the third sheet (62), said second portion (62c) being interposed between the second portion (54) of the first sheet (51) and the first portion (62a) of the third sheet (62),

wherein the fourth sheet (63) is integrally joined with the second portion (59) of the second sheet (57), said fourth sheet (63) comprising a portion (64) which emerges laterally from the second portion (59) of the second sheet (57) on the side opposite the first portion (58) of the same second sheet (57),

wherein the process comprises the steps of:

- folding the first and the second portion (62a, 62c) of the third sheet (62),
- constraining, by means of gluing, said first portion (62a) to the second portion (54) of the first sheet (51) and defining said second coupling portion (13).

[0047] In one aspect according to the preceding aspect the first and the second portion (62a, 62c) of the third sheet (62) are joined together by means of a weakened portion, wherein the second portion (62c) - following the step of constraining the first portion (62a) - defines the removable portion of the second coupling portion (13), wherein the portion (64) of the fourth sheet (63) defines the first coupling portion (12) of the container.

[0048] In one aspect according to any one of the preceding process aspects the first, second, third and fourth sheet are integrally joined to define a single flat blank obtained via die cutting of a single flat sheet, optionally made of paper material.

[0049] In one aspect according to any one of the preceding process aspects the third sheet (62) also comprises at least one third portion (62b) directly integrally joined with the first portion (62a) of the third sheet (62) itself and laterally emerging from the latter, said first portion (62a) of the third sheet (62) being interposed between the second portion (54) of the first sheet (51) and the first portion (62a) of the third sheet (62), wherein the process comprises the substeps of:

- folding the third portion (62b) of the third sheet (62) above the first portion (62a) of the third sheet itself,
- constraining, by means of gluing, said first and third portion (62a, 62b) of the third sheet (62) to each other, wherein the third portion (62b) of the third sheet (62), following the step of constraining with the first portion (62a), defines said support portion (19) of the second coupling portion (13).

DESCRIPTION OF THE DRAWINGS

[0050] Several embodiments and several aspects of the finding will be described hereinbelow with reference to the enclosed drawings, provided only as a non-limiting example wherein:

- Figure 1 is a blank employable for making a first embodiment of a container;
- Figure 2 is a detailed perspective view of the con-

tainer manufacturable by the blank of figure 1, during a closed condition of the same;

- Figures 3-6 are different views of the container of figure 2 arranged in the closed condition;
- Figure 7 schematically shows an open condition of the container of figure 2;
- Figure 8 is a sectional view of the container of figure 2, during a closing step of the same;
- Figure 9 is a further sectional view of the container of figure 2, arranged in the closed condition;
- Figure 10 is a blank employable for making a second embodiment of a container;
- Figure 11 schematically shows a step of folding the blank of figure 10;
- Figure 12 is a detailed perspective view of the container manufacturable by means of the blank of figure 11, during a closed condition of the same;
- Figure 13 is a perspective view of a third embodiment of a container.

DEFINITIONS AND CONVENTIONS

[0051] It is observed that in the present detailed description, corresponding parts illustrated in the various figures are indicated with the same numeric references. The figures could illustrate the object of the invention by means of representations that are not in scale; therefore, parts and components illustrated in the figures relative to the object of the invention might only regard schematic representations.

[0052] With the term "product" it is intended an article or a compound of articles of any kind. With the term "product" a pack may also be intended, for example bearing a plurality of articles.

[0053] With the term "paper material" it is intended paper or cardboard, optionally having at least 50% by weight, preferably at least 70% by weight, of organic material comprising one or more of cellulose, hemicellulose, lignin, lignin derivatives. The sheet paper material usable for making the container may have a basis weight comprised between 50 and 500 g/m2, optionally comprised between 200 and 400 g/m2. The paper material in question is extended between a first and a second main extension surface. The paper sheet material employed for making the container may be covered for at least one part of the first and/or second main extension surface by means of a plastic material covering, e.g., a film, whose object is that of reinforcing the paper sheet material. The covering may also be employed to define a kind of water and/or moisture barrier useful for preventing the weakening and the loss of structure of the coupling system and of the container (optionally of the band or of the bag) with consequent uncontrolled deformation of the paper material constituting the latter component. The covering may be applied to the paper material in the form of a so-called "coating" or lacquer deposited as a solution or sprayed whose thickness is generally comprised, in a non-limiting manner, between 0.2 and 10 pm. Alternatively, the covering may comprise a plastic film, e.g., a PE coating, applicable by means of a rolling process, on one or both sides of the paper material. In the event in which the covering is applied by means of rolling, the values of the plastic film (covering) may for example vary between 5 and 400 μm, optionally between 10 and 200 μm, still more optionally between 10 and 100 μm, of covering material (i.e., polythene). The plastic coating material may as an example be selected from among the following materials: PP, PE (HDPE, LDPE, MDPE, LLDPE), EVA, polyesters (including PET and PETg), PVdC.

[0054] With the term "softening point" it is intended a thermodynamic layer represented by temperature value, at which a material that does not have a defined melting point (e.g., a plastic material) starts to modify its own state of aggregation from solid to fluid.

[0055] With the term "heat-sensitive material" it is intended the property of the same to vary at least one between an optical and physical property following a variation of the temperature. In particular, the heat-sensitive material employed for the container, object of the present invention, is configured for varying at least one between an optical and physical property at temperatures greater than the ambient temperature, for example at temperatures equal to or greater than 50 °C.

DETAILED DESCRIPTION

Container

[0056] Reference number 1 overall indicates a tamper-evident container made of sheet material, e.g., of paper material, for containing and/or enclosing products.

[0057] The container 1 comprises a store 2 made of sheet material, optionally paper, defining an internal volume 3 configured for housing one or more products. The sheet material of the store 2 is at least partly enclosed on itself to form an overlap zone; as will be better described hereinbelow, the store is made by folding of at least one sheet: two portions of such sheet are overlapped and engaged with each other by means of a glued portion to define the overlap zone. As shown in figures 4 and 5, the overlap zone of the store 2 comprises at least one first and at least one second constraint portions that are overlapped and engaged with each other. The first constraint portion defines at least part of an internal surface of the store 2 delimiting the internal volume 3, while the second constraint portion delimits at least part of an external surface of the store 2. The first and the second constraint portion are parts of the same wound sheet, employed for reaching a three-dimensional configuration of the store: the stable engagement of the constraint portions allows the store 2 to define the internal volume 3. The constraint portions are engaged with each other by means of a glued portion, optionally by means of one or more glue points 80, e.g., hot glue or cold glue. Alternatively, the first and the second constraint portion

may be engaged with each other by means of a glued portion defined by one or more layers of adhesive material 80, optionally adhesive material strips, or similar fixing means.

[0058] The glued portion has a softening point defined at a predetermined temperature higher than 50°C, optionally comprised between 65°C and 90°C. In proximity to the softening point, the glued portion (optionally each point of glue 80 or of adhesive material) changes its own state of aggregation from solid to fluid. In other words, following a localized heating of the container at the glued portions, the glue of said portion is in the liquid state and consequently incapable of stably engaging the first and the second constraint portion.

[0059] The store 2 may comprise a predetermined number of lateral walls (at least one lateral wall) defining at least one passage opening 5 delimited by a free edge 6 and configured for placing the internal volume 3 in communication with the outside environment. The passage opening 5 defines the only part of the container 1 set, during use, for the passage of products, i.e., for picking up and/or inserting the products from/into the container 1. The store 2 may comprise only one passage opening 5 and have lateral walls and/or a bottom wall stably obstructed and engaged with each other by means of glue portions. The predetermined number of lateral walls of the store 2 may nevertheless be wound at least partly on itself along a longitudinal axis to define a tubular body; the lateral wall, at least partly wound on itself, forms the overlap zone which is longitudinally extended along said axis. In such configuration, the tubular body of the store defines two opposite longitudinal passage openings while the overlap zone is defined laterally on the tubular body and is extended between said opposite passage openings: the overlap zone may be extended substantially along the entire longitudinal extension of the lateral wall. The predetermined number of lateral walls has, according to a section orthogonal to said longitudinal axis, a tubular shape with closed profile: the predetermined number of lateral walls defines, at opposite longitudinal end edges, respective free edges 6 each of which delimiting a passage opening 5 configured for placing in communication the internal volume 3 of the store 2 with the outside environment; in such configuration, the overlap zone is defined between said longitudinal edges of the lateral wall and in particular is extended between the opposite free edges 6 (between the two respective passage openings 5 defined by said edges 6) of the lateral wall.

[0060] As shown in figures 4 and 5, the store 2 may have two passage openings 5 that are opposite each other with respect to the store 2 itself, in a manner such that the latter may substantially define a duct or tube laterally delimited by the predetermined number of lateral walls (hereinbelow simply termed lateral wall) and open at longitudinal ends.

[0061] The store 2 may have a rectangular prismatic shape (four flat lateral walls having rectangular shape); in detail, the store may have a front wall 4a and a rear wall 4b facing and parallel to each other: the front wall 4a and the rear wall 4b are connected to each other by means of a first and a second connection wall 4c, 4d, also facing and parallel to each other. The front wall 4a is spaced from the rear wall 4b; the first and the second connection wall 4c, 4d of the store 2 are also spaced from each other. The front and rear walls 4a, 4b have an identical rectangular shape (walls identical in shape and size); the connection walls 4c, 4d have an identical rectangular shape (walls identical in shape and size). Nevertheless, it is possible to make a store 2 having different shape, e.g., square, trapezoidal or cylindrical. As shown in figures 4 and 5, the overlap zone is only defined on the second connection wall 4d along the entire longitudinal extension of the same: the second connection wall 4d thus comprises the glued portion.

[0062] The front wall 4a may comprise a depression 23 (figures 2-9) defined at the free edge 6 and configured for allowing a user to grip a closure system 7 (described below) to allow opening the container 1. In particular, the front wall 4a may comprise a depression 23 defined at each passage opening 5. The depression 23 may have a substantially "C", "U" or "V" shape.

[0063] As mentioned above, the container 1 also comprises at least one closure system 7 made of sheet material, optionally paper. The closure system 7 placed at the passage opening 5 of the store and configured for obstructing said passage opening to define a closed condition of the container 1. In detail, the closure system 7 is movable with respect to the store at least between a closed condition of the container, wherein the closure system prevents the passage of products from the passage opening 5, and an open condition, wherein the closure system allows the passage of products from the passage opening 5. In fact, the closure system 7 defines a kind of movable cover of the container employed to manage, during use, the passage of products from the opening 5.

[0064] The closure system 7 comprises a tab 8 engaged at the free edge 6 and movable, optionally via rotation, relative to the store 2. In the closed condition (figures 3, 4-6 and 9) of the closure system, the tab 8 prevents the communication between the internal volume 3 of the store 2 and the outside environment, preventing the passage of the at least one product from the passage opening 5, while, in the open condition (figures 2, 7 and 8), the tab 8 allows the communication between the internal volume 3 and the outside environment, thus allowing the passage of products from the passage opening 5. The container 1 may comprise a closure system 7 for each passage opening 5 of the store 2. In the configuration of the container 1 having two passage openings 5, the container 1 has two closure systems 7 comprising respective tabs 8 engaged with free edges 6 of the store 2 that are longitudinally opposite each other. The closure systems 7 are therefore arranged opposite each other with respect to the store 2 itself, in tubular body form. Each closure system 7 may be integrally joined with the

store 2. Each closure system 7 comprises a tab 8 integrally joined with the free edge 6 and movable via rotation around this. Alternatively, the closure system 7 may be removably engageable with the store 2. For example, the closure system 7 may have a plurality of lateral walls defining a space countershaped to the passage opening 5, configured for at least partly housing the store 2 and preventing the insertion and the picking up of products from the store.

[0065] In more detail, the tab 8 comprises a closure portion 9 of sheet material directly engaged and integrally joined with the free edge 6 of the store 2: in detail, the closure portion 9 is directly hinged to the free edge 6 to allow the relative rotation between closure system 7 and store 2. The closure portion 9 is configured for preventing, in the closed condition, access to the internal volume 3 of the store 2. The closure portion 9 has a rectangular profile entirely countershaped with respect to the free edge 6.

[0066] The tab 8 also comprises an inserting portion 10 configured for being inserted, in the closed condition, in the internal volume 3 of the store 2. The inserting portion 10 is integrally joined with the closure portion 9 and emerges from the latter on the opposite side with respect to the free edge 6. The inserting portion 10 is extended from the closure portion 9: in the closed condition, the inserting portion 10 is completely positioned in the internal volume 3 of the store 2, optionally facing the recess 23. The inserting portion 10 also comprises substantially a flat sheet having substantially rectangular shape. It is intended that further shapes of the inserting portion 10 may be provided for, e.g., a square or trapezoidal shape.

[0067] The closure portion 9 and the inserting portion 10 have a fold edge 9a opposite the free edge 6 of the store 2 with respect to the same closure portion 9: the inserting portion 10 is movable via rotation with respect to the closure portion 9 around the fold edge 9a. The inserting portion 10, in the closed condition, is configured to define, according to a transverse section and in cooperation with the closure portion 9, a substantially "L" shape (see for example figure 6). In detail, as is visible for example in figure 7, the tab 8 is directly constrained to the rear wall 4b; the inserting portion 10, in the closed condition, is extended substantially parallel to the front wall 4a of the store 2.

[0068] The inserting portion 10 may have at least one grip portion (figures 2-9) configured for allowing a user, at least in the closed condition of the container 1, to grip the closure system 7 for the extraction of the inserting portion 10 from the internal volume of the store 2. The grip portion may emerge, at least during the closed condition, from the free edge 6 of the store. In detail, the grip portion is defined at the depression 23: the depression 23 provides the user with the space for grasping the grip portion and thus allow the movement of the closure system 7 from the closed condition to the open condition. The grip portion is in a single piece with the inserting portion 10 and lacks weakening portions configured for allowing the facilitated breakage of at least one said inserting portion 10 and grip portion: the inserting portion 10 and the grip portion lie on a single extension plane.

[0069] The closure system 7 may comprise a through access 26 defined, optionally defined, in the closed condition, at the free edge 6 of the store 2. The through access 26 may be entirely defined on the inserting portion 10; in such configuration, the through access 26 is extended starting from the fold edge 9a towards a central zone of the inserting portion 10 to define a depth of said through access 26. The through access 26 may be entirely on the closure portion 9; in such configuration, the through access 26 is extended starting from the fold edge 9a towards a central zone of the closure portion 9 (towards the free edge section 6 delimited by the rear wall 4b) to define a depth of said through access 26. The through access 26 may also be defined at least partly on the inserting portion 10 and at least partly on the closure portion 9 (see for example figures 2-6); said through access 26 comprises a single opening passing through the thickness of the closure system 7 and delimited by a single perimeter edge with closed profile; in detail, the through access 26 is arranged entirely within an external perimeter edge of the closure system 7. The through access 26 may have a substantially square or rectangular shape.

[0070] The container 1 may comprise at least one first coupling portion 12 (figures 2-9) carried directly by the tab 8 and at least one second coupling portion 13 carried directly by the store 2; the first and second coupling portion 12, 13 are configured for being stably engaged with each other during a first closed condition of the container (figures 3 and 6) to define an activation condition of the container.

[0071] In detail, in the closed condition, the first coupling portion 12 is configured for being inserted at least partly in the internal volume 3 of the store 2 for being stably engaged with the second coupling portion 13.

[0072] As illustrated in figure 3, in the closed condition, the first coupling portion 12 is entirely contained in the internal volume 3 of the store 2 and is spaced from the free edge 6: in the closed condition, the engagement between the first and the second coupling portion 12, 13 is completely defined in the internal volume 3 of the store 2.

[0073] The first and/or the second coupling portion 12, 13 comprises at least one removable portion 15 configured for being separated from at least one between said closure system 7 and store 2 following a first opening of the container, after the activation condition, to provide evidence of a tampering of the container 1. As shown in figure 7, the removable portion 15 is engaged with the second coupling portion 13 by means of a weakening portion. There is the possibility of arranging the removable portion on the first coupling portion 12. The first and the second coupling portion 12, 13 may be of the type described in the publication of the European patent application No. EP 3 453 637, from page 4, column 5, line 32 to page 7, column 12, line 20. For the comprehension

and clarity of the present disclosure, it is at any rate deemed useful to specify that the second coupling portion 13 is arranged at least partly in the store 2, both in the closed condition and in the open condition of the tab 8, in engagement with the store 2, optionally constrained to the front wall 4a of the store.

[0074] The second coupling portion 13 may comprise a base 25 directly fixed in the internal volume 3, for example by means of gluing, to the front wall 4a of the store 2. The base 25 of the second coupling portion 13 is engaged with the lateral wall 4a in proximity to the free edge 6. In particular, the base 25 is hinged to the free edge 6 of the store, folded within the store itself and constrained to the front wall 4a, for example by means of a glued portion. In other words, the base 25 is constrained to the front wall 4a by means of a glue point or strips of adhesive material. The second coupling portion 13 furthermore comprises at least one undercut 16, carried directly by the base 25: the undercut is not directly constrained to the front wall 4a but is engaged with the latter only by means of the base 25. The undercut 16 comprises at least one hook 16a constrained to the base 25 by means of at least one weakened portion to define said removable portion 15. The hook 16a is hinged to the base 25 and thus is angularly movable with respect to the latter; the hook 16a may thus be arranged in an angularly offset position (non-aligned) with respect to the base 25 to delimit a through opening with the latter configured for insertingly receiving at least one part of the first coupling portion 12 to allow the engagement thereof with the second coupling portion 13. The hook 16a is arranged within the store 2, separate and spaced from the free edge 6 and configured for being stably engaged, in the closed condition, with the first coupling portion 12. The hook 16a lacks glued portions since integrally joined with the base 25 only by means of weakened portions; the base 25 is the only part of the second coupling portion 13 which is constrained to the store by means of a glued portion.

[0075] The second coupling portion 13 comprises at least one support portion 19 constrained to the base portion 25 and configured for supporting the removable portion 15 during the activation condition of the container.

[0076] Furthermore, the second coupling portion 13 may comprise a projection 13a (figures 4 and 7), emerging from the internal volume 3 of the store due to the presence of the through access 26; the projection 13a is configured for allowing the user to have a tactile perception of the removable portion 15. In this manner, a visually impaired person is capable of tactilely perceiving the presence of the removable portion, thus verifying the integrity of the container and consequently the integrity of the contained product.

[0077] Figures 2-9 show a first embodiment of the container only having two glued zones: the overlap zone of the store 2 and the base 25 of the second coupling portion 13.

[0078] In figures 11 and 12 a variant of the container 1 is illustrated in which the inserting portion 10 of the closure system 7 comprises at least one glued portion configured for allowing the constraint of said inserting portion 10 with the store 2. In detail, the engagement between the inserting portion 10 and the store 2 is made by the arrangement of the glued portion between the inserting portion 10 and the store 2; in this manner, the tab 8 is locked with the store 2 and the opening of the container occurs due to the tearing off of the tab 8. In fact, the opening of the container may occur due to the ungluing of the two glued portions or by means of the breakage of one between the tab and the store. In the variant illustrated in figures 11 and 12, the container 1 has substantially two glued portions (e.g., two glue points 80): one at the overlap zone of the store and one at the lateral wall (e.g. the front wall 4a) of the store directly engaged and facing the inserting portion 10.

[0079] Illustrated in figure 13 is a further variant of the container 1 comprising a store 2 as described above and at least one closure system 7 for each passage opening 5; in the variant of figure 13 the closure system 7 only comprises the tab 8 and at least one label 90 configured to maintain the container in the closed condition: The container of figure 13 does not comprise the first and the second coupling portion 12, 13.

[0080] The label 90 is of the type that is tamper-evident, configured, following the removal of the latter, to provide evidence to a user that there was a first opening of the container; in detail, the label has, for example, an external surface having a holographic layer configured for indicating the integrity and the originality of the container. The label 90 is placed outside the container 1 and stably constrains the tab 8 to the store 2 by means of at least one glued portion. In detail, the label 90 comprises a support body made of sheet material on which a glued portion is applied (for example at least one glue layer or an adhesive layer); the label 90 is configured for being applied, in the closed condition of the closure system 7, to the tab and to the store to block them in such position. The boxy defines the structural component of the label 90 while the glued portion is used for allowing the engagement of the label itself with the container. Figure 13 illustrates a label 90 applied to the container.

[0081] The container 1 furthermore comprises at least one layer 40 made of heat-sensitive material defined at an external surface of the container 1 opposite at least one of the glued portions; the layer 40 is configured for irreversibly varying at least one between an optical and physical property thereof to provide evidence of an attempted tampering of the container 1. It is observed that the layer 40 is capable of undergoing an optical or physical variation without at all compromising the structural integrity of the container. In other words, the layer 40 is a covering applied in localized portions of the container, capable of changing at least one optical or physical characteristic thereof. As shown in figures 3 and 4, the layer 40 may at least partly cover (or define) an external surface of the overlap zone of the store 2. In particular, the layer 40 made of heat-sensitive material, covers the sur-

face of a main part of an external surface of the overlap zone of the second connection wall 4d. The layer 40 may thus be defined at the second constraint portion directly engaged, optionally directly glued and/or made adhesive, with the first constraint portion. The layer 40 allows giving proof to a user that there was a container opening attempt by means of the heating of the glued portion.

[0082] The layer 40 may only be placed in proximity to the overlap zone of the store 2; the zone of the store 2 in proximity to the second coupling portion 13 (for example in proximity to the front wall 4a) may lack said layer 40. In fact, the safety mechanism defined by the first and second coupling portion 12, 13 allow providing a highly effective lock, capable of functioning even after the ungluing of the second coupling portion 13. In fact, even after the heating of the glued portion in proximity to the second coupling portion 13 (e.g., the glued portion which keeps the base 25 joined to the store 2) and hence the ungluing of the base 25, the coupling portions 12, 13 would remain stably engaged with each other due to the hook structure, which would in any case allow tearing off the the removable portion 15 from the container.

[0083] In fact, in the event in which there was an attempt to open the container in any manner by movement of the closure system 7, the first and the second coupling portion 12, 13 would still be able to give proof of an attempted tampering since such movement would cause the tearing off of the removable portion; if however there was the attempt to bypass the closure system 7 and disassemble the container, by heating the glued portion of the overlap zone and then attempting to disassemble the store 2, then the layer 40 placed in proximity to the overlap zone would give proof of an opening attempt.

[0084] In any case, there is the possibility of providing for the layer 40 also on the store 2, in proximity to the second coupling portion 13; such layer 40, made of heat-sensitive material, would at least partly define an external surface of the front wall 4a of the store 2 directly glued to the second coupling portion 13: such layer 40 externally covers at least one part of an external surface of the front wall 4a that is countershaped with respect to the base 25. The container 1 as illustrated in figures 4 and 5 comprises a layer 40 which at least partly covers the surface of the overlap zone, as well as at least one further layer 40 which covers the wall of the store 2 directly constrained to the base 25 of the second coupling portion 13.

[0085] Such embodiment allows defining a container 1 that is even safer since, in proximity to each glued portion, the layer 40 is provided for. The layer 40 allows giving proof of an attempted tampering of the container in the event in which there was a removal of any one glued portion of the container.

[0086] Alternatively, the layer 40 may cover at least part of an external surface of the store 2 directly glued to the inserting portion 10 (figure 12). In the latter embodiment the container comprises a layer 40 that at least partly covers the surface of the overlap zone, as well as at least one further layer 40 which covers the wall of the store directly constrained to the inserting portion 10.

[0087] In the event in which the container is provided with label 90, the layer 40 may cover an external surface of the store 2 at the label 90 and/or a portion of the tab 8 still placed in proximity to the label. In detail, the layer 40 surrounds the label 90, in part at a lateral wall of the store and in part at the closure system 7. The container may also comprise a layer 40 which at least partly covers the surface the overlap zone of the store 2. In the event in which there is an attempt to remove the label, by heating the layer 40 placed in proximity to the label, said layer 40 would give proof of such attempted tampering.

[0088] In order to provide evidence of an attempted tampering, the layer 40 is configured for varying at least one between an optical and physical property following a heating of the same layer 40 at a predetermined reference temperature similar to the softening point of the glued portion. In detail, the layer 40 made of heat-sensitive material undergoes a variation of an optical and/or physical property upon reaching a temperature slightly lower than the softening point, in a manner such to give proof to a user of the irregular heating (or at least of a heating attempt) of the glued portion. In other words, the ratio between the predetermined reference temperature and the softening point is comprised between 0.8 and 1.2.

[0089] It is observed that the the layer 40 made of heat-sensitive material comprises at least one between a heat-sensitive paint or a heat-sensitive film. Following an irregular heating of the layer 40, the heat-sensitive layer or paint may undergo an optical variation, for example a variation regarding color, opacity, transparency, transmittance, refraction or brightness of the layer 40.

[0090] Furthermore, the layer 40 may undergo a variation of a physical property, for example, an external surface of the layer 40, following a heating to a temperature close to the glued portion softening state, may vary the consistency thereof or the roughness thereof, allowing a user to tactilely perceive the occurrence of an attempted tampering of the container.

Process of making the container 1

[0091] Also forming the object of the present invention is a process of making a container 1 in accordance with one or more of the enclosed claims and/or with the above-reported description.

[0092] The process provides for providing the store 2 which as described above is made of sheet material, optionally paper. In particular, such step provides for the arrangement of at least one first sheet 51 comprising at least one first and a second portion 52, 54 interconnected by a central connection portion 53. The first sheet 51 also comprises at least one first and a second lateral connection portion 55, 56. As is visible in figures 1 and 10, the central connection portion 53 is interposed between the first and the second portion 52, 54, the first portion 52 is interposed between the first lateral connection portion 56

and the central connection portion 53, while the second portion 54 is interposed between the second lateral connection portion 55 and the central connection portion 53. Advantageously, the first and the second portion 52, 54 have substantially the same shape and size, while the lateral connection portions 55, 56 also have a rectangular shape that is substantially identical. Each of said portions 52, 53, 54, 55, 56 comprises at least two opposite longitudinal edges and two opposite end edges: the portions 52, 54, the central connection portion 53 and said lateral connection portions 55, 56 are joined along the longitudinal edges and aligned along a single connection direction.

[0093] The step of providing the store 2 provides for a step of folding the first sheet 51 at the lateral edges of the portions 52, 53, 54, 55 and 56 in a manner such to join together the lateral connection portions 55, 56. In particular, the first sheet is wound on itself so as to bring the lateral connection portions 55 and 56 into contact (overlapped). In order to be able to maintain the store 2 in the folded three-dimensional shape, the process may provide for the application of a predetermined quantity of glue, for example a cold glue, on at least one of the longitudinal connection portions 55, 56 adapted to abut against each other: the joining of said portions allows locking the store 2 in the folded configuration. Illustrated as a non-limiting example in the enclosed figures is a process that provides for the application of a predetermined quantity of glue only on a longitudinal connection portion. There is the possibility to apply the glue on both portions 55 and 56.

[0094] The process also provides for the arrangement of the closure system 7. Such step provides for the arrangement of at least one second sheet 57, integrally joined with the first sheet 51 at an end edge of the first and/or second portion 52, 54 of the first sheet 51. The second sheet 57 comprises at least one first and a second portion 58, 59 integrally joined with each other: the first portion 58 of the second sheet 57 is connected to the first sheet 51 in a manner such that said first portion 58 is interposed between the second portion 59 of the second sheet 57 and the first sheet 51. Illustrated in the enclosed figures is a preferred but non-limiting configuration of the invention, in which two second sheets 57 are provided for that are engaged with the first sheet 51 and arranged opposite with respect to the latter. Each second sheet 57 is for example connected to a respective end edge of the first and/or of the second portion 52, 54 of the first sheet 51. Advantageously, the second sheet 57 is integral with the first sheet to define a single sheet; in particular, also the second sheet 57 is made of paper material. The process also provides for steps for folding the first and the second portion 58, 59 of the second sheet 57 to respectively form the closure portion 9 and the inserting portion 10 of the closure system 7. The step of folding the second sheet is preferably but not exclusively executed following the engagement of the portions 55 and 56 of the first sheet 51.

[0095] The step of arranging the closure system 7 may also provide for a substep for arranging at least one portion 61 connected to at least one central connection and/or lateral portion of the first sheet 51 and emerging with respect to the latter on the same side from which the second sheet 57 emerges. In particular, the process may provide for the arrangement of two portions 61 connected to the central portion 53 and emerging from the the latter opposite each other along respective end edges (emerging from the first sheet 51 on the same side from which the second sheet 57 emerges). The process may also provide for the arrangement of further two portions 61 connected to the longitudinal connection portion 55 or 56 and emerging from the latter opposite each other along respective end edges (emerging from the first sheet 51 on the same side from which the second sheet 57 emerges). Each portion 61 is made of flat sheet material, optionally of sheet paper material, and has a shape that is substantially square or trapezoidal.

[0096] It is observed that the first portion 52 of the first sheet, the second portion 54 of the first sheet, the second lateral connection portion 55 of the first sheet, the first portion 58 of the second sheet 57 may comprise at least one covering 70 made of heat-sensitive material, which, following the formation of the store 2, defines at least one part of an external surface of the container 1, opposite the at least one glued portion of the same, to define at least part of the layer 40 made of heat-sensitive material. In particular, as shown in figures 1 and 10, the second portion 54 of the first sheet and the second lateral connection portion 55 of the first sheet, have at least one covering 70 made of heat-sealable material. In detail, the second portion 54 of the first sheet 51, has two coverings 70 made of heat-sealable material, defined at end edges opposite each other. With reference to the first embodiment of the invention, whose blank is shown in figure 1, said coverings 70 made of heat-sealable material, following the formation of the store, are configured for being overlapped on a third sheet 62 of the blank 50 detailed below. With reference instead to the second embodiment of the invention, whose blank is shown in figure 10, said coverings 70 of heat-sealable material, following the formation of the store, are respectively configured for being overlapped on the second portions 59 of the second sheet 57.

[0097] In accordance with the blank of the first embodiment of the invention shown in figure 1, the process may provide for a step of arranging the first sheet 51, which also provides for at least one step of formation on the same 51 of at least one through groove 71 arranged on the first and/or on the second portion 52, 54 and configured to define the depression 23. In particular, the depression 23 is substantially executed at the lower and/or upper edge of at least one of said portions 52, 54. Advantageously but not exclusively, the through groove 71 is executed on the same portion of the sheet on which the notch 69 is defined, optionally above the latter. In particular, the through groove 71 is defined on at least

one transverse edge of the first or second portion 52, 54 of the first sheet 51. The through groove 71 defines an open profile having substantially "C", or "U", or "V" form. The process may also provide for a step of formation, on each second sheet 57, of at least one through notch 69 defined at least on the second portion 59 of the second sheet 57, optionally interposed between the first and the second portion 58, 59 of the second sheet 57, configured to define the through access 26. The notch 69 is executed substantially at a connection edge between the first and the second portion 58, 59 of the second sheet 57.

[0098] The process may provide for the arranging of at least one third sheet 62 laterally emerging from the first sheet 51 on the side of the second portion 54 of the same first sheet 51. In particular, the third sheet 62 may comprise:

- at least one first portion 62a directly integrally joined with the second portion 54 of the first sheet 51 and laterally emerging from the latter,
- at least one second portion 62c directly carried by the first portion 62a of the third sheet 62 and interposed between the second portion 54 of the first sheet 51 and the first portion 62a of the third sheet 62,
- at least one third portion 62b directly integrally joined with the first portion 62a of the third sheet 62 itself and laterally emerging from the latter interposed between the second portion 54 of the first sheet 51 and the first portion 62a of the third sheet 62 to define the support portion 19 of the second coupling portion 13.

[0099] As shown in figure 1, the process may also provide for, following the steps of arranging the third sheet 62, the substeps di:

- folding the first and the second portion 62a, 62c of the third sheet 62,
- constraining, by means of gluing, the first portion 62a to the second portion 54 of the first sheet 51 to define the second coupling portion 13,
- folding the third portion 62b of the third sheet 62 above the first portion 62a of the same third sheet,
- constraining together, by means of gluing, the first and the third portion 62a, 62b of the third sheet 62.

[0100] It is observed that the first and the second portion 62a, 62c of the third sheet 62 are joined together by means of a weakened portion. In fact, the second portion 62c, following the step of constraining the first portion 62a, defines the removable portion 15 of the second coupling portion 13.

[0101] The process may also provide for arranging a fourth sheet 63 comprising at least one portion 64 integrally joined with the second portion 59 of the second sheet 57. The portion 64 of the fourth sheet 63 is also made of sheet material, optionally paper material, and longitudinally emerges from the second sheet 57 on the side opposite the first sheet 51: the portion 64 of the fourth sheet 63 is configured to define the first coupling portion 12 of the container 1. Illustrated in the enclosed figures, in a non-limiting manner, is a configuration of the fourth sheet 63 directly connected to the second portion 59 of the second sheet 57 (emerging away therefrom). In more detail, the step of forming the portion 64 of the fourth sheet 63 provides for at least the following substeps:

- forming an extension sheet emerging from the second portion 59 of the second sheet 57, substantially parallel to the same second sheet 57 on the opposite side with respect to the first portion 58 of the second sheet 57;
- forming at least one undercut adapted to define the first coupling portion 12 of the container 1.

[0102] Each of the sheets belonging to the blanks shown in figures 1 and 10 may be integrally joined to form a single sheet blank 50 of sheet paper material.

[0103] The process may provide for the engagement of the portion 64 of the fourth sheet 63 with the second portion 59 of the second sheet 57, by means of a weakening line 67 to define the removable portion 15 of the container 1. In fact, as described above, the removable portion 15 may be carried by the first coupling portion 12, by the second coupling portion 13 or by both coupling portions 12, 13.

[0104] Advantageously, the sheets are obtained starting from a single flat sheet, optionally of paper material, which by means of a process of die cutting, define the blank 50.

ADVANTAGES

[0105] The present invention involves considerable advantages with respect to the solutions of the prior art. Indeed, the presence of a store 2 provided with a glued overlap zone, in proximity to which the layer 40 is present, allows providing a container 1 with extremely simple structure, closable/manufacturable by commonly known fold-glue plants, and simultaneously extremely safe since it prevents any one opening attempt aimed to bypass the closure system.

[0106] In the embodiment illustrated in figures 4 and 5, the container 1 has a closure system 7 that is extremely simple and effective which allows minimizing the use of the glue; in fact, the closure system provided with the first and second coupling portion 12, 13 allows providing a safety device of the container capable of effectively blocking the latter in the closed condition, reducing the quantity of glue necessary, applied only on the base 25: the hooks of the first and second coupling portion totally lack glued portions and are capable of effectively preventing container tampering attempts. In the container of figures 4 and 5, the layer is placed at each glued portion: any one attempt to unglue the container 1 to open it would be readily made evident by the layer 40.

[0107] The container provided with label 90 is instead extremely simple and effective, since any one attempt to unglue the label 90 to allow the opening of the container 1 would be readily made evident by the layer 40.

Claims

1. Tamper-evident container comprising:

- a store (2) defining an internal volume (3) configured for housing at least one product, the store (2) having a predetermined number of lateral walls defining at least one passage opening (5) delimited by a free edge (6), said passage opening (5) being configured for placing the internal volume (3) in communication with the outside environment to allow the passage of said at least one product, wherein the predetermined number of lateral walls of the store (2) has an overlap zone which comprises at least one first and at least one second constraint portions at least partly overlapped and engaged with each other by means of a glued portion,
- at least one closure system (7) arranged at the passage opening (5) of the store and configured for obstructing said passage opening to define a closed condition of the container (1),

characterized by the fact that the container (1) comprises, at the glued portion of the overlap zone of the store (2), at least one layer (40) made of heat-sensitive material configured for irreversibly varying at least one of an optical and physical property of the same layer to provide evidence of an attempted tampering of the container (1).

2. Container according to claim 1, wherein the heat-sensitive material of the layer (40) is configured for varying, following a heating of said layer (40), at least one optical property thereof.

3. Container according to any one of the preceding claims, wherein the heat-sensitive material of the layer (40) is configured for at least partly varying, following a heating of said layer (40), at least one of the following optical properties: color, opacity, transparency, transmittance, refraction, brightness.

4. Container according to any one of the preceding claims, wherein the layer (40) defines at least one part of an external surface of the container (1), substantially overlapped on the glued portion of the store.

5. Container according to any one of the preceding claims, wherein the layer (40) comprises at least one of: a heat-sensitive paint, a heat-sensitive film.

6. Container according to any one of the preceding claims, wherein the first constraint portion defines at least part of an internal wall of the store (2) delimiting said internal volume (3) while the second constraint portion delimits at least part of an external wall of the store (2),
wherein said layer (40), made of heat-sensitive material, at least partly covers the surface of the wall of the second constraint portion to define at least part of an external surface of the container.

7. Container according to any one of the preceding claims, wherein the store (2) is made of sheet material, optionally paper, at least partly wound on itself to essentially form a tubular body defined by the predetermined number of lateral walls which delimits two opposite longitudinal passage openings (5), wherein at least one enclosed portion of the predetermined number of lateral walls is overlapped and is engaged by glue to define said overlap zone, wherein said overlap zone is extended between the two opposite passage openings (5), wherein the layer (40), made of heat-sensitive material, is only arranged on the store (2) in proximity to the glued overlap zone.

8. Container according to any one of the preceding claims, wherein the predetermined number of lateral walls comprises a front wall (4a) and a rear wall (4b) facing and parallel to each other, the front wall and the rear wall being connected to each other by a first and a second connection walls (4c, 4d), also facing and parallel to each other,

the front wall (4a) being spaced from the rear wall (4b) by said first and second connection wall (4c, 4d), said first and second connection walls being spaced from each other by the front and rear wall,
wherein at least the second connection wall (4d) comprises said overlap zone, wherein the layer (40) made of heat-sensitive material at least partly externally covers said second connection wall (4d), at least in proximity to the glued portion.

9. Container according to the preceding claim, wherein the overlap zone is only defined on the second connection wall (4d), wherein the layer (40) made of heat-sensitive material externally covers a main part of the second connection wall (4d).

10. Container according to any one of the preceding claims, wherein the glued portion comprises at least one of:

- one or more glue portions, optionally cold glue,
- one or more portions of adhesive material, op-

tionally adhesive material strips,

wherein the layer (40) made of heat-sensitive material is defined at the second constraint portion directly engaged, optionally directly glued and/or made adhesive, to the first constraint portion.

11. Container according to any one of the preceding claims, wherein the closure system (7) is at least partly made of sheet material and comprises a tab (8) engaged at said free edge (6) of the passage opening (5) and movable, optionally via rotation, relative to the store (2), the tab (8) of the closure system (7) being configured to define at least:

- a closed condition in which the tab (8) itself prevents the communication between the internal volume (3) of the store (2) and the outside environment, preventing the passage of the at least one product from the passage opening (5),
- an open condition in which the tab (8) itself allows the communication between the internal volume (3) and the outside environment, allowing the passage of the at least one product from the passage opening (5),

wherein the closure system (7) comprises:

- at least one first coupling portion (12) carried by the tab (8),
- at least one second coupling portion (13),

wherein said first and second coupling portion (12, 13), in the closed condition of the container (1), are configured for being stably engaged with each other to define an activation condition of the container, wherein at least one between said first and second coupling portion (12, 13) comprises at least one removable portion (15) configured for being separated from at least one of said closure system (7) and store (2) following a first opening of the closure system (7), following said activation condition, to provide evidence of a tampering of the container (1).

12. Container according to any one of the preceding claims, wherein the glued portion has a softening point defined at a predetermined temperature, optionally higher than 50°C, still more optionally comprised between 65°C and 90°C,
wherein the layer (40) is configured for varying at least one of an optical and physical property following a heating of said layer (40), at a predetermined reference temperature, wherein the ratio between the predetermined reference temperature and the softening point is comprised between 0.8 and 1.2.

13. Container according to any one of the preceding claims, wherein the closure system (7) lacks said layer (40), made of heat-sensitive material.

14. Container according to any one of the claims from 11 to 13, wherein the second coupling portion (13) defines at least one undercut (16) configured for stably engaging the first coupling portion (12), in the closed condition of the container to define said activation condition,
wherein the undercut (16) of the second coupling portion comprises at least one hook (16a) configured for stably engaging said first coupling portion (12), wherein said hook (16a) lacks glued portions.

15. Process of making a container in accordance with any one of the preceding claims, wherein said process comprises the following steps:

- providing the store (2),
- providing the closure system (7),

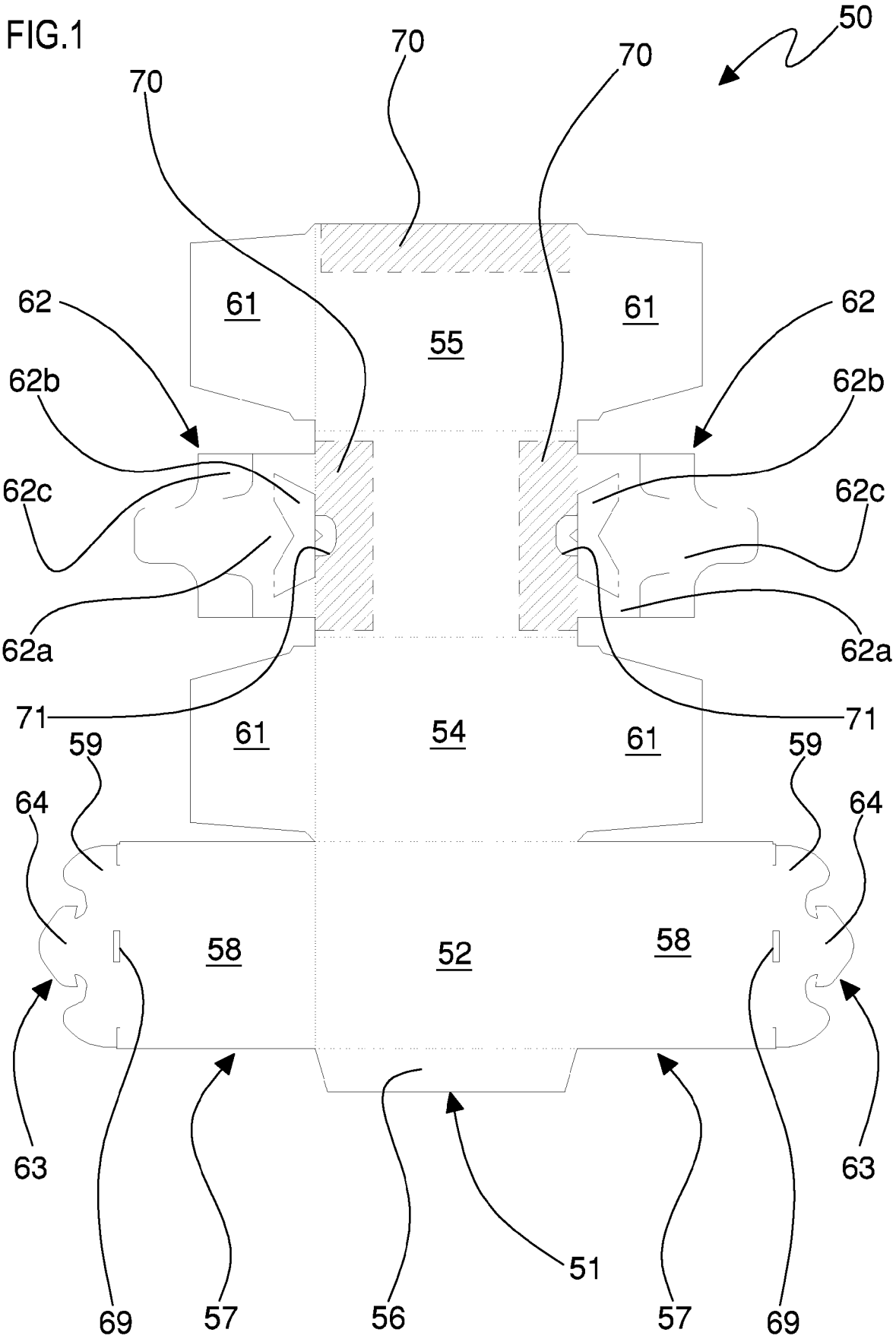
wherein the step of providing the store (2) comprises at least the following substeps:

- providing a first sheet (51) comprising at least one first and a second portion (52, 54) interconnected by a central connection portion (53), the first sheet (51) also comprising at least one first and at least one second lateral connection portion (55, 56), the second portion (54) being interposed between the first lateral connection portion (55) and the central connection portion (53), while the second lateral connection portion (56) may be connected to the first lateral connection portion (55) or to the first portion (52), each of said portions (52, 53, 54, 55, 56) comprising at least two opposite longitudinal edges and two opposite end edges, said portions (52, 54), said central connection portion (53) and said first and second lateral connection portion (55, 56) being joined along the longitudinal edges and aligned along a single connection direction,
- folding the first sheet (51) along said longitudinal edges so as to arrange the lateral connection portion at the first portion (52),
- joining, by gluing, the second lateral connection portion (56) with said first portion (52) or said first lateral connection portion (55) to define said store,

wherein the step of providing the closure system (7) comprises the substep of providing at least one second sheet (57) connected to an end edge of the first portion (52), the second sheet (57) comprising a first and a second portion (58, 59) integrally joined with each other, the first portion (58) of the second sheet (57) being interposed between the first portion (52) of the first sheet (51) and the second portion (59) of

the second sheet (57),
the process also comprising a step of providing, on at least one part of the first sheet, a covering (70) of heat-sensitive material, the covering (70), following the arrangement of the store, defining at least part of the layer (40), made of heat-sensitive material.

FIG.1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62
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62b
62b
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62a
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51
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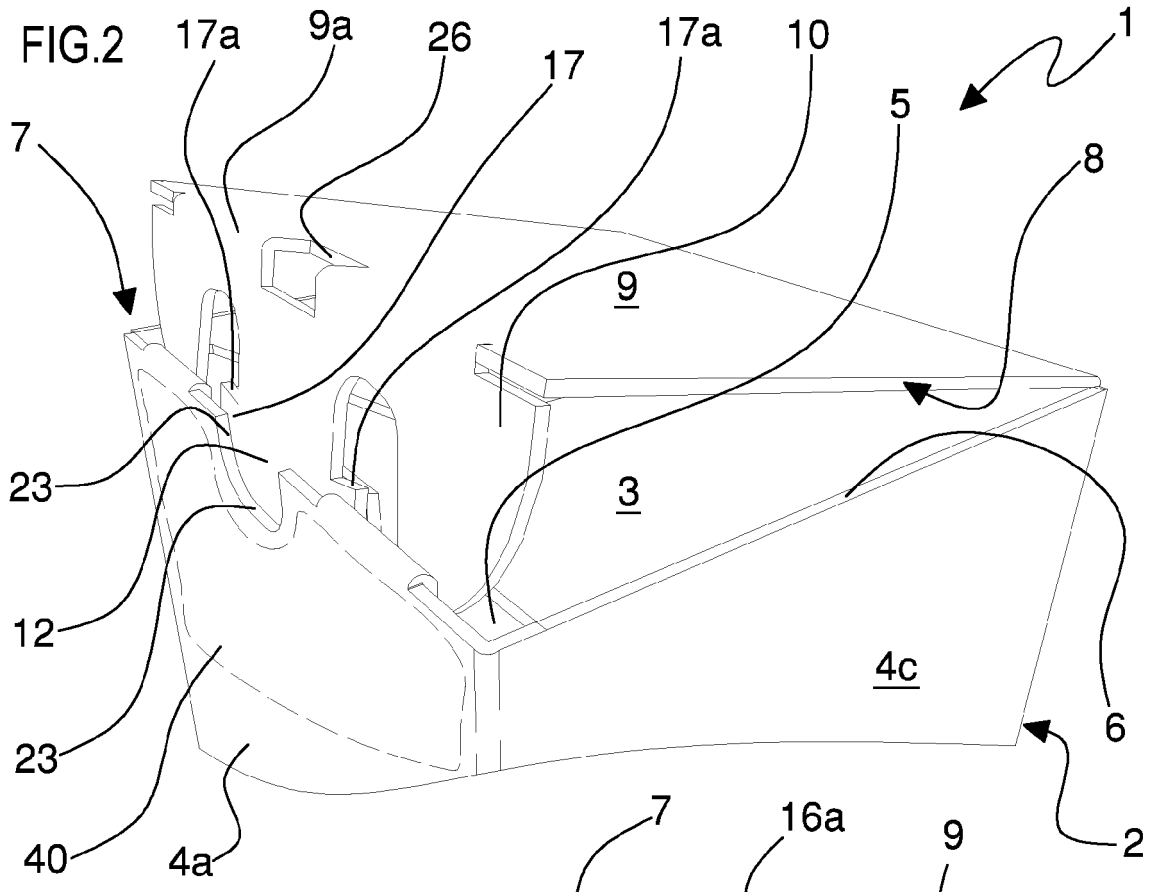
69

FIG.2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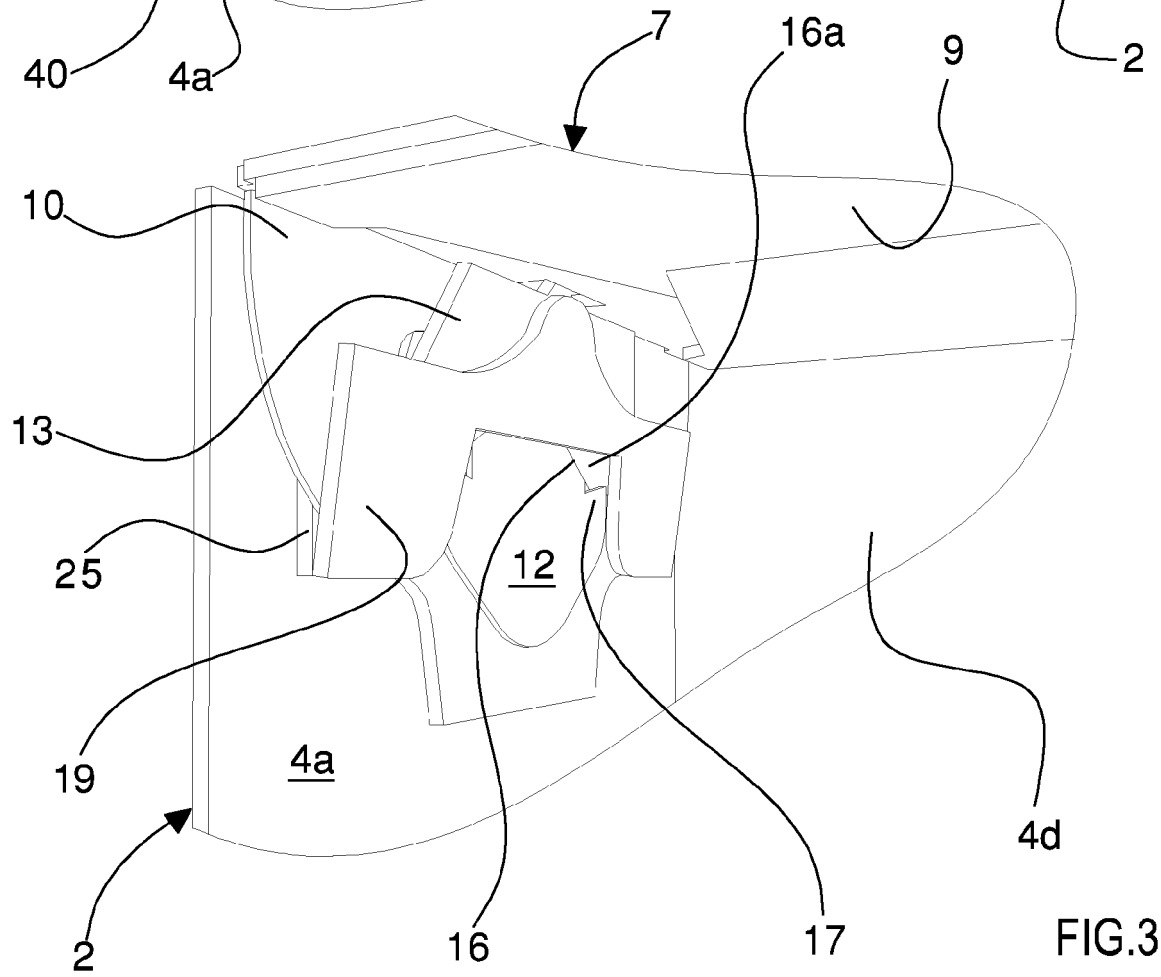
4a
2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16a
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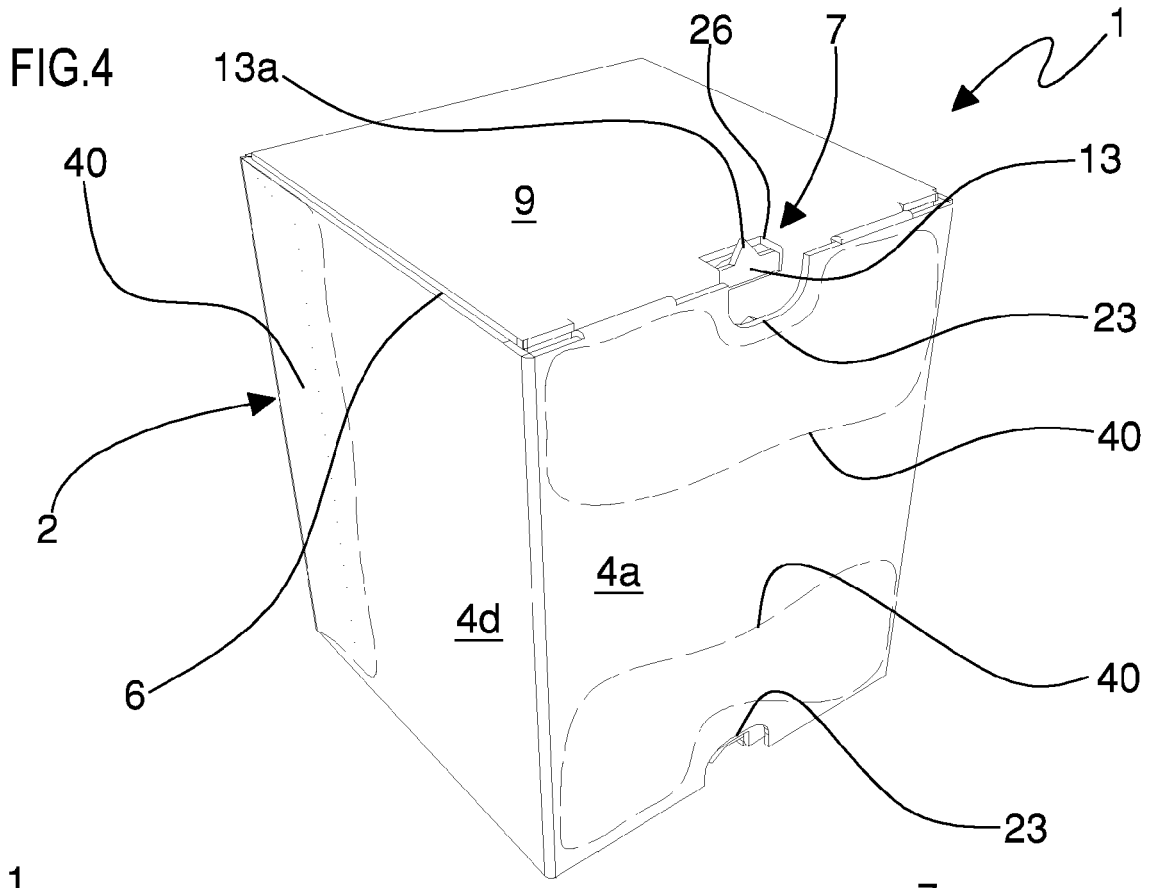
13
25
12
19
4a
4d
2
16
17

FIG.3

FIG.4



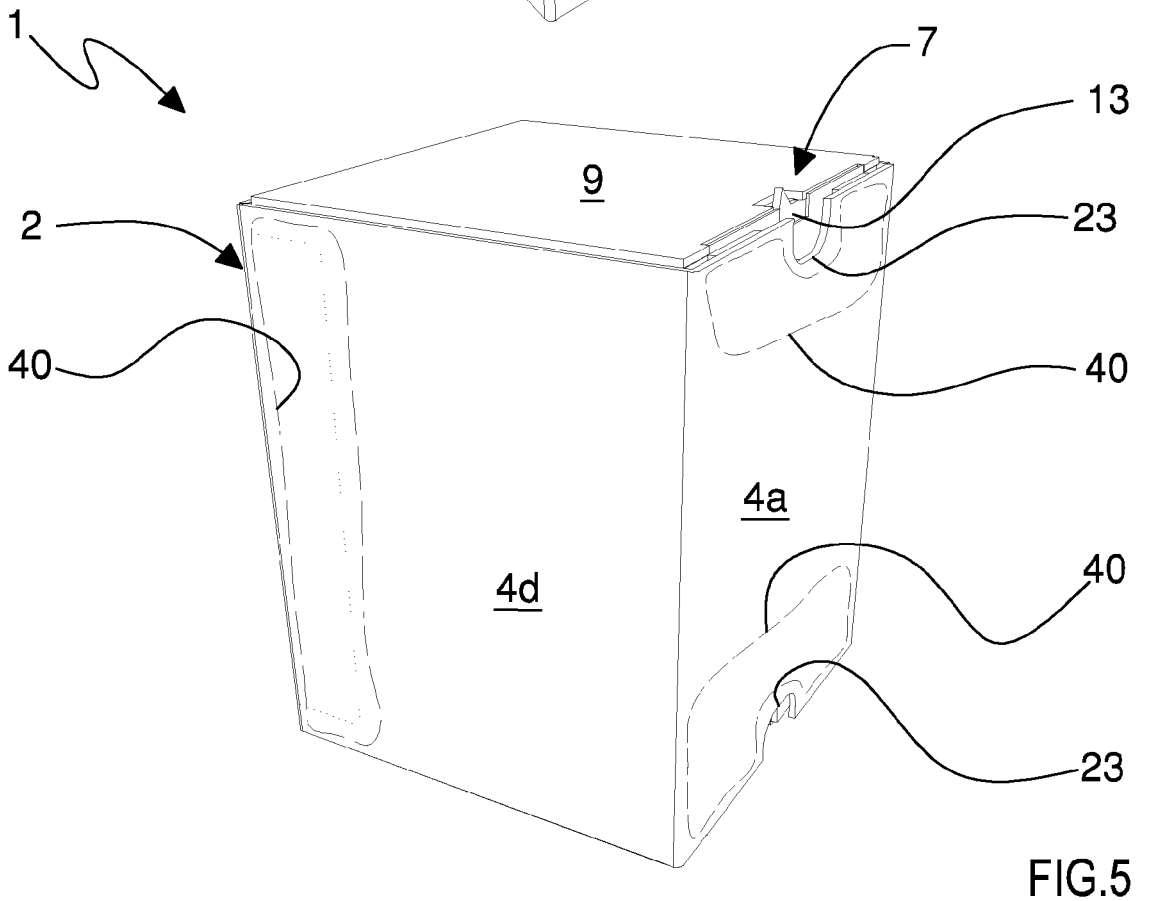
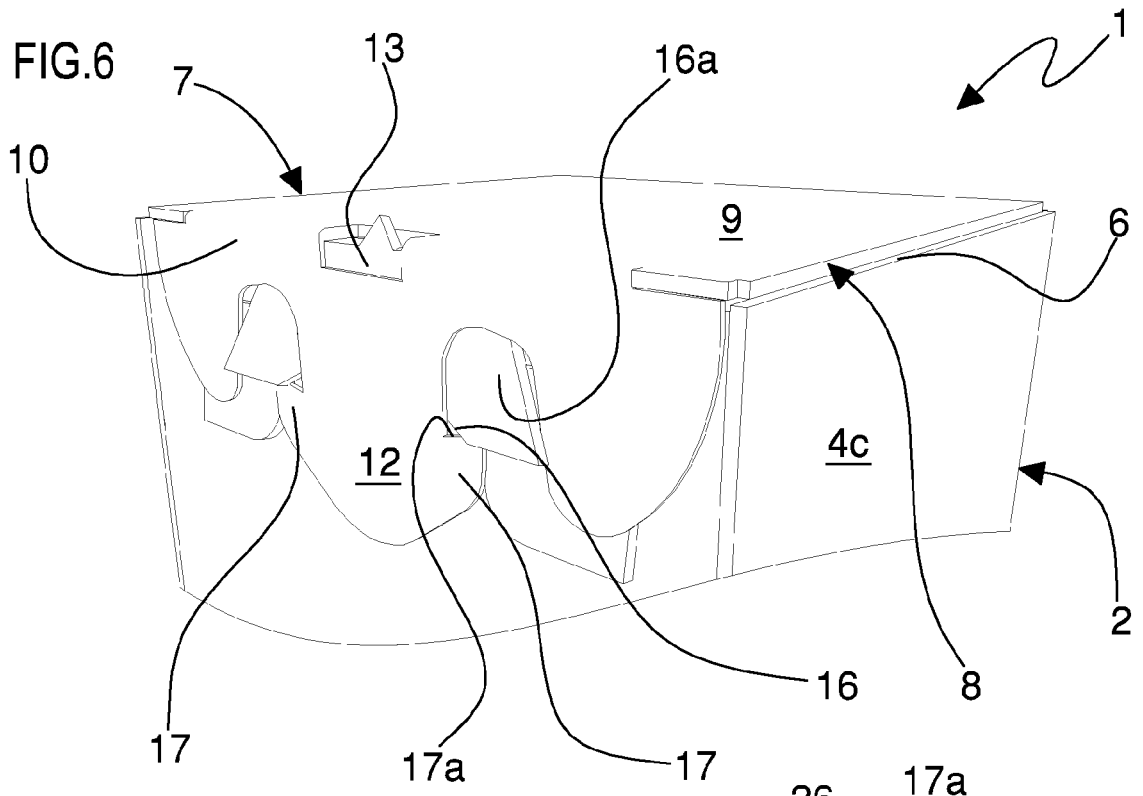


FIG.5

FIG.6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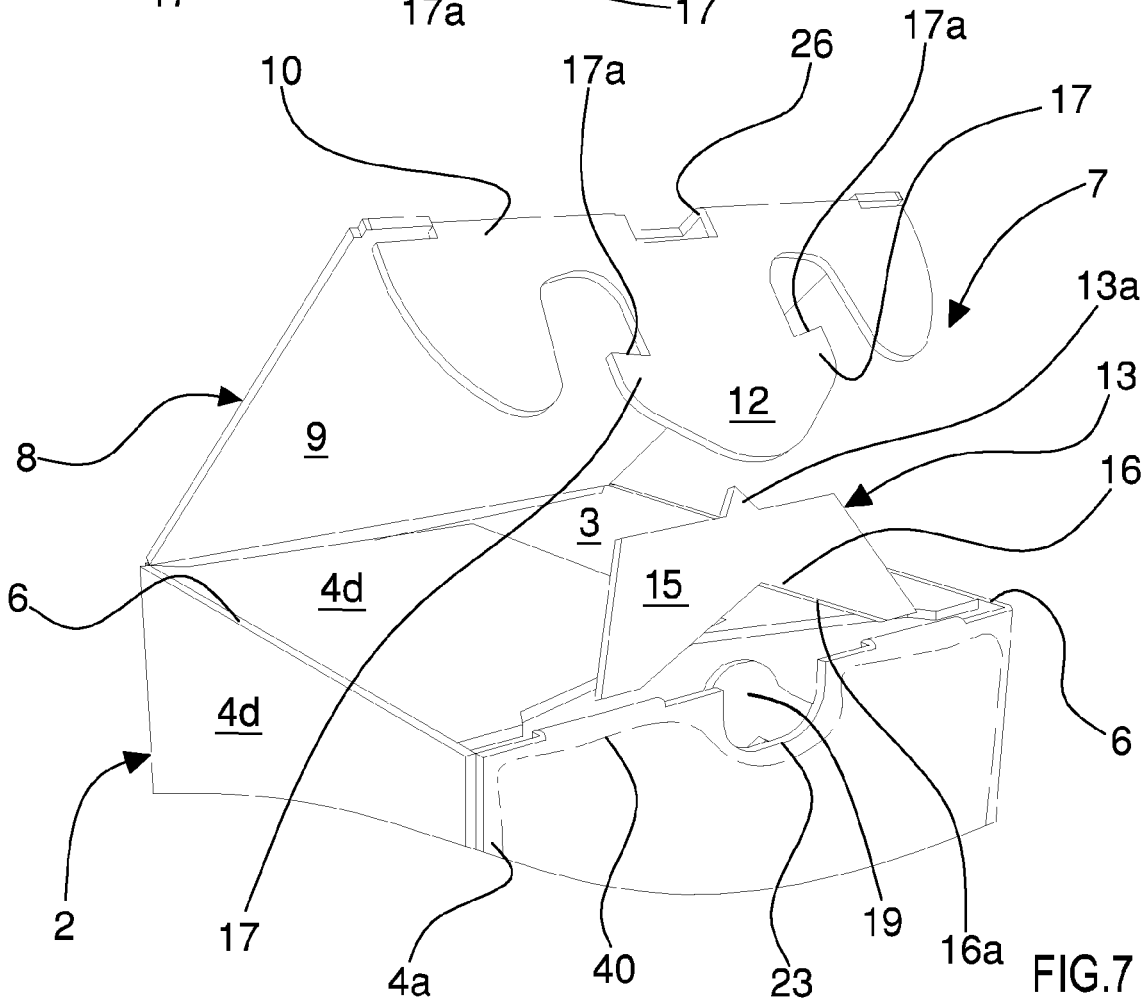
17a
17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17a
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13a
13
16
8
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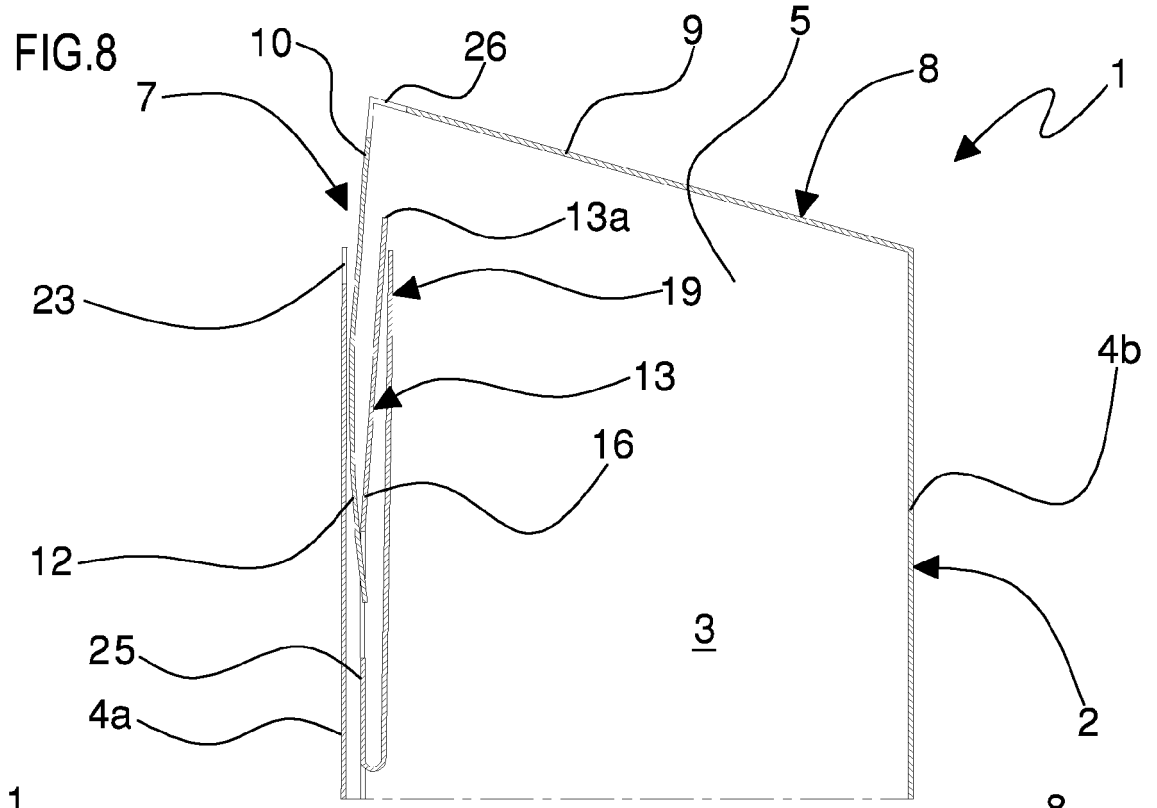
4d
15
4d
6
2
17
4a
40
23
19
16a

FIG.7

FIG.8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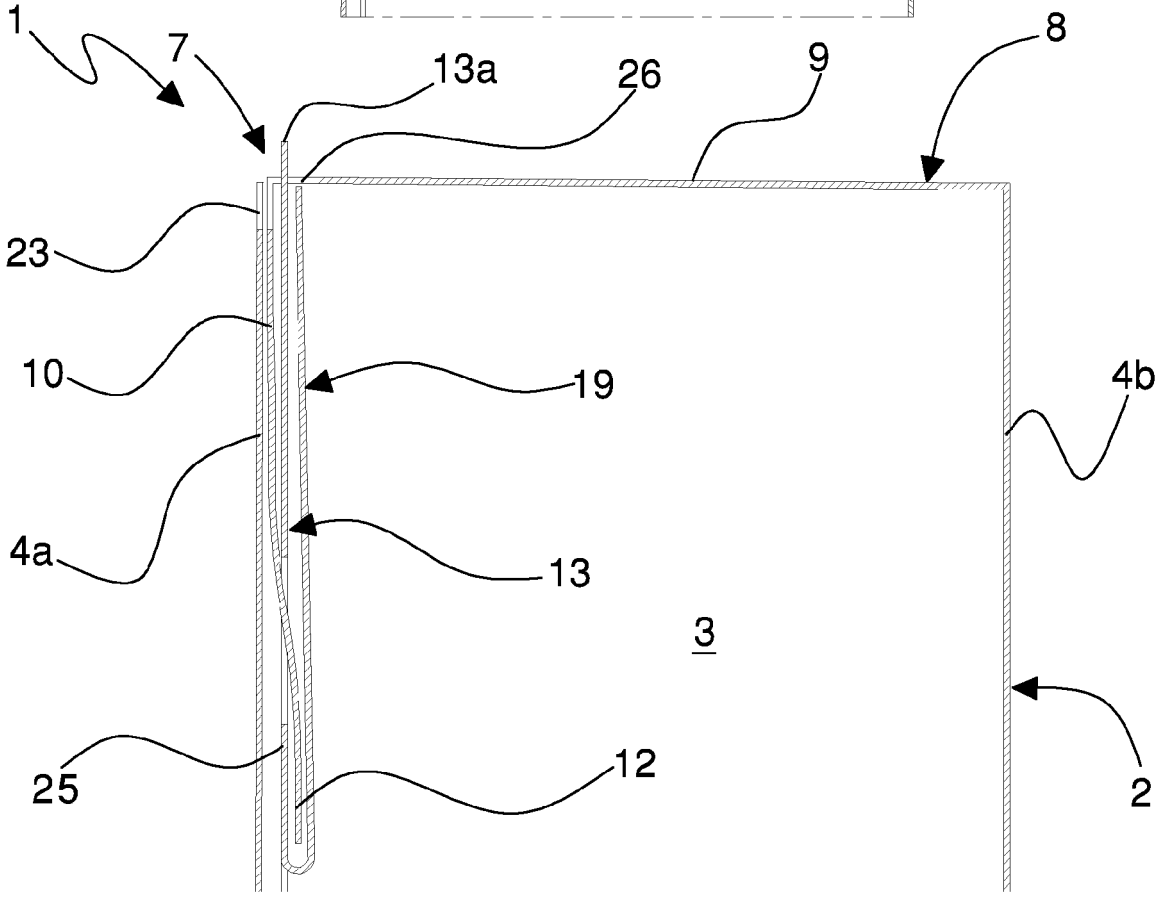
23
19
13
4b
16
12
3
25
4a
2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7
13a
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9
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23
10
19
4b
4a
13
3
25
12
2

FIG.9

FIG.10

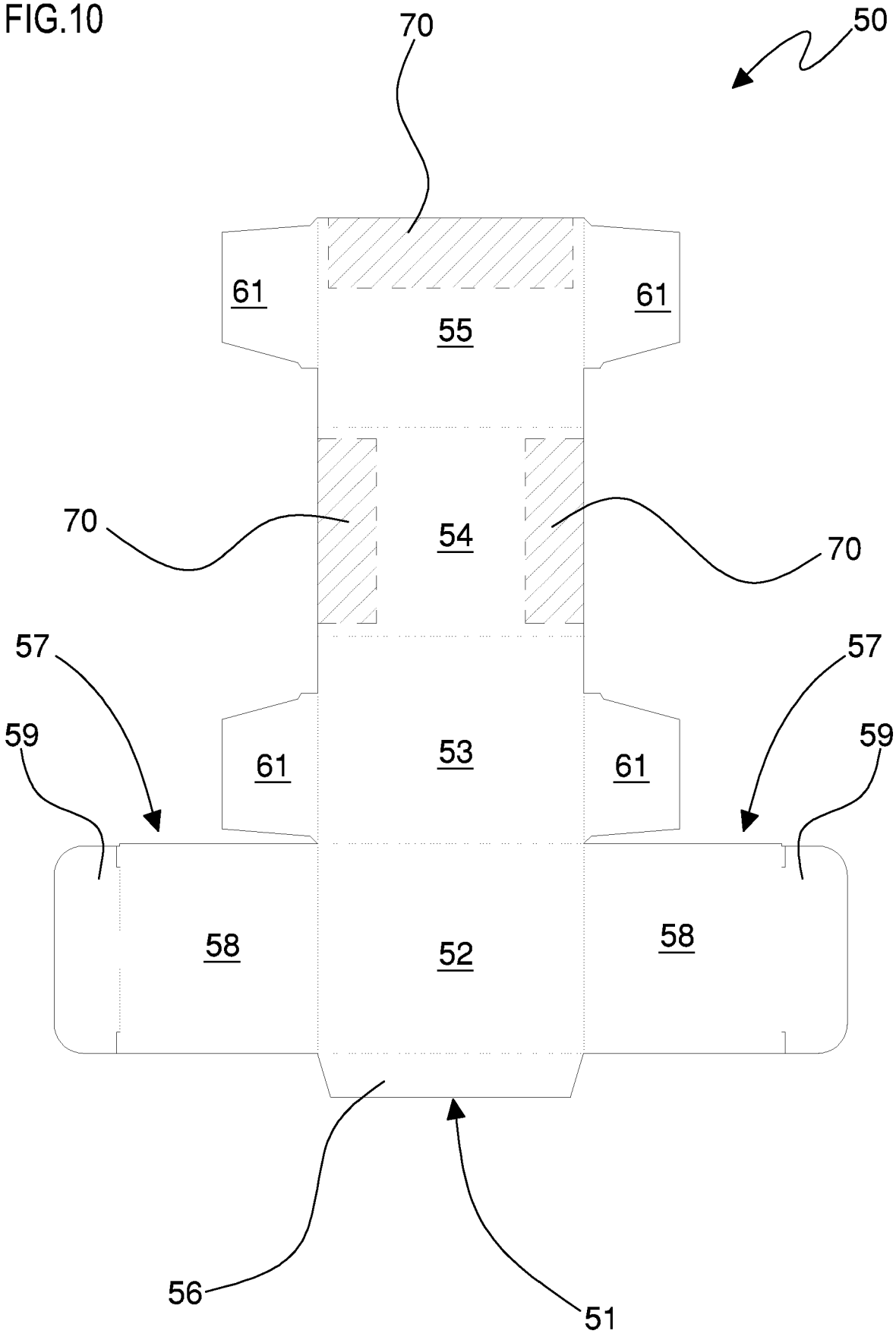


FIG.11

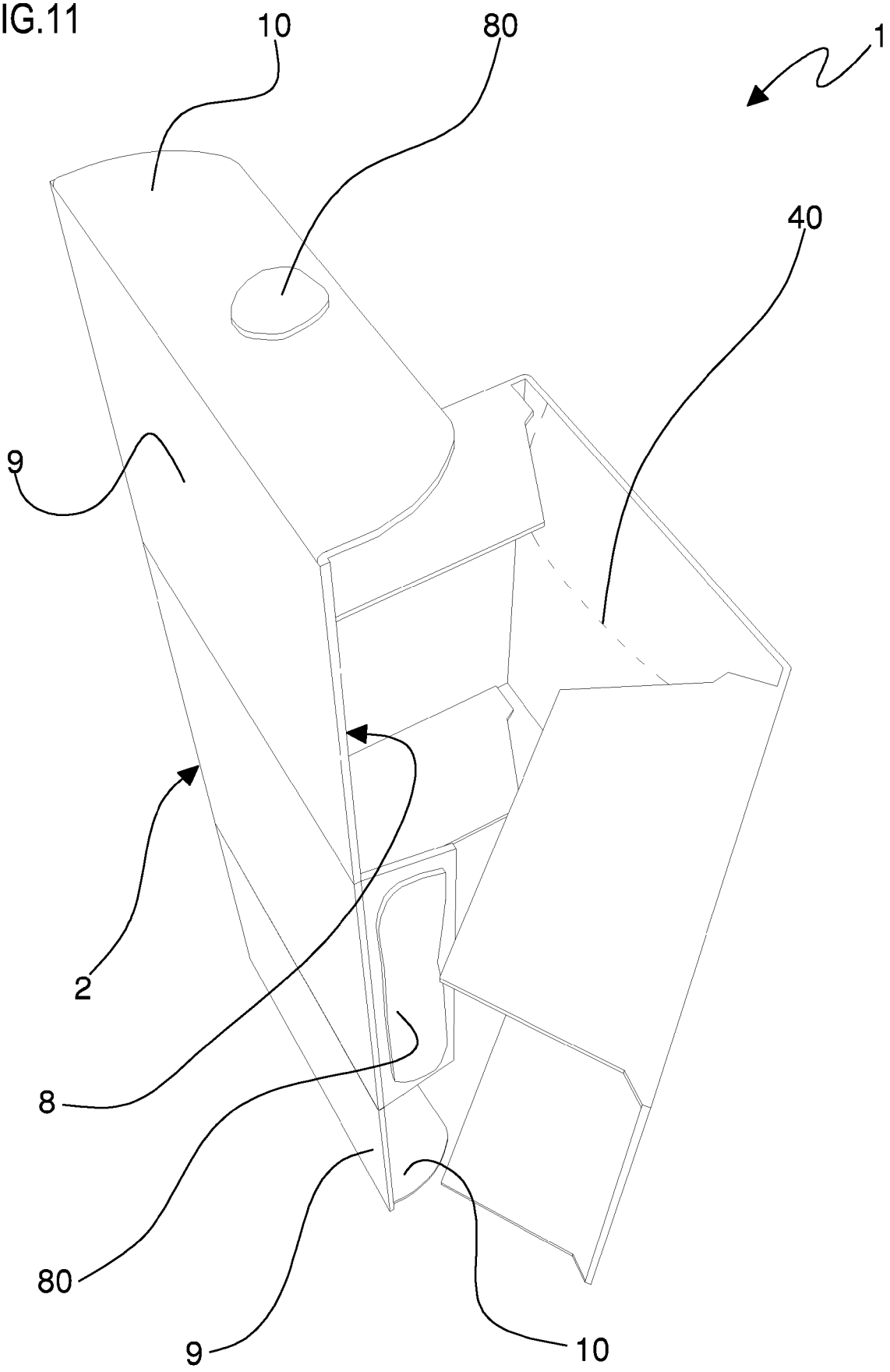
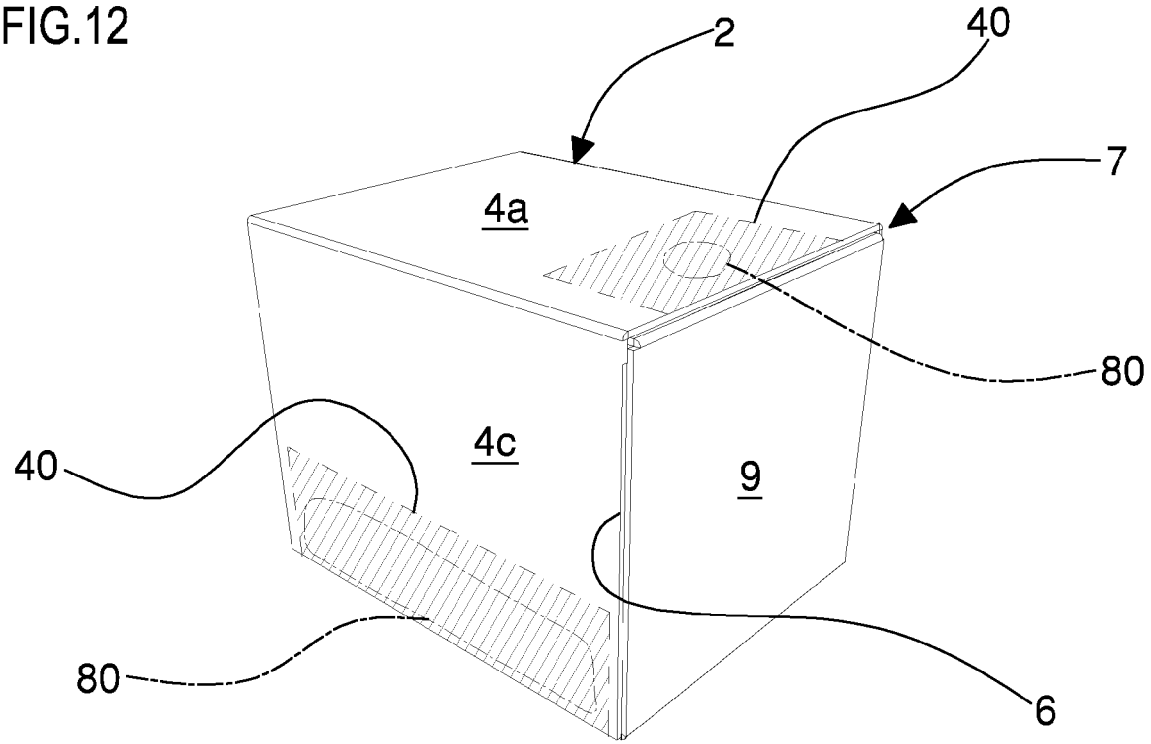


FIG.12



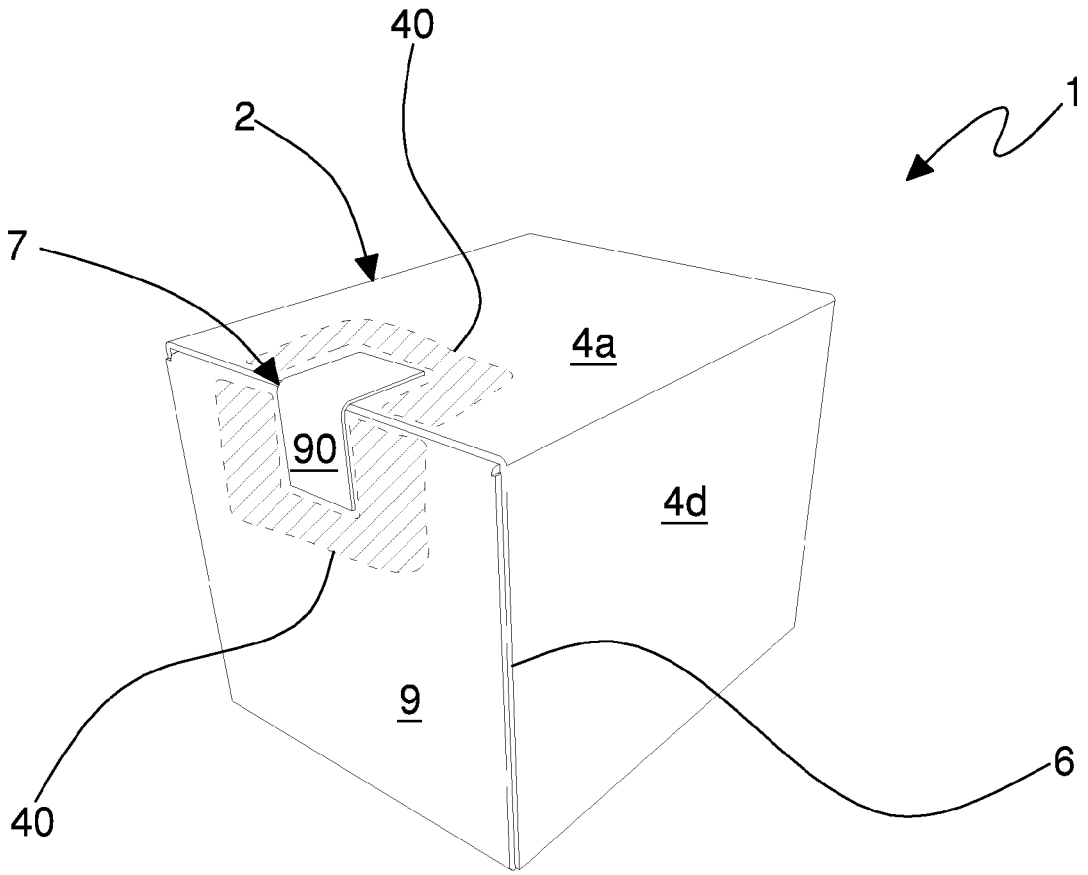


FIG.13

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 17 7459

DOCUMENTS CONSIDERED TO BE RELEVANT

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