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(54) BUILDING UNIT OF PLASTIC, IN PARTICULAR BOTTLE-SHAPED

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UNITÉ DE BÂTIMENT PLASTIQUE, EN PATICULIER EN FORME DE BOUTEILLE

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EP 3 101 189 B1

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Description

Technical field

[0001] The invention aims to reuse the recycled material in architecture and civil engineering. So far, architecture has not focused on recycling materials too much and, therefore, there is a lot of untapped potential. As regards weight-based building units, it is a brick-sized unit, lightweight but load-bearing, which allows mobility and flexibility of structures, specifically temporary ones.

State of the art

[0002] PET bricks, as known at present, are described and documented on the Czech market. Two prototypes of PET bricks - star-shaped and bottle-shaped PET bricks - are known in the world. The brick sizes correspond to the sizes of bottles of different volumes because they are manufactured on a standardized line for bottle production.

[0003] The star-shaped brick from Taiwan consists of two parts in the shape of a cylinder, which are turned relative to one another so they fit into each other when installed. They are developed in three sizes by volume: 400 ml, 670 ml and 6,000 ml. The disadvantage of the star-shaped brick design is that although the bricks are adapted in shape to fit into each other, they do not hold together, there is no interlocking mechanism. They need to be bonded with silicone and, moreover, connected with auxiliary plates.

[0004] A plastic bottle-shaped brick is also known, i.e. a container for drinking water and a building unit in one. On the peripheral shell of the bottle there are projections and depressions and the individual units are held together so that these projections fit into the depressions; however the connecting method does not allow standard bond between bricks. This Swiss solution is problematic in particular in corners as well as on the brick-wall interface where additional structures, wires, must be used. With this bottle-shaped brick it is not possible to create multi-layered walls and conventional bonds between individual units. Another disadvantage of this solution is that it is shape-dependent, i.e. it looks like a bottle, can be gripped in one hand, even for the first use of the object, which is a user-friendly shape for beverage consumption. Another disadvantage is the very costly material these bottle-shaped bricks are made of. No information has been found that they are made from recycled materials. A container for beverages made of plastic has been found in German patent No. 19960520, designed to have interlocking projections and depressions, but it is not clear from the drawings how the closure is resolved, for example for connecting additional parts.

[0005] A transparent building element with a cavity is known under Czech utility model No. 27743; it is filled with a substance accumulating solar energy. This element consists of two parts and its material is not clear. It cannot be joined without mortar. A system of embedding PET bottles in a prefabricated wall is also known - Czech utility model No. 12054 and Czech patent No. 294 646 - wherein the binder is concrete, which is a disadvantage from an environmental viewpoint. Bottles only form air insulation in this case. PET bottles were also used in the building design of Czech patent No. 294 667, in the prefabricated element of outer walls. The bottles act as self-acting shuttering there and help form cavities, but they are not load-bearing.

[0006] An interlocking modular system is protected by Czech utility model No. 6946, where moulded blocks are made of concrete, therefore lacking all the benefits that could be derived from the characteristics of plastics. PET bottle types of unusual shapes are also registered, for example Czech triangular bottles under Czech industrial design No. 34615 and bottles with tongue and groove on the vertical plane under Czech industrial design No. 28247. These have a potential that has not been used for unit connectivity. A Lego-type bottle with a projection and depressions is registered under Czech industrial design No. 33409. It is obvious from the type of projections that the bottles do not hold together connected by themselves and the purpose of the design the purpose of the design is not constructional, but only compositive. Bottles intended for construction purposes are known and designed primarily of glass, Heineken WOBO and Bottle Brick of GlassLab, both in the United States of America. It is impossible to connect such units, produced from a hard and rigid material, such as glass and concrete, without using any other means.

[0007] Czech invention application No. 2624-97 has also been found, concerning the use of waste bottles of plastics for building purposes, where the author claims that it is possible to lay the bottles absolutely freely between vertical structures. Experiments and research using 150,000 PET bottles imply that such a solution does not have an actual determined and documented form. Another brick for mortar-less walls is Czech industrial design No. 13 800 from 1983, which proposes a brick of a similar shape, made of a rigid material. The bricks fit together, but only in two axes, with no regard given to their front and back joints.

[0008] The use of recycled PET is known even from Chinese patent application No. 201410001247, where the brick is created from construction grit with many layers, among other things with a layer of fluorescent materials and PET on top, which protects the brick from weather. PET bottles are just one of the layers. Several Romanian patents have been found regarding a building and roof construction unit of plastic and, specifically, also PET, where the bottles are cast in other substances, such as concrete, etc., so they cannot be individually connected again. None of these examples allows binding between the components in the vertical direction and does not provide load-carrying capacity of the element. A bottle-shaped building unit made of plastic is also described in WO 2015/001275 A1.

Essence of invention

[0009] The deficiencies mentioned above are, to a large extent, eliminated by a building unit of plastic, in particular bottle-shaped, based on this invention. Its essence is that it has the shape of a prism whose bottom has an aspect ratio of 1:2 and a bevel angle of 45°, with rounded corners with a unified radius. The prism height is equal to once to twice its width, with one shorter side of the prism having a projection in the shape of two continuous equal-armed crosses with rounding in the inner corners and the opposite shorter side has a negative depression matching the projection. Along its central axis, the bottom has a depression for up to three necks of other building units, including caps, and the projections are bevelled on all sides at an angle of 45°, with the recesses being bevelled at an angle of 45° on all sides.

[0010] The depression in the prism body has advantageously a spacing of 180° and its depth corresponds to the height of the neck with the cap, with the depression being terminated with a semi-circle whose radius matches the outer perimeter of the neck with the cap.

[0011] The height of the projections is advantageously 0.2 mm smaller than the depth of the recesses and their width is 0.2 mm smaller than the width of the recesses, The corners have a unified radius of 10 mm.

[0012] The building unit is advantageously made of recycled plastic, in particular materials selected from the group of PET, HDPE, LDPE, PE, PP. The building unit can be filled with a material selected from the group of liquid, gas and bulk materials and its walls can be covered with an adhesive substance.

[0013] The essence of the invention is based on the need to address excessive plastic waste. The solution is derived from experiments carried out on PET bottles, where PET bottles turned out to be a load-carrying building unit. The building unit is self-supporting and can be connected without any additional adhesives, thus retaining its recyclability. It uses the flexibility of the plastic - polyethylene terephthalate - in the sense that the building units have a shape that allows their interconnection, thus the cohesion of units without any additional bonding material, such as an adhesive etc. The possibility of connection is provided by projections on the building unit - "brick", which fit into the recesses. The bricks can be connected using construction methods - by interlocking them together. The bricks can also be installed perpendicularly, i.e. at an angle of 90°. Unlike the familiar drinking bottle, the proposed solution allows multi-layer masonry, which can be more rugged and stable against external forces thanks to its joints. The bricks fit into one another on four sides: from the top, from the bottom, from the front - cap and from the back - bottom of the bottle. Furthermore, it is primarily made from recycled materials or from PET with a high share of recycled materials, thus entering the recycling cycle and extending its duration. Units can be advantageously made from plastics such as HDPE, LDPE, PE, PP, but especially from PET.

[0014] The building unit has the potential to fulfil several functions dependent on the specific composition of the recycled material: in construction but also as a container for beverages. Subject to compliance with sanitary regulations using the bottle to bottle recycling method, the building unit meets the conditions for beverage filling. It is also possible to make a multi-layer unit with a high share of recycled materials, where only the inner layer complies with sanitary regulations.

[0015] It is possible to fill the building unit with a liquid, especially water, gas, and especially with air and air with a high share of CO_2 and with solids, in particular bulk. It can also be filled with mixtures of substances.

[0016] The building unit can be made in different sizes while preserving the principle of joining. The aspect ratio must comply with the proposed scheme, the size ratios depend on the shape and size of the closure.

Clarification of drawings

[0017] The building unit as described in this invention will be described in greater detail on a specific embodiment using the attached charts, where figure 1 shows an exemplary building unit in an exploded view. Figure 2 shows this unit in a bottom view. Figure 3 shows a side view and figure 4 a plan view.

Embodiment of the invention

[0018] Most of the restrictions on the dimensions of the building unit are based on the specificities of the production technology, mostly the dimensions of the injection / blowing mould. It has three parts, one bottom and two opposite parts enclosing the bottle perfectly from all sides. Considering the maximum height of 50 mm of the bottom part of this mould, all the other dimensions must be adapted. Another determining factor is the shape of the neck and the shape of the cap - i.e. Also the proposed brick. The aspect ratio is the principal property of the proposed solution. The layout aspect ratio must be 1 : 2, so that individual bricks can be easily joined into the resulting wall.

[0019] The plan view of the building unit is based on a rectangle with an aspect ratio of 1 : 2, with edges bevelled at an angle of 45°. In all eight corners, rounding f has a unified radius of r = from 6 to 20 mm. Height h of the entire product is determined as once to twice the width, plus the height of projections a. Height g of the brick body is also defined: g = h-(v+p)). See the drawings.

[0020] On the top surface of the building unit there is projection a in the shape of two continuous equal-armed crosses, with rounding on inner corners b. Projection a has thickness t of 6 to 40 mm and edge rounding a1 in the vertical direction, see the brick view. There is a matching negative recess on the bottom side of the unit, which the above-mentioned projection a fits in a holds fast. The difference in the vertical dimensions of projection a and the recess is defined using parameter q of 0 to 2 mm.

[0021] Height v of 2 to 20 mm for these projections a is associated with depth p of depressions e on the bottom side of the brick as follows: p = v + q. The difference in the contour of depressions e from the contour of projections a in the plan view is also described by parameter q of 0 to 2 mm. Projections a are then bevelled again at an angle of 45° on all sides i, where they touch the plan view perimeter. The peripheral edges of depressions j at the bottom of the unit - product - are solved similarly.

[0022] The building unit - brick is unique in terms of materials and shape in combination with the method of sorting and joining without any additional materials. In addition, this brick is produced using the same method as PET bottles, without significant interference with standard technology.

[0023] On side n, which is opposite neck m, there is depression o on the central axis, which can accommodate up to three necks of other bricks, including caps. This depression o sinks in the body of the product with a spacing of 180° at a depth corresponding to the height of neck m, including the standard size of the cap, to which the material thickness is added. This depression o is, at the plane of view, terminated with semi-circle r whose radius of 17.2 mm is equal to the outer perimeter of the neck with a standard-size cap. The total profile of the moult for this depression o must run in a length not exceeding 55 mm from the edge of the product.

[0024] All edges pertaining to surfaces s, which would contain a right angle, are bevelled once more at an angle of 45°, edge c is bevelled at a gradually changing angle between o and 45°, where o° is located at the tip of arc r.

[0025] The building unit has the potential to fulfil several functions dependent on the specific composition of the recycled material: in construction but also as a container for beverages. The building unit can be produced in different sizes while maintaining its principle of joining, in particular from preforms which are intended for the production of 1.5 litre bottles. The aspect ratio must comply with the proposed scheme, the size ratios depend on the shape and size of the closure.

[0026] Furthermore, the building unit is primarily made from recycled materials or from E with a high share of recycled materials. Units can be advantageously made from plastics such as HDPE, LDPE, PE, PP, but especially from PET. It is possible to fill the unit with a liquid, especially water, gas, and especially with air and air with a high share of CO_2 with the advantage of pressurizing, and with solids, in particular bulk. It can also be filled with mixtures of substances. The bricks can be connected using construction methods - by interlocking them together. The bricks can also be installed perpendicularly, i.e. at an angle of 90°. The bricks fit into one another on four sides: from the top, from the bottom, from the front and from the back.

[0027] The building unit - brick is made from recycled polyethylene terephthalate (rPET) of any colour. It can be transparent, translucent as well as dull. Other materials suitable for production are recycled HDPE, LDPE, PE and PP.

Industrial use

[0028] The building unit of plastic according to this invention can be used in the construction of temporary buildings or mobile structures. However, the shape of the brick makes it also possible to build ordinary structures, too. The building unit is designed as a construction element intended for dry walling. When walling, individual construction elements are generally arranged in different patterns so as to achieve a rigid and strong final structure. For this purpose, it is desirable to produce individual elements industrially.

Claims

1. A building unit of plastic, in particular bottle-shaped, ***characterized in that*** it has the shape of a prism whose bottom (n) has an aspect ratio of 1 : 2 and bevelled edges (z) at an angle of 45° with rounded corners (f) with a unified radius and the height of the prism is also equal to once to twice its width, with one shorter side of the prism having projection (a) in the shape of two continuous equal-armed crosses, with rounding on inner corners (b) and the opposite shorter side having negative depression (e) matching projection (a), and bottom (n) having depression (o) for up to three necks of other building units, including caps, on its central axis and with projections (a) on all edges (i) being bevelled at an angle of 45° and depressions (e) on all edges(j) being bevelled at an angle of 45°.

2. The building unit as in Claim 1, ***wherein*** depression (o) has a spacing of 180° in the body of the prism and a depth corresponding to the height of neck (m) with a cap, with depression (o) being terminated in the plane of view with semi-circle (r) whose radius matches the outer perimeter of the neck with the cap.

3. The building unit as in Claim 1 or 2, ***wherein*** the height of projections (a) is up to 0.2 mm smaller than the depth of depression (e) and the width of projections (a) is up to 0.2 mm smaller than the width of depression (e).

4. The building unit as in any of the above Claims, ***wherein*** corners (f) have a unified radius of 10 mm.

5. The building unit as in any of the above Claims, ***wherein*** the unit is made from recycled plastics.

6. The building unit as in any of the above Claims 1 to 4, ***wherein*** the unit is made from a material selected from the group of PET, HDPE, LDPE, PE, PP.

7. The building unit as in any of the above Claims, ***wherein*** the unit is filled with a material selected from the group of liquid, gas and bulk materials.

8. The building unit as in any of the above Claims, ***wherein*** its walls are covered with an adhesive substance.

Patentansprüche

1. Die Baueinheit aus Plast, besonders in Form einer Flasche, ***dadurch gekennzeichnet,*** **dass** sie die Gestalt eines Prismas aufweist, dessen Boden (n) ein Seitenverhältnis 1: 2 und abgeschrägte Kanten (z) unter einem Winkel von 45° mit abgerundeten Ecken (f) mit einheitlichem Radius hat und die Prismenhöhe der Einbis Zweifache der Breite gleich ist, wobei die eine schmalere Seitenwand des Prismas mit einem Vorsprung (a) in Form von zwei kontinuierlich anschließenden gleichschenkligen Kreuzen mit Abrundung in den inneren Ecken (b) und die gegenüberliegende schmalere Seite mit einer dem Vorsprung (a) entsprechenden negativen Aussparung (e) versehen ist, und der Boden (n) an der Mittelachse mit einer Vertiefung (o) zur Positionierung von bis zu drei Stutzen anderer Baueinheiten einschließlich Deckel angeordnet ist, und die Vorsprünge (a) an allen Kanten (i) unter einem Winkel von 45° abgeschrägt und die Aussparungen (e) an allen Kanten (j) unter einem Winkel von 45° abgeschrägt sind.

2. Die Baueinheit nach Anspruch 1, ***dadurch gekennzeichnet,*** **dass** die Vertiefung (o) im Körper des Prismas eine Teilung von 180° und eine der Höhe des Stutzens (m) mit dem Deckel entsprechende Tiefe aufweist, wobei die Vertiefung (o) in der Draufsicht durch einen Halbkreis (r) beendet ist, der mit seinem Radius dem äußeren Umfang des Stutzens einschließlich Deckels entspricht.

3. Die Baueinheit nach dem Anspruch 1 oder 2, ***dadurch gekennzeichnet,*** **dass** die Höhe der Vorsprünge (a) bis zu 0,2 mm kleiner als die Tiefe der Aussparung (e) ist und die Breite der Vorsprünge (a) bis zu 0,2 mm kleiner als die Breite der Aussparung (e) ist.

4. Die Baueinheit nach einem beliebigen der vorgenannten Ansprüche, ***dadurch gekennzeichnet,*** **dass** die Ecken (f) einen einheitlichen Radius von 10 mm aufweisen.

5. Die Baueinheit nach einem beliebigen der vorgenannten Ansprüche, ***dadurch gekennzeichnet,*** **dass** sie aus Kunststoffrecycling hergestellt ist.

6. Die Baueinheit nach einem beliebigen der vorgenannten Ansprüche 1 bis 4, ***dadurch gekennzeichnet,*** **dass** sie aus der ausgewählten Materialgruppe PET, HDPE, LDPE, PE, PP hergestellt ist.

7. Die Baueinheit nach einem beliebigen der vorgenannten Ansprüche, ***dadurch gekennzeichnet,*** **dass** sie mit einer aus der Gruppe Flüssigkeit, Gas, Schüttgut ausgewählte Füllung versehen ist.

8. Die Baueinheit nach einem beliebigen der vorgenannten Ansprüche, ***dadurch gekennzeichnet,*** **dass** ihre Wände mit einer Klebemasse versehen sind.

Revendications

1. Une unité de construction en plastique, en particulier en forme de bouteille, ***caractérisée en ce que*** celle-ci a la forme d'un prisme dont le fond (n) a un rapport d'aspect de 1: 2 et les bords chanfreinés (z), l'angle de chanfrein étant de 45° avec les coins arrondis (f) dont le rayon est uniforme et la hauteur du prisme est également égale à une fois ou à deux fois sa largeur, le côté plus court du prisme étant pourvu d'une saillie (a) en forme de deux croix isocèles continues dont les coins intérieurs (b) sont arrondis et le côté opposé plus court étant pourvu d'une dépression négative (e) correspondant à la saillie (a) et le fond (n) est, sur son axe central avec les saillies (a), pourvu de dépressions (o) pour jusqu'à trois goulots d'autres unités de construction, y compris les capuchons, et les saillies sont chanfreinées de chaque côté (i), l'angle de chanfrein étant de 45°, et les dépressions (e) sont chanfreinées de chaque côté (j), l'angle de chanfrein étant de 45°.

2. L'unité de construction selon la revendication 1, ***caractérisée en ce que*** la dépression (o) a un espacement de 180° dans le corps du prisme et une profondeur correspondant à la hauteur du goulot (m) avec le capuchon, la dépression (o) étant terminée dans le plan de vue par un demi-cercle (r) dont le rayon correspond au périmètre extérieur du goulot avec le capuchon.

3. L'unité de construction selon la revendication 1 ou 2, ***caractérisée en ce que*** la hauteur des saillies (a) est inférieure de 0,2 mm par rapport à la profondeur de la dépression (e) et la largeur des saillies (a) est inférieure de 0,2 mm par rapport à la largeur de la dépression (e).

4. L'unité de construction selon l'une quelconque des revendications précédentes, ***caractérisée en ce que*** les coins (f) ont un rayon uniforme de 10 mm.

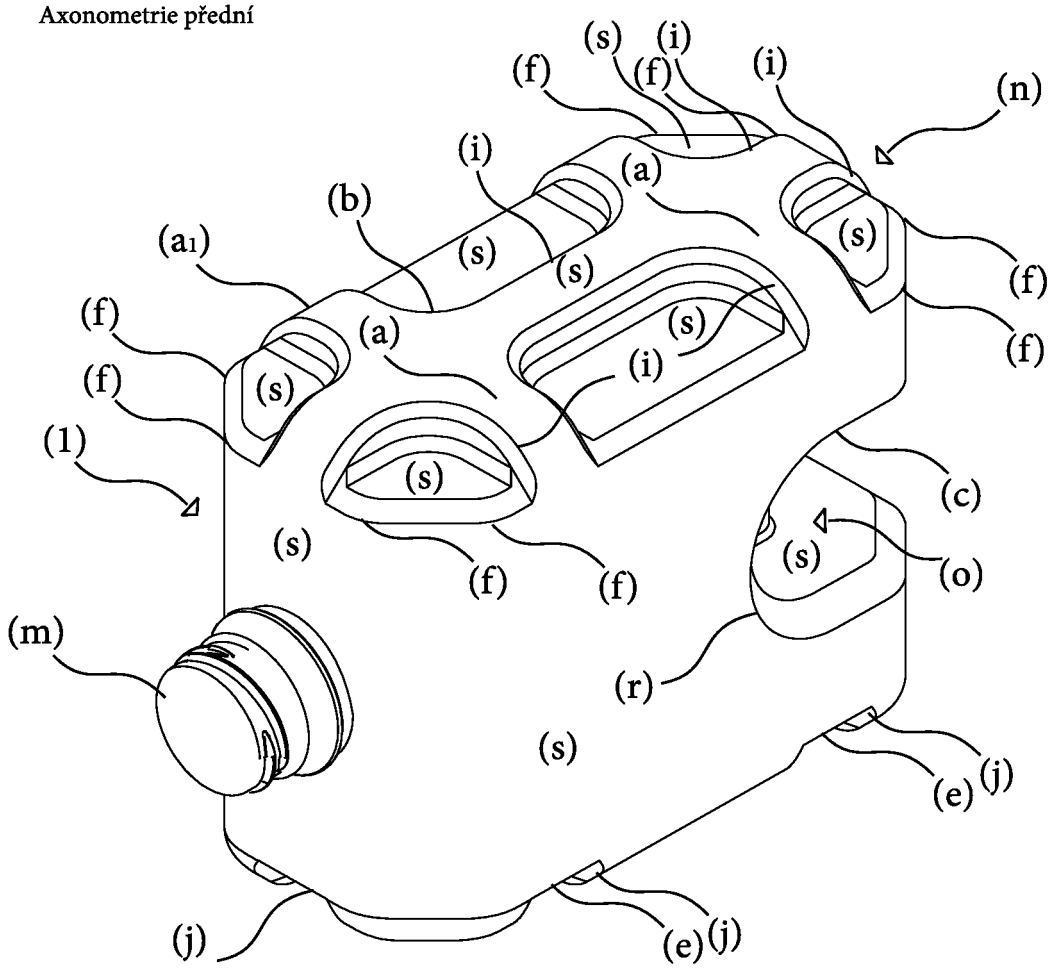
5. Unité de construction selon l'une quelconque des revendications précédentes, ***caractérisée en ce que*** l'unité est fabriquée à partir de matière plastique recyclée.

6. L'unité de construction selon l'une quelconque des revendications 1 à 4, ***caractérisée en ce que*** l'unité est constituée d'un matériau choisi dans le groupe des PET, HDPE, LDPE, PE, PP.

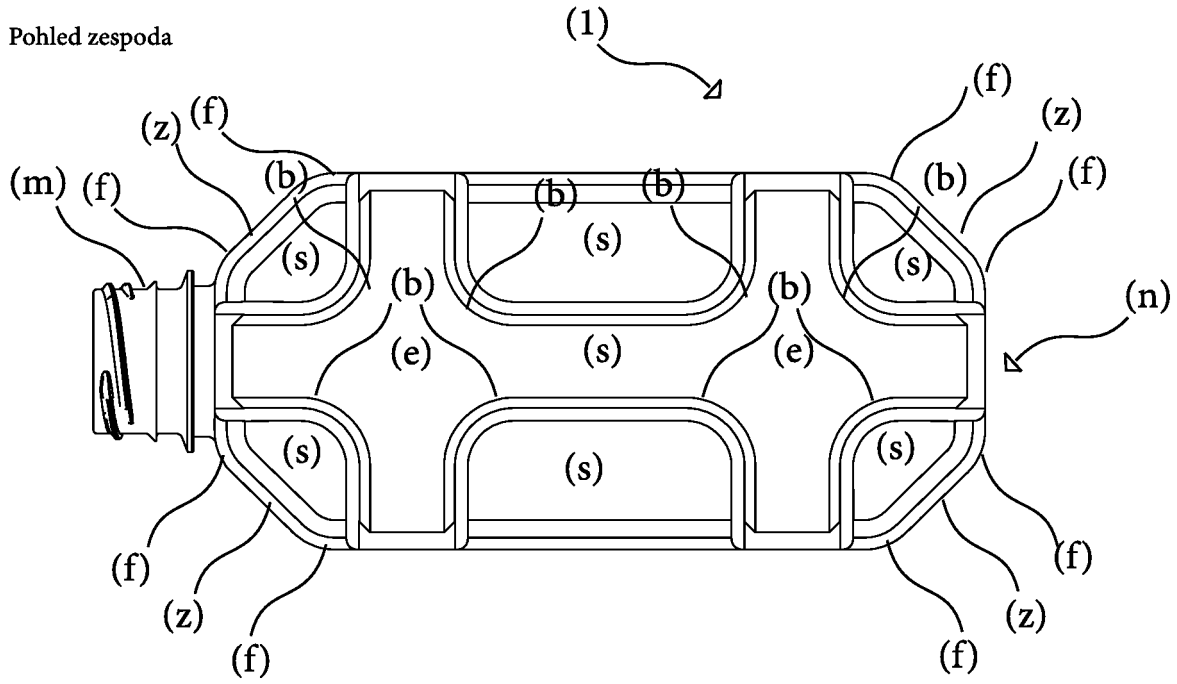
7. L'unité de construction selon l'une quelconque des revendications précédentes, ***caractérisée en ce que*** l'unité est remplie d'un matériau choisi dans le groupe des matériaux liquides, gazeux et poudreux.

8. L'unité de construction selon l'une quelconque des revendications précédentes, ***caractérisée en ce que*** ses parois sont recouvertes d'une substance adhésive.

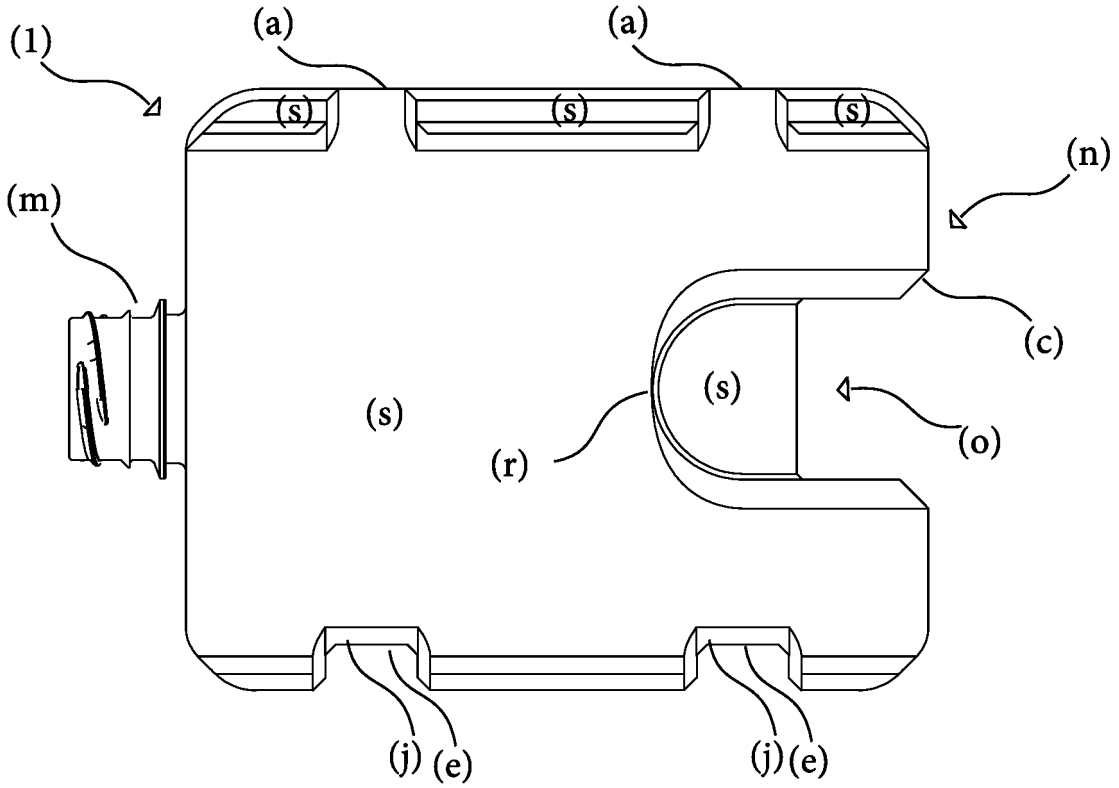
Axonometrie přední



Pohled zespoda



Boční pohled



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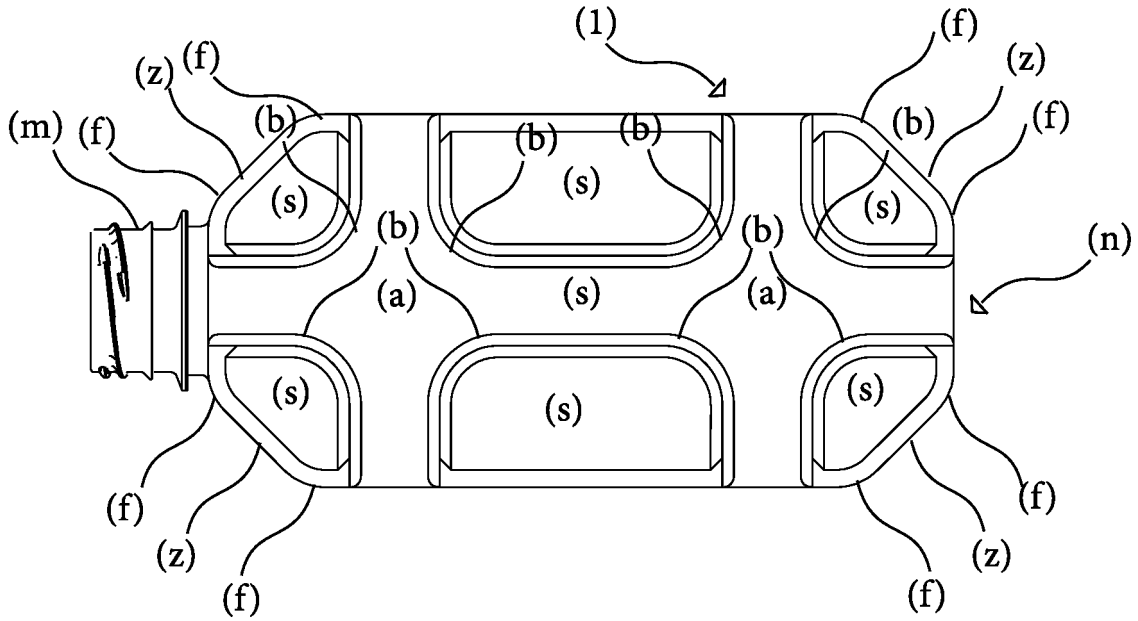

REFERENCES CITED IN THE DESCRIPTION

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