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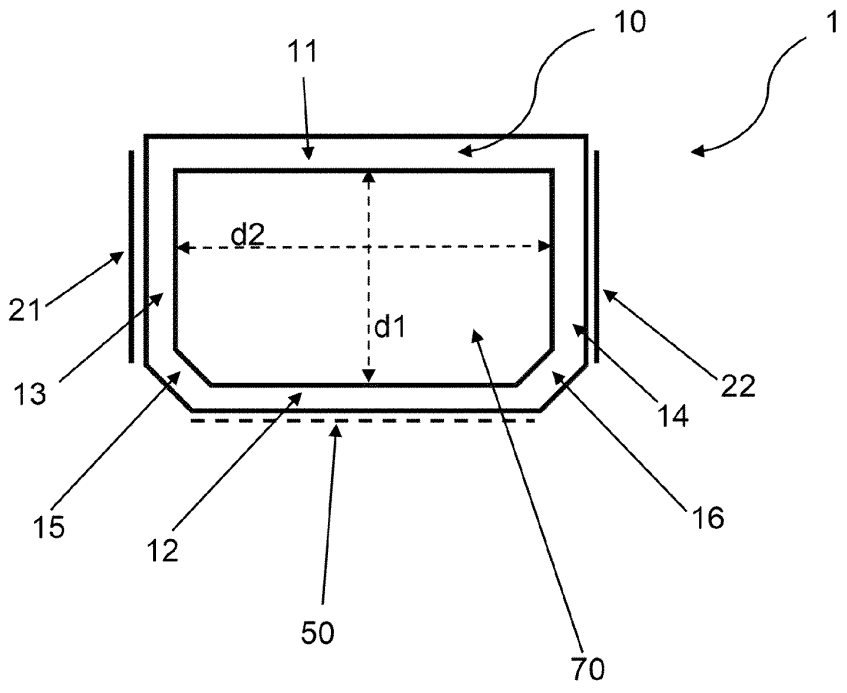
(54) TORSION RESISTANT SPACER PROFILE

(57) A spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing panes, the spacer profile comprising a spacer body made of a synthetic material comprising talc and/or fiberglass; and extending in a longitudinal direction (Z); a diffusion barrier and
- a first reinforcement element and a second reinforcement element separated from each other by a third distance.

FIGURE 2



EP 4 477 832 A1

Description

Field of the Invention

[0001] The present invention relates to a spacer profile for forming a spacing between glass panes, said spacer profile having improved torsion resistance. The spacer profile comprises a spacer body made of a synthetic material and having a compartment enclosed by an inner wall, an outer wall, a first side surface and a second side surface. The spacer profile further comprises a diffusion barrier and at least two reinforcement elements being separated by a distance.

Background of the Invention

[0002] It is well known to provide spacers in order to define the spacing between the panes of insulating glazing consisting of a plurality of parallel glass panes spaced apart by an insulating cavity.

[0003] A plurality of such spacers made of various materials and of various shapes is known in the art. Spacers made by roll formed of a metal foil are widely used in the art and considered one of the preferred alternatives because of their stability and their low gas diffusion properties.

[0004] Insulating Glass Units (IG units) having a plurality of glass panes are made by automatic manufacturing machines. Spacers are bent automatically to the desired size and shape and are arranged between two neighbouring glass panes. Spacers made of metal foils are easily bent and will remain in such bent position.

[0005] Furthermore, spacers made of metal foils have a high resistance against diffusion of gases and moisture penetration. Within the space between the neighbouring glass panes, a gas is arranged, for instance argon having good insolating properties. In order to avoid any loss of gas, the spacers delimiting the cavity need to be resistant against diffusion of such gaseous elements.

[0006] However, known spacers, which are exclusively made of metal, such as aluminium and galvanised steel, also have some disadvantages. Due to a relatively high heat conductivity of metal, spacers made of a metal foil still have a heat conductivity which may be too high under certain circumstances.

[0007] In order to reduce the heat conductivity further, it has been suggested to use plastic/polymer material for forming such spacers. However, plastic material has relatively high gas diffusion as compared to metal. Thus, it has been suggested to provide a metal foil over a plastic body. Such a spacer is shown in e.g. EP 0852280B2. Alternatively, it has been suggested to use diffusion barriers of other materials in combination with a reinforcement layer extending from one side of the spacer to the other side.

[0008] In general, the reinforcement materials have a higher heat conductivity i.e. a lower resistance to transfer of heat through the material. Hence, in order to reduce heat transmission even further, spacers have been developed, where the reinforcements are divided into at least two separated pieces. Examples of such spacers are illustrated in EP3781774A1 and EP3162999A1. There, a spacer profile made of a synthetic material is reinforced with at least two separated reinforcement elements and in addition to that is provided with a diffusion barrier covering at least a part of the outer surface.

[0009] However, such spacers have been found to have a challenge with torsion around the longitudinal axis when being mounted between the panes. This torsion requires additional time and labour to mount the spacer properly between the panes. Hence, there is a need for a spacer having the heat resistant properties of the spacers with separated reinforcement elements while at the same time keeping the resistance towards torsion.

[0010] The inventors have found a solution to the torsion problem by adding materials to the spacer body.

Summary of the invention

[0011] According to the invention, there is provided a spacer profile for use as part of a spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing panes, the spacer profile comprising a spacer body made of a synthetic material and extending in a longitudinal direction (Z), said spacer body comprising:

- an inner wall facing the intervening space between the glazing panes and extending in a transverse direction (X),
- a first sidewall and a second sidewall extending in a height direction (Y) and separated by a second distance,

said spacer profile further comprises

- a diffusion barrier extending at least from the first sidewall to the second sidewall and separated from the inner wall by a first distance d1 so that the inner wall, the first sidewall, the second sidewall and the diffusion barrier define a chamber suitable for desiccants,
- a first reinforcement element and a second reinforcement element separated from each other by a third distance d3,
- at diffusion barrier provided on at least the outer wall,

characterized in that at least a part of the synthetic material comprises 10-60 w% talc and/or fiberglass.

[0012] In a preferred embodiment, the profile body further comprises areas with reduced thickness. By having areas with reduced thickness the folding of the spacer profile can be controlled during bending into a spacer frame.

[0013] Preferably, the synthetic material comprises

15-50 w/w% talc and/or fiberglass, more preferred is 20-45 w/w%.

[0014] In a preferred embodiment, the first and the second reinforcement elements each has an end located closer to the inner wall than to the diffusion barrier, and said end comprises at least four bendings and one of them being a 180 degree bend resulting in two parallel and overlapping layers, where said overlapping layers are essentially perpendicular to the first and second sidewalls, respectively.

[0015] With a bend is understood a change in direction in which said reinforcement element extends followed by a segment of said reinforcement element extending in a new direction.

[0016] In a preferred embodiment the first bending is between 45 degrees and 135 degrees. This has the effect of a better absorption of the forces during bending of the spacer profile into a frame for the IGU and therefore results in less wrinkles on the side walls. Wrinkles are not desires as they can result in leaking from the interior of the IGU.

[0017] In a preferred embodiment, the first and the second reinforcement elements have two ends, and each end is terminated with a 180 degree bend.

[0018] In a preferred embodiment, the first and the second reinforcement elements are positioned at least on and partially in the first and second sidewalls, respectively. In an alternative embodiment, the first and the second reinforcement elements are positioned inside the profile body.

[0019] In a preferred embodiment, a part of the diffusion barrier is positioned between the first and second reinforcement elements and the first and second sidewalls, respectively.

[0020] In a preferred embodiment, the first and the second side walls each comprises a slanting elongation element. The purpose of the slanting element is twofold. It makes a better and smoother connection with the diffusion barrier extending from the first side wall to the second side wall. It also makes additional room for the primary/secondary sealings, when the spacer profile is mounted in the IGU.

[0021] In a preferred embodiment, the profile body further comprises an outer wall positioned on the inner side of the diffusion barrier.

[0022] In a preferred embodiment, the spacer profile further comprises a first connection element connecting the first sidewall with the outer wall and an a second connection element connecting the second sidewall with the outer wall.

[0023] In a preferred embodiment, the spacer profile further comprises both an outer wall and two connection elements connecting the sidewalls with the outer wall.

[0024] In a particularly preferred embodiment, the previously described variants further comprise a third and a fourth reinforcement element. Said third and fourth reinforcement elements can have many shapes, but wires, flattened wires, threads are preferred.

[0025] The third and fourth reinforcement elements can be made of a metal such as stainless steel, alumina or tin.

[0026] According to a further aspect of the invention, there is provided a spacer profile for use as part of a spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing panes, the spacer profile comprising a spacer body made of a synthetic material and extending in a longitudinal direction (Z), said spacer body comprising:

- an inner wall facing the intervening space between the glazing panes and extending in a transverse direction (X),
- an outer wall separated from the inner wall by a first distance,
- a first sidewall and a second sidewall extending in a height direction (Y) and separated by a second distance,
- where the inner wall, the first sidewall, the second sidewall and the outer wall define a chamber suitable for desiccants,

said spacer profile further comprises

- a first reinforcement element provided at least in and/or on the first sidewall, wherein said first reinforcement element comprises at least four bendings,
- a second reinforcement element provided at least in and/or on the second side wall, wherein said second reinforcement element comprises at least four bendings,
- said first and second reinforcement elements being separated by a third distance d3,
- at diffusion barrier provided on at least the outer wall,

characterized in that the synthetic material comprises 10-60 w% talc and/or fiberglass.

[0027] In a preferred embodiment, the first and the second reinforcement elements are positioned at least on and partially in the first and second sidewalls, respectively. In an alternative embodiment the, first and the second reinforcement elements are positioned inside the profile body.

[0028] In a preferred embodiment, the first and the second reinforcement elements have two ends and each end is terminated with a 180 degree bend.

[0029] In a particularly preferred embodiment, the previously described variants further comprise a third and a fourth reinforcement element. Said third and fourth reinforcement elements can have many shapes, but wires, flattened wires, threads are preferred.

[0030] A particularly suited spacer profile according to the invention is a spacer profile for use as part of a spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing

panes, the spacer profile comprising a spacer body made of a synthetic material and extending in a longitudinal direction (Z), said spacer body comprising:

- an inner wall facing the intervening space between the glazing panes and extending in a transverse direction (X),
- a first sidewall and a second sidewall extending in a height direction (Y) and separated by a second distance, the first and the second sidewalls each comprises a slanting elongation element,

said spacer profile further comprises

- a diffusion barrier extending at least from the first sidewall to the second sidewall and separated from the inner wall by a first distance d1 so that the inner wall, the first sidewall, the second sidewall and the diffusion barrier define a chamber suitable for desiccants,
- a first reinforcement element and a second reinforcement element separated from each other by a third distance d3, the first reinforcement element and the second reinforcement element each has a section positioned between the side first sidewall and the second sidewall, respectively, and the diffusion barrier, the first reinforcement element and the second reinforcement element have two ends, and each end is terminated with a 180 degree bend,
- a third and a fourth reinforcement element,

characterised in that at least a part of the synthetic material comprises 10-60 w% talc and/or fiberglass.

[0031] In a preferred embodiment, the first and the second reinforcement elements have two ends, and each end is terminated with a 180 degree bend.

[0032] In a preferred embodiment, the third reinforcement element is positioned between the first reinforcement element and the chamber, whereas the fourth reinforcement element is positioned between the second reinforcement element and the chamber.

[0033] In a preferred embodiment, the spacer body has areas with reduced thickness. Such areas have the effect that the folding of the spacer profile when being bended into a spacer frame can be controlled. Preferably, the areas with reduced thickness are positioned near the corners and/or near the connection between the sidewalls with the connection elements and/or near the connection between the connection elements and the outer wall.

List of figures

[0034]

Fig. 1 illustrates a spacer profile according to the invention without an outer wall,

Fig. 2 illustrates a spacer profile according to the invention with an outer wall,

Fig. 3 illustrates the spacer profile of Fig. 2 with a particularly good bending pattern of the reinforcement layer,

Fig. 4 illustrates a spacer profile which further comprises secondary reinforcement elements,

Fig. 5 illustrates a spacer profile, where the reinforcement elements are positioned inside the spacer body.

Detailed description

[0035] In the previously described spacer profiles, various versions of diffusion barriers can be used. However, in preferred embodiments, the diffusion barrier has one of the following configurations. Diffusion barriers of the following configurations have shown to be particularly compatible with spacer profiles with separated reinforcements elements.

[0036] The diffusion barrier can be a barrier made of inorganic materials, or the diffusion barrier can made of a polymeric material. The diffusion barrier can be a single sheet, or it can be of multiple overlapping sheets.

[0037] Suitable polymeric diffusion barriers are made of materials such as ethylene-vinyl-alcohol copolymers (EVOH) or polyvinyl alcohols.

[0038] Another suitable polymer-based diffusion barrier is made of polyethylene (PE) or polyethylene terephthalate (PET) preferably sputtered with a SiOx material, where $0 \leq X \leq 2$.

[0039] Preferred inorganic diffusion barriers are metal layers or aluminium oxide layers or SiOx layers, where $1 \leq x \leq 2$.

[0040] In a preferred embodiment, the diffusion barrier is a multilayer diffusion barrier foil. Among the advantages of multilayer barrier foils are that multiple properties can be incorporated in one foil or enhanced diffusion impermeability can be achieved

[0041] For instance, by using different layers in the multilayer diffusion barrier foil, inert gasses such as argon can be contained in the intervening space between the glass panes by one of the layers, while another layer keeps moisture out of the intervening space.

[0042] A particularly suited multilayer diffusion barrier foil for use in spacer according to the invention:

- a first support layer,
- a first organic or inorganic diffusion barrier layer provided on the first support layer,
- optionally a first coating provided on the first inorganic diffusion barrier layer,
- a first adhesive layer provided on the first inorganic layer or on the optionally first coating,
- a second support layer provided on the first adhesive

layer,

- a second organic or inorganic diffusion barrier layer provided on the second support layer,
- optionally a second coating provided on the second inorganic diffusion barrier layer.

[0043] In some embodiments, it is advantageous to have the multilayer diffusion barrier foil further comprise:

- a second adhesive layer provided on the second inorganic layer or on the optionally second coating,
- a third support layer provided on the second adhesive layer,
- a third inorganic diffusion barrier layer provided on the third support layer,
- optionally a third coating provided on the third inorganic diffusion barrier layer.

[0044] The first, second and third inorganic layers can independent of each other be selected from the group consisting of metals, aluminium oxides and silicium oxides.

[0045] Preferably, the silicium oxides have the formula SiOx, where $1 \leq x \leq 2$.

[0046] Preferably, the aluminium oxides have the formula AlOy, where $0.5 \leq y \leq 1.5$.

[0047] In a preferred version, at least part of the profile body is made of a polymeric material. Preferably, the polymeric material is a poor heat conduction. Suited polymeric materials can be selected from the group consisting of Polyolefins such as polypropylene or polyethylene terephthalate, polyamides, polycarbonates, ABS, SAN, PCABS. Co-polymers of the mentioned polymers can also be used.

[0048] The first and second reinforcement elements can have various bending patterns so as to increase stability and foldability. A preferred bending pattern comprises at least four (4) bendings, where the first bending is a bending of at least 80°, preferably at least 90°. Another preferred bending pattern comprises a 180° bend as the last bending thereby forming two substantially parallel overlapping layers. An even more preferred bending pattern comprises a first bending of at least 90° and a last bending of 180° thereby forming two substantially parallel overlapping layers.

Description of figures

[0049] In the following, the invention will be described in further details with reference to the figures. It is to be understood that the following is for illustrative purposes and should not be considered limiting in any way.

[0050] In figure 1 is a spacer profile 1 suitable for the invention is illustrated. The spacer profile 1 comprises a profile body 10, where the profile body comprises an inner wall 11. When mounted between the panes in an IG unit, the inner wall is facing the interior of the IG unit, i.e. the intervening space formed between the panes and the spacer. The profile body in figure 1 further comprises a first sidewall 13 and a second sidewall 14. The sidewalls 13, 14 can be parallel to each other, or they can be slightly slanted. The first sidewall 13 is separated from the second sidewall 14 by a second distance d2. The spacer profile 1 further comprises as first reinforcement element 21 and a second reinforcement element 22 being positioned on the first sidewall 13 and the second sidewall respectively. A diffusion barrier 50 extends at least from the first sidewall 13 to the second sidewall 14 and thereby together with the inner wall 10, the first sidewall 13 and the second sidewall 14 define a chamber suitable for a desiccant. The diffusion barrier can be extended up on the outer side on the sidewalls 13, 14 and can be fixed either between the side walls 13, 14 and the reinforcement elements 21, 22 or on the outer side of the reinforcement element. Optionally, the spacer profile can comprise additional reinforcement elements (not shown) such as a third and a fourth reinforcement element in form of a wire.

[0051] In figure 2, a spacer profile 1 suitable for the invention is illustrated. The spacer profile 1 comprises a profile body 10, where the profile body comprises an inner wall 11 and an outer wall 12 being separated from the inner wall 11 by a first distance d1. When mounted between the panes in an IG unit, the inner wall is facing towards the interior of the IG unit, i.e. the intervening space formed between the panes and the spacer. The profile body in figure 1 further comprises a first sidewall 13 and a second sidewall 14. The sidewalls 13, 14 can be parallel to each other, or they can be slightly slanted. The first sidewall 13 is separated from the second sidewall 14 by a second distance d2. In figure 2, the inner wall and the outer wall are illustrated as being parallel, but that does not have to be the case. Solutions exist, where the inner wall and the outer wall are separated by a first distance d1, and where they are slanted, curved etc. relative to each other. A first connection element 15 and a second connection element 16 connect the sidewall with the outer wall 12. The inner wall 11, the outer wall 12, the first sidewall 13, the second side wall 14, the first connection element 15, the second connection element 16 and the outer wall 12 define a chamber 50, the chamber being suitable for containing a desiccant. The spacer profile 1 further comprises as first reinforcement element 21 and a second reinforcement element 22 being positioned on the first sidewall 13 and the second sidewall, respectively. A diffusion barrier 50 is provided at least on the outer wall. The diffusion barrier can be extended up on the outer side on the sidewalls 13, 14 and can be fixed either between the sidewalls 13, 14 and the reinforcement elements 21, 22 or on the outer side of the reinforcement elements 21,22. Optionally, the spacer profile can comprise additional reinforcement elements (not shown) such as a third and a fourth reinforcement element in form of a wire.

[0052] Figure 3 illustrates the profile of figure 2, where the first 21 and the second 22 reinforcement elements

further comprise a bending pattern in the end being closest to the inner wall, where said bending pattern comprises a 180 degree bend resulting in two overlapping layers 41 being essentially perpendicular to the sidewall. The bending pattern illustrated further comprises three bendings resulting in four bendings in total. The first bending 31 is a bending of at least 45°, preferably at least 80°, more preferably at least 90°.

[0053] An even more preferred bending pattern comprises a first bending 31 of at least 90° and a last bending 34 of 180° and forming two substantially parallel overlapping layers 41 substantially parallel with the inner wall.

[0054] Figure 4 illustrates in addition to the elements illustrated in figure 3 a third reinforcement element 61 and a fourth reinforcement element 62. The third reinforcement element 61 and the fourth reinforcement element 62 are here illustrated to be in the shape of a wire, but other shapes are also possible. They can be a flattened wire, a metal thread or similar. In this figure, the third reinforcement element 61 and the fourth reinforcement element 62 are positioned near the outer wall 12, but embodiments are also possible, where the third reinforcement element 61 and the fourth reinforcement element 62 are positioned in the inner wall 11 or in the corners.

[0055] Figure 5 illustrates a spacer profile, where the first 21 and the second 22 reinforcement elements are positioned inside the spacer body. The first reinforcement element 21 and the second reinforcement element 22 each has two ends comprising a bending pattern resulting in an overlapping layer 41, 42 in each end. The overlapping layer 41 being closest to the inner wall is perpendicular to the first and second sidewalls 13, 14. The third reinforcement element 61 is positioned between the first reinforcement element 21 and the chamber 70, whereas the fourth reinforcement element 62 is positioned between the second reinforcement element 22 and the chamber 70.

List of reference numbers

[0056]

1 Spacer profile
10 spacer body
11 inner wall
12 outer wall
13 first sidewall
14 second sidewall
15 first connection element
16 second connection element
21 first reinforcement element
22 second reinforcement element
41 overlapping layers being perpendicular to the sidewall
42 overlapping layers
50 diffusion barrier
31 first bend
32 second bend
33 third bend
34 180 degree bend forming two overlapping layers
61 third reinforcement element
62 fourth reinforcement element
70 chamber suitable for desiccant

Claims

1. A spacer profile for use as part of a spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing panes, the spacer profile comprising a spacer body made of a synthetic material and extending in a longitudinal direction (Z), said spacer body comprising:

- an inner wall facing the intervening space between the glazing panes and extending in a transverse direction (X),
- a first sidewall and a second sidewall extending in a height direction (Y) and separated by a second distance,

said spacer profile further comprises

- a diffusion barrier extending at least from the first sidewall to the second sidewall and separated from the inner wall by a first distance d1 so that the inner wall, the first sidewall, the second sidewall and the diffusion barrier define a chamber suitable for desiccants
- a first reinforcement element and a second reinforcement element separated from each other by a third distance d3,

characterised in that at least a part of the synthetic material comprises 10-60 w% talc and/or fiberglass.

2. A spacer profile according to claim 1, where the synthetic material comprises 20-45 w% talc and/or fiberglass.

3. A spacer profile according to claim 1 or 2, wherein the spacer profile further comprises a third and a fourth reinforcement element.

4. A spacer profile according to any one of the previous claims, wherein the spacer body further comprises an outer wall.

5. A spacer profile according to any one of the previous claims, wherein the spacer body has areas with reduced thickness.

6. A spacer profile according to any one of the previous claims, wherein the third reinforcement element in

positioned between the first reinforcement element and the chamber; and the fourth reinforcement element is positioned between the second reinforcement and the chamber.

7. A spacer profile according to any one of the previous claims, wherein the diffusion barrier is a multilayer diffusion barrier foil comprising a layer with silicium oxides having the formula SiOx, where $1 \leq x \leq 2$.

8. A spacer profile for use as part of a spacer profile frame, which is suitable for being mounted in and/or along an edged area of an insulating glazing unit so as to surround an intervening space between glazing panes, the spacer profile comprising a spacer body made of a synthetic material and extending in a longitudinal direction (Z), said spacer body comprising:

- an inner wall facing the intervening space between the glazing panes and extending in a transverse direction (X),
- an outer wall separated from the inner wall by a first distance,
- a first sidewall and a second sidewall extending in a height direction (Y) and separated by a second distance,
- where the inner wall, the first sidewall, the second sidewall and the outer wall define a chamber suitable for desiccants,

said spacer profile further comprises

- a first reinforcement element provided at least in and/or on the first sidewall, wherein said first reinforcement element comprises at least four bendings,
- a second reinforcement element provided at least in and/or on the second sidewall, wherein said second reinforcement element comprises at least four bendings,
- said first and second reinforcement elements being separated by a third distance d3,
- at diffusion barrier provided on at least the outer wall,

characterized in that the synthetic material comprises 10-60 w% talc and/or fiberglass.

9. A spacer profile according to claim 8, where the synthetic material comprises 20-45 w% talc and/or fiberglass.

10. A spacer profile according to claim 8 or 9, wherein the spacer profile further comprises a third and a fourth reinforcement element.

11. A spacer profile according to any one of claims 8-10, wherein the spacer body has areas with reduced thickness.

12. A spacer profile according to any one of claims 8-11, wherein the third reinforcement element is positioned between the first reinforcement element and the chamber; and the fourth reinforcement element is positioned between the second reinforcement and the chamber.

FIGURE 1

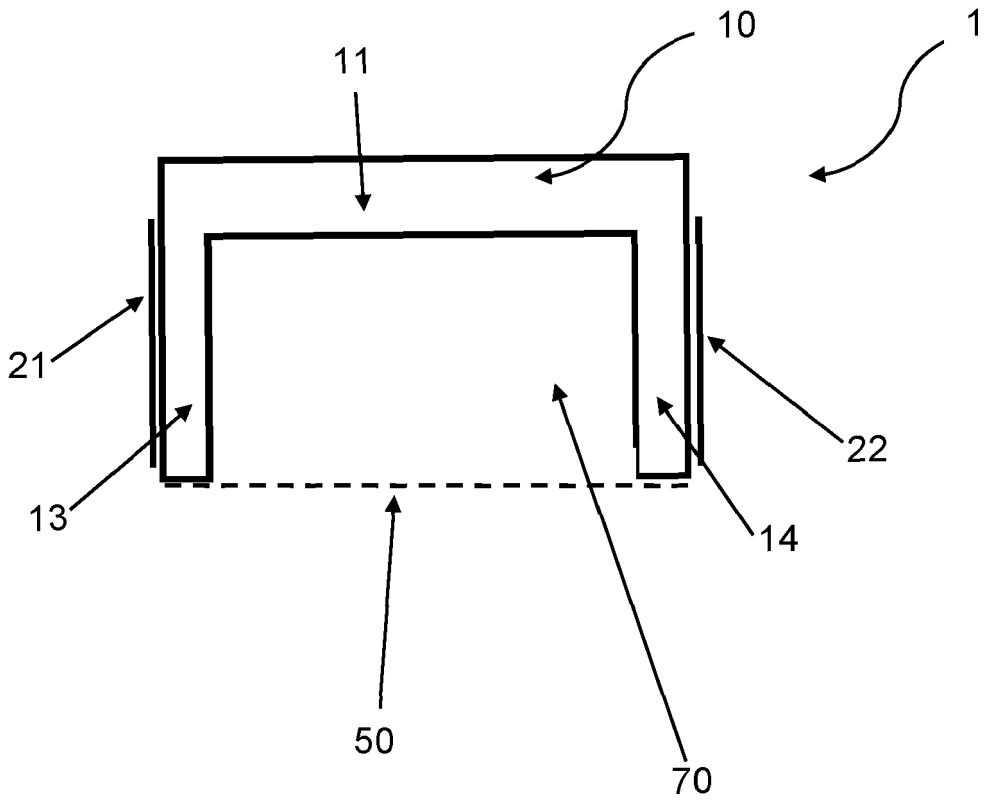


FIGURE 2

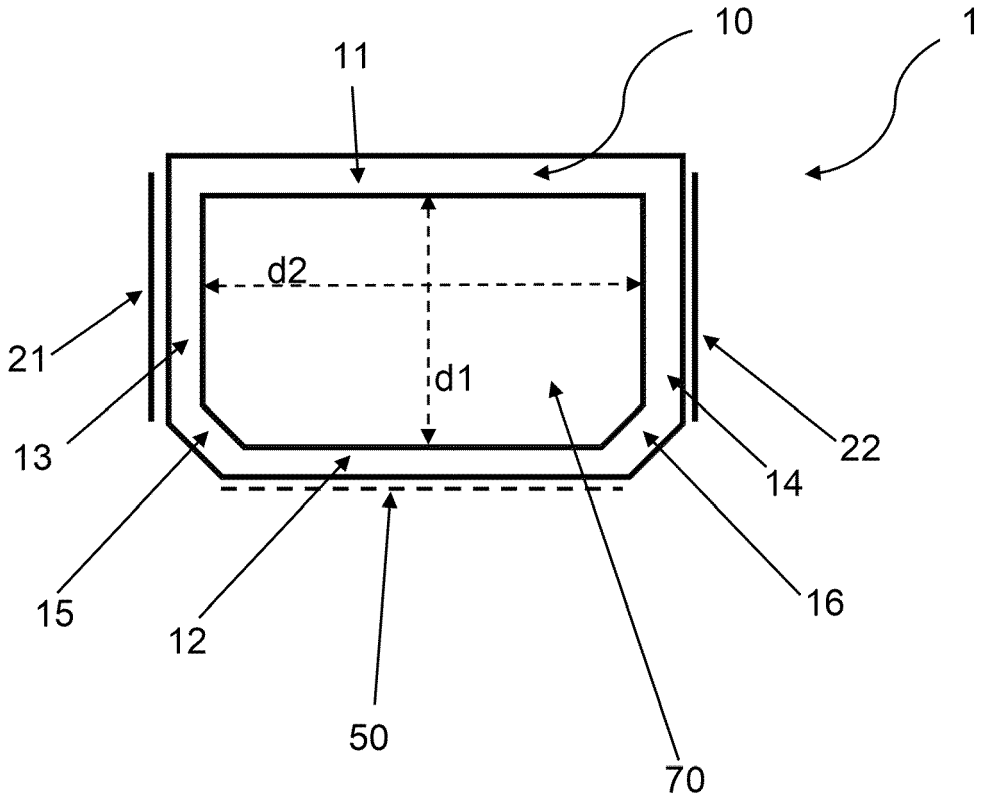


FIGURE 3

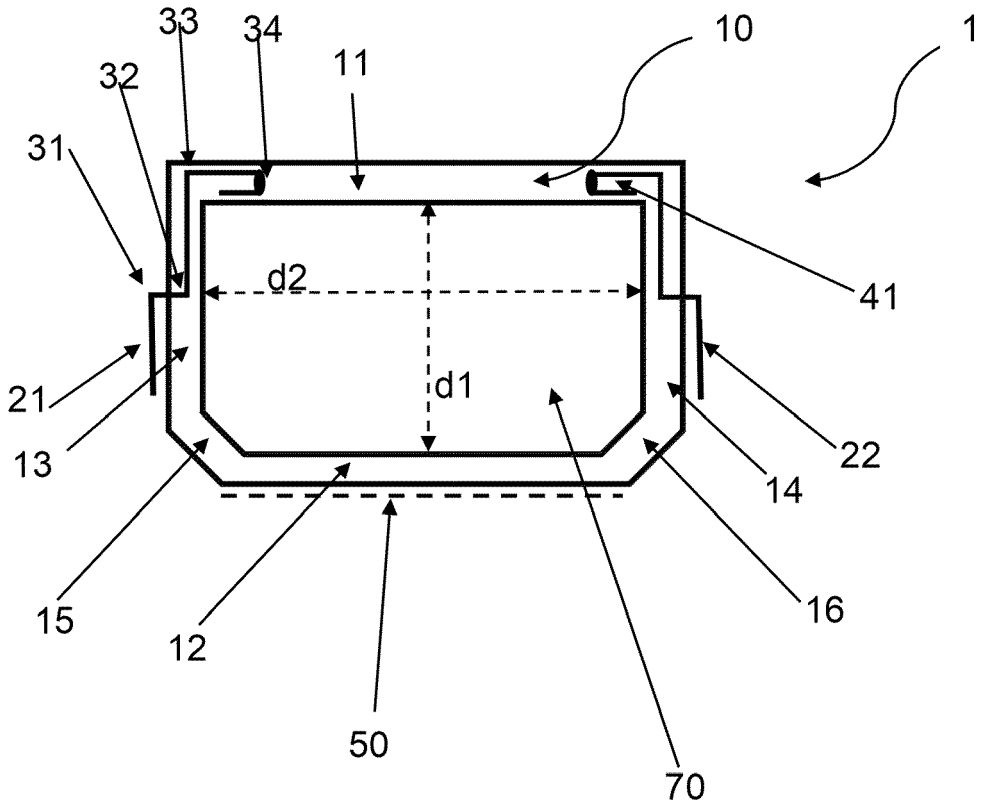


FIGURE 4

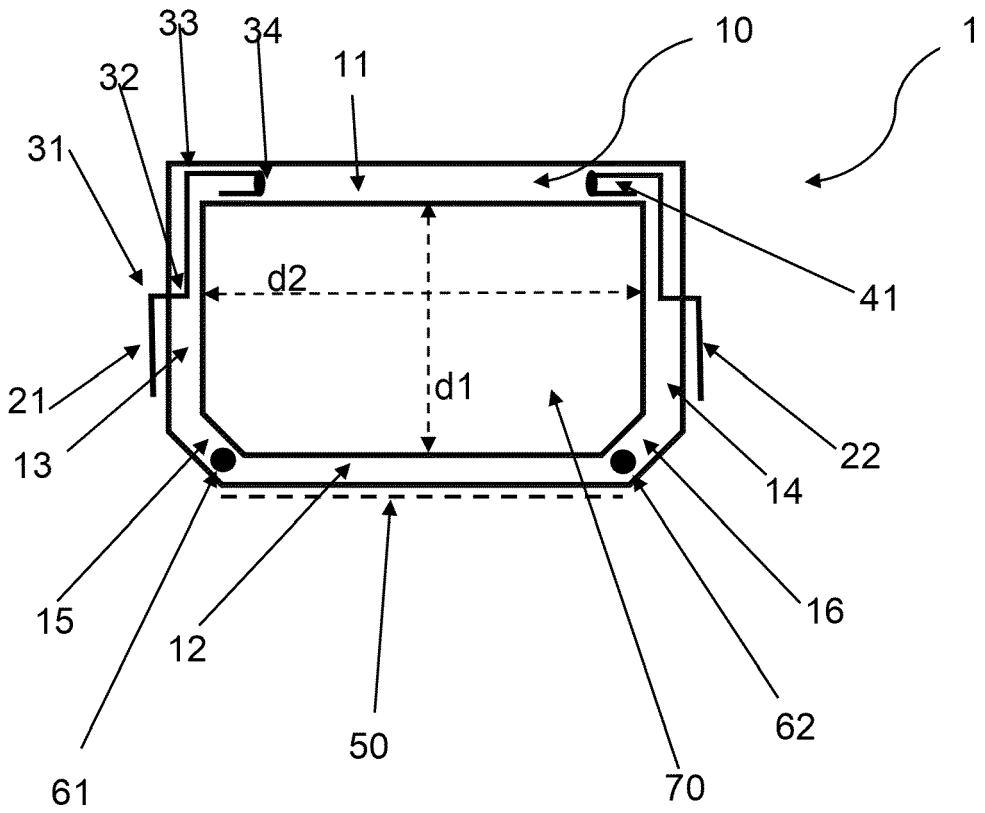
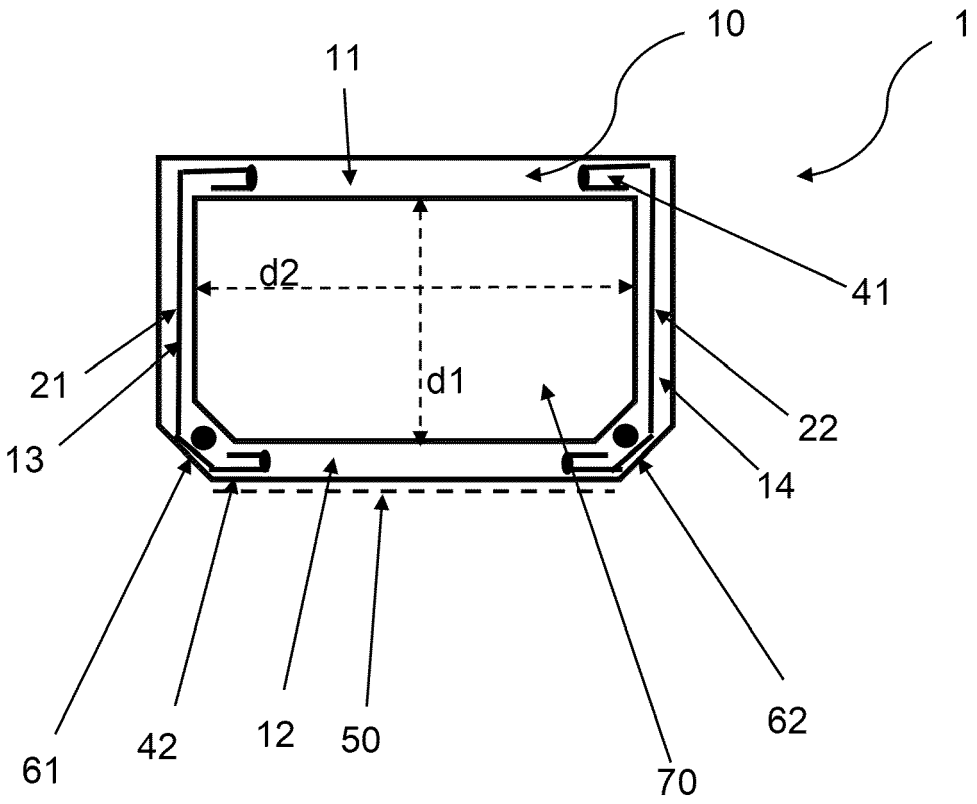


FIGURE 5



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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 9186

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 10 633 914 B2 (ENSINGER GMBH [DE]) 28 April 2020 (2020-04-28) * column 20, line 14 - line 20; figures 1-4 * * column 7, line 14 - line 18 *	1-12	INV. E06B3/663
X	WO 2023/030813 A1 (SAINT GOBAIN [FR]) 9 March 2023 (2023-03-09) * figures 1-6 * * page 13, line 29 - page 14, line 11 *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 November 2023	Cobusneanu, D

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