

(19)



(11)

EP 2 799 654 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.11.2014 Bulletin 2014/45

(51) Int Cl.:
E06B 3/263^(2006.01)

(21) Application number: **13166086.2**

(22) Date of filing: **30.04.2013**

(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

(72) Inventors:
• **Genetello, Mario**
9230 Wetteren (BE)
• **Vermeersch, Joan**
9230 Wetteren (BE)
• **Willockx, Matthias**
9230 Wetteren (BE)

(71) Applicant: **Recticel N.V.**
1140 Brussels (BE)

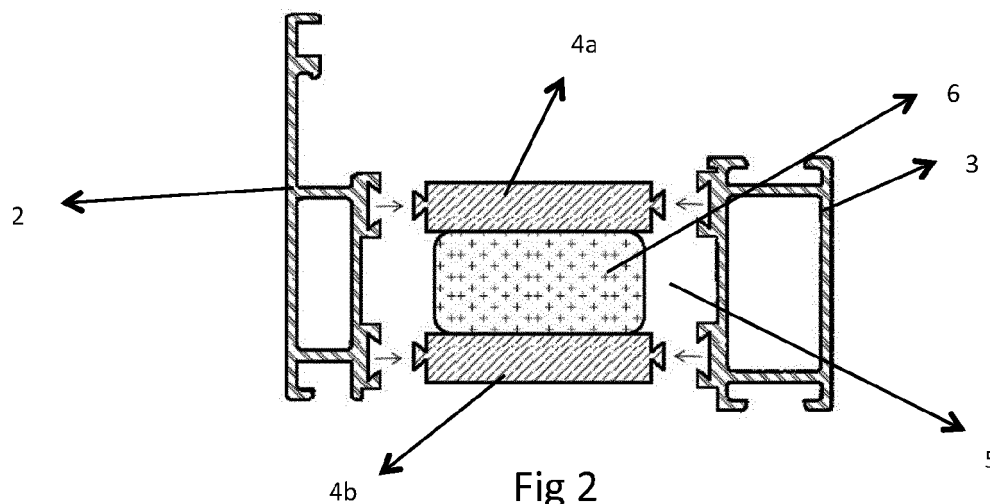
(74) Representative: **BiiP cvba**
Culliganlaan 1B
1831 Diegem (Bruxelles) (BE)

(54) **Method of assembly of a window profile comprising insulation material**

(57) A method of assembly of a window profile comprising an inner shell and an outer shell and an insulating thermal bridge connecting both shells, wherein said method comprises the steps of:

- (a) providing an inner shell and an outer shell;
(b) providing two legs of insulating material that together will define the thermal bridge;

- (c) sandwiching a slab of foam material between said legs wherein said foam slab is compressed in at least one dimension when sandwiched between the legs;
(d) simultaneously and/or subsequently fixing said legs to the inner and outer shells while maintaining the slab of foam sandwiched between both legs.



EP 2 799 654 A1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a method of assembly of a window or door profile comprising an inner and an outer shell separated by an insulating bridge. Such profile structure is well-known for aluminium window or door profiles.

BACKGROUND TO THE INVENTION

[0002] Aluminium profiles generally comprise an inner shell and an outer shell in aluminium which are connected to each other by a thermal bridge. The thermal bridge in most cases comprises two legs that each connect the inner shell to the outer shell of the profile, whereby a cavity is defined between the outer and inner shells and the legs of the thermal bridge.

[0003] In DE 102010064034 a method of assembly of such a profile is described, wherein prior to fixation of the legs of the thermal bridge to the inner and outer shells, a slab of rigid PU foam is adhered to one of the legs of the thermal bridge. The dimension of this slab is chosen such that after assembly of the profile, the slab fills the cavity defined by the thermal bridge from one leg to nearly the second leg, leaving a minimum of free space between the slab and the legs. DE 102009046554 discloses a method wherein the slab of insulate material is fixed to one of the legs of the thermal bridge by clamping the insulate material between brackets provided on the leg.

[0004] An inconvenience of the prior art is that the legs of the thermal bridge need to be designed for fixation or adherence of the insulate material thereon and that the insulating material is to be attached to one of the legs of the thermal bridge prior to assembly. A disadvantage of the prior attachment of the slab of insulating material is that the insulating material can be damaged during further handling and that rather large material stocks need to be maintained of both legs of the thermal bridge.

[0005] From the above it is clear that there remains a need for an improved production method allowing optimized stock management and a high degree of freedom in design of the legs of the thermal bridge, whilst maintaining optimal insulation properties of the finished profile.

SUMMARY OF THE INVENTION

[0006] The present invention provides a solution to the above mentioned needs by a method of assembly of a window profile comprising an inner shell and an outer shell and an insulating thermal bridge connecting both shells, wherein said method comprises the steps of:

- (a) providing an inner shell and an outer shell;
- (b) providing two legs of insulating material that together will define the thermal bridge;

(c) sandwiching a slab of foam material between said legs wherein said slab of foam is compressed in at least one dimension when sandwiched between the legs;

(d) simultaneously and/or subsequently fixing said legs to the inner and outer shells while maintaining the slab of foam sandwiched between both legs.

BRIEF DESCRIPTION OF THE INVENTION

[0007] Preferably, the slab of foam material comprises a rigid polyurethane or polyisocyanurate based foam, wherein said rigid foam preferably has a compression strength at room temperature of lower than 300 kPa, preferably lower than 250 kPa. (measured according to ISO 844)

[0008] It is further preferred that the rigid foam has a recovery rate at room temperature and/or at 100°C of 90%, preferably 95% or more within a period of 90 minutes after 20% compression. More preferably the rigid foam has an expansion rate, defined as the difference between recovery (%) at room temperature after 24 hrs and immediate recovery (%) at room temperature after 20% compression, of at least 6% or more, most preferably at least 10%.

[0009] The rigid foam used preferably has a lambda value lower than 0,030 W/mK (measured according to ISO 8301), and a density of lower than 100 kg/m³, preferably lower than 50 kg/m³.

[0010] The water uptake of the rigid foam used is preferred to be maximally 10% (measured according to ISO 2896).

[0011] The rigid foam preferably is a closed cell foam.

[0012] The slab of foam material can, besides the rigid foam, also contain a flexible foam material. This flexible foam material can be arranged as a continuous layer on at least one outer surface of the rigid foam material, so that, when sandwiching the slab of foam material between both legs, this flexible foam layer contacts at least one of the insulating legs. It can also be arranged on the rigid foam material so that, when sandwiching the slab of foam material between both legs, it contacts at least partially one of the aluminum profiles

[0013] According to yet another embodiment, the at least one of the legs of the thermal bridge provided has, on its surface designed to face the slab of foam material, a flexible foam material attached thereto.

BRIEF DESCRIPTION OF THE FIGURES

[0014]

Figure 1 schematically represents a cross-section of a profile assembled with a method according to the present invention;

Figure 2 schematically represent a method according to the present invention;

Figure 3 represents an alternative embodiment of

the profile in figure 1;

Figure 4 represents an non-exhaustive number of alternatives of the embodiment of the profile in figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] Figure 1 represents a window or door profile 1 comprising an inner shell 2 and an outer shell 3 that are rigidly connected by a thermal bridge 4 comprising two legs 4a and 4b. A cavity 5 is defined between the inner and outer shells and the legs 4a and 4b of the thermal bridge. This cavity is at least partially filled with a slab 6 of insulating foam material extending over the entire width of the cavity defined between the legs of the thermal bridge.

[0016] The inner and outer shells are preferably manufactured in metal, in particular aluminium alloy. The legs of the thermal bridge are typically manufactured in a rigid plastic material such as: polypropylene, polyethylene, polyamide, polyurethane, acrylnitril-butadiene-styrol or polyethylenetherephthalate. In a method according to the present invention both legs of the thermal bridge are separate and distinct parts, i.e. they are not fixed to each other prior to assembly of the profile with a method according to the present invention.

[0017] The slab 6 of insulating material is preferably a polyurethane (PU) based or polyisocyanurate (PIR) based rigid foam material.

[0018] Rigid foam is hereby defined as a foam having a compression strength of at least 150 kPa (measured according to ISO844).

[0019] Preferred PU or PIR materials used for manufacture of the slab 6 for use in a method according to the present invention have following properties:

- a compression strength (hardness) at room temperature (21 °C) and in non-compressed state of lower than 300 kPa, preferably lower than 250 kPa;
- a recovery rate at room temperature of 90%, preferably 95% or higher in a period of 90 minutes, preferably 30 minutes after 20% compression;
- a recovery rate at 100°C of 90%, preferably 95% or higher in a period of 90 minutes, preferably 30 minutes after 20% compression;
- a lambda value of lower than 0,030 W/mK.

[0020] The recovery rate is measured by compressing a block of foam with a dimension of 500 cm (length) * 50 cm (width) * 50 cm (height, h_1) (after 24 hours of conditioning at 21 +/- 2°C and a relative humidity of 50 +/- 10 %) in the height direction at a rate of 120mm/min; releasing the block and after a given time measuring the height (h_2) of the block; the recovery time corresponds to $100 \cdot h_2 / h_1$.

[0021] The PU or PIR foam is preferably a closed cell foam.

[0022] More preferred PU or PIR foams additionally meet the properties of:

- a density lower than 100 kg/m³, preferably lower than 50 kg/m³, more preferably lower than 35 kg/m³;
- a water uptake of maximally 10% according to ISO 2896;

[0023] Figure 2 schematically represents a method according to the present invention for assembly of a window or door profile, the method comprising the steps of:

- (a) providing an inner shell 1 and an outer shell 2;
- (b) providing two legs 4a and 4b of insulating material that together will define the thermal bridge 4;
- (c) sandwiching a slab 6 of foam between said legs 4a and 4b wherein said slab 6 of foam is compressed in at least one dimension A when sandwiched between the legs;
- (d) simultaneously and/or subsequently fixing said legs 4a and 4b to the inner and outer shells 1 and 2 while maintaining the slab 6 of foam sandwiched between both legs 4a and 4b to obtain the assembled window or door profile.

[0024] When sandwiching the slab 6 of foam between the legs of the thermal bridge, the slab is slightly compressed to ensure that it remains well positioned between the legs that are kept at a mutual distance substantially corresponding to the distance between these legs in the assembled profile.

[0025] Fixation of the legs to the inner and outer shells 1 and 2 is well known in the art and is typically performed by sliding dovetail-like protrusions at the extremities of the legs in compatible slots in the inner and outer shells.

[0026] It is clear that the slab of foam material preferably extends over the entire length of the profile or that several slabs are provided one next to the other in a lengthwise direction of the profile to obtain an assembled profile with an foam slab provided therein and extending over substantially the entire length of the profile.

[0027] As no direct attachment of the slab of foam material to any of the legs 4a or 4b is necessary in a method according to the present invention, no attaching means or fixation surfaces for the slab of foam material need to be provided in or on these legs and their design can be optimized in terms of stability of the assembled profile, rigidity and insulation properties. Moreover both legs can be identical, thereby reducing stock requirements and complexity of the method of assembly of the profile.

[0028] According to an alternative embodiment, the slab of foam can comprise several foam materials, one of which is a rigid foam as described supra. Other foam materials that can be comprised in the slab of foam are:

- a rigid open cell foams such as shape memory foams. Shape memory polymer foams are hereby defined as foams that remain compressed (or de-

formed) if they are compressed at a temperature higher than the glass transition temperature (T_g) of the polymer and then cooled below T_g in their compressed or deformed state. They substantially recover from their compressed state to their expanded state when heated to a temperature higher than T_g . The expanded state is the shape of the shape memory material after it is manufactured and before it is compressed. The recovery of the foam to its expanded shape is referred to as "shape memory". (ref. WO2012004277)

- A flexible foam. Flexible foams are hereby defined as foams having a compression strength of lower than 100 kPa, preferably < 75 kPa.

[0029] Foam slabs comprising both a rigid foam and a flexible foam are preferred.

[0030] The foams comprised in the foam slabs can be arranged in several shapes, as continuous layer, discontinuous layers, as patterned geometries, etc.

[0031] A first example of such alternative embodiment comprising a foam slab having more than one type of foam is represented in figure 3. In this example the slab of foam is a layered structure with at least one flexible foam layer 7 and a layer 8 of rigid foam, whereby the layer of flexible is oriented such as to be positioned in between the layer 8 of rigid foam and one of the legs of the thermal bridge when sandwiching the slab of foam between both legs in accordance with a method of the present invention.

[0032] An advantage of such alternative embodiment is that sandwiching the slab of foam between the legs 4a and 4b of the bridge is more forgiving and the chance of damaging the rigid foam due to excessive force exerted on the legs for sandwiching the slab is even further limited, thereby minimizing the risk of insulation loss. Furthermore, the flexible layer enables to compensate for variations in the thickness of the rigid layer, surface variations on the legs 4a, 4b or slight dimensional variations in the inner and outer shells.

[0033] It is noted that the layer 7 of flexible foam does not need to be continuous but on the contrary can be designed according to a specific pattern creating air pockets 9 or air channels between the legs 4a and/or 4b of the thermal bridge and the layer 8 of rigid foam. Such patterned design of the flexible layer is considered particularly beneficial in case the flexible foam layer has insulation properties lower than the insulation properties of still air.

[0034] As mentioned above it is clear that instead of a two layered slab also three or more layered slabs of insulating materials can be used or other configurations of foam material slabs can be applied. A non-limiting number of examples is represented in figure 4 wherein the slab is represented as sandwiched between the legs 4a and 4b of the thermal bridge to clarify orientation of the layers in view of these legs.

[0035] According to another alternative embodiment,

at least one of the legs 4a, 4b of the thermal bridge 4 comprises - at its surface facing the cavity of the assembled profile - a flexible foam attached, for example by an adhesive, thereto. Such alternative embodiment is believed to facilitate sandwiching the slab of rigid foam between the legs and may prevent accidental movement of the slab of rigid foam in view of the legs when sandwiched there between. This flexible foam can be in the form of a layer of flexible foam extending lengthwise along the leg or can be present as a pattern of discrete patches of flexible foam material.

[0036] Fig. 4.1 depicts a three layered foam slab with a central layer of rigid foam and two outer layers of flexible foam, each outer layer facing an opposite leg 4a, 4b of the thermal bridge. Fig. 4.2 represents a two layered foam slab, with a layer of rigid foam having a pattern of flexible foam islands provided on one of its surfaces facing a leg 4a or 4b of the thermal bridge. Fig. 4.3 represents a foam slab having a transverse cross section with a core of rigid foam material that is enveloped with a layer of flexible foam material. Fig. 4.4 shows a foam slab having a central layer of flexible foam and two outer layers of rigid foam, each outer layer facing an opposite leg 4a, 4b of the thermal bridge. In figures 4.5 and 4.6, the foam slab comprises two outer layers of rigid foam with facing surfaces that are profiled such as to match when positioned one on top of the other, whereby a layer of flexible foam is applied in between both rigid foam layers. In fig. 4.6 this flexible foam layer is applied on only part of the interface of both rigid foam layers. Fig. 4.7 represents an alternative wherein a rigid foam layer extending between both legs 4a and 4b of the thermal bridge is flanked on its two sides facing the half shells of the aluminum profile with flexible foam slabs. Fig. 4.8 shows a rigid foam slab profiled as a X the legs of which are sandwiched between the legs 4a and 4b of the thermal bridge. Fig. 4.9 shows an embodiment wherein the foam slab comprises two layers of rigid foam having slanting facing surfaces and a central layer of flexible foam in between both layers of rigid foam.

[0037] Fig. 4.10 shows an embodiment wherein the foam slab comprises two layers of rigid foam having corresponding slanting facing surfaces, whereby the rigid layers are flanked with slabs of flexible foam on their surfaces facing the half shells of the aluminum profile. Fig. 4.11 concerns an alternative embodiment with a rigid foam slab having surfaces - facing the legs 4a and 4b of the thermal bridge - that are profiled to show a pattern of open cavities filled with a flexible foam or air. Fig. 4.12 represents yet another alternative embodiment, wherein two L shaped slabs of rigid foams are provided with a slab of flexible foam therebetween.

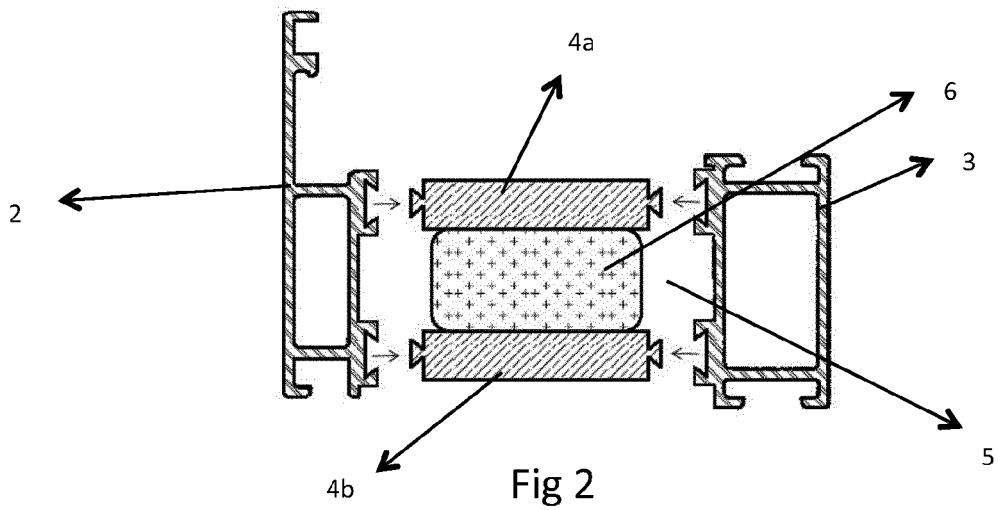
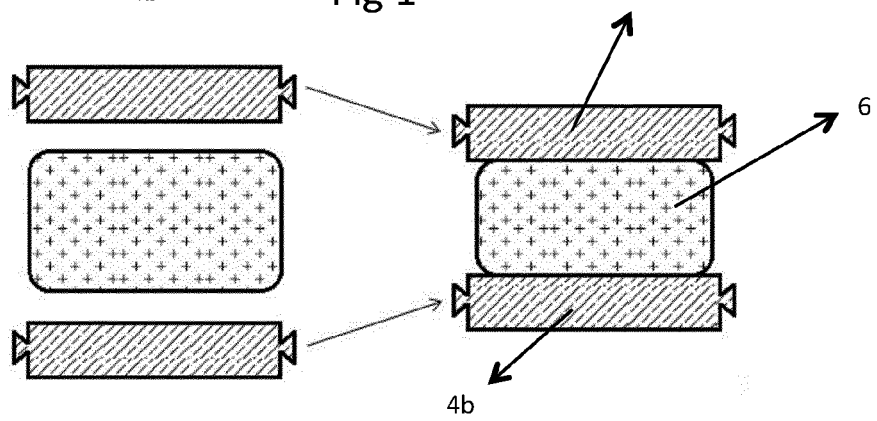
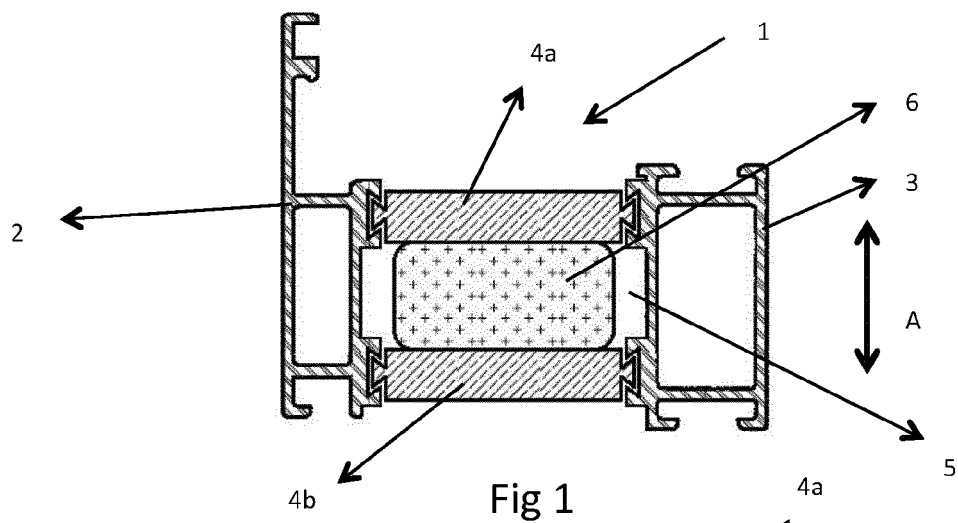
[0038] It is to be noted that in the examples of figures 3 and 4 and in particular in the examples of figures 4.7 and 4.10, the flexible foam can be replaced with a shape memory foam. In case of applying a shape memory foam this foam is preferably applied in a compressed state at a temperature below its T_g , whereby during post treat-

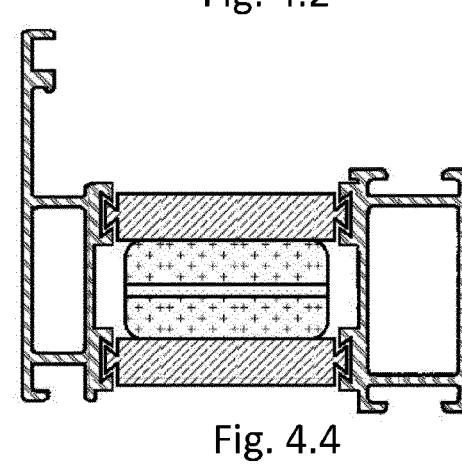
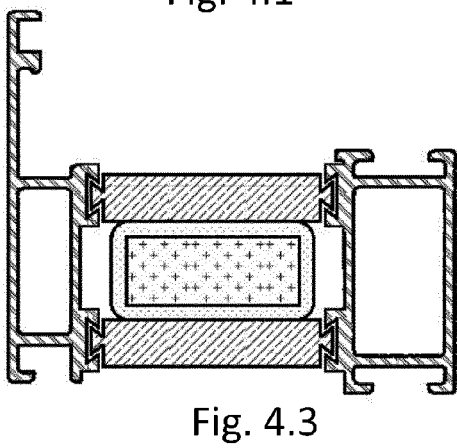
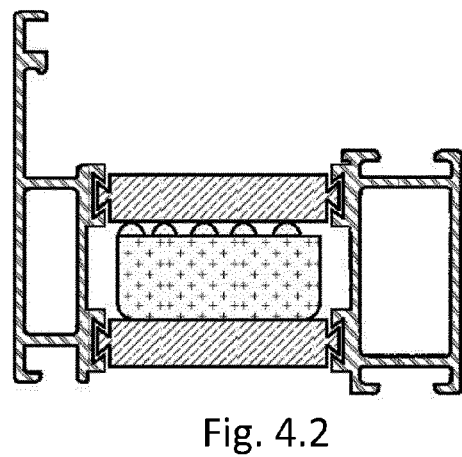
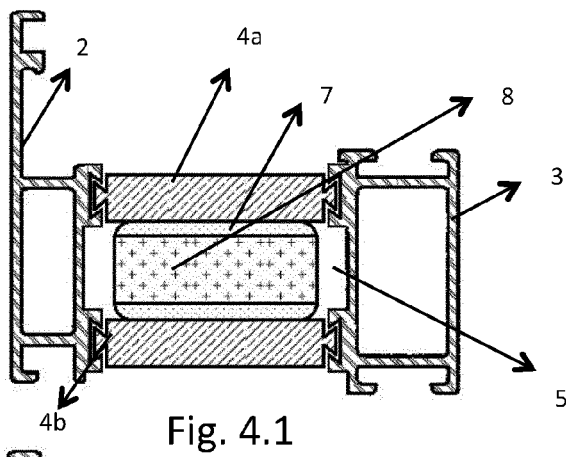
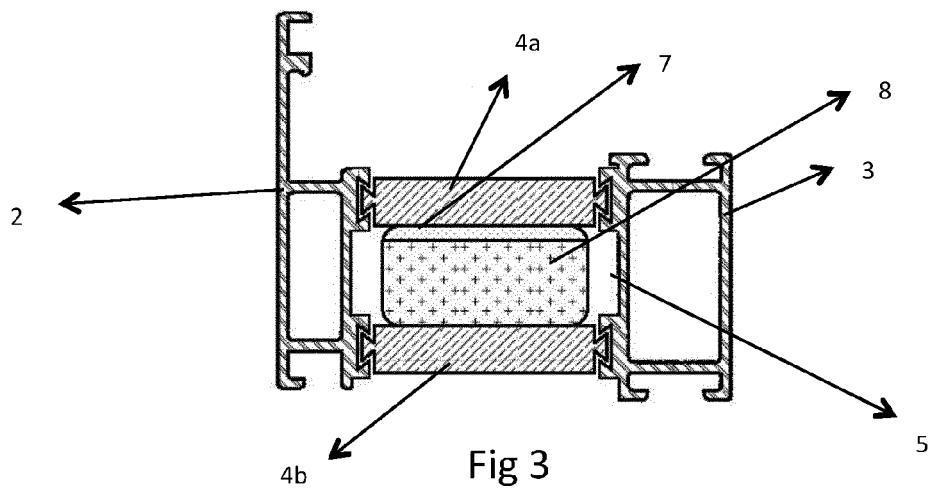
ment of the assembled profile (example given during lacquering at elevated temperatures above T_g of the shape memory foam) the shape memory foam is allowed to expand and hence fill a remainder of the cavity 5.

[0039] Instead of a shape memory foam, any heat expandable foam material may be applied in these embodiments.

Claims

1. A method of assembly of a window profile comprising an inner shell and an outer shell and an insulating thermal bridge connecting both shells, wherein said method comprises the steps of:
 - (a) providing an inner shell and an outer shell;
 - (b) providing two legs of insulating material that together will define the thermal bridge;
 - (c) sandwiching a slab of foam material between said legs wherein said foam slab is compressed in at least one dimension when sandwiched between the legs;
 - (d) simultaneously and/or subsequently fixing said legs to the inner and outer shells while maintaining the slab of foam sandwiched between both legs.
2. The method according to claim 1, wherein said slab of foam comprises at least a rigid foam.
3. The method according to claim 2, wherein the rigid foam comprises a rigid polyurethane or polyisocyanurate based foam.
4. The method according to claim 2 or 3, wherein said rigid foam has a compression strength at room temperature of lower than 300 kPa, preferably lower than 250 kPa..
5. The method according to any of the claims 2-4, wherein said rigid foam has a recovery rate at room temperature of 90%, preferably 95% or more within a period of 90 minutes after 20% compression.
6. The method according to any of the claims 2-5, wherein said rigid foam has an expansion rate of at least 6%, preferably at least 10%.
7. The method according to any of the claims 2-6, wherein said rigid foam has a recovery rate at 100°C of 90%, preferably 95% or more within a period of 90 minutes after 20% compression.
8. The method according to any of the claims 2-7, wherein said rigid foam has a λ value of < 0,030 W/mK.
9. The method according to any of the claims 2-8, wherein said rigid foam has a density of < 100 kg/m³, preferably < 50 kg/m³.
10. The method according to any of the claims 2-9, wherein said rigid foam has a water uptake of maximally 10% measured according to ISO 2896.
11. The method according to any of the claims 2-10, wherein said rigid foam is a closed cell foam.
12. The method according to any of the claims 2-11, wherein said slab of foam material comprises a flexible foam.
13. The method according to claim 12, whereby the flexible foam is arranged on the rigid foam such as to be positioned in between the rigid foam and one of the legs of the thermal bridge when sandwiching the slab of foam material between both legs.
14. The method according to claims 1-13, wherein at least one of the legs of the thermal bridge has, on its surface designed to face the slab of foam material, a flexible foam material attached thereto.





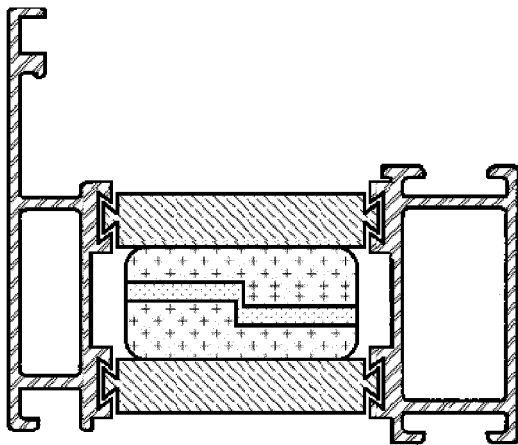


Fig. 4.5

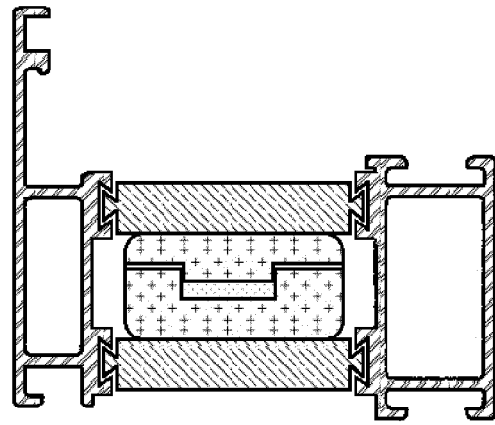


Fig. 4.6

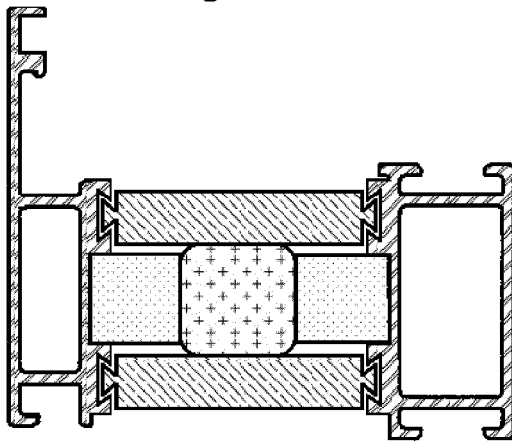


Fig. 4.7

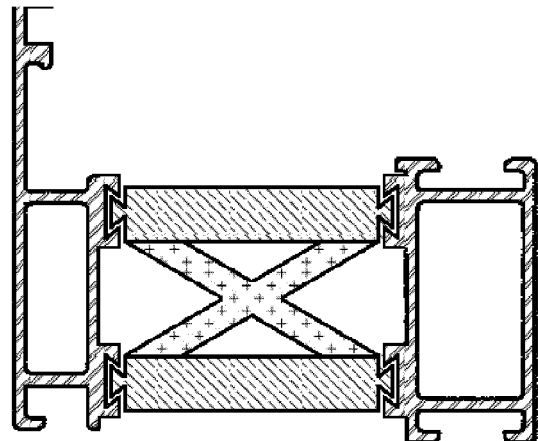


Fig. 4.8

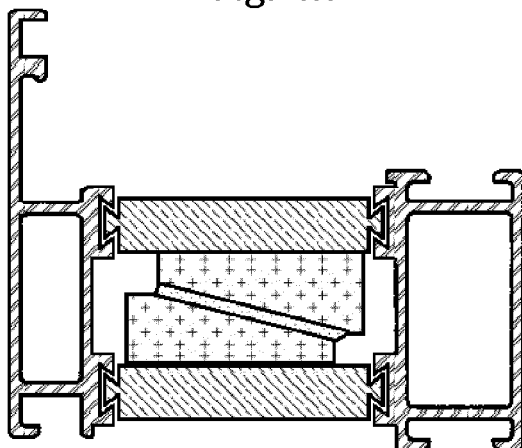


Fig. 4.9

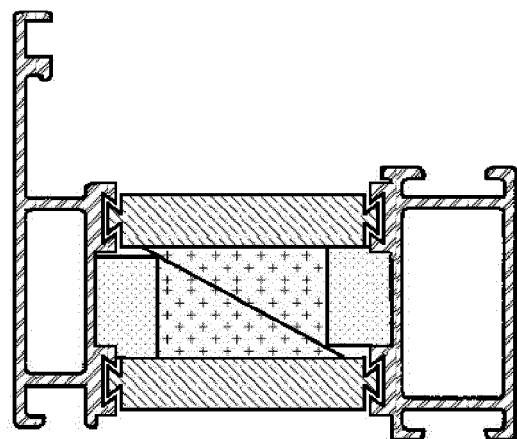


Fig. 4.10

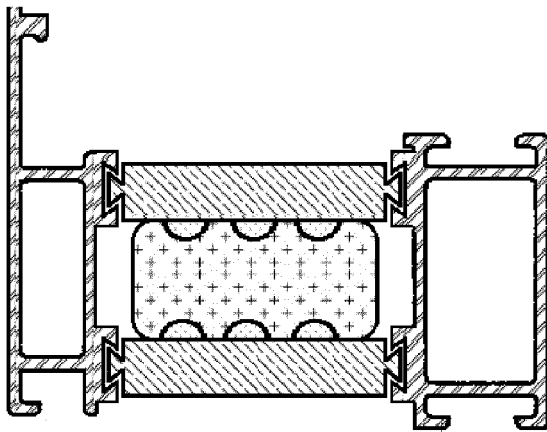


Fig. 4.11

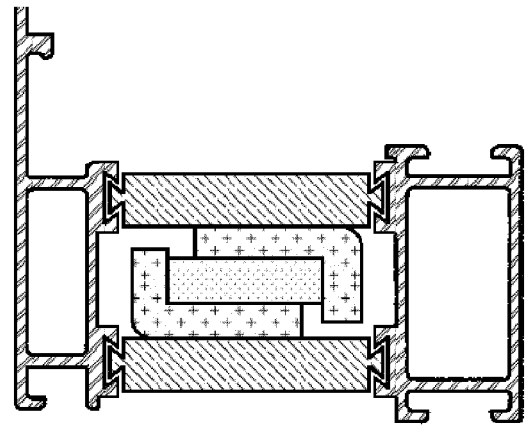


Fig. 4.12



EUROPEAN SEARCH REPORT

Application Number
EP 13 16 6086

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 080 864 A1 (ALCOA ALUMINIUM DEUTSCHLAND IN [DE]) 22 July 2009 (2009-07-22) * paragraph [0039] - paragraph [0041]; figure 5 *	1-14	INV. E06B3/263
A	DE 30 16 076 A1 (NAHR HELMAR) 5 November 1981 (1981-11-05) * page 9, paragraph 2 - page 10, paragraph 1; figures 3,4,7,8 *	1	
A	DE 34 40 710 A1 (STRAUB THEODOR) 7 May 1986 (1986-05-07) * page 6, paragraph 4; figures 1-3 * * page 8, paragraph 4 *	1	
A	EP 2 374 977 A2 (SOPENA METALES SL [ES]) 12 October 2011 (2011-10-12) * paragraph [0022]; figure 1 *	2	
A	US 2010/175339 A1 (MORIYA MASANORI [US] ET AL) 15 July 2010 (2010-07-15) * paragraph [0058]; figure 2 *	2	TECHNICAL FIELDS SEARCHED (IPC) E06B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 September 2013	Examiner Jülich, Saskia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 16 6086

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-09-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2080864 A1	22-07-2009	AT 461346 T EP 2080864 A1 ES 2343094 T3 PT 2080864 E	15-04-2010 22-07-2009 22-07-2010 25-06-2010
DE 3016076 A1	05-11-1981	DE 3016076 A1 DE 3050779 C2	05-11-1981 15-12-1983
DE 3440710 A1	07-05-1986	NONE	
EP 2374977 A2	12-10-2011	EP 2374977 A2 ES 1072278 U	12-10-2011 18-06-2010
US 2010175339 A1	15-07-2010	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 102010064034 [0003]
- DE 102009046554 [0003]
- WO 2012004277 A [0028]