



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.10.2010 Bulletin 2010/42

(51) Int Cl.:
E06B 3/267 (2006.01)

(21) Application number: **09425131.1**

(22) Date of filing: **07.04.2009**

(84) Designated Contracting States:
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 SE SI SK TR
Designated Extension States:
AL BA RS

(72) Inventor: **Barulli, Marinella**
SM - 47893 Borgo Maggiore (SM)

(74) Representative: **Paolizzi, Marco**
C/o Bugnion S.p.A.
Via A. Valentini, 11/15
47900 Rimini (IT)

(71) Applicant: **Alfa Solare S.A.**
47891 Galazzano (SM)

(54) **Thermal break window or door profile with insulating foam expanded in-situ**

(57) A profile (1) designed to be integrated in a composite thermal break system, comprising:

- a support (2);
- a first thermally expandable element (3) connected to

the support (2).

After predetermined heating, the first thermally expandable element (3) adopts an expanded configuration which is substantially maintained even after any cooling which may occur.

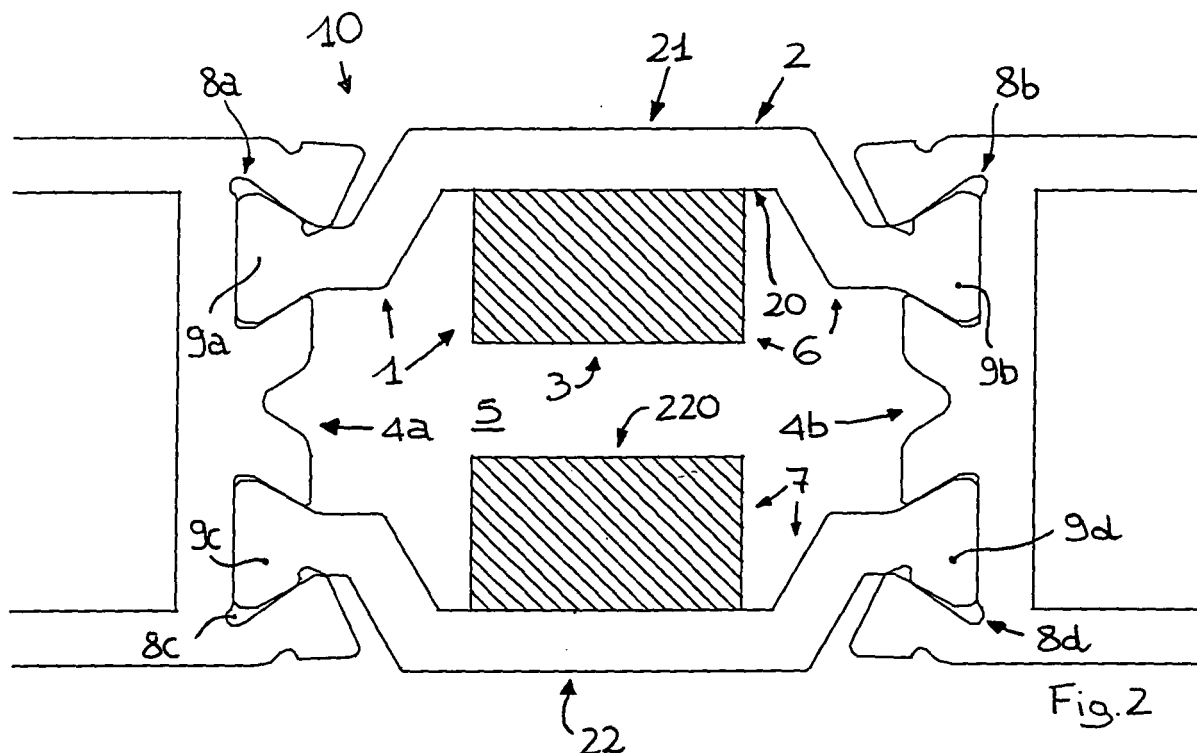
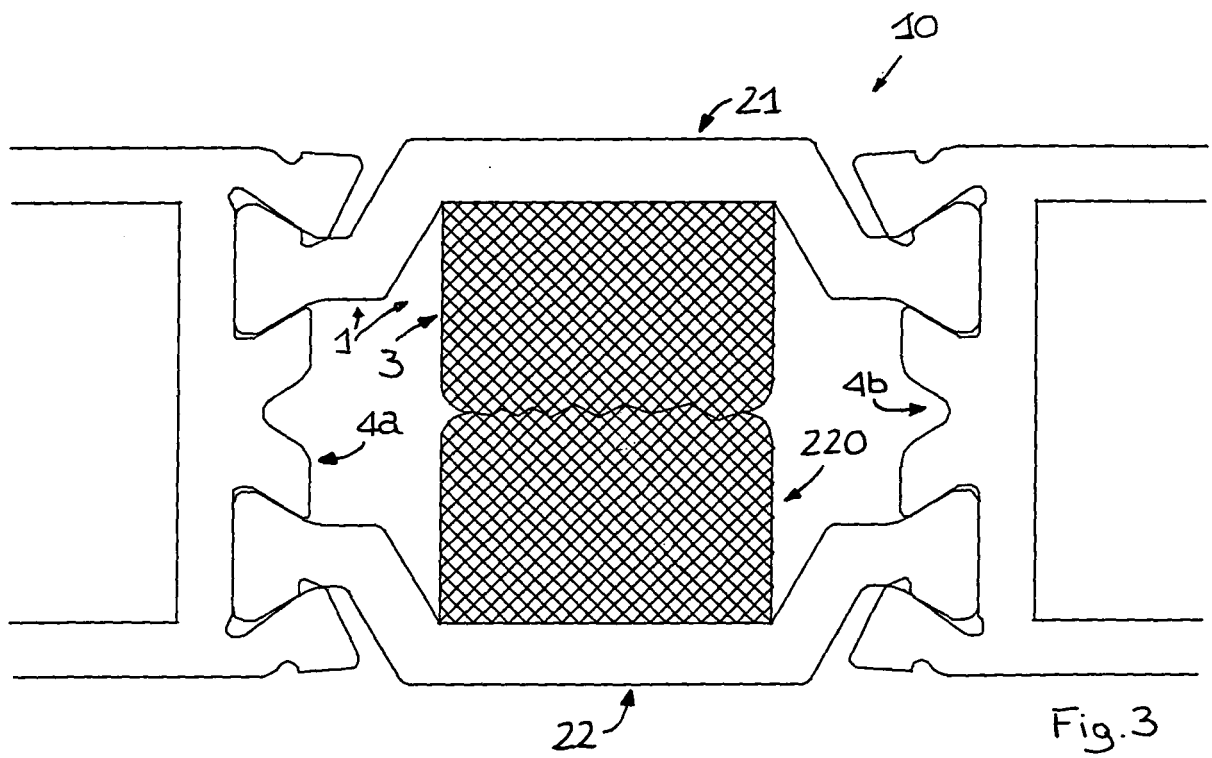


Fig. 2



Description

[0001] The present invention relates to a profile designed to be integrated in a composite thermal break system. The present invention also relates to a composite thermal break system and a method for obtaining it.

[0002] There are prior art thermal break systems which are normally used to minimise heat loss between two environments. Thermal break systems are, for example, used in door and window frames. Such thermal break systems comprise:

- two thermally conductive elements: one in contact with the first environment, one in contact with the second environment; the two thermally conductive elements being opposite each other;
- two heat insulating bars facing each other; each of the bars being interposed between and connected to the two thermally conductive elements. The two thermally conductive elements and the two insulating bars therefore delimit a compartment interposed between them in which there is normally air.

[0003] The thermally conductive elements are normally made of aluminium (for example, they are an integral part of the door or window frame), whilst the heat insulating bars are made of polyamide.

[0004] Although these systems offer good results, the transfer of heat from the hotter environment to the colder environment can never be completely eliminated.

[0005] In this context, the technical purpose which forms the basis of the present invention is to propose a profile designed to be integrated in a composite thermal break system which optimises the thermal insulation between a hotter environment and a colder environment.

[0006] The present invention may also have for an aim to provide a profile designed to be integrated in a composite thermal break system which can improve structural strength.

[0007] Another aim of the present invention is to provide a composite thermal break system designed to comprise the profile.

[0008] Yet another aim of the present invention is to provide a method for making a composite thermal break system.

[0009] The technical purpose indicated and the aims specified are substantially achieved by a profile designed to be integrated in a composite thermal break system, by a composite thermal break system and by a method for making a composite thermal break system comprising the technical features described in one or more of the appended claims.

[0010] Further features and advantages of the present invention are more apparent in the non-limiting description of a preferred embodiment of it, as illustrated in the accompanying drawings, in which:

- Figure 1 is a perspective view of a first example of

a composite thermal break system;

- Figure 2 is a cross-section of a first configuration of a second example of a composite thermal break system;
- Figure 3 is a cross-section of a second configuration of a second example of a composite thermal break system.

[0011] The numeral 1 denotes a profile designed to be integrated in a composite thermal break system 10.

[0012] The profile 1 comprises a support 2 and a first thermally expandable element 3 connected to the support 2. The support 2 stably supports the first thermally expandable element 3.

[0013] The first thermally expandable element 3 is connected to at least one surface 20 of the support 2.

[0014] For example, the support 2 comprises or coincides with a first heat insulating bar 21 suitable for being interposed between two thermally conductive elements of the composite system 10.

[0015] The first bar 21 extends mainly longitudinally (see example in Figure 1). In this description, references to the bar 21 (or another element) being heat insulating mean that it is made of a material (or a combination of materials) which does not allow good heat conduction (for example, rubber, plastic materials, etc.). Advantageously, the first bar 21 is made of polyamide. Appropriately, the first thermally expandable element 3 extends mainly longitudinally. The first thermally expandable element 3 is applied to the first bar 21 in such a way that its longitudinal main direction of extension is parallel with the longitudinal main direction of extension of the first bar 21.

[0016] Advantageously, the first thermally expandable element 3 is glued to the first bar 21. This may be done using an adhesive interposed between the first thermally expandable element 3 and the first bar 21. In particular, between the first element 3 and the first bar 21 there is a double-sided adhesive material, preferably in the form of a double-sided adhesive strip. Appropriately, one surface of the strip is connected to the first bar 21 and the other surface of the strip is connected to the first thermally expandable element 3. In a particular construction embodiment not illustrated, the first thermally expandable element 3 is at least partly housed in a groove in the first bar 21. This allows (or at least contributes to) a stable connection between the first thermally expandable element 3 and the first bar 21. In a particular embodiment not illustrated, an edge of the first thermally expandable element 3, when inserted in a groove in the first bar 21, could be coupled to the latter.

[0017] Appropriately, after predetermined heating, the first thermally expandable element 3 adopts an expanded configuration (see Figure 3) which is substantially maintained even after any cooling which may occur. Advantageously, the predetermined heating involves heating at a temperature greater than 170°C. This is important because the first thermally expandable element 3 is nor-

mally obtained by means of hot extrusion at around 120°C and the process for extrusion and forming of the first thermally expandable element 3 must not cause the expansion (except to a very limited and negligible degree).

[0018] Appropriately, the predetermined heating is drawn out over several minutes (advantageously at least 10 minutes, preferably around 20 minutes).

[0019] The first thermally expandable element 3 comprises PVC and a foaming substance (for example, it may comprise only those two components). The quantity of foaming substance present, by weight, is between 0.2% and 2%, preferably between 0.4% and 1.5%.

[0020] The foaming substance comprises or coincides with 4,4'-oxybis(benzene sulfonyl hydrazide). At ambient temperature the first thermally expandable element 3 has a specific weight of around 1.2 g/cm³, ultimate tensile strength of 15 N/mm² and ultimate elongation of 350%.

[0021] The present invention also relates to a composite thermal break system 10 comprising at least:

- two opposite thermally conductive profiles 4a, 4b;
- a first heat insulating profile 6 interposed between the two thermally conductive profiles 4a, 4b and having one or more of the technical features of the profile 1 (described above) designed to be integrated in a composite thermal break system 10.

[0022] Advantageously, the two thermally conductive profiles 4a, 4b are made of metal material, advantageously aluminium. For example, they are part of a door or window frame.

[0023] The composite system 10 also comprises a second heat insulating bar 22 interposed between the two thermally conductive profiles 4a, 4b.

[0024] The first thermally expandable element 3 of the first profile 6 is interposed between the support 2 of the first profile 6 and the second bar 22. The first thermally expandable element 3 is inside a compartment 5 formed by the combination of the support 2, the second bar 22 and at least one portion of each of the two thermally conductive profiles 4a, 4b.

[0025] After heating, the volume of the first thermally expandable element 3 increases. In a construction embodiment not illustrated the first thermally expandable element 3 occupies at least two thirds of the compartment 5 (preferably it almost completely occupies the compartment 5).

[0026] As shown in Figure 1 by way of example only and without limiting the scope of the invention, the composite system 10 comprises a second thermally expandable element 220 which is connected to the second bar 22 and which is located inside the compartment 5. The second thermally expandable element 220 is interposed between the first thermally expandable element 3 and the second bar 22. The second thermally expandable element 220 is applied to the second bar 22 in such a way that its longitudinal main direction of extension is

parallel with the longitudinal main direction of extension of the second bar 22.

[0027] Advantageously, the second thermally expandable element 220 is stably connected to the second bar 22, for example by gluing, or by coupling means. For example, the second thermally expandable element 220 may be connected to the second bar 22 by a double-sided adhesive strip. The second thermally expandable element 220 could be at least partly inside a groove in the second bar 22 (embodiment not illustrated). Advantageously, the groove would allow the second thermally expandable element 220 to be coupled to the second bar 22.

[0028] The second thermally expandable element 220 is made of the same material as the first thermally expandable element 3.

[0029] In particular, the second thermally expandable element 220 comprises PVC and a foaming substance (for example, it comprises only those two components). The quantity of foaming substance present, by weight, is between 0.2% and 2%, preferably between 0.4% and 1.5%.

[0030] The foaming substance comprises or coincides with 4,4'-oxybis(benzene sulfonyl hydrazide). At ambient temperature the second thermally expandable element 220 has a specific weight of around 1.2 g/cm³, ultimate tensile strength of 15 N/mm² and ultimate elongation of 350%.

[0031] At least after predetermined heating, the first and second thermally expandable elements 3, 220 change configuration, passing from a first, non-expanded configuration (see Figure 1 or 2) to a second, expanded configuration (see Figure 3). In the first, non-expanded configuration the first and second thermally expandable elements 3, 220 are spaced from each other, whilst in the second, expanded configuration the first and second thermally expandable elements 3, 220 are in contact with each other. In particular, in the second, expanded configuration the first and second thermally expandable elements 3, 220 create a barrier which is interposed between the first and the second thermally conductive profiles 4a, 4b. In this way the Applicant has shown through experimentation that the composite system 10 has better thermal insulation than the situation in which there is only air inside the compartment 5. Moreover, in the expanded configuration the stiffness of the composite thermal break system 10 is also improved compared with the situation in which there is only air in the compartment 5. It is important that even in the non-expanded configuration the first and second heat insulating elements 3, 220 are connected respectively to a corresponding wall of the compartment 5 to prevent them from coming off during the movement and to prevent positioning errors immediately before expansion.

[0032] Appropriately, the first and second thermally expandable elements 3, 220 only make contact with each other after heating at a temperature greater than 170°C. In particular, after being heated at a temperature greater

than 170°C for at least 10 minutes, the volume of the first and/or the second thermally expandable element 3, 220 increases by at least 20% compared with the initial volume, preferably increasing its volume by between 30% and 50% compared with the initial volume.

[0033] As already indicated, the same effect could also be achieved using only the first thermally expandable element 3. For example, in this case the first thermally expandable element 3 in the expanded configuration would advantageously make contact with the second bar 22. In this way, a barrier would still be obtained between the first and the second thermally conductive profiles 4a, 4b.

[0034] In an alternative embodiment, the support 2 to which the first thermally expandable element 3 is applied could coincide with the first thermally conductive profile 4a. Similarly, the second thermally expandable element 220 (if present) could be applied to the second thermally conductive profile 4b. However, said embodiment means that assembly of the composite thermal break system 10 is more complex.

[0035] The present invention also relates to a method for making a composite thermal break system 10 comprising the following steps:

- positioning a first heat insulating profile 6 between two thermally conductive profiles 4a, 4b, the first heat insulating profile 6 being a profile 1 of the type described above;
- positioning a second heat insulating profile 7 in such a way that it is opposite the first heat insulating profile 6 and is interposed between the two thermally conductive profiles 4a, 4b, the assembly consisting of the first heat insulating profile 6, the second heat insulating profile 7 and the two thermally conductive profiles 4a, 4b forming the walls of a compartment 5;
- heating the first thermally expandable element 3 of the first heat insulating profile 6. This causes the first element 3 to expand inside the compartment 5.

[0036] The step of positioning a first heat insulating profile 6 between two thermally conductive profiles 4a, 4b involves inserting the first heat insulating profile 6 in corresponding grooves 8a, 8b in the two thermally conductive profiles 4a, 4b. Advantageously, at least one shaped portion 9a, 9b of the first heat insulating profile 6 is inserted in at least one element shaped to match it which is formed by the grooves 8a, 8b made in the thermally conductive profiles 4a, 4b.

[0037] The shaped portion 9a, 9b of the heat insulating profile 6 is made in the first bar 21. The first thermally expandable element 3 is connected to the first bar 21 before positioning the first heat insulating profile 6 between the two thermally conductive profiles 4a, 4b. In this way, the operation to insert the first bar 21 in the two thermally conductive profiles 4a, 4b can be carried out extremely rapidly and using machines known to experts in the field and normally used for that operation.

[0038] After the step of positioning the first heat insulating profile 6 relative to the two thermally conductive profiles 4a, 4b, the element shaped to match, formed by the grooves 8a, 8b in the thermally conductive profiles is clamped on the corresponding shaped portion 9a, 9b of the first heat insulating profile 6.

[0039] The step of positioning a second heat insulating profile 7 between the two thermally conductive profiles 4a, 4b involves inserting the second heat insulating profile 7 in corresponding grooves 8c, 8d in the two thermally conductive profiles 4a, 4b. Advantageously, at least one shaped portion 9c, 9d of the second heat insulating profile 7 is inserted in at least one element shaped to match it which is formed by the grooves 8c, 8d made in the thermally conductive profiles 4a, 4b. After the step of positioning the second heat insulating profile 7 relative to the two thermally conductive profiles 4a, 4b, the element shaped to match, formed by the grooves 8c, 8d in the thermally conductive profiles is clamped on the corresponding shaped portion 9c, 9d of the second heat insulating profile 7.

[0040] Appropriately, the second heat insulating profile 7 comprises a second heat insulating bar 22 and a second thermally expandable element 220 connected to the second bar 22. Advantageously, the second thermally expandable element 220 is connected to the second bar 22 before positioning the second heat insulating profile 7 between the two thermally conductive profiles 4a, 4b.

[0041] The step of heating the first thermally expandable element 3 also causes heating and expansion of the second thermally expandable element 220. Said expansion of the second thermally expandable element 220 takes place inside the compartment 5.

[0042] The step of heating the first and second thermally expandable elements 3, 220 causes them to expand in such a way that they make contact with each other. The step of heating the first thermally expandable element 3 comes after the step of positioning the first and second heat insulating profiles 6, 7 between the two thermally conductive profiles 4a, 4b.

[0043] Before being heated, the first and second thermally expandable elements 3, 220 are not in contact with each other. This facilitates positioning of the first and second heat insulating profiles 6, 7 relative to the two thermally conductive profiles 4a, 4b. The first and second thermally expandable elements 3, 220 do not make contact with each other during positioning of the first and second heat insulating profiles 6, 7 relative to the first and second thermally conductive profiles 4a, 4b.

[0044] Appropriately, the step of heating the first thermally expandable element 3 takes place in an oven. Said step involves in particular heating the composite thermal break system 10 in an oven. Advantageously, this involves heating the composite system 10 in an oven at a temperature greater than 170°C (preferably at a temperature of between 180°C and 200°C), advantageously for a period of between 10 and 25 minutes.

[0045] Advantageously, the step of heating the first

thermally expandable element 3 takes place at least partly simultaneously with the painting operation (this operation is always necessary and usually involves heating the composite thermal break system 10 in an oven at a temperature greater than 180°C). The painting operation is normally carried out in a painting oven by means of polymerisation of the paint powders previously applied on at least part of the thermally conductive profiles. In this way, during painting, expansion of the first and second thermally expandable elements 3, 220 is also achieved (optimising the steps in the method).

[0046] The invention brings important advantages. First, it allows improved thermal insulation in a composite thermal break system. At the same time it allows the prevention of an increase in assembly times for a composite thermal break system. Moreover, it allows the use of common machines and equipment currently used for assembling a composite thermal break system.

[0047] The invention described may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all details of the invention may be substituted by other technically equivalent elements. In practice, all of the materials used, as well as the dimensions may vary according to requirements.

Claims

1. A profile (1) designed to be integrated in a composite thermal break system, comprising:

- a support (2);
- a first thermally expandable element (3) connected to the support (2);

the profile being **characterised in that**, after predetermined heating, the first thermally expandable element (3) adopts an expanded configuration which is substantially maintained even after any cooling which may occur.

2. The profile according to claim 1, **characterised in that** the first thermally expandable element (3) is connected to at least one surface (20) of the support (2).
3. The profile according to claim 1 or 2, **characterised in that** the support (2) comprises or coincides with a first heat insulating bar (21) suitable for being interposed between two thermally conductive elements of the composite system.
4. The profile according to claim 3, **characterised in that** the first thermally expandable element (3) is glued to the first bar (21).
5. The profile according to claim 3 or 4, **characterised**

in that the first thermally expandable element (3) is at least partly housed in a groove in the first bar (3).

6. The profile according to any of the foregoing claims, **characterised in that** the predetermined heating involves heating at a temperature greater than 170°C.
7. The profile according to any of the foregoing claims, **characterised in that** the first thermally expandable element (3) comprises PVC and a foaming substance, the quantity of the latter present, by weight, being between 0.2% and 2%.
8. A composite thermal break system comprising:
- two opposite thermally conductive profiles (4a, 4b);
 - a first heat insulating profile (6) interposed between the two thermally conductive profiles (4a, 4b), the first heat insulating profile (6) being a profile (1) according to any of the claims from 1 to 7;
 - a second heat insulating bar (22) interposed between the two thermally conductive profiles (4a, 4b);

the first thermally expandable element (3) of the first profile (6) being interposed between the support (2) of the first profile (6) and the second bar (22) and being located inside a compartment (5) formed by the combination of the support (2), the second bar (22) and at least a portion of each of the two thermally conductive profiles (4a, 4b).

9. The system according to claim 8, **characterised in that** it comprises a second thermally expandable element (220) which is connected to the second bar (22) and which is located inside the compartment (5).
10. The system according to claim 9, **characterised in that** the second thermally expandable element (220) is made of the same material as the first thermally expandable element (3).
11. The system according to claim 9 or 10, **characterised in that**, at least after predetermined heating, the first and second thermally expandable elements (3, 220) change configuration, passing from a first, non-expanded configuration to a second, expanded configuration, in the first, non-expanded configuration the first and second thermally expandable elements (3, 220) being spaced from each other, whilst in the second, expanded configuration the first and second thermally expandable elements (3, 220) being in contact with each other.
12. The system according to any of the claims from 9 to 11, **characterised in that** the first and second ther-

mally expandable elements (3, 220) only make contact with each other after they have been heated at a temperature greater than 170°C.

13. A method for making a composite thermal break system comprising the following steps: 5

- positioning a first heat insulating profile (6) between two thermally conductive profiles (4a, 4b), the first heat insulating profile (6) being a profile (1) according to any of the claims from 1 to 7; 10
- positioning a second heat insulating profile (7) in such a way that it is opposite the first heat insulating profile (6) and is interposed between the two thermally conductive profiles (4a, 4b), the assembly consisting of the first heat insulating profile (6), the second heat insulating profile (7) and the two thermally conductive profiles (4a, 4b) forming the walls of a compartment (5); 15
- heating the first thermally expandable element (3) of the first heat insulating profile (6), causing the first thermally expandable element (3) to expand inside the compartment (5). 20

14. The method according to claim 13, **characterised in that** the second heat insulating profile (7) comprises a second heat insulating bar (22) and a second thermally expandable element (220) connected to the second bar (22), the step of heating the first thermally expandable element (3) also causing heating and expansion of the second thermally expandable element (220). 25 30

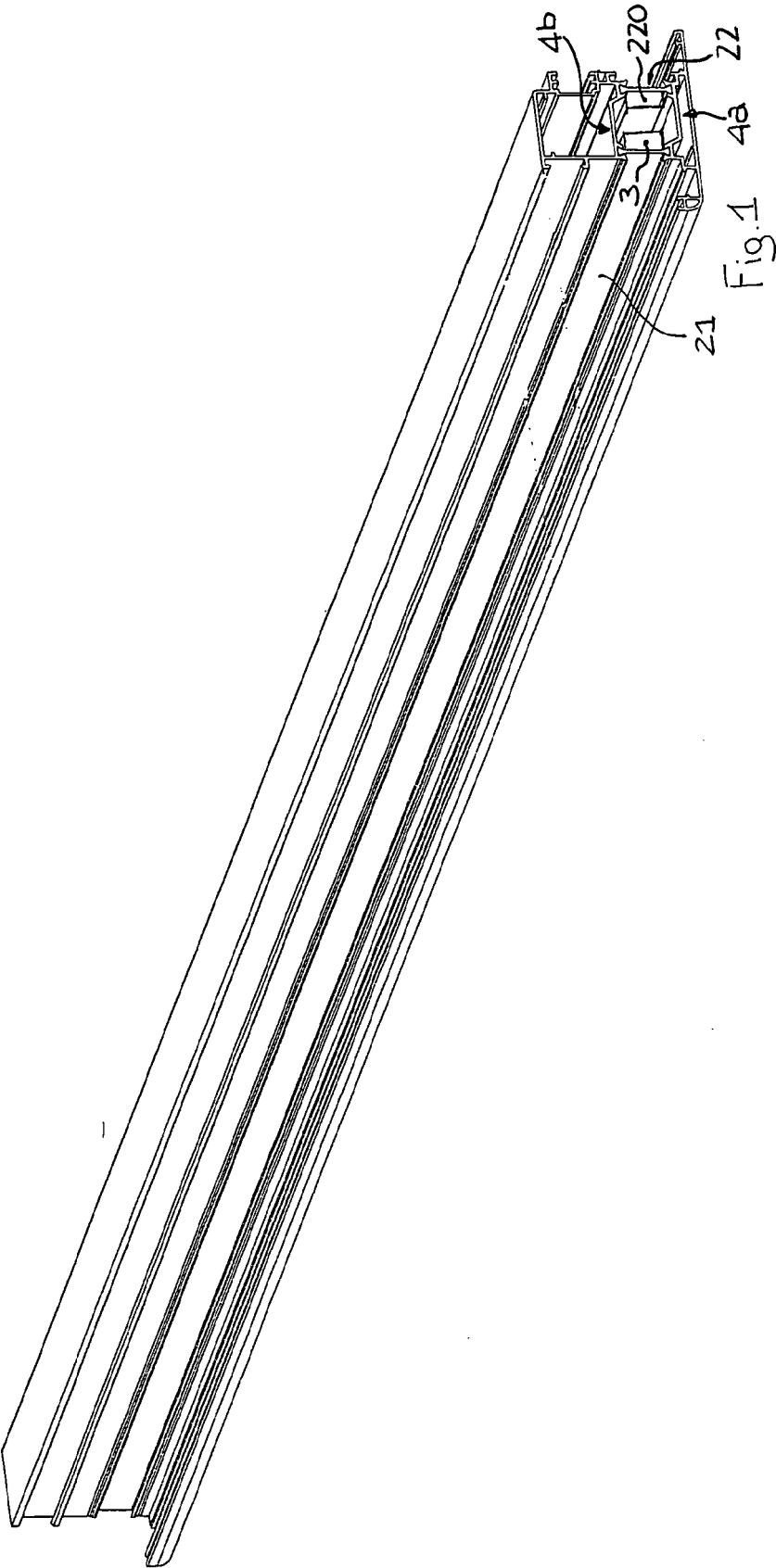
15. The method according to claim 14, **characterised in that** the step of heating the first and second thermally expandable elements (3, 220) causes them to expand in such a way that they make contact with each other. 35

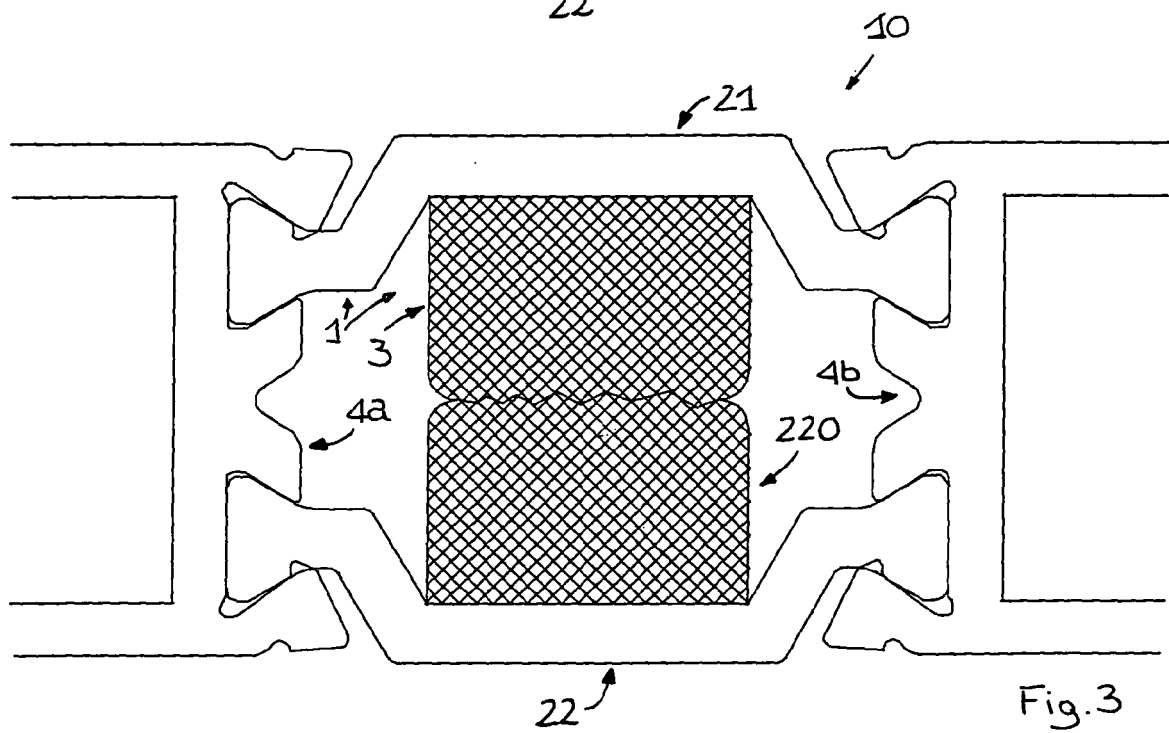
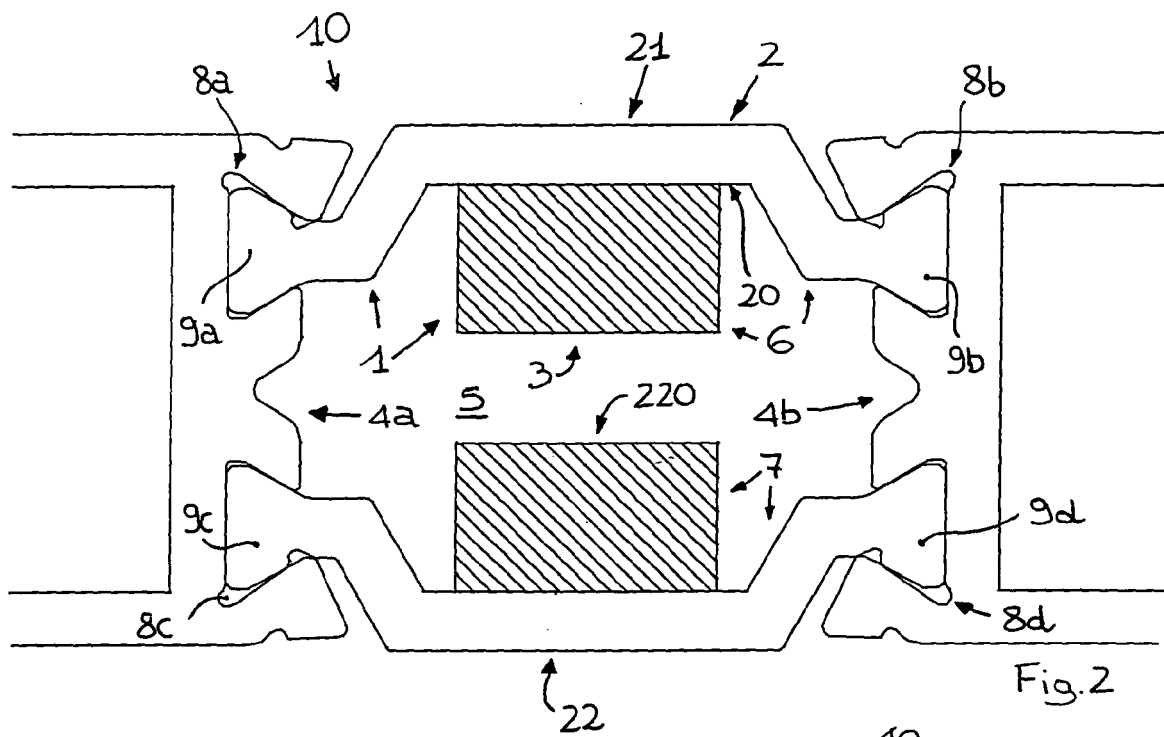
40

45

50

55







EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5131

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	DE 195 04 601 A1 (WICONA BAUSYSTEME GMBH [DE]) 25 July 1996 (1996-07-25)	1-5, 8-11, 13-15	INV. E06B3/267
Y	* column 1 - column 3; figures 1-10 *	7	
X	WO 98/11319 A (MAZZER MATERIE PLASTICHE DI MA [IT]; MAZZER GIACOMO EZIO [IT]; PESSINA) 19 March 1998 (1998-03-19)	1-5,8,13	
Y	* the whole document *	7	
X	DE 41 31 511 A1 (ENSINGER WILFRIED [DE]) 1 April 1993 (1993-04-01)	1-4,6,8, 13	
Y	* column 4, line 20 - line 67; figures 9,10 *	7	
X	EP 0 131 279 A (NAHR HELMAR) 16 January 1985 (1985-01-16)	1-6,8-15	
Y	* page 2; claims 1-11; figure 2 *	7	
Y	EP 0 432 096 A (CIBA GEIGY AG [CH]) 12 June 1991 (1991-06-12)	7	
	* pages 3,22,26 *		TECHNICAL FIELDS SEARCHED (IPC)
A	EP 1 094 189 A (HUELS TROISDORF [DE] PROFINE GMBH [DE]) 25 April 2001 (2001-04-25)	7	E06B C08J
	* claim 3 *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 November 2009	Examiner Schwertfeger, C
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			

4

EPO FORM 1503 03.82 (P04C01)

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

EP 09 42 5131

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.

20-11-2009

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 19504601	A1	25-07-1996	NONE	

WO 9811319	A	19-03-1998	AU 4396697 A	02-04-1998
			IT MI960609 U1	13-03-1998

DE 4131511	A1	01-04-1993	NONE	

EP 0131279	A	16-01-1985	DE 3342700 A1	17-01-1985

EP 0432096	A	12-06-1991	CA 2031436 A1	07-06-1991
			JP 3190967 A	20-08-1991

EP 1094189	A	25-04-2001	AT 265604 T	15-05-2004
			CZ 20003573 A3	12-12-2001
			DE 10049311 A1	12-07-2001
			PL 342960 A1	09-04-2001
			SK 14572000 A3	03-12-2001
