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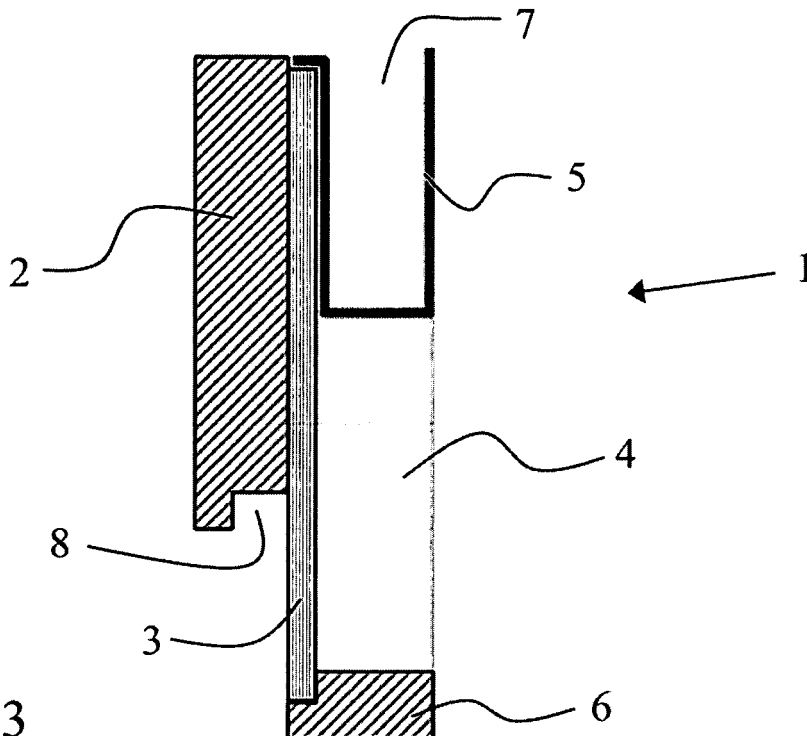
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(54) **Roof window frame and method of manufacturing thereof**

(57) A roof window frame (1) having top, bottom and side parts surrounding an opening, which side parts are made up as a sandwich construction comprising a first insulating member (4) secured to a first supporting member (3) on a side opposite the opening. To provide a frame having improved insulating properties, the first supporting member (3) is secured to a second supporting member (5) along a substantial length of the parts.

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**Fig. 3**

## Description

**[0001]** The present invention relates to a roof window frame having top, bottom and side parts surrounding an opening, which side parts are made up as a sandwich construction comprising a first insulating member secured to a first supporting member on a side opposite the opening.

**[0002]** Attics and lofts are increasingly being used for living, which requires installation of roof windows. With increasing prices of energy there is a growing demand for energy saving solutions for roof windows, and various solutions have been proposed in recent years.

**[0003]** A frame box for roof windows is the subject of EP-B1-0 679 773. This frame box comprises a window frame, which carries the window sash, and a window frame carrier, which carries the window frame and is insertable in the roof. The carrier is a sandwich construction made up of heat insulating material with a supporting member. This construction is depicted in Fig. 2 and will be described in more detail with reference to the drawing. It is found, however, that the insulating property of the frame is mediocre.

**[0004]** US patent no. 6,263,624 discloses a skylight assembly comprising a curb of a plastic sheet material. The sheet further extends to form an integral surrounding flashing portion. Strips of rigid foam insulation material are adhesively attached to the inner peripheral portions of the curb, and wood trim strips are adhesively attached to the inner peripheral portions of the foam strips. This construction is a light-weight dome type of skylight without a separate frame, and is hence not suited for roof windows.

**[0005]** A further example of related art is WO-A1-98/31896, which relates to an insulation and installation frame for a roof window. An embodiment comprises insulating frame elements provided with reinforcing and supporting strips. A conventional roof window frame can be installed on the installation frame, whereby installation of the roof window is facilitated and insulation of the window construction in the installed position is improved. However, the installation frame is somewhat delicate, and in addition relatively bulky, so there is a risk that the installation frame will be damaged, thereby increasing the cost and time necessary for handling and installation of the frame.

**[0006]** Another insulation and installation frame is described in EP-A1-1 061 199. This document relates to an insulating installation frame for a roof window, where the frame is made up of insulating elements. The installation frame is adapted for attachment to a roof construction, and will provide a seat for the roof window for installation of the roof window. This insulation and installation frame is delicate and subject to damage.

**[0007]** Although these known constructions are all steps in the right direction, they all have some drawbacks and they appear as half measures resulting in sub-optimization of the insulating properties.

**[0008]** It is an object of the present invention to provide a roof window frame with improved insulating properties.

**[0009]** To meet this object, the roof window frame outlined in the introduction is characterized in that the first supporting member of at least the two side parts are secured to a second supporting member along a substantial length of the side parts. The second supporting member makes it possible to provide an integral, self-supporting window frame with improved insulating properties. Hereby a separate insulating and installation frame is not needed, and hence installation of the window frame is facilitated. The window frame can be produced cost efficiently in an automated process to be ready for installation in one operation. Further the resulting integral window frame is also relatively robust compared to the relatively delicate insulating and installation frames discussed above.

**[0010]** In an embodiment of the invention, the second supporting member of the roof window frame, in a mounted position of the frame, is arranged exterior to a building in which the roof window frame is mounted. By arranging the second supporting member, which will typically be made of a material having poor insulating properties, in a region exterior to the building, i.e. remote from the warm interior of the building, the second supporting member will only have a very limited effect on the insulating properties of the window frame. Further the amount of insulating material may be increased in regions that affect the insulating properties of the window frame.

**[0011]** The second supporting member may be made from any suitable high-strength material, e.g. plastics or reinforced plastics, but it is presently preferred that the second supporting member is made of metal, such as a U-shaped steel profile, which will provide a relatively cheap and high-strength member. The U-shape inherently provides favourable strength properties and further allows hinges etc. to be accommodated within the supporting member. Moreover the U-shaped profile provides outer surfaces for attachment of mounting brackets and the like. Alternatively the second supporting member may be massive or for example L-shaped, although such embodiments presently are considered to be less than optimum. The second supporting member will allow the dimension of the first supporting member to be reduced, thereby reducing the effect of heat conduction through the first supporting member, so the effect of the second supporting member as a thermal bridge is reduced. Further the second supporting member will relieve the first supporting member, whereby alternative materials can be used for the first supporting member, e.g. materials of reduced strength and low thermal conductivity, thereby improving the insulating properties of the window frame construction.

**[0012]** To further increase the insulating capabilities of the roof window frame the first supporting member may, on a side facing the opening, carry a second insulating member. The second insulating member may also provide be considered as trim, and may further provide an

abutment face for a lining.

**[0013]** In an embodiment the roof window frame further comprises a slat arranged interior to the first insulating member to facilitate aesthetical building-in of the window frame, e.g. by plaster.

**[0014]** The present invention also relates to a method for manufacturing the window frame outlined above. The method comprises the steps of providing a set of first supporting members, and assembling the first supporting members to sub-frame of first supporting members surrounding an opening, providing a set of second supporting members at a side of the first supporting members opposite the opening along a substantial part of side parts of the window frame, and providing first insulating members at a side of the first supporting members opposite the opening.

**[0015]** In an easily automated embodiment, the step of providing first insulating members is performed by placing the sub-frame in a mould and foam moulding in-situ. This embodiment will especially be advantageous when manufacturing the window frame in relatively large numbers, as the production time per unit can be low, and the cost per unit hence also low. Furthermore a consistent quality can easily be achieved.

**[0016]** In an alternative embodiment, the first insulating members are cut in shape and attached to the first supporting member. This embodiment is particularly attractive when manufacturing relatively small numbers of window frames, as the cost of production tooling is small.

**[0017]** According to an embodiment, the first insulating members are made of polyurethane foam having a density in the range of 100-150 kg/m<sup>3</sup>, which is found to provide advantageous results with regard to insulating properties and this material is easy to use in the production.

**[0018]** In an embodiment a film is provided to the outer surface of the first insulating members to protect the surface of the first insulating members, although it may be superfluous depending on the material of the first insulating members and the environment in which the window frame is installed. If provided, the film would protect the first insulating members from exposure to e.g. moisture, and hence reduce the risk of deterioration of the first insulating members. Further the film would encapsulate the first insulating members and reduce the risk of release of any potentially harmful particles, such as fibres.

**[0019]** In the following the invention will be described in more detail by way of example and with reference to the accompanying drawing, in which:

Fig. 1 is a perspective view of a roof window,  
 Fig. 2 is a cross-sectional view of a prior art installation frame,  
 Fig. 3 is a cross-sectional view of a side part of an embodiment of a window frame according to the invention,  
 Fig. 4 is a cross-sectional view corresponding to Fig. 3 of an alternative embodiment of the invention,  
 Fig. 5 is a cross-sectional view of a side part accord-

ing to another embodiment,

Fig. 6 is a cross-sectional view of a bottom part of a frame according to the invention,

Fig. 7 is a cross-sectional view of a top part,

Fig. 8 is a cross-sectional view of a side part, and

Fig. 9 is a cross-sectional view similar to Fig. 8 with isotherms plotted through the side part.

**[0020]** A roof window is illustrated in perspective in Fig. 1. The roof window comprises a frame 1 and a sash 11 provided with a pane 13.

**[0021]** A prior art window construction is illustrated in Fig. 2, which is a cross-sectional view of a side of the prior art window construction known from EP-B1-0 679 773. This prior art construction comprises a mounting frame 140, which is a sandwich construction comprising a supporting member 103 and an insulating member 104. The mounting frame 140 is secured to the roof rafter 143 by means of a screw 130. The supporting member 103 of the mounting frame 140 is provided with a step 141 for supporting a window frame 102. The window frame 102 is secured to the mounting frame 140 by a screw 109, and a lining 120 is provided.

**[0022]** A window frame construction according to an embodiment of the invention can be seen in the cross-sectional view of Fig. 3 and 4. The window frame 1 side part is a sandwich construction comprising a first insulating member 4 attached to a first supporting member 3. Commonly the window frame side parts are loaded more than the top and bottom frame parts, and further the space available for insulating material at the side parts is relatively restricted compared to the situation at the top and bottom parts, and hence the side parts normally have the greatest influence on the overall insulating property of the window frame.

**[0023]** The first insulating member 4 is arranged to a side of the first supporting member 3 opposite the window frame opening. Typically the first insulating member 4 consists of a foam material, such as polyurethane foam. Polyurethane foam having a density of 110-120 kg/m<sup>3</sup> was used with favourable result in a prototype of the invention. The skilled person will however appreciate that other suitable materials for the first insulating member include common insulating materials, such as stone wool, glass wool or the like. For the first supporting member 3, it is presently preferred to use plywood, which is a suitably strong and relatively cheap material, although other materials could be envisaged, such as plastic materials, wood, fibre board etc. A board of plywood having a thickness of approximately 6-7 mm and a height of for example approximately 150 mm will normally provide a first supporting member 3 of sufficient thickness.

**[0024]** The frame 1 further comprises an outwardly open U-shaped steel profile doing duty as a second supporting member 5 attached to the first supporting member 3. The second supporting member 5 is the primary supporting member of the frame 1 at the side parts and is arranged at the outer side of the frame in a frame region,

which in the mounted state of the frame on a roof construction of a building is situated exterior to the building. The second supporting members extend for a substantial length of the side parts, such as at least 50% of the length of the side parts, at least 80%, or even 100%. The relative length of the second supporting member can be chosen dependent on the size and load of the window frame, as a large window frame carrying a heavy window sash will normally require a large relative length of the second supporting member, whereas a small window frame carrying a light window sash may require only a small relative length of the second supporting member. Suitable dimensions of the U-shaped profile made of 2 mm steel plate is a height of approximately 60 mm and a width of approximately 25-27 mm.

**[0025]** The second supporting member 5 can be used for anchoring of mounting brackets (not shown) for installation to a roof structure of a building. The cavity 7 of the second supporting member 5 can advantageously accommodate a pivot hinge (not shown) for a moveable window sash.

**[0026]** On the side of the first supporting member 3 facing the opening of the window frame 1, the first supporting member 3 carries a second insulating member 2. The second insulating member 2 may be a board of wood as illustrated in Fig. 3 or alternatively a board comprising a hard outer shell 9 of a plastic material, such as high density polyurethane, filled with an insulating core 10 of low density polyurethane foam. Common to the embodiments of the insulating member 2 illustrated in Fig. 3 and 4 is that the member 2 comprises a groove 8 adapted for receiving a key of a lining for the opening.

**[0027]** As illustrated a slat 6 may be arranged to the interior side of the frame 1 at the first insulating member 4 to provide a suitable surface for plaster, if considered necessary or convenient.

**[0028]** Fig. 5 illustrates a similar, but slightly different embodiment of the frame 1 in a cross-sectional view of a side part thereof. The frame 1 is shown with a sash 11 carrying an insulating pane 13 covering the opening 12 of the frame 1. A collar 14 is provided for connection to an underroof. A covering 15 is arranged to cover the outer surface of the sash 11 and frame 1.

**[0029]** A bottom part of the frame 1 and sash 11 is seen in cross-sectional view in Fig. 6. The bottom part comprises a first insulating member 4, a first supporting member 3 and a second insulating member 2. A second supporting member will normally not be necessary to provide a frame bottom part of sufficient strength, but can of course be provided if it is considered convenient. The bottom part may be provided as a massive part or a sort of sandwich construction as illustrated.

**[0030]** A top part of the frame 1 and sash 11 is seen in cross-section in Fig. 7. The top part comprises a first insulating member 4, a first supporting member 3 and a second insulating member 2. A second supporting member will normally not be necessary to provide a frame top part of sufficient strength, but can of course be provided

if it is considered convenient. The top part may be provided as a massive part or a sort of sandwich construction as illustrated. A housing 14 for a roller shutter 15 may be integrated at the frame top part, and a guiding rail 16 may be arranged for guiding the roller shutter 15. Such a roller shutter 15 may be provided initially or be retrofitted to an installed window.

**[0031]** Fig. 8 is a cross-sectional view of a side part of a window frame

1. The second supporting member 7 may accommodate a spring 18 serving as lifting assistance means for the sash. The spring 18 is well protected in the U-shaped steel profile, and hidden, so the spring 18 does not negatively affect the appearance of the window.

**[0032]** A plot of isotherms 17 in a cross-sectional view of a side part of the window can be seen in Fig. 9. It is evident to the skilled person that the isotherms 17 follow advantageous paths. The second supporting member 7 is positioned in an exterior region of the frame 1, i.e. a relatively cold region of the construction, and hence the relatively poor insulating properties of the second supporting member 7 does not influence the insulating properties of the window construction negatively in any serious degree. This is illustrated by the relatively smooth course of the isotherms in the first insulating member 4.

## Claims

1. A roof window frame (1) having top, bottom and side parts surrounding an opening, which side parts are made up as a sandwich construction comprising a first insulating member (4) secured to a first supporting member (3) on a side opposite the opening, **characterized in that** the first supporting member (3) is secured to a second supporting member (5) along a substantial length of the side parts.
2. A roof window frame (1) according to claim 1, wherein the second supporting member (5) of the roof window frame (1), in a mounted position of the frame, is arranged exterior to a building in which the roof window frame (1) is mounted.
3. A roof window frame (1) according to claim 1 or 2, wherein the second supporting member (5) is made of metal, such as a U-shaped steel profile.
4. A roof window frame (1) according to any of the claims above, wherein the first supporting member (3), on a side facing the opening, carries a second insulating member (2).
5. A roof window frame (1) according to any of the claims above, further comprising a slat (6) arranged

interior to the first insulating member (4).

6. A method for manufacturing a window frame according to any of the claims above, **characterized in that** the method comprises the steps of providing a set of first supporting members, and assembling the first supporting members to sub-frame of first supporting members surrounding an opening, providing a set of second supporting members at a side of the first supporting members opposite the opening along a substantial part of side parts of the window frame, and providing first insulating members at a side of the first supporting members opposite the opening.
7. A method according to claim 6, wherein the step of providing first insulating members is performed by placing the sub-frame in a mould and foam moulding in-situ.
8. A method according to claim 6, wherein the first insulating members are cut in shape and attached to the first supporting member.
9. A method according to any of the claims 6-8, wherein the first insulating members are made of polyurethane foam having a density in the range of 100-150 kg/m<sup>3</sup>.
10. A method according to any of the claims 6-9, wherein a film is provided to the outer surface of the first insulating members.

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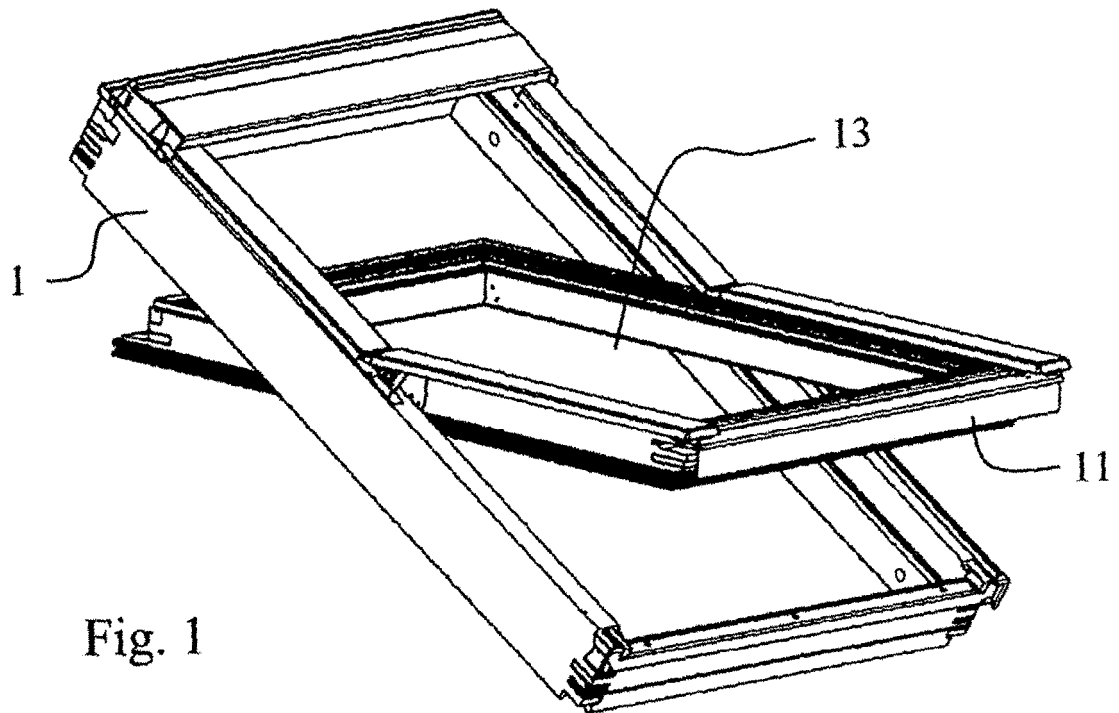


Fig. 1

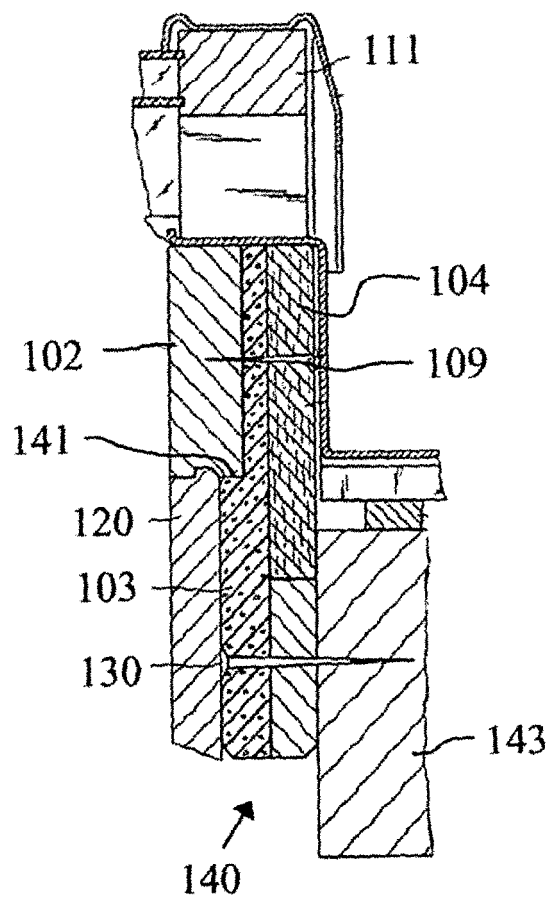


Fig. 2  
(Prior art)

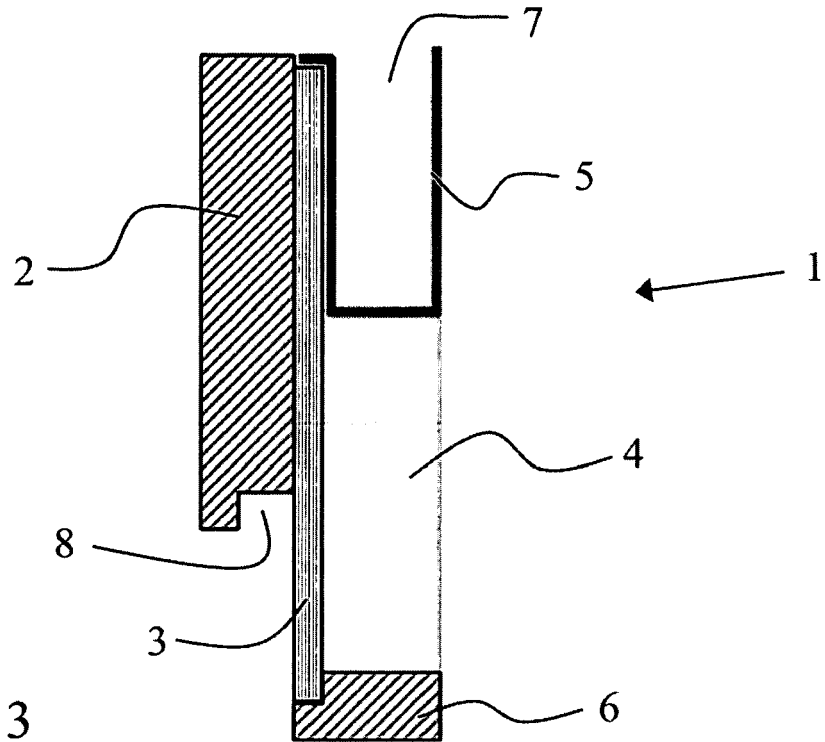


Fig. 3

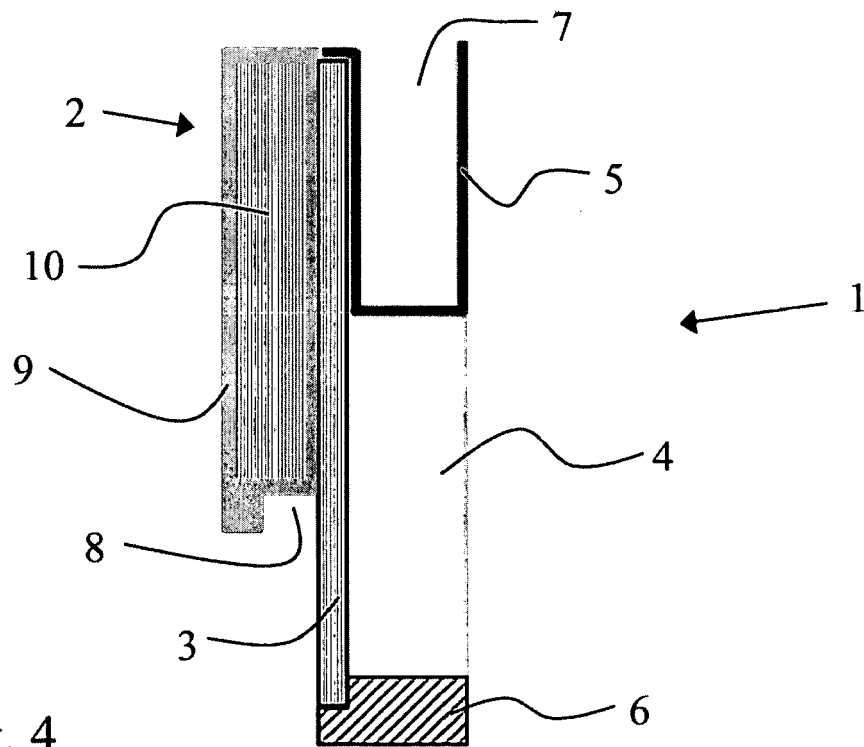
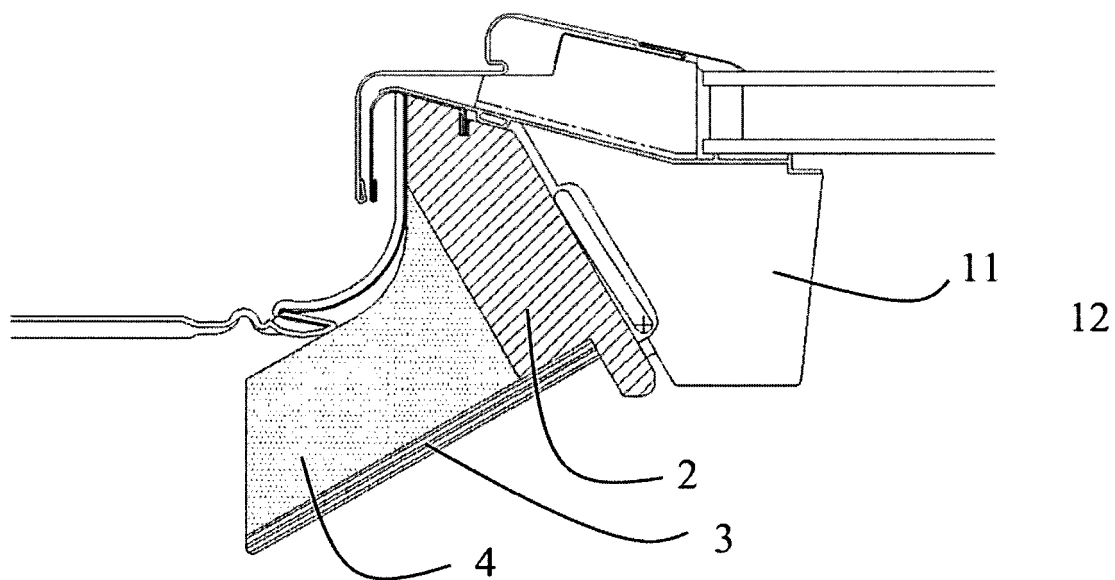
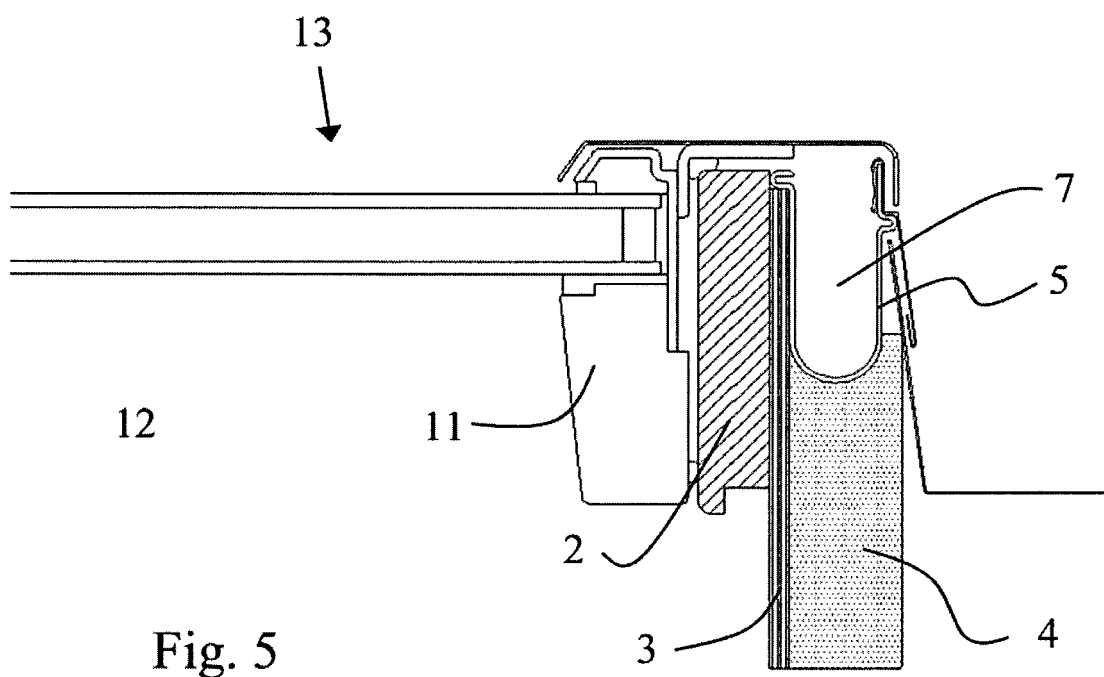


Fig. 4



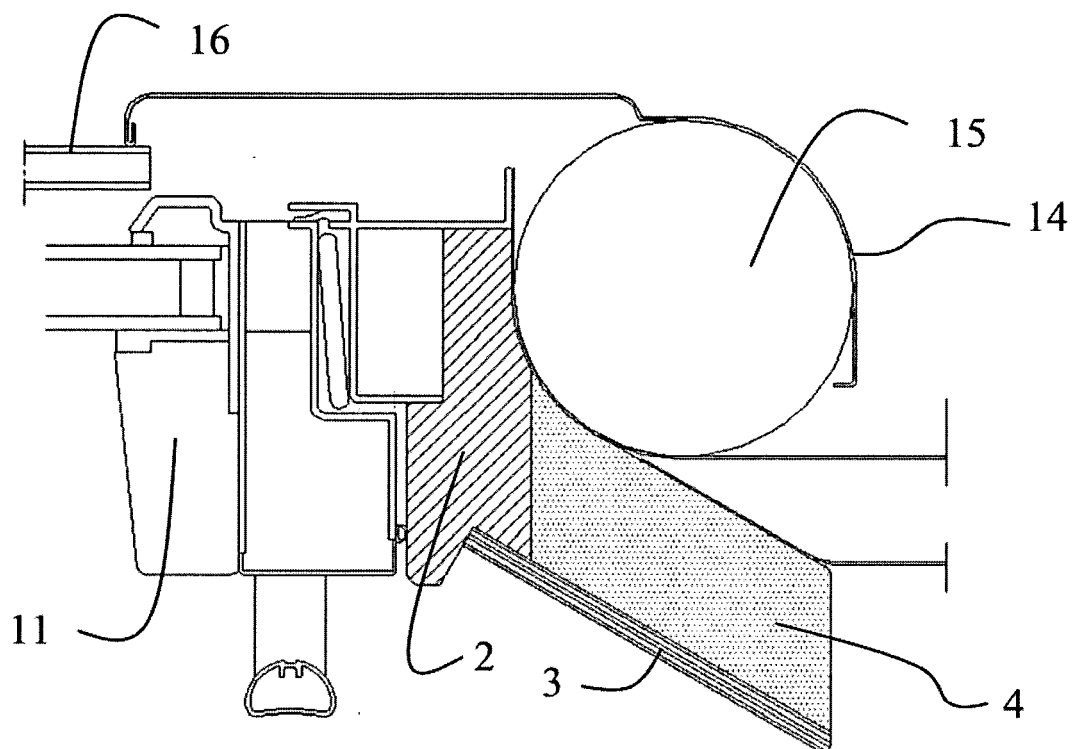


Fig. 7

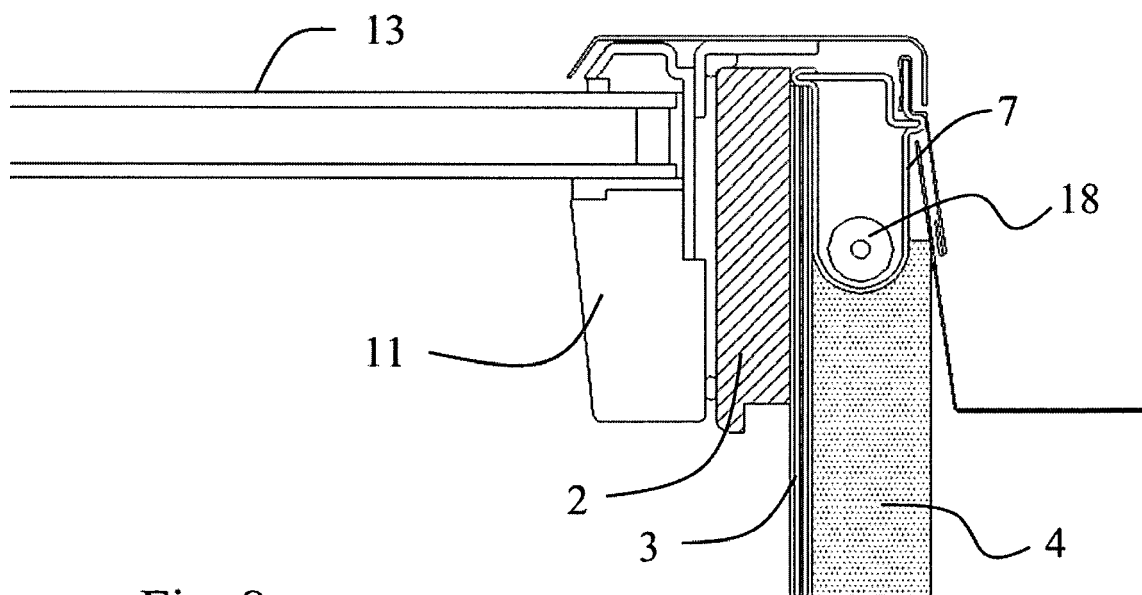


Fig. 8

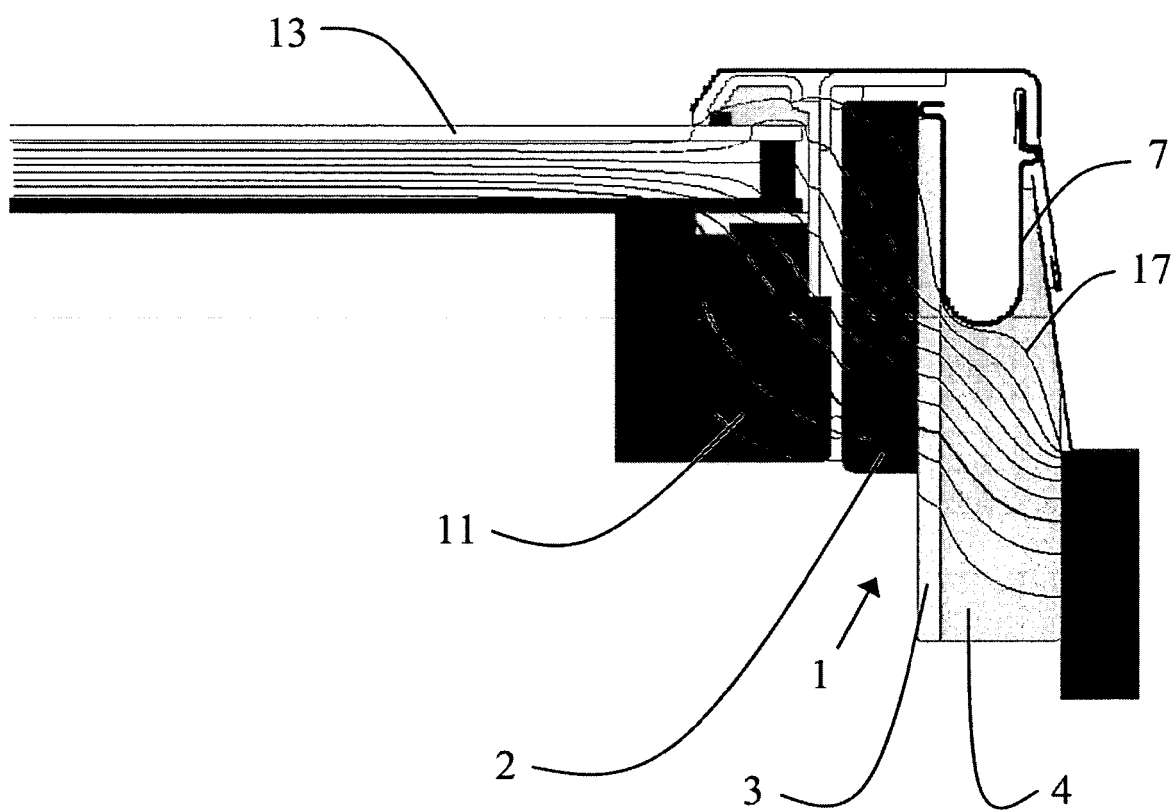


Fig. 9



European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 05 38 8077

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	FR 2 697 272 A (HARAS STE INDUSTRIELLE) 29 April 1994 (1994-04-29) * page 2, line 28 - page 3, last line ; figures *	1-3,6,8, 9	E04D13/03
D,X	US 6 052 956 A (HOY ET AL) 25 April 2000 (2000-04-25) * column 2, line 30 - line 34; figures *	1,2,4-6, 8,9	
X	US 3 417 527 A (KIEKHAEFER ELMER C) 24 December 1968 (1968-12-24) * column 1, line 45 - line 54; figures *	1-3,6,7, 9	
D,X	EP 0 679 773 A (ROTO FRANK AKTIENGESELLSCHAFT) 2 November 1995 (1995-11-02) * column 3, line 35 - line 51; figure 1 *	1,2,5	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 January 2006	Examiner Demeester, J
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EPO FORM 1503 03.82 (P04C01)

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

EP 05 38 8077

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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24-01-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2697272	A	29-04-1994	NONE	
US 6052956	A	25-04-2000	US 6263624 B1	24-07-2001
US 3417527	A	24-12-1968	NONE	
EP 0679773	A	02-11-1995	AT 187790 T	15-01-2000
			DE 9406932 U1	16-06-1994
			DK 679773 T3	29-05-2000

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- EP 0679773 B1 [0003] [0021]
- US 6263624 B [0004]
- WO 9831896 A1 [0005]
- EP 1061199 A1 [0006]