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(54) AN INSULATOR ELEMENT

(57) An insulated door system (1) comprises a plurality of door panel elements (2), a plurality of different types of insulator elements (3, 4, 5, 6, 7), two side guide elements (8), an upper guide element (9), and a lower sealing element (10). The first type of insulator element (3) is located in the junction area (14) between an upper door panel element (2) and a lower door panel element (2). The second type of insulator element (4) comprises a first insulator member (15) and a second insulator member (16). The first insulator member (15) has a main body part (19) and two protruding finger parts (20, 21). The main body part (19) of the first insulator member (15) and the second insulator member (16) are located between a door panel element (2) and a support element (22). One of the protruding finger parts (21) of the first insulator member (15) is located between the door panel element (2) and one of the side guide elements (8). The other protruding finger part (20) of the first insulator member (15) is located between the side guide element (8) and the support element (22). One third insulator element (5) is mounted to each side of each door panel element (2). The fourth insulator element (6) is mounted to an upper surface (26) of the uppermost door panel element (2). The fifth insulator element (7) is mounted to a lower surface (30) of the lowermost door panel element (2).

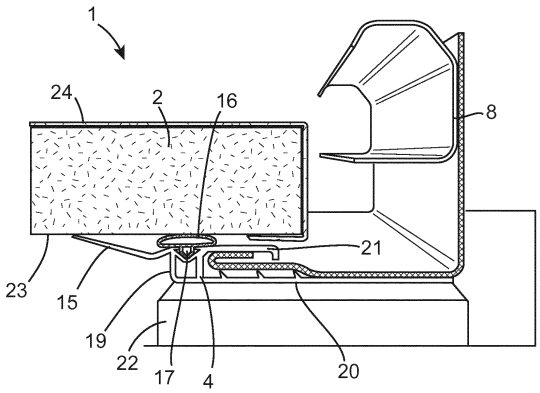

Fig. 4

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Description

Introduction

[0001] This invention relates to an insulator element. The invention also relates to an insulated door system comprising a plurality of door panel elements and a plurality of insulator elements.

Summary of Invention

[0002] According to the invention there is provided an insulator element to minimise both heat transfer and air permeability through a first panel element. The invention provides both thermal break and reduced air permeability. The insulator element improves the thermal efficiency of the first panel element and reduces the air leakage through the first panel element. The insulator element may be included as part of an insulated garage door, for example as part of a domestic garage door or as part of an industrial door. The insulator element breaks the thermal bridge between the outside of the installed garage door and the inside of the garage to minimise conduction. The insulator element results in the garage door being more air impermeable.

[0003] In one embodiment of the invention at least part of the insulator element is locatable in a junction area between a first panel element and a second panel element. Preferably at least part of the insulator element is compressible. Ideally the insulator element comprises a compression seal element.

[0004] In another embodiment a first part of the insulator element is locatable between a first panel element and a support element. In this manner the insulator element breaks the thermal bridge between the first panel element and the support element, such as a concrete wall. Preferably a second part of the insulator element is locatable between a first panel element and a guide element. In this manner the insulator element breaks the thermal bridge between the first panel element and the guide element, such as a metallic guide rail. Ideally a third part of the insulator element is locatable between a guide element and a support element. In this manner the insulator element breaks the thermal bridge between the guide element and the support element. Most preferably the insulator element comprises a first insulator member and a second insulator member. The first insulator member may be mountable to the second insulator member. Preferably the second insulator member is engagable against a surface of a first panel element. Ideally the second insulator member is engagable against an internal surface of a first panel element. Most preferably the first insulator member is substantially rigid. At least part of the second insulator member may be compressible.

[0005] In one case the insulator element is mountable to a first panel element. Preferably at least part of the insulator element is locatable extending across at least part of a side surface of a first panel element. In this manner the insulator element breaks the thermal bridge between the side surface of the first panel element guide element and an adjacent support element or an adjacent guide element. Ideally at least part of the insulator element is locatable extending across at least part of an external surface of a first panel element. Most preferably at least part of the insulator element is locatable extending across at least part of an internal surface of a first panel element. At least part of the insulator element may be extendable from an external surface of a first panel element across at least part of a side surface of the first panel element to an internal surface of the first panel element. Preferably the insulator element comprises a side cap element.

[0006] In another case at least part of the insulator element is locatable extending across at least part of an upper surface of a first panel element. In this manner the insulator element breaks the thermal bridge between the upper surface of the first panel element guide element and an adjacent support element or an adjacent guide element. Preferably at least part of the insulator element is extendable from an external surface of a first panel element across at least part of an upper surface of the first panel element to an internal surface of the first panel element. Ideally the insulator element comprises an upper cap element. Most preferably the insulator element comprises one or more protrusions. The protrusion may be extendable away from an upper surface of a first panel element. Preferably the protrusion comprises a neck part and a head part. Ideally the neck part is substantially perpendicular to the head part.

[0007] In one embodiment at least part of the insulator element is locatable extending across at least part of a lower surface of a first panel element. In this manner the insulator element breaks the thermal bridge between the lower surface of the first panel element guide element and an adjacent support element such as the ground. Preferably at least part of the insulator element is extendable from an external surface of a first panel element across at least part of a lower surface of the first panel element to an internal surface of the first panel element. Ideally the insulator element comprises a lower cap element.

[0008] In another embodiment at least part of the insulator element is engagable with a sealing element. Preferably at least part of the insulator element is engagable with a lower sealing element. The lower sealing element reduces the air leakage in the gap between the lower surface of the first panel element and the ground.

[0009] In one case the insulator element comprises a polymeric material. Preferably the insulator element comprises polythermalyne. Polythermalyne is a brand name. It will be appreciated that the insulator element may be provided by

any suitable material, for example a plasticised component that replaces the normal steel component and thus provides a thermal break, such as PVC or a similar plastic material. The insulator element may comprise a foam.

[0010] The invention also provides in another aspect an insulator system comprising one or more insulator elements of the invention. One of these insulator elements may be the same or different to another one of these insulator elements.

[0011] In one embodiment of the invention the insulator system comprises a first panel element. Preferably the insulator system comprises a second panel element. Ideally the first panel element is connectable to the second panel element. Most preferably the insulator system comprises a junction area between the first panel element and the second panel element. The first panel element may be movable relative to the second panel element between a closed configuration and an open configuration. Preferably the insulator element is at least partially locatable in the junction area in both the closed configuration and the open configuration. In this manner the insulator element improves the thermal efficiency of the two panel elements and reduces the air leakage through the junction area between the two panel element in both the closed configuration and the open configuration.

[0012] In another embodiment the insulator system comprises a guide element, such as a metallic guide rail.

[0013] In one case the insulator system comprises a sealing element. Preferably the sealing element is mountable to the insulator element. Ideally a lower surface of the sealing element is engagable with the ground. The sealing element reduces the air leakage in the gap between the lower surface of the lowest panel element and the ground. Most preferably the sealing element comprises a polymeric material. The sealing element may comprise EPDM.

[0014] In another case the first panel element comprises a door panel element. The invention may provide an insulated door system. The door may be a domestic garage door or an industrial door.

[0015] In one embodiment the first panel element comprises a composite insulating panel element. Preferably the first panel element comprises an external sheet, an internal sheet, and an insulating body between the external sheet and the internal sheet. Ideally the insulating body comprises a foam. The foam may comprise a polyurethane foam. The foam may comprise an isophenic (IPN) foam.

[0016] In one embodiment, there is provided an insulated door system comprising a plurality of door panel elements and a plurality of insulator elements to minimise heat transfer and/or air permeability through the door panel elements and further, comprising:

a first insulator element located in a junction area between a first door panel element and a second door panel element of the plurality of door panel elements;
a second insulator element having a first part located between a first door panel element of the plurality of door panel elements and a support element;
a third insulator element, wherein at least part of the third insulator element extends across at least part of a side surface of the first door panel element;
a fourth insulator element, wherein at least part of the fourth insulator element extends across at least part of an upper surface of an uppermost door panel element; and
a fifth insulator element, wherein at least part of the fifth insulator element extends across at least part of a lower surface of a lowermost door panel element;

such that thermal bridges between the outside of the door system and the inside of the door system are broken between, and around the perimeter of, each of the door panel elements.

[0017] Providing insulator elements at each of these locations in combination ensures that optimal thermal efficiency and air impermeability are achieved.

Brief Description of the Drawings

[0018] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is an isometric view of an insulated door system according to the invention,

Fig. 2 is an enlarged cross-sectional side view of two panel elements of the insulated door system of Fig. 1,

Fig. 2bis is an enlarged cross-sectional side view of two panel elements of another insulated door system according to the invention,

Fig. 3 is an enlarged isometric view of an insulator element of the insulated door system of Fig. 1,

Fig. 4 is an enlarged cut-away isometric view from above of the insulator element of Fig. 3 and a panel element of

the insulated door system of Fig. 1, in use,

Fig. 5 is an enlarged isometric view of two other insulator elements of the insulated door system of Fig. 1,

Fig. 6 is an enlarged cross-sectional plan view of one of the insulator elements of Fig. 5 and a panel element of the insulated door system of Fig. 1, in use,

Fig. 7 is an enlarged isometric view of another insulator element of the insulated door system of Fig. 1,

Fig. 8 is an enlarged cut-away isometric view from the side of the insulator element of Fig. 7 and a panel element of the insulated door system of Fig. 1, in use,

Fig. 9 is an enlarged isometric view of another insulator element of the insulated door system of Fig. 1,

Fig. 10 is an enlarged cut-away isometric view from the side of the insulator element of Fig. 9 and a panel element of the insulated door system of Fig. 1, in use,

Fig. 11 is an enlarged isometric view of an insulator element of another insulated door system according to the invention,

Fig. 12 is an enlarged cut-away isometric view from the side of the insulator element of Fig. 11 and a panel element of the insulated door system, in use,

Fig. 13 is an enlarged cross-sectional plan view of an insulator element and a panel element of an insulated door system according to an embodiment of the invention,

Fig. 14 is an enlarged cross-sectional plan view of an insulator element and a panel element of an insulated door system according to another embodiment of the invention,

Fig. 15 is an enlarged cross-sectional side view of an insulator element and a panel element of an insulated door system according to an embodiment of the invention,

Fig. 16 is an enlarged cross-sectional side view of an insulator element and a panel element of an insulated door system according to an embodiment of the invention, and

Fig. 17 is an enlarged cross-sectional side view of an insulator element and a panel element of an insulated door system according to an embodiment of the invention.

Detailed Description

[0019] Referring to the drawings, and initially to Figs. 1 to 10 thereof, there is illustrated an insulated door system 1 according to the invention. The insulated door system 1 comprises a plurality of door panel elements 2, a plurality of different types of insulator elements 3, 4, 5, 6, 7, two side guide elements 8, an upper guide element 9, and a lower sealing element 10.

[0020] Each door panel element 2 is provided in the form of a composite insulating door panel element. Each door panel element 2 comprises a profiled external sheet 11, a profiled internal sheet 12, and an insulating body 13 between the external sheet 11 and the internal sheet 12 (Fig. 2). The insulating body 13 comprises a foam, for example a polyurethane foam or an isophenic (IPN) foam.

[0021] Each door panel element 2 is connected to an adjacent door panel element 2 (Fig. 2). The insulated door system 1 comprises a junction area 14 between each pair of adjacent door panel elements 2. The upper door panel element 2 is movable relative to the lower door panel element 2 in a pivoting manner between a closed configuration (Fig. 2) and an open configuration to facilitate raising and lowering of the plurality of door panel elements 2.

[0022] The first type of insulator element 3 is located in the junction area 14 between the upper door panel element 2 and the lower door panel element 2 in both the closed configuration (Fig. 2) and in the open configuration. The first insulator element 3 is compressible. In this case the first insulator element 3 is provided in the form of a compression seal element. The insulated door system 1 includes one of these first insulator elements 3 in each junction area 14 between each pair of adjacent door panel elements 2.

[0023] The first insulator element 3 is provided in the form of a foam material.

[0024] The compression seal element 3 (Fig. 2) acts to minimise air permeability though the panel elements 2 and also acts as a thermal break.

[0025] It will be appreciated that the first insulator element 3 of the invention is suitable for use with a plurality of different types of panel elements 2, with different shapes, with different profiles, and with different configurations for the junction area 14, as illustrated in Fig. 2bis.

[0026] The second type of insulator element 4 comprises a first insulator member 15 and a second insulator member 16 (Fig. 3). The second insulator member 16 has a male protrusion 17 and the first insulator member 15 has a corresponding female recess 18. In this manner the first insulator member 15 is mountable to the second insulator member 16. In this case the first insulator member 15 is substantially rigid, and the second insulator member 16 is compressible.

[0027] The first insulator member 15 has a main body part 19 and two protruding finger parts 20, 21. In use, the main body part 19 of the first insulator member 15 and the second insulator member 16 are located between a door panel element 2 and a support element 22 (Fig. 4). The support element 22 may be a concrete wall adjacent to the doorway. The second insulator member 16 engages against an external surface 23 of the door panel element 2. One of the protruding finger parts 21 of the first insulator member 15 is located between the door panel element 2 and one of the side guide elements 8. The other protruding finger part 20 of the first insulator member 15 is located between the side guide element 8 and the support element 22.

[0028] Both the first insulator member 15 and the second insulator member 16 extend along the full height of the plurality of door panel elements 2.

[0029] Both the first insulator member 15 and the second insulator member 16 are provided in the form of a polymeric material, such as polythermalyne.

[0030] In this case the third type of insulator element 5 is provided in the form of a side cap element (Fig. 5). In use, one third insulator element 5 is mounted to each side of each door panel element 2 (Fig. 6). The third insulator element 5 extends across part of an internal surface 24 of the door panel element 2, extends across the full thickness of a side surface 25 of the door panel element 2, and extends across part of the external surface 23 of the door panel element 2. In particular the third insulator element 5 extends from the internal surface 24 of the door panel element 2 across the side surface 25 of the door panel element 2 to the external surface 23 of the door panel element 2.

[0031] The third insulator element 5 extends along the full height of the plurality of door panel elements 2.

[0032] The third insulator element 5 is provided in the form of a polymeric material, such as polythermalyne.

[0033] In this case the fourth type of insulator element 6 is provided in the form of an upper cap element (Fig. 7). The fourth insulator element 6 comprises a plurality of protrusions 27. Each protrusion 27 comprises a neck part 28 and a head part 29. Each neck part 28 is arranged substantially perpendicular to each corresponding head part 29.

[0034] In use, the fourth insulator element 6 is mounted to an upper surface 26 of the uppermost door panel element 2 (Fig. 8). The neck part 28 of each protrusion 27 extends away from the upper surface 26 of the uppermost door panel element 2. The fourth insulator element 6 extends across part of the internal surface 24 of the uppermost door panel element 2, extends across the full thickness of the upper surface 26 of the uppermost door panel element 2, and extends across part of the external surface 23 of the uppermost door panel element 2. In particular the fourth insulator element 6 extends from the internal surface 24 of the uppermost door panel element 2 across the upper surface 26 of the uppermost door panel element 2 to the external surface 23 of the uppermost door panel element 2.

[0035] The fourth insulator element 6 extends along the full width of the uppermost door panel element 2.

[0036] The fourth insulator element 6 is provided in the form of a polymeric material, such as polythermalyne.

[0037] Similarly the fifth type of insulator element 7 is provided in the form of a lower cap element (Fig. 9). The fifth insulator element 7 comprises a plurality of protrusions 27. Each protrusion 27 comprises a neck part 28 and a head part 29. Each neck part 28 is arranged substantially perpendicular to each corresponding head part 29.

[0038] In use, the fifth insulator element 7 is mounted to a lower surface 30 of the lowermost door panel element 2 (Fig. 10). The neck part 28 of each protrusion 27 extends away from the lower surface 30 of the lowermost door panel element 2. The fifth insulator element 7 extends across part of the internal surface 24 of the lowermost door panel element 2, extends across the full thickness of the lower surface 30 of the lowermost door panel element 2, and extends across part of the external surface 23 of the lowermost door panel element 2. In particular the fifth insulator element 7 extends from the internal surface 24 of the lowermost door panel element 2 across the lower surface 30 of the lowermost door panel element 2 to the external surface 23 of the lowermost door panel element 2.

[0039] The fifth insulator element 7 extends along the full width of the lowermost door panel element 2.

[0040] The fifth insulator element 7 is provided in the form of a polymeric material, such as polythermalyne.

[0041] A lower surface 31 of the lower sealing element 10 is engagable with the ground 32. Two of the protrusions 27 of the fifth insulator element 7 are engagable with the lower sealing element 10 to mount the lower sealing element 10 to the fifth insulator element 7 (Fig. 10).

[0042] The lower sealing element 10 is provided in the form of a polymeric material, such as EPDM.

[0043] Each of the first insulator elements 3, the two second insulator elements 4, the two third insulator elements 5, the fourth insulator element 6, and the fifth insulator element 7 act to minimise both heat transfer and air permeability

through the plurality of door panel elements 2.

[0044] The invention improves the thermal efficiency and reduces air leakage which are both critical aspects in products designed for modern living and both must be addressed equally. The invention provides a sectional door 1 suitable for industrial and commercial applications. The doorleaf is fully thermally broken so that there are no more conduction/thermal-bridges between outside of the installed door 1 and inside of the garage. The door 1 may be 300% more air impermeable than a standard sectional door. Watertightness of the door 1 is also substantially improved.

[0045] The sectional door 1 has a fully thermally-broken door leaf and frame. The sectional door components enable such air permeability performance. The kit of components 3, 4, 5, 6, 7 for a the insulated door 1 may enable an air-permeability classification 4 to be achieved and a U value to be improved by up to 22% with improved insulation performance.

[0046] Air-permeability is the amount of airflow which can pass through the door leaf, in principle through the panel joints, the sides, the top and bottom of the door. The U value of a material is a measure of the amount of heat that passes through a surface area of 1 m^2 for each degree of temperature difference between the inside and outside. Therefore, the lower the U value, the more energy-efficient the material is. The U value is a function of the thickness of the material and the materials' thermal conductivity. To properly calculate the U value of a sectional door, one needs to take into account not only the U value of a sectional door panel but also to include the panel joints, sides seals and any other places that the heat can be conducted through an assembled door.

[0047] The invention improves the thermal performance of the sectional door 1 by taking into account both: the U value of the door as a whole, and its air-permeability performance.

[0048] The invention includes the panel 2, which may have any suitable thickness for example 40 mm, achieving the best values in terms of energy efficiency (U value) thanks to the foam technology, the panel joints design with the duo-shell panel concept with the double sealing system which eliminates cold bridging, and the components 3, 4, 5, 6, 7.

[0049] In the invention highly conductive materials such as steel and aluminium have been replaced by high-quality polythermalyne profiles 4, 5 and endcaps 6, 7, thereby substantially reducing thermal bridging which is cold/heat transfer. The side seal 4 minimises the air leakage and cold bridging through the door frame.

[0050] The panel foam technology ensures minimum thermal conductivity. Thermal conductivity through the panel joint is reduced due to the duo-shell panel concept. The panel joints ensure a thermal breaking between the internal 12 and external 11 sheets of the panel 2. The double seals system provides enhanced air-tightness on the panel joints. The duo-shell panel design together with the high-performing insulation foam core gives an outstanding thermal performance to the sectional door 1.

[0051] The side weatherseal 4 placed on the vertical angles and the lintel eliminates the thermal bridging created by the contact with the building's cold surfaces 22, for example wall, concrete, steel etc. The compression seal 16 placed into the weatherseal 4 improves air-tightness.

[0052] The endcaps 5 are placed to the left and right of each section 2 of the door, eliminating the cold bridging between the internal and external side of the panel 2. Placed at the base 30 of the bottom panel 2, component 51 eliminates cold bridging between the interior and exterior of the door 1. The bottom seal 10 is slid into the bottom profile 51, it greatly reduces air-permeability beneath the door 1.

[0053] Placed at the bottom 30 or at the top section 26 of the door 1 of which the bottom or top joint of the panel 2 has been cut; the polythermalyne profile 6, 7 also eliminates cold bridging.

[0054] The following table illustrates the performance comparison with or without the components 3, 4, 5, 6, 7.

Table 1: Comparison table of the U value for residential garage doors and industrial doors based on 40 mm duo-shell panel and components. *Indicative values.

Residential doors : EasyClick 200 / EasyClick 70				Industrial doors		
Door opening mm (LxH)	2500 x 2000	3000 x 2125	4500 x 3000	3000 x 3000	4000 x 4000	4500 x4500
U value (W/m^2K)						
WITHOUT components 3, 4, 5, 6, 7	1,23	1,15	1,06	1,14	1,04	1
WITH components 3, 4,5,6,7	0,99	0,94	0,84	0,89	0,85	0,83
Improvement	20%	18%	20%	22%	18%	17%

(continued)

U value (W/m^2K)						
Mono-shell panel 60 mm*	1,10	1,02	0,92	1,01	0,91	0,87

Table 2: Comparison table for air-permeability for residential garage doors and industrial doors based on 40 mm duo-shell panel and components. Air-permeability Δp at a pressure of 50 Pa [m3/m2h] - class 2 $\leq$ 12 m3/m2h - class 4 $\leq$ 3m3/m2h loss of air through the door. *Indicative values.

Air-permeability						
WITHOUT components3, 4,5,6,7	Classe 2	Classe 2	Classe 2	Classe 2	Classe 2	Classe 2
WITH components3, 4, 5, 6,7	Classe 4	Classe 4	Classe 4	Classe 4	Classe 4	Classe 4
Improvement	300%	300%	300%	300%	300%	300%
Mono-shell panel 60 mm*	Classe 2	Classe 2	Classe 2	Classe 2	Classe 2	Classe 2

[0055] The invention achieves a sectional door 1 with enhanced thermal performance (U value) and enhanced air-permeability class. The invention is suitable for residential garage doors and industrial doors for all lift types.

[0056] In Figs. 11 to 12 there is illustrated another insulated door system 50 according to the invention, which is similar to the insulated door system 1 of Figs. 1 to 10, and similar elements in Figs. 11 to 12 are assigned the same reference numerals.

[0057] In this case the fifth type of insulator element 51 is provided in the form of a frusto conical tube with an opening 52 at the lower side (Fig. 11). The fifth insulator element 51 has two inwardly protruding fingers 53 at either side of the opening 52.

[0058] In use, the fifth insulator element 51 is mounted to the lower surface 30 of the lowermost door panel element 2 (Fig. 12). The fifth insulator element 51 extends across only part of the lower surface 30 of the lowermost door panel element 2. The fifth insulator element 51 does not extend across the internal surface 24 of the lowermost door panel element 2, and does not extend across the external surface 23 of the lowermost door panel element 2.

[0059] The fifth insulator element 51 extends along the full width of the lowermost door panel element 2.

[0060] The fifth insulator element 51 is provided in the form of a polymeric material, such as polythermalyne.

[0061] The two inwardly protruding fingers 53 of the fifth insulator element 51 are engagable with the lower sealing element 10 to mount the lower sealing element 10 to the fifth insulator element 51 (Fig. 12).

[0062] Figures 13 and 14 illustrate a side cap insulator element 5 mounted to a side surface of a door panel element 2. As in Figure 6, the insulator element 5 extends across part of an internal surface 24 of the door panel element 2, extends across the full thickness of a side surface 25 of the door panel element 3 and extends across part of the external surface 23 of the door panel element 2. The side cap insulator element 5 extends along the full height of the plurality of door panel elements 2. As in Figures 5 and 6, the side cap insulator element 5 is provided in the form of a polymeric material, such as PVC, or polythermalyne.

[0063] Traditionally, sectional doors are provided with steel endcaps on either side of the door panel elements, extending along the full height of the sectional door. Typically, the fixings required to mount the door in a door frame, such as the roller carrier and top and bottom brackets are attached to the steel endcaps. With the present invention, the steel endcaps are replaced with side cap insulator elements formed from a polymeric material. While the use of insulating endcaps has significant advantages in terms of creating a thermal break between the outer and inner surfaces of the door panel, the polymeric materials used are not typically as strong as steel. For small doors, this is not usually a problem, but for larger doors, a steel attachment point is preferable.

[0064] The present invention provides a cover endcap 60 which is mounted to the door panel element 2 outside the side cap insulator element 5. The cover endcap 60 is typically made from steel. To assemble, the side cap insulating member 5 is fitted within the steel cover endcap 60 and the assembly is fitted to the door panel element in the same way as a standard endcap. In certain embodiments, as shown in Figure 13, the steel endcap extends further along the

inner surface of the door panel element 2 than the side cap insulator element 5, and in this embodiment, an extension insulator element 5' is provided.

[0065] This arrangement has the advantages associated with steel endcaps in that it has sufficient strength to allow roller carriers to be attached to the endcaps, even for large doorleaf sizes. However, it also maintains a thermal break between the inner and outer surfaces of the panel, due to the side cap insulator element.

[0066] As set out above, the various insulator elements of the present invention may be formed from a polymeric insulating material. For standard-thickness door panels (typically 40mm), this can be achieved at a reasonable cost. However, for thicker panels (60mm or 80mm), while polymeric insulating members may also be desirable, it may be more cost effective to provide an alternative, more cost-effective arrangement.

[0067] Figure 15 illustrates a lower cap insulator element 61 for a double-thickness door panel. As in Figure 10, the insulator element 61 comprises a plurality of protrusions 62. Each protrusion 62 comprises a neck part 63 and a head part 64. Each neck part 63 is arranged substantially perpendicular to each corresponding head part 64. In use, the lower cap insulator element is mounted to a lower surface 30 of the lowermost door panel element 2. The neck part 63 of each protrusion 62 extends away from the lower surface 30 of the lowermost door panel element 2. The lower cap insulator element 61 extends from the internal surface 24 of the lowermost door panel element 2, across the lower surface 30 of the lowermost door panel element to the external surface 23 of the lowermost door panel element 2.

[0068] The lower cap insulator element 61 extends along the full width of the lowermost door panel element 2. Lower surfaces 31 of lower sealing elements 10 are engageable with the ground 32. Two of the protrusions 62 of the lower cap insulator element 61 are engageable with each of the lower sealing elements 10 to mount the lower sealing elements to the lower cap insulator element 61.

[0069] As shown in Figure 15, the lower cap insulator element comprises a first non-insulating portion 69 and a second non-insulating portion 65. The non-insulating portions are typically formed from aluminium. The lower cap insulator element further comprises an insulating portion 66, typically provided in the form of a polymeric material such as polyamide. A first end 67 of the insulating portion 66 is engageable with the first non-insulating portion 694 and a second end 68 of the insulating portion 66 is engageable with the second non-insulating portion 65.

[0070] The lower cap insulator element 61 shown in Figure 15 provides a thermal break between the inner and outer surfaces of the lowermost door panel element 2, by way of the insulating portion 66.

[0071] Figure 16 illustrates a side cap insulator element 71 for a double-thickness door panel. The insulator element 71 comprises a plurality of protrusions 72. Each protrusion 72 comprises a neck part 73 and a head part 74. Each neck part 73 is arranged substantially perpendicular to each corresponding head part 74.

[0072] In use, the side cap insulator element is mounted to each side of a door panel element 2. The neck part 73 of each protrusion 72 extends away from the side surface 25 of the door panel element 2. The side cap insulator element 71 extends from the internal surface 24 of the door panel element 2, across the side surface 25 of the door panel element to the external surface 23 of the door panel element 2.

[0073] The side cap insulator element 71 extends along the full height of the plurality of door panel elements 2.

[0074] As shown in Figure 16, the side cap insulator element comprises a first non-insulating portion 704 and a second non-insulating portion 75. The non-insulating portions are typically formed from aluminium. The side cap insulator element further comprises an insulating portion 76, typically provided in the form of a polymeric material such as polyamide. A first end 77 of the insulating portion 76 is engageable with the first non-insulating portion 704 and a second end 78 of the insulating portion 76 is engageable with the second non-insulating portion 75. A central region 79 of the insulating portion 76, intermediate the ends 77 and 78, is in contact with the side surface 25 of the door panel 2, in use.

[0075] The side cap insulator element 71 shown in Figure 16 provides a thermal break between the inner and outer surfaces of the door panel element 2, by way of the insulating portion 76.

[0076] Figure 17 illustrates an upper cap insulator element 81 for a double-thickness door panel. As in Figure 8, the insulator element 81 comprises a plurality of protrusions 82. Each protrusion 82 comprises a neck part 83 and a head part 84. Each neck part 83 is arranged substantially perpendicular to each corresponding head part 84.

[0077] In use, the upper cap insulator element is mounted to an upper surface 26 of the uppermost door panel element 2. The neck part 83 of each protrusion 82 extends away from the upper surface 26 of the uppermost door panel element 2. The upper cap insulator element 81 extends from the internal surface 24 of the lowermost door panel element 2, across the upper surface 26 of the uppermost door panel element to the external surface 23 of the uppermost door panel element 2.

[0078] The upper cap insulator element 81 extends along the full width of the uppermost door panel element 2.

[0079] As shown in Figure 17, the upper cap insulator element comprises a first non-insulating portion 804 and a second non-insulating portion 85. The non-insulating portions are typically formed from aluminium. The upper cap insulator element further comprises an insulating portion 86, typically provided in the form of a polymeric material such as polyamide. A first end 87 of the insulating portion 86 is engageable with the first non-insulating portion 804 and a second end 88 of the insulating portion 86 is engageable with the second non-insulating portion 85. A central region 89 of the insulating portion 86, intermediate the ends 87 and 88, is in contact with the upper surface 26 of the uppermost

door panel 2, in use.

[0080] The lower cap insulator element 81 shown in Figure 17 provides a thermal break between the inner and outer surfaces of the uppermost door panel element 2, by way of the insulating portion 86.

[0081] The insulator elements 61, 71, 81 shown in Figures 15, 16 and 17 are shown in use with double-thickness door panel elements, and may be particularly advantageous when used in conjunction with such panels. However, the embodiments shown in these figures are equally applicable to standard-thickness panels.

[0082] The invention is not limited to the embodiments hereinbefore described, with reference to the accompanying drawings, which may be varied in construction and detail.

Claims

1. An insulated door system, comprising a plurality of door panel elements and a plurality of insulator elements to minimise heat transfer and/or air permeability through the door panel elements.

2. An insulated door system as claimed in claim 1 wherein a first insulator element of the plurality of insulator elements is locatable in a junction area between a first door panel element and a second door panel element of the plurality of door panel elements.

3. An insulated door system as claimed in claim 1 or claim 2 wherein a first part of a second insulator element of the plurality of insulator elements is locatable between a first door panel element of the plurality of door panel elements and a support element.

4. An insulated door system as claimed in claim 3 wherein a second part of the second insulator element is locatable between the first door panel element and a guide element.

5. An insulated door system as claimed in claim 4 wherein a third part of the second insulator element is locatable between the guide element and the support element.

6. An insulated door system as claimed in any of claims 3 to 5 wherein the second insulator element comprises a first insulator member and a second insulator member.

7. An insulated door system as claimed in claim 6 wherein the second insulator member is engagable against an internal surface of the first door panel element.

8. An insulated door system as claimed in any of claims 1 to 7 wherein a third insulator element of the plurality of insulator elements is mountable to a first door panel element of the plurality of door panel elements.

9. An insulated door system as claimed in claim 8 wherein at least part of the third insulator element is extendable from an external surface of the first door panel element across at least part of a side surface of the first door panel element to an internal surface of the first door panel element.

10. An insulated door system as claimed in any of claims 1 to 9 wherein at least part of a fourth insulator element of the plurality of insulator elements is locatable extending across at least part of an upper surface of an upper door panel element of the plurality of door panel elements.

11. An insulated door system as claimed in claim 10 wherein at least part of the fourth insulator element is extendable from an external surface of the upper door panel element across at least part of an upper surface of the upper door panel element to an internal surface of the upper door panel element.

12. An insulated door system as claimed in any of claims 1 to 11 wherein at least part of a fifth insulator element is locatable extending across at least part of a lower surface of a lower door panel element.

13. An insulated door system as claimed in claim 12 wherein at least part of the fifth insulator element is extendable from an external surface of the lower door panel element across at least part of a lower surface of the lower door panel element to an internal surface of the lower door panel element.

14. An insulated door system as claimed in claim 12 or claim 13 wherein at least part of the insulator element is engagable

with a sealing element.

15. An insulated door system as claimed in claim 1, comprising:

a first insulator element located in a junction area between a first door panel element and a second door panel element of the plurality of door panel elements;
a second insulator element having a first part located between a first door panel element of the plurality of door panel elements and a support element;
a third insulator element, wherein at least part of the third insulator element extends across at least part of a side surface of the first door panel element;
a fourth insulator element, wherein at least part of the fourth insulator element extends across at least part of an upper surface of an uppermost door panel element; and
a fifth insulator element, wherein at least part of the fifth insulator element extends across at least part of a lower surface of a lowermost door panel element;
such that thermal bridges between the outside of the door system and the inside of the door system are broken between, and around the perimeter of, each of the door panel elements.

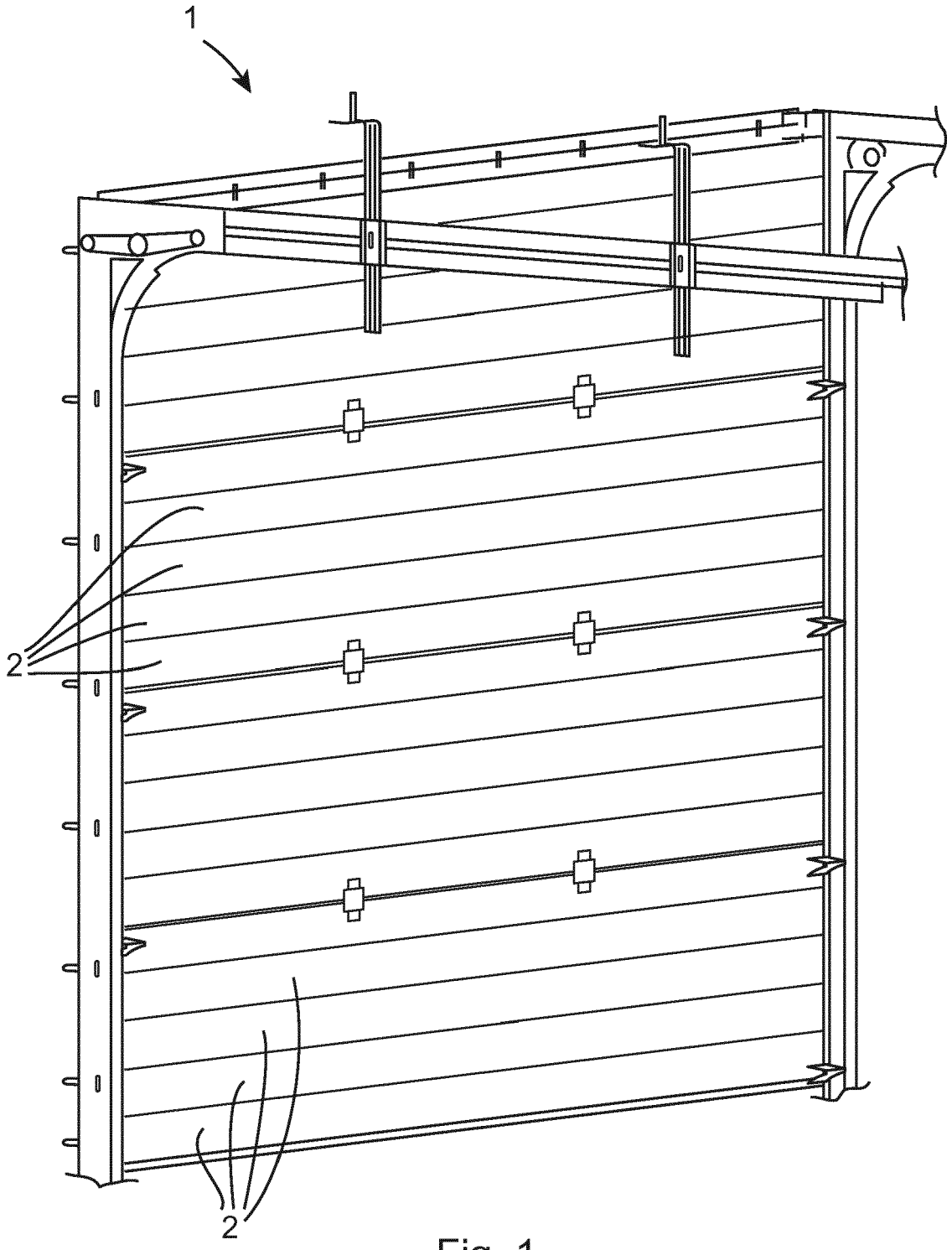

Fig. 1

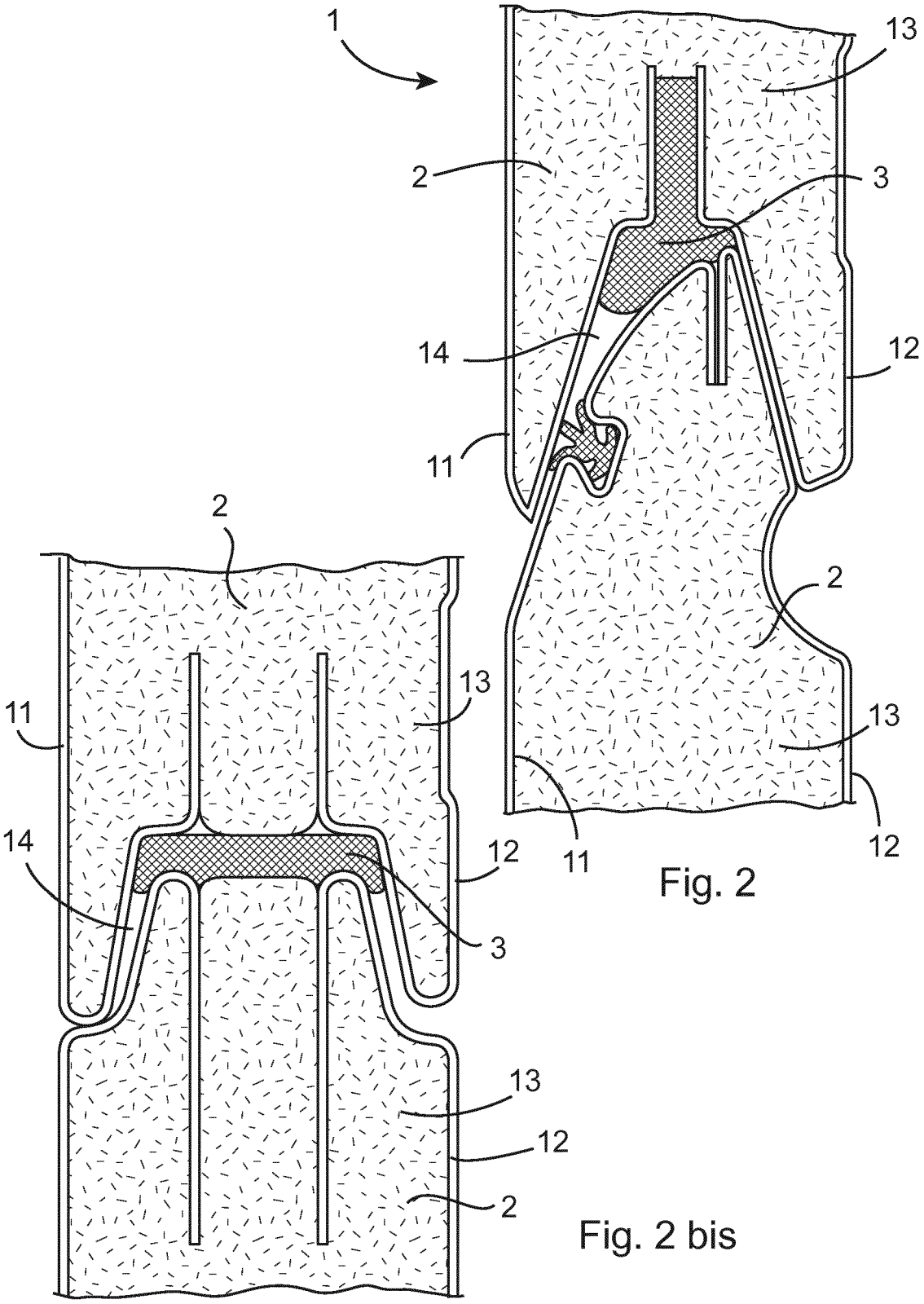

Fig. 2

Fig. 2 bis

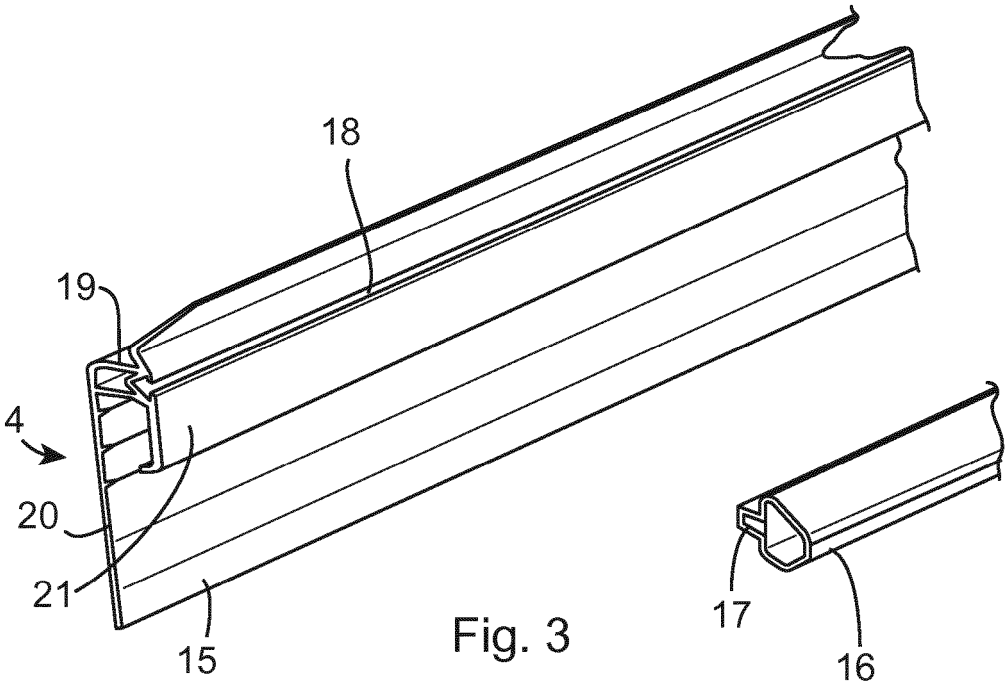

Fig. 3

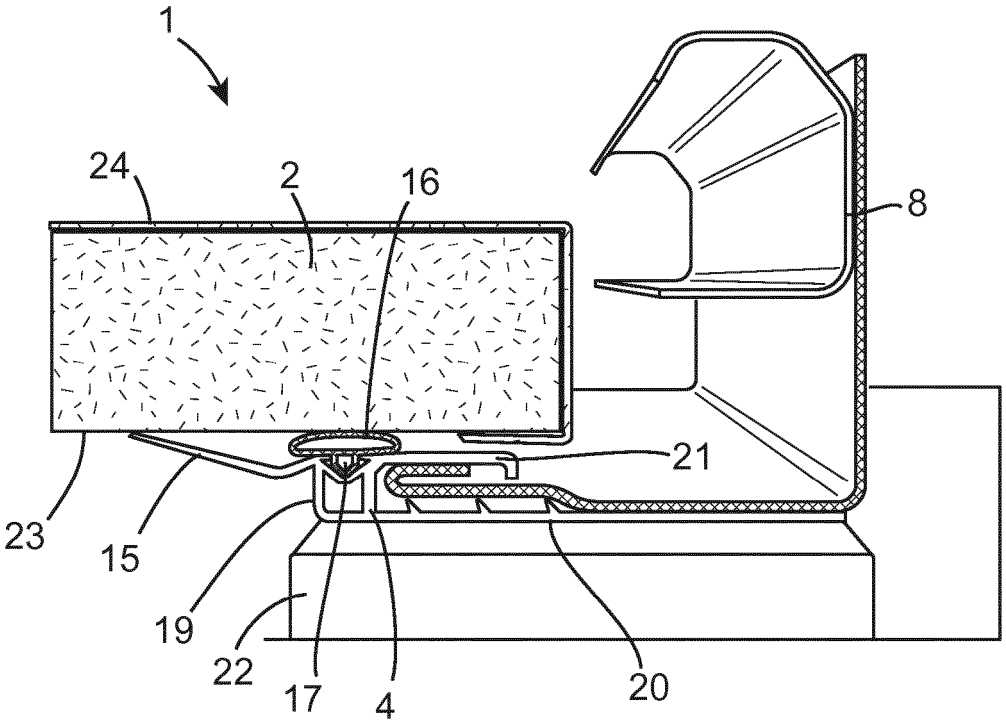

Fig. 4

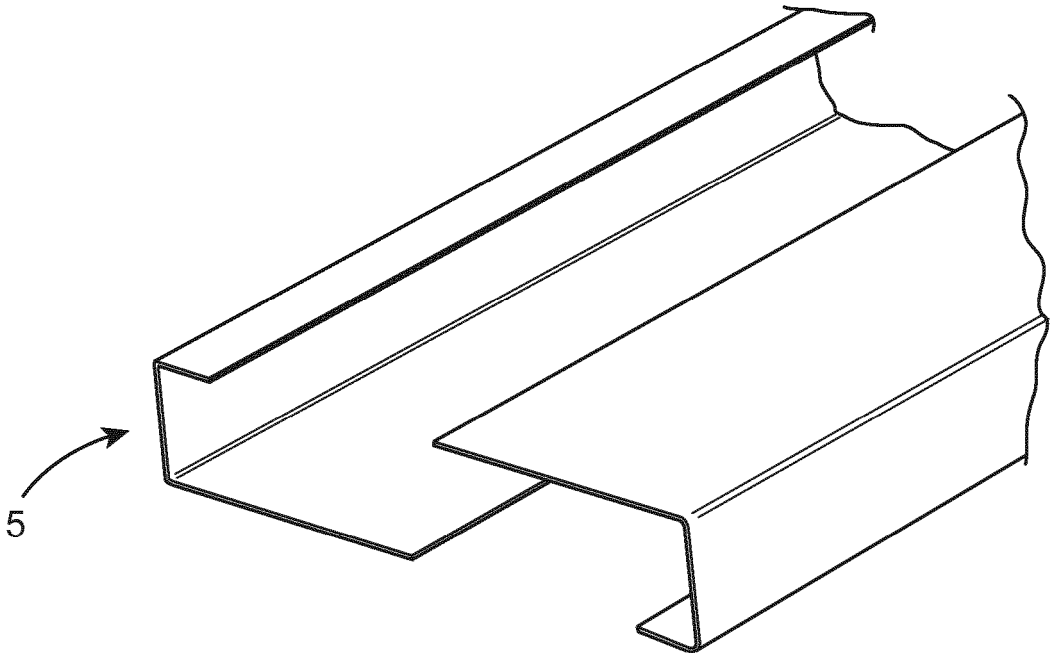

Fig. 5

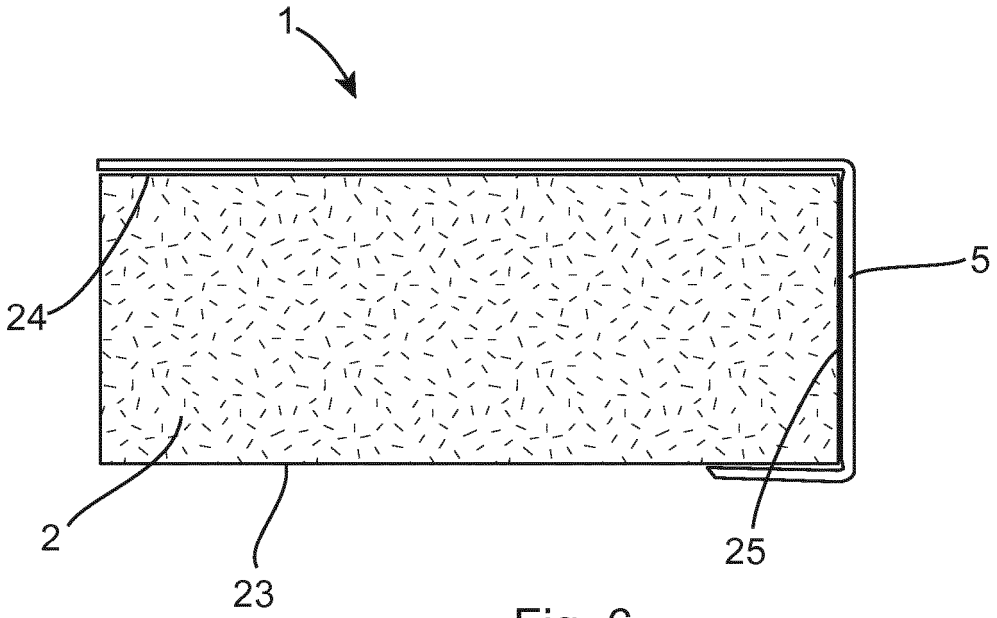

Fig. 6

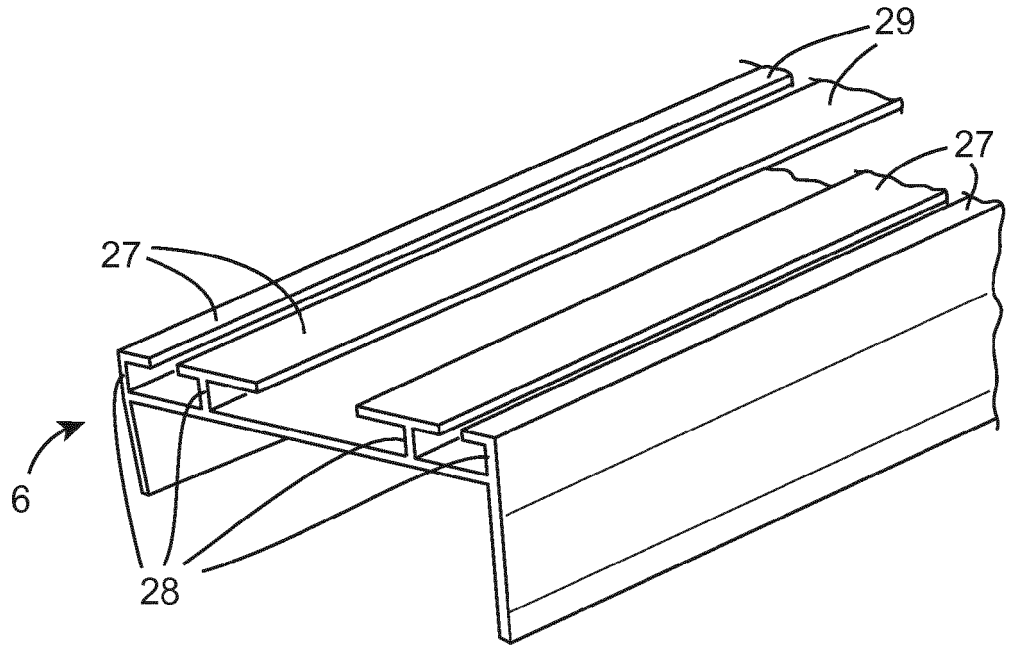

Fig. 7

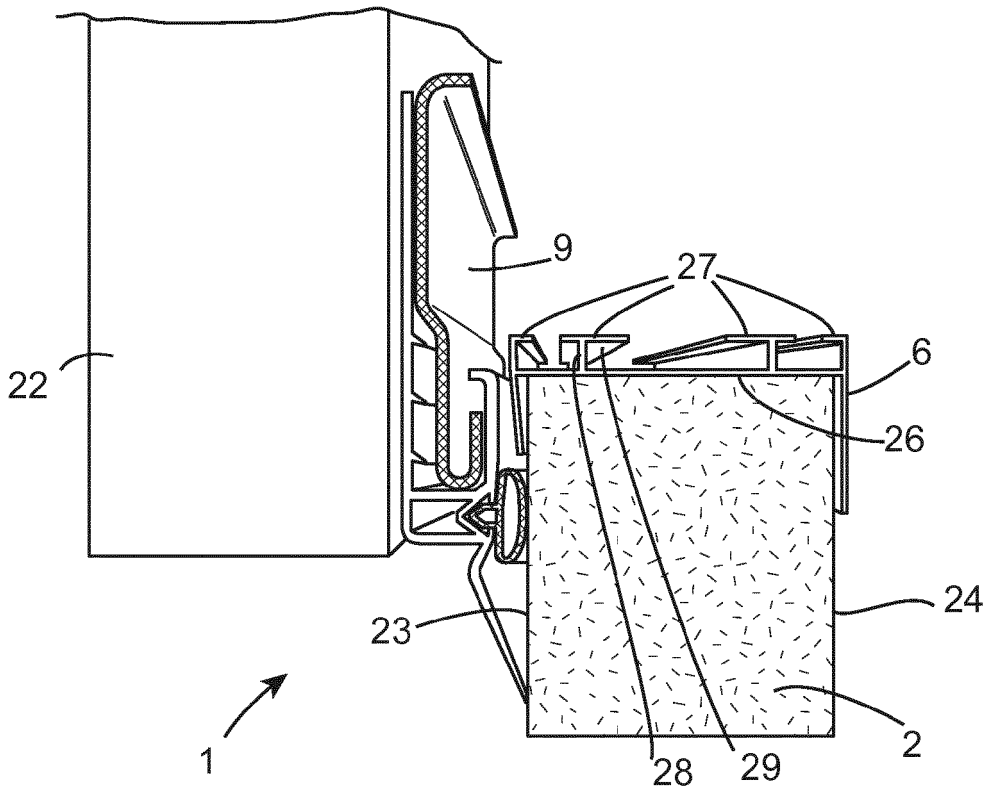

Fig. 8

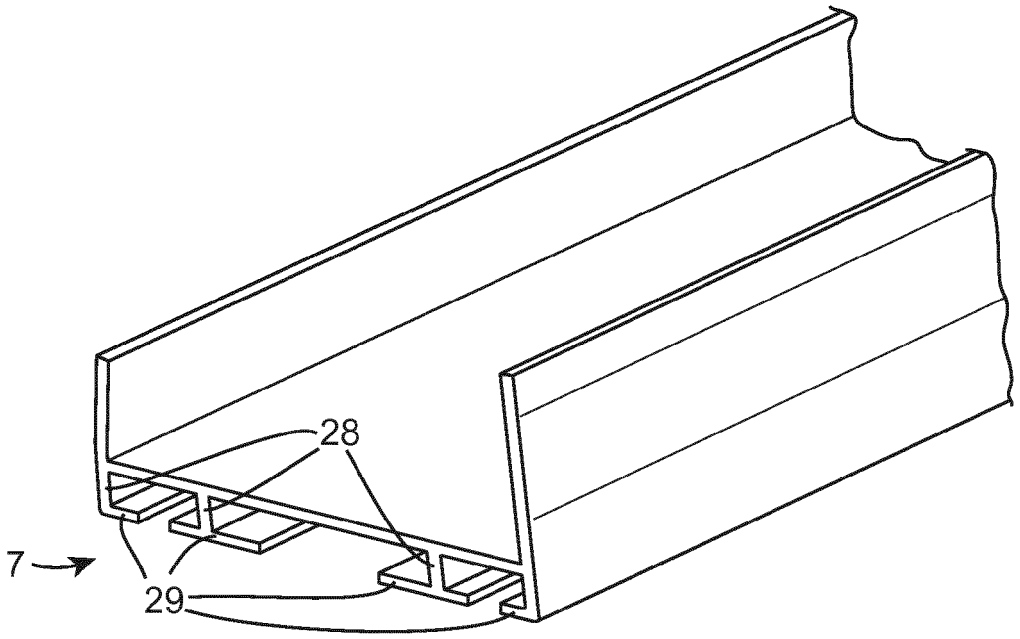

Fig. 9

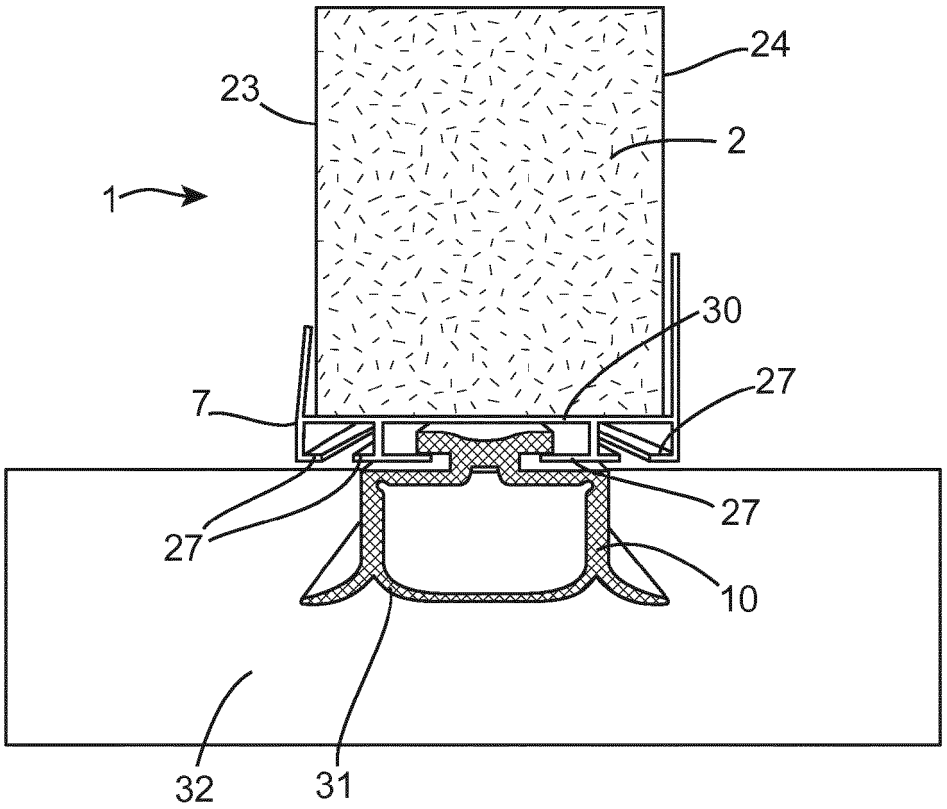

Fig. 10

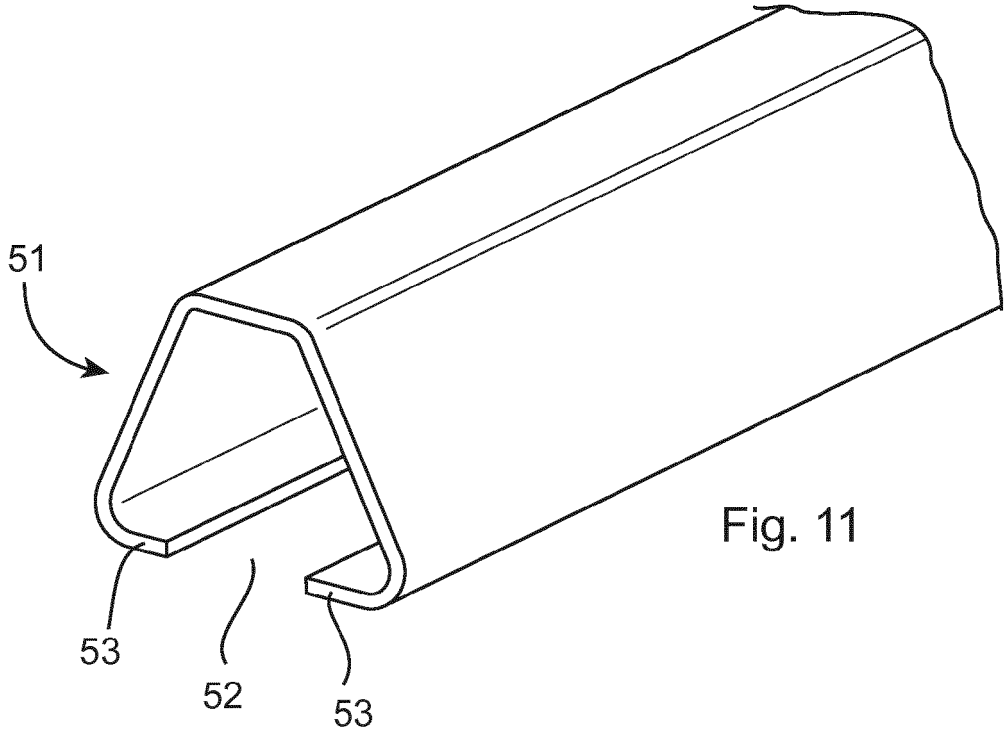

Fig. 11

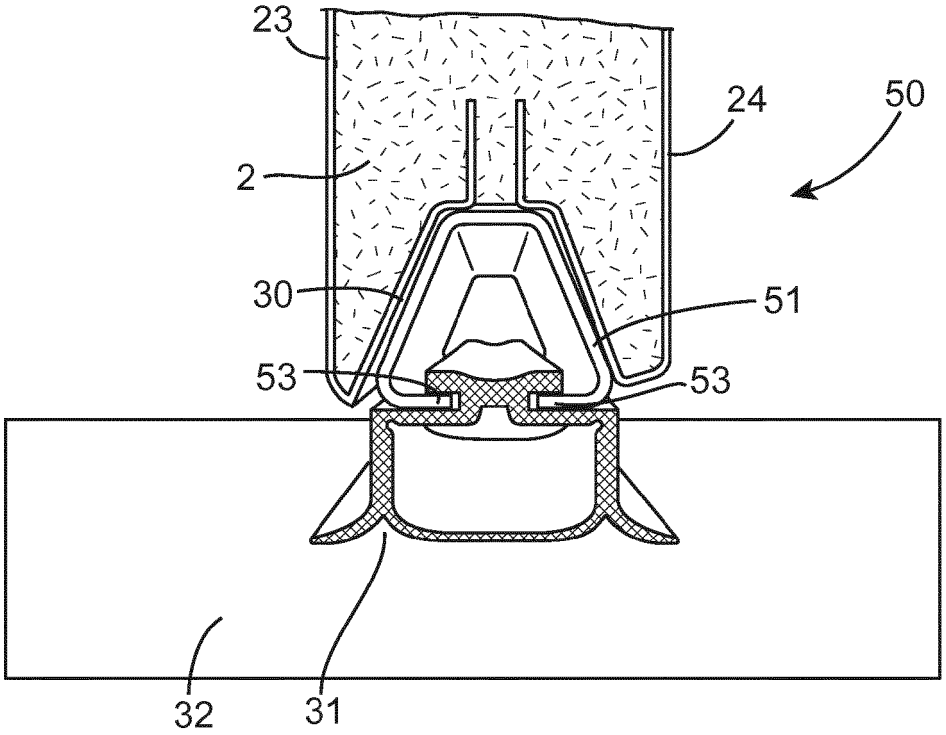

Fig. 12

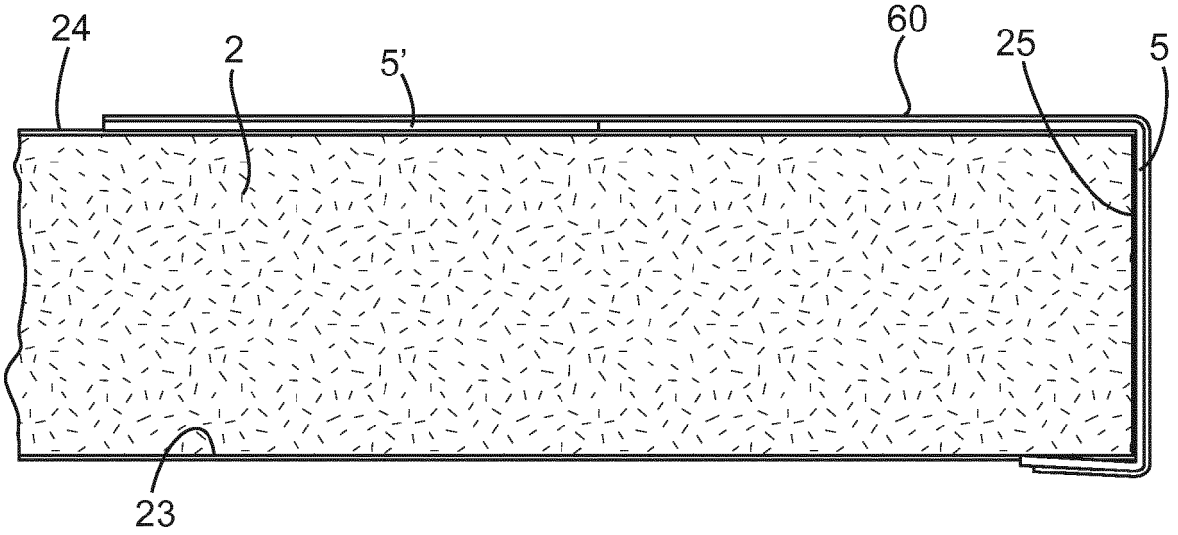

Fig. 13

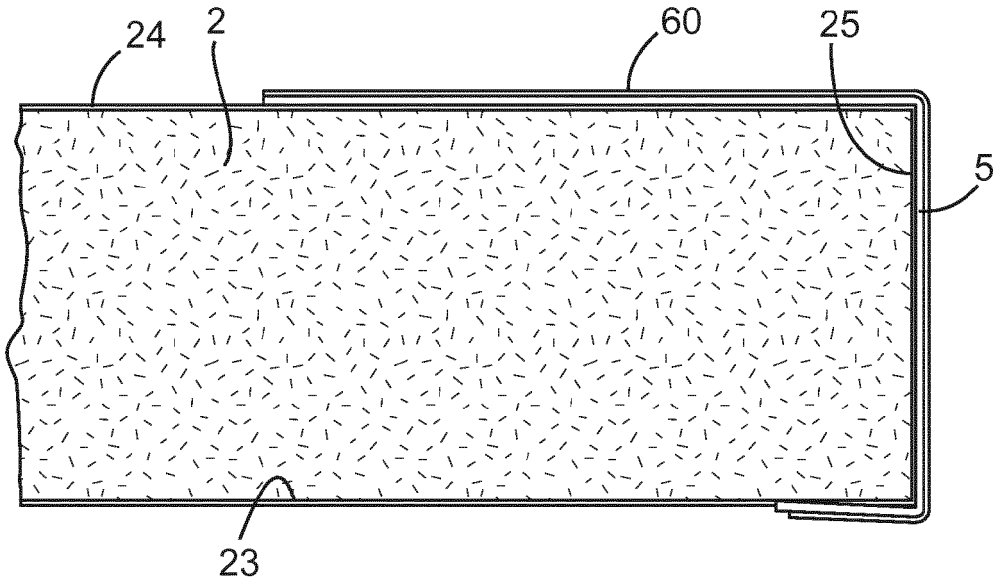

Fig. 14

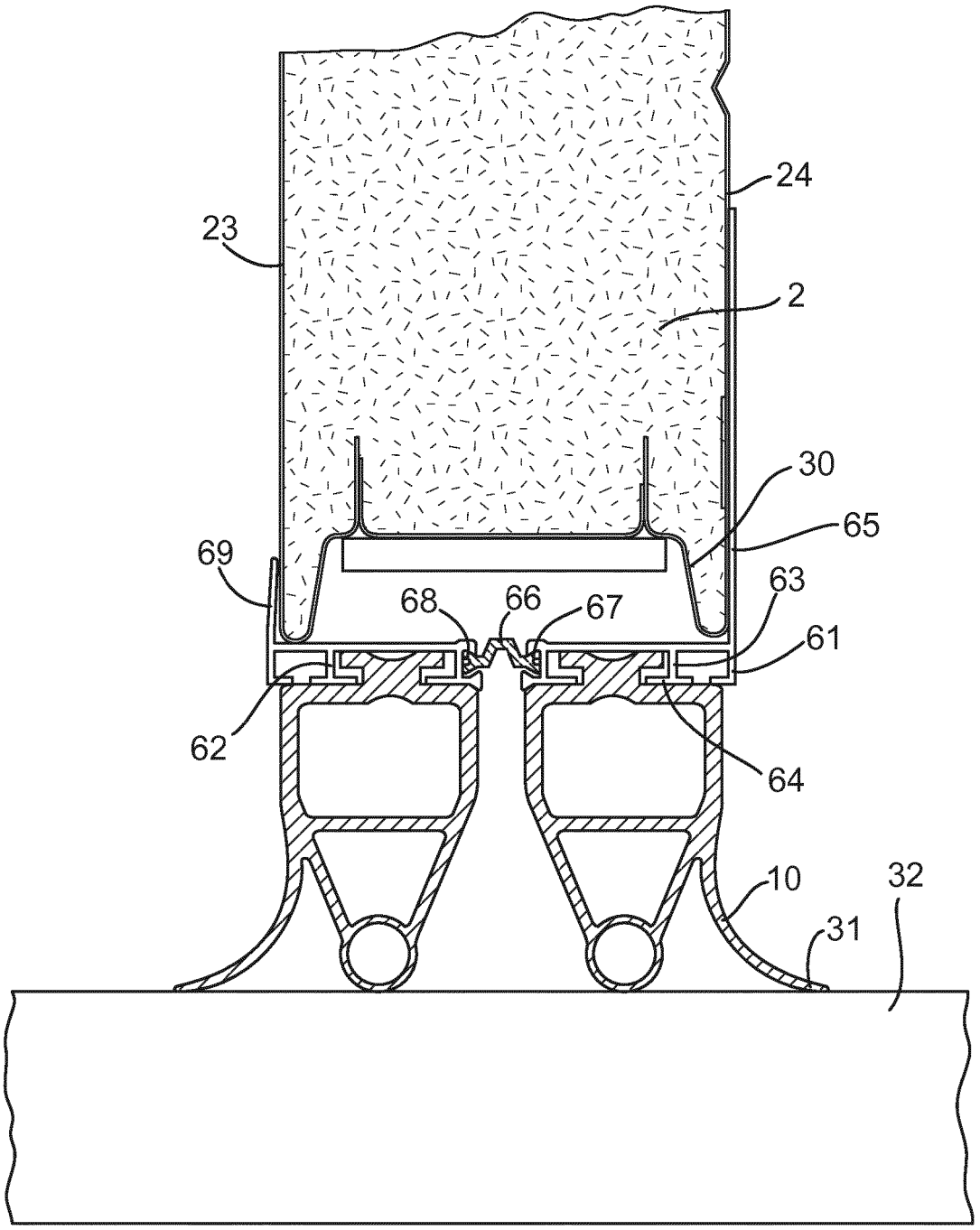

Fig. 15

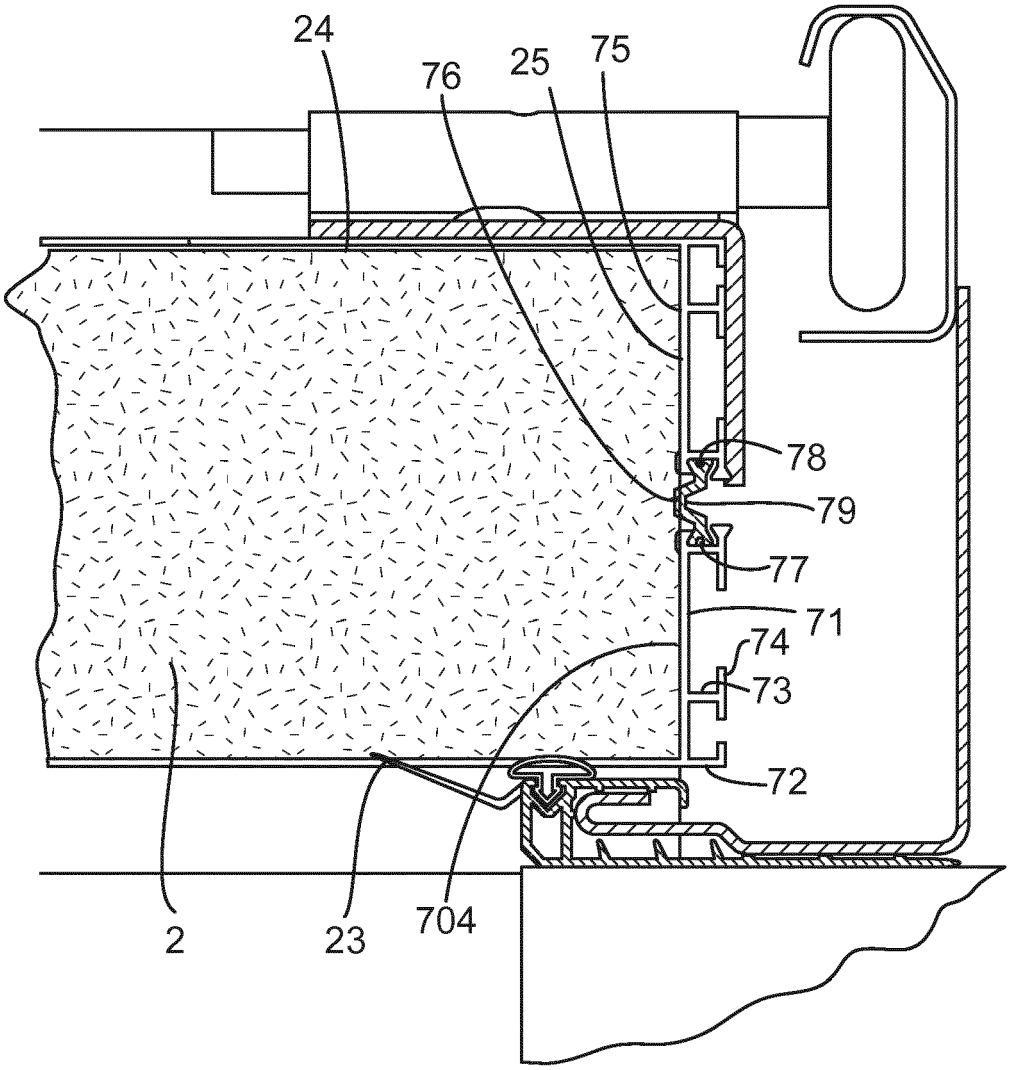

Fig. 16

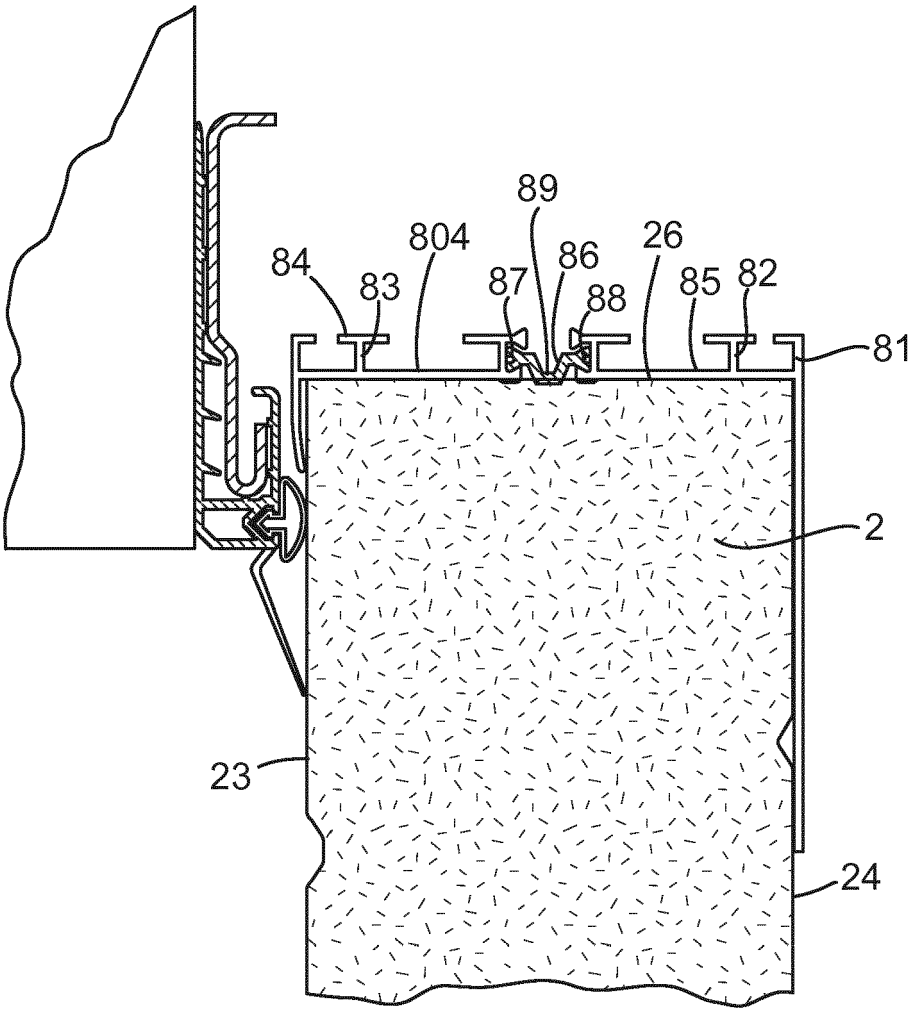

Fig. 17