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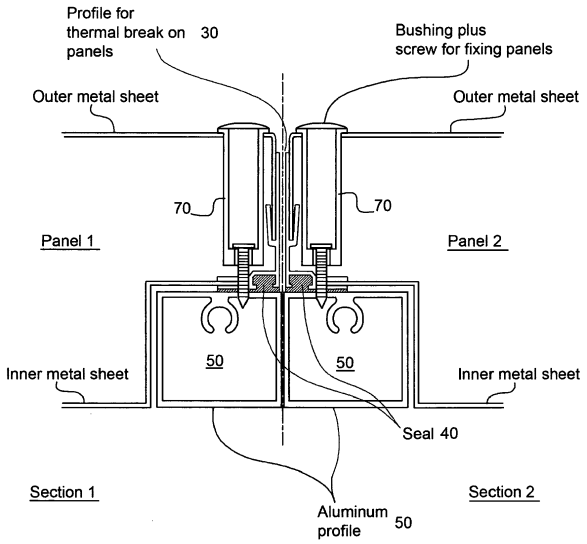
(54) A JOINING SYSTEM IN AIR TREATMENT UNITS

(57) The present invention relates to a panel for an air treatment unit (ATU) or an air treatment system (ATS), the panel being formed by sheet metal walls, said walls comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance, said outer and inner metal sheet forming respectively the two front faces of the panel and being connected to each other by a side wall (203, 204, 205, 206) of metal sheet in such a way as to internally define a containing space suitable for containing a filler material, for example a foam material such as polyurethane or a solid material such as rock wool;

According to the invention, the panel comprises a component (30, 330) made of thermally insulating material arranged in such a way as to generate a discontinuity of material in one or more areas of said sheet metal walls constituting the panel and thus generate an interruption and/or a reduction of heat transmission between the outer and inner sheet and/or vice versa.

FIG.6



EP 4 089 341 A1

Description

Scope of the invention

[0001] The present invention relates to the field of air treatment units.

[0002] In particular, the invention refers to an innovative system in said units that considerably reduces heat dispersion, thereby improving energy saving, in particular in the areas of coupling between two sections or within the same section, for example in correspondence with the joint between two panels, one of which, for example, fixed with a dividing function or rotatable with a door function.

Overview of the prior art

[0003] The air treatment unit, better known by the acronym ATU, is an item of equipment for the treatment of air in closed environments. It is a machine with modular sections, each of which intended for a different function.

[0004] For large air conditioning systems, the definition of air treatment system, or ATS, is adopted, whether the air is solely external air or mixed.

[0005] Their purpose is to take the air and treat it depending on thermo-hygrometric needs.

[0006] The parameters involved in air treatment are temperature, humidity, speed and purity.

[0007] For each of these parameters there is a part or a component of the machine capable of controlling, adjusting and/or modifying it.

[0008] These units therefore have the main function of improving air quality, ensuring correct replacement and control of the air conditions in work and processing environments - with the appropriate heat recovery systems, they are also able to guarantee efficient energy saving.

[0009] Generally in winter, the unit increases the temperature and humidity of the air, through the succession of pre-heating, humidification and post-heating stages.

[0010] In summertime, it reduces the temperature and humidity of the air through the succession of cooling and post-heating.

[0011] ATUs are made up of different devices, each of which plays a key role in ensuring correct operation and consequently quality of the final product and quality of the air.

[0012] In particular, an ATU can comprise:

- an external envelope of insulated and soundproofed sheet metal panels (for example, through rock wool or polyurethane foam) fixed on structures or frames generally of aluminum and divided into sections;
- supply and return fans;
- air flow and flow regulation dampers;
- batteries for water heating and cooling;
- batteries for post- and pre-heating and cooling with water or direct expansion (when necessary);
- one or more filtration sections with filters of different types, for example from bag filters to absolute filters (depending on the type of filtration required);
- a humidification section (when necessary);
- a cross-flow or other type of heat exchanger (when indicated but generally always recommended).

[0013] Figure 1 schematically shows an ATU 100 unit according to the prior art, in order to highlight one or more of the above-listed elements.

[0014] A technical problem related to these ATU units, or ATS, is the formation of condensation.

[0015] In fact, even in everyday applications, unfavorable weather conditions, or technical installation rooms where high temperatures or high levels of humidity are reached can, if the technical characteristics of the insulation from thermal bridges are poor, give rise to the formation of condensation on the surface of the structure.

[0016] A structure's risk of condensation is definitely determined by its quality in relation to thermal bridges (kb factor) and there are substantial differences between classes of thermal bridge. The "thermal bridge factor" indicates how much thermal power is dissipated through the thermal bridges present on the structure.

[0017] Thermal transmittance is, in turn, a parameter that influences energy consumption of air treatment units and gives a measure of the additional energy costs of heating and/or cooling necessary to compensate for the greater dispersions of the envelope, with considerations very similar to those usually made in the civil sector to characterize the energy class of building envelopes.

[0018] Basically and in summary, there are critical points in an ATU structure that can cause greater heat dispersion and this therefore results in greater consumption to compensate for these losses.

[0019] As schematized in Figure 2 and 3 of the prior art, the most critical areas of the ATU from the thermal point of view (i.e. thermal bridge factor and thermal transmittance) are the joining section, i.e. where the different sections of the unit join, or the joint of two elements within the same section to be able to apply, for example, a door or a partition panel. In this way, in the same section, on a predetermined face of the section, it is possible to insert doors or numerous panels in succession to close said face, for example when the use of a single panel would not be possible given the excessively high area dimension.

[0020] Joining is made with profiles generally made of extruded aluminum and joined through the use of polyamide bars, as immediately detailed below.

[0021] In fact, Figure 2 and Figure 2A equally show two non-joined sections that have to be joined together, while Figure 3 shows a front view of two sections already joined and inside which is a joining profile for two components (for example, a door panel) and with this profile inside the section which in technical jargon is generally referred to as "Omega" (as shown in fact in Figure 3).

[0022] By way of clarification, both Figures 2 and 2A show the separation space to indicate the two joining

faces of the two sections.

[0023] According to the prior art construction method, the production of two or more sections involves construction of the supporting skeleton which is formed by aluminum profiles schematically represented in Figure 2 (pr1, pr2... prn) .

[0024] The panels (P1, P2, Pn) are prepared separately in the factory by fitting an outer metal sheet to an inner metal sheet with any material interposed between them, for example rock wool or polyurethane.

[0025] The panels are then fixed to the skeleton through screw systems or similar.

[0026] Figure 4 shows a section along a longitudinal plane highlighted in Figure 2A in order to show the prior art solution used to reduce dispersions in the area where one section is coupled with the other. The numbering pr3 therefore indicates the two profiles constituting part of the skeleton of the two sections 1 and 2, also highlighted for clarity in Figure 2. The transverse dotted line identifies the coupling plane of the two sections.

[0027] Figure 5 also shows the case in which a panel is added within the same section so that it represents a view according to a cross section shown in Figure 2A.

[0028] Ultimately, therefore, Figure 4 and Figure 5 of the prior art structurally show the two aforementioned prior art cases, namely:

Solution with two joining profiles (pr3) in Figure 4 which are currently used to place two different sections side by side, thus limiting thermal dispersion and Figure 5 for the case of a single profile (Omega profile in the technical jargon) inside the section, for example to introduce a door or a fixed dividing panel.

[0029] As clearly seen from Figure 4, the outer and inner metal sheet relative to the wall (or roof, in this case) of section 1 and the outer and inner metal sheet (still a roof in this case) relative to section 2 are indicated.

[0030] As said, the outer and inner metal sheet can have filler material inside, generally with an acoustically insulating function, and are assembled in the factory in such a way as to form the panels ready to be fixed to the skeleton.

[0031] The panels used, as also discussed later in the description of the invention, are obtained from a sheet metal wall whereby with two sheets laid one on top of the other and spaced apart and joined by a sheet that forms the side wall.

[0032] The sheet metal panels, during the construction phase, can be filled with rock wool or expandable foam material, such as polyurethane.

[0033] The panels are therefore hollow inside in order to contain such a filler material which can have anti-noise functions, acoustic insulation, for example.

[0034] Thickness of the sheets varies from case to case but can also be under a millimeter, of the order of a millimeter or more than a millimeter.

[0035] Figure 4 therefore shows how the connection is made between the two sections.

[0036] In particular, for this purpose, screw systems 150 are used to fix the panels (ready in the factory) to the profiles and the set of profiles is so structured as to minimize dispersion.

[0037] In fact, going into more detail in Figure 4, the prior art profile system provides for the presence side by side of the two bottom profiles pr3. A further profile 110 is coupled at the top to the bottom profile through the use of polyamide bars 120.

[0038] Each bottom profile pr3, i.e. the right one and the left one, represents a closed section with a generally L-shaped cross-section and are coupled to each other back to back in the sense that the two vertical legs of the L are coupled one to the other. In this way, the panels can be placed on the shelf formed by the L with a screw fixing as illustrated in Figure 4. In this way, as shown in Figure 4, the screw system 150 passes through the section until it intercepts the leg of the L, thereby making the connection.

[0039] Another profile 110 is laid on top of an L-shaped profile through the polyamide bars 120.

[0040] The two sections are thus placed side by side with the aforementioned system which tries to isolate losses as much as possible.

[0041] The two sections are connected stably to each other with known joining accessories applied between the two panels of the two sections.

[0042] Further sealing elements 130 are also present at the screw insertion points.

[0043] Figure 5 shows, in a completely similar way, the solution for inserting a panel within the same section.

[0044] In this case, Figure 5 shows a sectioning portion highlighted in Figure 2A (cross-section) in order to show, for example, a coupling between a panel constituting the front face of the section and a further panel.

[0045] Again in this case the solution refers to a system of profiles (200, 210), generally of aluminum.

[0046] Below there is a profile 200 and above a further profile 210 coupled together through two polyamide bars 220.

[0047] Seals 230 are then provided at the screw insertion points.

[0048] Exactly as in the case of Figure 4, the screw system 250 comprises a bushing which is inserted through the sheets of the panel or door (outer and inner sheet) and which ends with a threaded screw.

[0049] These types of structures attempt to minimize heat losses by reducing the passage of heat by transmission by creating separate aluminum profiles connected with polyamide joints which reduces the transmission of heat through the metal (generally, as already seen, aluminum).

[0050] Then the polyamide bars inserted as shown in Figures 4 and 5 attempt to create a thermal break.

[0051] However, the known solutions described here suffer from the following technical problems:

As can be seen from Figures 4 and 5, there is no interruption in the thermal bridge made by the contact between the inner and outer metal sheet forming the panels.

There is therefore a structural continuity in the panel itself which creates transmission and/or passage of heat from the inside to the outside and vice versa.

[0052] This causes a substantial heat loss.

[0053] Generally the profiles used are made of aluminum (generally extruded aluminum) and the aluminum used for the production of the profiles has excellent thermal conductivity, only partially limited by the use of polyamide bars.

[0054] Basically the use of the interposed polyamide bars limits dispersion, without offering optimal limitation.

[0055] Assembling the aluminum profiles with the polyamide bars entails high production and/or management costs.

[0056] The outer part of the aluminum profiles is in contact with the outside air. They must therefore be protected from atmospheric/chemical agents present in the air (with use outside the building), using anodizing or painting processes. For reasons inherent in the thermal break profile assembly process, the internal part of the profile must also be worked/protected, even though there is no need (not in contact with the outside).

[0057] The high contact surface of the internal part of the aluminum profiles (inherent in the construction type of the joining section and the omega profile) increases thermal dispersion/transmittance.

[0058] Finally, there is an extensive contact between the thermal break profiles, only partially limited by the seal, where provided.

Summary of the invention

[0059] Object of the present invention is therefore to provide an innovative panel for an air treatment unit which solves the above-mentioned technical drawbacks.

[0060] In particular, there is a need to produce a system and method of joining between sections of a unit or between components within the same section which reduces heat losses to a minimum, thereby optimizing energy savings.

[0061] These and other objects are achieved with the present panel for an air treatment unit (ATU) or an air treatment system (ATS), according to claim 1.

[0062] Such a panel is shaped by walls of sheet metal.

[0063] These walls comprise an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance, said outer and inner metal sheet respectively forming the two front faces of the panel and being connected to each other by a side wall (203, 204, 205, 206) of sheet metal in such a way as to internally define a containing space suitable for containing a filler material, for example a foam material such as polyurethane or a solid material such as rock wool.

[0064] According to a first aspect of the invention, the panel comprises one or more elements (30, 330) made of thermally insulating material arranged in such a way as to generate a discontinuity of material in the sheet forming the walls in one or more areas, where arranged, thus generating an interruption and/or a reduction of heat transmission along the walls of the sheet in the arranged area(s).

[0065] In this way, heat transmissions along the walls of the panel can be reduced and, by specially arranging these thermally insulating elements, the reduction of thermal dispersion can be optimally controlled.

[0066] Discontinuity points are thus created in the sheet forming the panel through which there is a thermal bridge.

[0067] Advantageously, the said element can be arranged in at least one part of the side wall of the said panel, in such a way as to generate said discontinuity of material in the said part of the side wall, where arranged, and thus generate said interruption and/or reduction of heat transmission between the outer metal sheet and the inner metal sheet and/or vice versa.

[0068] Basically, whereas in the prior art the side wall of the panel is continuous or is in any case made up of two parts that are continuously touching (this determines passage of heat and therefore thermal continuity), according to the solution, this thermal continuity is interrupted by interposing a profile in insulating material that physically creates a separation into two parts.

[0069] More particularly, the said at least part of the said side wall advantageously forms an opening (203') which creates a separation zone between the outer metal sheet (201) and the inner metal sheet (202);

[0070] In this case, said element (30, 330) made of thermally insulating material is arranged in correspondence with said opening to close said opening in such a way that said element creates said interruption and/or reduction in the passage of heat between the outer metal sheet and the inner one and/or vice versa.

[0071] Advantageously, said element (30, 330) is a profile of predetermined longitudinal length and with predetermined cross-sectional shape.

[0072] For example, advantageously, in cross-section, this profile may comprise:

- a vertical wall (35, 335);
- a horizontal wall (36, 336) connected to the vertical wall;
- a vertical seat (31; 331) made at a certain height of the vertical wall into which the free end of the vertical flap (10') generated by said opening (203') is inserted;
- a horizontal seat (32; 332) made in a point of the horizontal wall, preferably at its end, into which the free end of the horizontal flap (20') generated by said opening is inserted.

[0073] Advantageously, at least the side wall part of the panel comprising the said thermally insulating element shapes a seat obtained at a height different from the arrangement opening of the said element and with said seat suitable for accommodating a profile (50) in such a way that the said profile is at least partially covered

by said panel, the profile preferably being metallic, for example extruded aluminum.

[0074] This seat is a sort of step formed by the metal sheet into which the profile is inserted.

[0075] The panel, in essence, therefore forms a sort of step in the side that is to face the other panel in the joining of two sections, exactly as in the prior art. However, according to the invention, the step is placed immediately below, i.e. at a different height from that of the thermally insulating profile and its dimension is such as to be able to accommodate the metal profile.

[0076] In practice, the two panels (both the panel-panel and the door-panel) touch each other face-to-face causing the thermally insulating profile to align, one in front of the other (see for example Figures 6 and 7).

[0077] This layout optimizes the technical effects of thermal loss reduction.

[0078] Advantageously, the said seat which accommodates the metal profile is formed by the said horizontal flap (20') whose free end fits into the horizontal seat (32) of the thermally insulating profile and by a vertical flap (20") which branches off from the horizontal flap in a direction away from the outer metal sheet to connect to the inner sheet.

[0079] Advantageously, said element made of thermally insulating material can be plastic material, preferably polypropylene.

[0080] A coupling system is also described here for air treatment units (ATU) or air treatment systems (ATS) and comprising:

- at least one panel according to one or more of the above-described characteristics;
- at least one metal profile (50, 350), of aluminum for example, accommodated in said seat shaped by the panel in accordance with one or more of the above-described characteristics, and in which are included connecting means (70) which connect the said panel to the said metal profile.

[0081] Advantageously, the following can be included:

- two panels, according to one or more of the above-described characteristics, arranged side by side in such a way that the respective thermally insulating components are placed side by side;
- the seats of said two side-by-side panels defining a single seat which contains said at least one metal profile (35, 350) which thus remains entirely covered by said two side-by-side panels;
- and in which said metal profile (50, 350) is fixed to at least one of said two panels by means of said connecting means (70) which penetrate from the outer metal sheet to intercept said metal profile.

[0082] Advantageously, said connecting means also intercept at the same time the horizontal wall (36, 336) of said profile made of thermally insulating material.

[0083] Advantageously, two metal profiles (50) are included, placed side by side in said seat.

[0084] Advantageously, one of the two panels can shape or be a door.

[0085] In the case of a door, the connecting means (70) which connect said door to the at least one metal profile (350) are not included.

[0086] Also described here is an air treatment unit or air treatment system comprising a coupling system in accordance with one or more of the above-described characteristics to create the coupling of two different sections of the unit or system or to interpose two components in the same section.

[0087] Also described here is a method of constructing an air treatment unit or system or parts thereof and which includes:

- the construction of at least two panels intended to be placed side by side, each one of said at least two panels being formed by sheet metal walls, said walls comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance, said outer and inner metal sheet forming the two front faces of the panel respectively and being connected to each other by a side wall (203, 204, 205, 206) of sheet metal in such a way as to internally define a containing space suitable for containing a filler material, for example a foam material such as polyurethane or a solid material such as rock wool
- and in which the method provides for the application of one or more profiles (30, 330) made of thermally insulating material which is/are arranged in each one of the two panels in one or more relative opening(s) obtained in the sheet forming the said two panels, in such a way as to generate a discontinuity of metallic material thus creating an interruption and/or reduction of the passage of heat through the metal.

[0088] Advantageously, in both said two panels the said opening is obtained in at least one portion of the side wall of the two panels which are intended to face each other in such a way as to reduce and/or interrupt the passage of heat between the outer metal sheet and the inner one and vice versa.

[0089] For example, if the panel has a rectangular or square shape, the side wall will be formed by four faces of the rectangle or square.

[0090] The said opening where the said thermally insulating profile is accommodated can involve only one of the side walls, or two, three or all four, entirely or only partially.

[0091] Advantageously, the production of at least two sections side by side may be included, and this includes:

- construction of a supporting skeleton for the first and second section, said supporting skeleton being obtained by joining together a plurality of metal profiles,

of aluminum for example;

- construction of a plurality of panels suitable for covering said supporting skeletons in such a way as to produce the said two sections;
- and in which the panels that have said profiles made of thermally insulating material are at least two and one of which belongs to one section and the other belongs to the other section and which are placed side by side in such a way that the said profiles made of insulating material face each other.

[0092] Advantageously, as mentioned, these two panels are shaped in such a way as to form a step-like seat that covers the metal profiles (the step forms an invitation that guides correct application of the panel on the metal profile) and therefore, the two panels that are placed side by side bringing the two profiles made of thermally insulating material to mate or to almost mate with each other.

[0093] Advantageously, the joining of two components in the form of panels, for example panel-panel or door-panel, within the same section constituting an air treatment unit or air treatment system, may be included.

[0094] Advantageously, the panels having said profiles made of thermally insulating material are at least two, placed side by side within the section so that said profiles in insulating material face each other.

[0095] Advantageously, therefore, at least one metal profile (50, 350) may be applied under said two panels side by side and equipped with the profile made of insulating material in such a way as to be covered by said two panels and in which said metal profile is fixed to at least one of said two panels.

[0096] Basically, as mentioned, the two panels form a seat (i.e. a step) under the insulating profile such that they can be supported and fixed to at least one metal profile which is entirely covered by the said two panels which are touching bringing the thermally insulating profiles to mate or to almost mate, as shown for example in Figure 6 or 7.

[0097] Another object of the present invention is the use of one or more profiles (50, 350) of predetermined longitudinal length made of thermally insulating material in a sheet metal panel, the walls forming said panel comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance, said outer and inner metal sheet respectively forming the two front faces of the panel and being connected to each other by said side wall (203, 204, 205, 206), said one or more profiles being inserted in respective openings in the walls of the panel in such a way as to create discontinuity in the metal material of the wall and generate an interruption and/or reduction of the passage of heat.

[0098] Advantageously, said opening is made in at least one part of the side wall of the panel in such a way as to prevent and/or reduce the passage of heat from one face to the other of the panel.

[0099] The present invention also relates to a profile (30, 330) of predetermined longitudinal length made of thermally insulating material configured to be able to be inserted in an opening that separates at least partially the two front faces of a sheet metal panel in such a way as to prevent the passage of heat through said profile from one face of the panel to the other in the section in which it is inserted.

[0100] Advantageously, the profile may comprise:

- a vertical wall (35, 335);
- a horizontal wall (36, 336) connected to the vertical wall;
- a vertical seat (31) made at a certain height of the vertical wall;
- a horizontal seat (32) made in a certain point of the horizontal wall.

[0101] Advantageously, the profile may be made of plastic material, for example polypropylene.

Brief description of the drawings

[0102] Further characteristics and advantages of this panel, assembly and method, according to the invention, will be clarified with the description that follows of some of its embodiments, provided as an example and in no way exhaustive, with reference to the attached drawings, where:

- Figures 1 to 5 show solutions according to the prior art;
- Figure 6 shows a solution according to the joining of two different sections;
- Figure 6A shows an exploded view of a panel in cross-section to which the thermally insulating profile is applied in the corresponding seat provided;
- Figure 6B extrapolates only the thermally insulating joining element which is used in accordance with the configurations of Figures 6, 7 and 7A;
- Figure 7 shows in fact a solution for the so-called "Omega" profile in which the joining element is always present in the form of Figure 6B; in particular, Figure 7 refers to the case of joining two panels within the same section while Figure 7A shows, still within the same section, the joining of a panel and a door (for this purpose, in fact, the bushing and screw system is not present to allow the door to be opened/closed).
- Figure 8 is a further variant of the invention in which the shape of the joining component 30 has been modified in accordance with that of the component 330, again thermally insulating;
- Figure 9 and Figure 10 show the solution adopted in Figure 8 applied respectively to the case of joining two sections or Omega profile solution while Figure 10A replaces the case of Figure 10 with the door panel, equivalent to the case of Figure 7A;
- Figure 11 shows an exploded example of a panel

according to the present invention formed by sheet metal walls, i.e. the top wall or outer metal sheet 201, the bottom wall or inner metal sheet 202 and the side walls (203, 204, 205, 205); the Figure shows the opening 203', for example obtained in correspondence with at least one part of (or the entire) longitudinal length of the side wall 203, where the profile 30 is arranged to close the same, being placed between the upper and lower flaps of said opening in such a way as to be effectively interposed between the top wall 201 and the bottom wall 202, in order to create the thermal break between them; Figure 11 also shows an exploded view of the metal profile (50; 350) which is thus arranged, following assembly, in the seat shaped by the panel in correspondence with the side wall; the seat is of such a size that, both in the case of a single metal profile and two panels side by side and in the case of two metal profiles and - again - two panels side by side, said panels touch or almost touch each other through the insulating profiles that face each other with the single metal profile or the two metal profiles entirely contained in the seat obtained by placing the two panels side by side and therefore entirely covered by the panels;

- Figures 11A and 11B also show exploded views of the panel showing the top metal sheet and the bottom metal sheet separated from each other together with the filler material, both in the case of rock wool and polyurethane; In both cases, the section showing application of the thermally insulating profile in its two configurations is also indicated; The thermally insulating profile has been highlighted for greater clarity in the section relating to the exploded Figure and may be present on any part of the side wall; in the specific case of Figures 11A and 11B the section plane ("section plane") is represented and, next to the 3D exploded image, part of the relative section is highlighted for clarity, showing the two side sides of the panel (the two side walls) on which the thermal break profile is applied;

Description of some preferred embodiments

[0103] The solution proposed here, and described in detail below, allows optimization of the reduction of the heat loss in the coupling points of two sections or within the same section where a panel or an additional element is integrated, such as for example a door (and here referred to as the "omega profile" case).

[0104] It should be noted that the construction method remains unchanged in some stages, as already described in the prior art.

[0105] In particular, in construction of the sections, the skeleton is built through the profiles to which the panels are then coupled.

[0106] Each panel is previously prepared separately, for example in the factory, and then transported to the site in order to be assembled, covering the skeleton.

[0107] If elements are added inside a same section, for example door(s) or other panel(s), the relative profile(s) are added to the skeleton which then allow/s the addition of the element (generally the so-called "omega" profile).

[0108] The panel, as already described in the prior art, is formed by an outer metal sheet and an inner metal sheet and between which sheets material may be included or interposed, generally with a thermal and/or acoustic insulation function, for example rock wool or polyurethane.

[0109] The side wall creates a joint between the outer and inner sheet.

[0110] The panel can have any surface extension (generally with a rectangular or square shape, even if other shapes are not excluded) and is formed, as mentioned, by the top metal sheet and the bottom metal sheet spaced apart.

[0111] The side walls, again of sheet metal, shape the panel as a whole according to its final form.

[0112] Figures 11A and 11B are a very good exploded view of the top and bottom metal sheet with the shape of a rectangular box lid which are laid one on top of the other to shape the panel.

[0113] Branching off orthogonally from the top and bottom metal sheet are the side walls which, in the coupling, are laid partly one on top of the other.

[0114] Unlike the prior art, at least the panels which are used in the coupling of sections or components within the same section now come with a certain difference, described below.

[0115] In practice, an opening is made which separates the top metal sheet from the lower one and which runs at least in part along the side wall (see for example the cross-sections of Figures 11A and 11B).

[0116] Said opening creates a thermal discontinuity, that is, it prevents the passage of heat from one face of the panel to the other through transmission through the metal constituting the panel along the side wall.

[0117] It should, in fact, be remembered that the panel, as in the prior art, is made of sheet metal walls and is hollow internally (except possibly, for filler material), so that the passage of heat occurs mainly through the walls of the sheet whose thickness can be variable, depending on the case.

[0118] Preferably, the opening (or notch) is present in the panels that are placed side by side in the joining section - section and/or components within the same section - and runs at least along the face of each panel intended to be coupled with the other panel relating, for example, to the other section to be placed side by side or to the component to be placed side by side.

[0119] As said, this notch interrupts the thermal bridge and allows the insertion of a new thermally insulating element shown in its configurations in Figure 6B, in Figure 8 and equivalently in the sections of Figures 11A and 11B.

[0120] In greater detail, in accordance with the inven-

tion, the two sheets are machined (the outer and the inner one) in such a way as to obtain, when assembled, an opening (for example, a part is removed) in the side wall and which generates a discontinuity. The joining element with thermal break function is to be placed in this opening.

[0121] For example, with reference to Figures 11A and 11B, part of the material is removed from the side wall of the top metal sheet and similarly from the side wall of the bottom metal sheet in order to create the space for inserting the profile in insulating material (see the cross-sections of Figures 11A and 11B).

[0122] This metal-metal discontinuity is therefore obtained through the interposition of said joining element which is thermally insulating (i.e., does not allow the passage of heat) and which is in the form of a relative profile.

[0123] This is a characteristic which is common for all the configurations of the invention presented here and allows better thermal insulation, interrupting the thermal bridge through the interposition of a component (a suitable profile) which is thermally insulating.

[0124] The said element which generates a thermal break may have different configurations, as described below, and the set of coupled parts may have structurally different configurations depending on the case, described in greater detail immediately after.

[0125] In particular, the following will be obtained:
A specific construction solution in the case of coupling of two different sections to be coupled and for this construction solution, use is possible of two different thermal break elements to be inserted in the part from which material has been removed in the panels that are coupled together.

[0126] A specific construction solution in the case of coupling two elements (for example, a door-panel or a panel-panel) within the same section and for this constructive solution, use is again possible here of two different thermal break elements to be inserted in the part from which material has been removed in the panels (or door-panel) that are coupled together.

[0127] Figure 11, similarly to the aforementioned Figures 11A and 11B, schematically shows a panel object of the invention.

[0128] For the production of this panel it is possible to proceed according to, for example, two different methods, depending on whether the filler material of the panel is a foam material or a solid material.

[0129] For example, in the case of foam material that expands and solidifies, polyurethane for instance, the method of procedure may be as follows:
The two metal sheets (for example, of aluminum or other materials normally used for such panels such as stainless steel, galvanized sheet, etc.) are cut to size, any folds included, (thus creating the top and bottom panel, for example in Figure 11B).

[0130] The thermally insulating profile (for example, of plastic material as mentioned) is made and cut to size (see component 30 drawn separately in Figure 11).

[0131] The sheets are assembled to the thermally insulating profile creating the panel (in fact, Figure 11 shows the direction indicating application of the insulating profile 30 to the metal sheet to form the panel), so that with the insulating profile that is interposed between the outer and inner metal sheets for at least one part of the length of the side wall of the panel, therefore separating the two faces of the panel over this section.

[0132] The panel made is therefore assembled but is empty inside, that is, being an assembly of sheets, it forms an empty, internal chamber.

[0133] This can be filled with filler material such as polyurethane.

[0134] In the case of polyurethane (or other foam material

- see Figure 11B), the panel is placed in a press with heated shelves where, through a hole made in the formed panel, the polyurethane is injected, expanding instantaneously, filling the panel and gluing it all together (in particular, outer metal sheet to inner metal sheet and thermally insulating profile).

[0135] The panel is now ready.

[0136] Where solid materials that do not expand such as, for example, rock wool (see Figure 11A), are used as fillers, one possible method of procedure is to assemble the bottom metal sheet, already cut to size, any folds included, to the thermally insulating profile (made, for example, of plastic as mentioned) also cut to size.

[0137] Glue is spread on the bottom metal sheet and the rock wool is put in position (as if it were a mat). The glue is then applied to the top metal sheet, already cut to size, any folds included, which is then assembled with the plastic profile.

[0138] The glue is left to dry.

[0139] The panel obtained is shown in Figure 11 which shows an exploded view of the panel with the thermally insulating profile (in this case, the first profile configuration is shown but matters are the same for the second configuration as well).

[0140] The generic panel therefore comprises the two parallel sheet metal walls laid one on top of the other and spaced apart, i.e. walls 202 and 201.

[0141] Then there are the side walls 204, 205, 206 and 203.

[0142] Figure 11 shows, by way of non-limiting example, the opening 203' in correspondence with the wall 203 where, according to one of the construction methods described above, the profile 30 made of thermally insulating material is arranged.

[0143] The panel is then applied to cover the metal profile (50; 350) which is inserted in the specially arranged step and covered by the panel.

[0144] Having structurally described (and with the aid of some embodiments) the panel which represents an important element of the invention that is common to all configurations, the possible inventive configurations mentioned above are now structurally described in detail.

JOINING OF TWO SECTIONS (SECTION 1 and SECTION 2):

[0145] With reference to Figure 6, the dashed line, as also shown in Figure 4, shows the line along which the two sections are placed side by side in which the profiles 50 of the two sections, thus forming part of the support skeleton, are placed side by side.

[0146] Unlike the prior art, the panels (which may be part of the roof, side wall or other) now have a discontinuity of metal material between the outer metal sheet and the inner metal sheet located at least in the face of the panel intended for coupling with another panel or component and with this discontinuity interrupted by the thermal break profile 30.

[0147] This discontinuity or cut by removal of material from the panel is preferably present all along the line where the panels are side by side.

[0148] In accordance with Figure 6 (example of two sections placed side by side), it may be seen that the panels of the two sections are always formed each one by an outer metal sheet which is joined to an inner metal sheet, as already indicated.

[0149] This is also shown in Figure 6A which represents the conformation of the outer metal sheet and the conformation of the inner metal sheet which, however, now present said discontinuity and therefore a removal of material which effectively interrupts the thermal bridge, i.e. prevents the transmission of heat from the inner metal sheet towards the outside and vice versa.

[0150] To consolidate the cut panel and obviously close the panel as well as to reduce the passage of heat, the discontinuity between the outer and inner metal sheet is interrupted with a new profile in the form of the interposed element 30, again schematized in Figure 6A and

[0151] Figure 6B.

[0152] The interposed element 30, shown in a separate way in the schematic diagram of Figures 6A and 6B, allows the outer metal sheet to be joined to the inner metal sheet thus avoiding direct contact between them and therefore interrupting the thermal bridge.

[0153] In fact, the appendage 10' on the L-shaped end of the outer metal sheet is inserted into a seat 31, substantially V-shaped, for example, formed by the element 30, in the same way as the end 20' of the bottom (or inside) metal sheet is inserted in a specially arranged seat 32 made in the base of the element 30.

[0154] The element 30 is therefore a profile with a predetermined longitudinal length.

[0155] Structurally, it therefore has a vertical wall 35 from which a horizontal wall 36 branches off in such a way as to substantially assume an L-shape.

[0156] From the vertical wall 35, an arm 35' branches off from the side of the horizontal section 36 and which forms the seat 31. The arm 35' rises upwards together with the arm 35, this arm 35' starting from an intermediate point of the arm 35. The arm 35' is progressively distanced from the arm 35 thereby forming the V-shaped (or substantially V-shaped) seat 31.

[0157] The part of the horizontal wall, on the other hand, shapes a seat 33 for a seal and, at its end, forms the further accommodating seat 32 through the branching off of two appendages 38' and 38" that are overlapping and spaced apart.

[0158] The element 30 is made of thermally insulating material, thereby acting as a joint for the outer metal sheet with the inner one, reducing and/or preventing the dissipation of heat as it physically interrupts the passage of heat from the inner metal sheet to the outside and/or vice versa.

[0159] Generally this profile 30 is made of polypropylene, even though obviously any material suitable for thermal insulation can be used, thus preventing the passage of heat, for example materials derived from plastic.

[0160] As said, this thermally insulating profile then forms the further seat 33 which may possibly serve to accommodate a replaceable seal 40, for instance in the case of doors.

[0161] Thanks to this thermal break component 30, the shape of the profiles in the joining areas may be optimized and modified.

[0162] As shown in Figure 6, in fact, two aluminum profiles 50, generally of rectangular or square cross section, facing each other, are used and placed side by side.

[0163] Panel 1 and panel 2 of Figure 6 are then machined in such a way that, in addition to the cut that generates the discontinuity between the top and bottom metal sheets, the bottom metal sheet forms a seat for housing the profile 50 of such a size that the profile 50 is completely covered by the panel itself.

[0164] In this way, as clearly shown in Figure 6, the panel has a sort of L-shaped opening (or step) so it may be correctly applied to the profile 50, the latter being totally covered by the panel itself.

[0165] In this way, the two panels, as shown in Figure 6 and valid for all configurations, are actually side by side and substantially in contact with each other through the profiles made of thermally insulating material that face each other, unlike in the prior art, where the metal profile was physically interposed between the two panels creating a physical subdivision.

[0166] This new layout further optimizes performance.

[0167] Heat dispersion through the aluminum profile 50 is prevented by the element 30 and therefore the profile 50, in addition to being protected from external atmospheric agents because it is totally covered by the panels, can be made of standard material and not necessarily of materials that generate a thermal break, as was the case in some prior art solutions (see also Figure 4).

[0168] The screw system 70 used, identical to that of the prior art, passes through the outer and inner metal sheets of the panel from top to bottom (i.e. it crosses the panel transversely) in order to intercept the joining element 30 in correspondence with its walls which shapes the horizontal seat 32, also passing through the bottom

metal sheet and profile 50 and generating the connection. In this way a stable connection is created which connects the profile 50 and the panel together.

[0169] Inside the seat 33, delimited to the bottom by the horizontal side of profile 50, the seal 40 is inserted, the function of which is to create greater sealing, as for all known seals.

[0170] The seal can be replaceable but this is not an essential element of the invention. It may even not be present, therefore, and the same goes for the relative seat 33.

[0171] Figure 6A therefore schematizes conformation of the inner metal sheet of the panel which forms the L-shaped seat for the metal profile 50 (in dashed line) and which therefore includes the vertical section 20'' and the horizontal section 20' between which the profile 50 is inserted, thus remaining well covered.

[0172] Also shown is the thermal break element 30 (also called thermal break profile 30), which is applied to the panel taking care to allow the vertical section 10' of the outer metal sheet to enter the seat 31 and the horizontal section 20' of the inner metal sheet to enter seat 32.

[0173] Figure 6A shows precisely the separation between outer and inner metal sheet and therefore the interposition of the element 30 which obviously in Figure 6A is seen in front view but is clearly an element of predetermined length, generally with a length corresponding to the entire side of the panel to which it is applied and on which the cut is made.

[0174] Figure 11 shows an exploded view of this particular solution, valid also for the second configuration of insulating element 350 described below.

SOLUTION WITH JOINING PROFILE WITHIN THE SAME SECTION (CALLED OMEGA PROFILE):

[0175] Figure 7 shows a similar solution in all respects, except for the fact that it is applied within the same section, in order for example to apply an additional panel.

[0176] In this case the two aluminum profiles become a single one because this improves performance, although two profiles 350 could be used similarly to the solution in Figure 6.

[0177] In this case, as can be seen from Figure 7, preferably only one section 350 is therefore provided.

[0178] For the remainder, the solution is identical to that of Figures 6, 6A and 6B in which a discontinuity is created between the outer metal sheet and the inner metal sheet, with this discontinuity being interrupted by a thermally insulating element 30 exactly in the form of Figure 6B.

[0179] Figure 7A shows the case of the door connected to the panel within the same section and this solution is identical to that of Figure 7 except obviously for the lack of screw connection system in the door, since the door must be rotatable (i.e. opening/closing) with respect to the profile 350 which forms its stop.

ADVANTAGES OF THE DESCRIBED SOLUTIONS:

[0180] The advantages obtained by these solutions described in Figures 6, 7 and 7A are numerous.

[0181] First of all, there is an interruption of the thermal bridge given by the contact between the inner and outer metal sheet since a thermally insulating profile 30 is now used, for example in polypropylene or other thermally insulating material, for example plastic material.

[0182] Furthermore, the polyamide bars (120, 220) of the prior art solutions are eliminated entirely, thus reducing the costs associated with the polyamide bars and their assembly with the aluminum profiles.

[0183] The new profile 50 and 350 is of standard type and not with a thermal break as in the prior art since, when in position, it is completely covered by the panels and its heat transmission is interrupted by the component 30.

[0184] Being totally covered, the profiles are protected without the need for special treatments.

[0185] There is therefore no need for protection processes, such as anodizing and painting).

FURTHER VARIANT OF THE INVENTION:

[0186] A further variant of the invention is described structurally with reference to Figure 8.

[0187] Everything remains the same as previously described but the cross-sectional shape of the thermally insulating profile changes slightly.

[0188] In this case, the said thermally insulating profile 330 is made of the same materials as that indicated in Figure 6B but its overall geometry changes in that a substantially rectangular front part 339 is added.

[0189] Exactly as for the previous configurations, it is a profile of predetermined longitudinal length depending on the material removal cut made in the panel and having the cross-section shown in Figure 8.

[0190] In greater detail, the rear part 330 still provides for the vertical wall 335 which is connected to a sort of horizontal wall 336.

[0191] The vertical wall 335 forms a substantially V-shaped seat 331 thanks to the side 339' relative to the front rectangle 339 which departs upwards from a joining point together with said vertical wall 335. The end part of the side (339') is connected to a horizontal section substantially parallel to the respective underlying side 338" and connected to each other through the transversal section 339''.

[0192] As in the first solution, the section (338'') is placed above the section (338') thus forming a horizontal accommodating seat 332 whose purpose is to accommodate the horizontal section of the inner metal sheet cut and therefore separated from the outer metal sheet in this area.

[0193] Basically, again in this case, the horizontal section 20' of the metal sheet enters the seat 332 whereas the vertical section (10') enters the vertical seat 331, thus

creating a thermally insulated joint, i.e. in which there is no heat transmission from the inner metal sheet to the outer one and vice versa.

[0194] In greater detail, Figure 9 shows the two sections placed side by side (SECTION 1 and SECTION 2) in which the two coupled profiles 50 are still present and to which the relative panel is coupled to each one through component 330 and screw system.

[0195] The screw system comprises, again in this case exactly as for the other configurations described previously, a bushing into which the screw that penetrates the profile is inserted and, in this case, the bushing penetrates through the rectangle 339 contained within.

[0196] The advantage of this solution is greater structural solidity.

[0197] Figure 10 shows the equivalent solution in the Omega profile case (i.e. panel-panel connection within the same section) while Figure 10A shows the case in which a panel is connected to a door (equivalent to the case of Figure 7A), again within the same section.

[0198] In this description, the generic term of air treatment unit is used to include both air treatment units (ATU) and air treatment systems (ATS).

[0199] In this description, by outer metal sheet of the panel is meant the one facing, when in use, towards the outside of the section to which it is applied and therefore forming the face of the panel in use facing the outside of the section to which it is applied while the inner metal sheet is the one in use facing the inside of the section to which it is applied and which therefore forms the face facing the inside of the same.

[0200] The outer and inner faces of the panel are parallel to each other or substantially parallel and spaced apart from each other.

[0201] The side wall rises vertically from the two faces, shaping the panel.

[0202] The sheet metal panel, as mentioned, is obtained by laying the two halves on top of one another, as shown in Figures 11A and 11B, the two halves having the shape of a box lid, rectangular in shape for example. The vertical walls of the two halves are laid one on top of the other over a section and the join is made through the foam filling material injected or through glues (for example applied in part on the vertical walls of the two overlapping parts) if filler materials such as rock wool (i.e. non-expandable materials) are used.

Claims

1. A panel for an air treatment unit (ATU) or an air treatment system (ATS), the panel being shaped by sheet metal walls, said walls comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance, forming the two front faces of the panel and a side wall (203, 204, 205, 206) of metal sheet in such a way as to internally define a containing space suitable for containing a filler material, for example a foam material such as polyurethane or a solid material such as rock wool;

   - **characterized in that** the panel comprises one or more elements (30, 330) made of thermally insulating material arranged in such a way as to generate a discontinuity of material in one or more areas of said sheet metal walls constituting the panel and thus generate an interruption and/or a reduction of heat transmission along the sheet metal walls in the arranged area(s).

2. The panel, according to claim 1, wherein said element is arranged in at least one part of the side wall of said panel in such a way as to generate said discontinuity of material in said part of the side wall where it is arranged and generate said interruption and/or reduction of heat transmission between the outer metal sheet and the inner one and/or vice versa.

3. The panel, according to claim 2, wherein:

   - said at least one part of said side wall forms an opening (203') which creates a separation zone between the outer metal sheet (201) and the inner metal sheet (202);
   - and wherein said element (30, 330) made of thermally insulating material is arranged in correspondence with said opening so as to close said opening in such a way that said element creates said interruption and/or a reduction of the passage of heat between the outer metal sheet and the inner one and/or vice versa.

4. The panel, according to one or more of the preceding claims, wherein said element (30, 330) is a profile of predetermined longitudinal length and with predetermined cross-sectional shape.

5. The panel, according to claim 4, wherein said profile in cross-section includes:

   - a vertical wall (35, 335);
   - a horizontal wall (36, 336) connected to the vertical wall;
   - a vertical seat (31) made at a certain height of the vertical wall into which the free end of the vertical flap (10') generated by said opening (203') is inserted;
   - a horizontal seat (32) made in a point of the horizontal wall, preferably at its end, into which the free end of the horizontal flap (20') generated by said opening is inserted.

6. The panel, according to one or more of the preceding claims, in which at least the side wall part of the panel

comprising said thermally insulating element forms a seat made at a different height from the opening for arranging said element and with said seat suitable for accommodating a profile (50; 350) in such a way that said profile is at least partially covered by said panel, the profile preferably being metallic, for example extruded aluminum.

7. The panel, according to claim 5 and 6, wherein said seat is formed by a horizontal flap (20') the free end of which is inserted in the horizontal seat (32) of the thermally insulating profile and by a vertical flap (20") which branches off from the horizontal flap in a direction away from the outer metal sheet to connect to the inner metal sheet.

8. A coupling system for an air treatment unit (ATU) or an air treatment system (ATS) and comprising:

- at least one panel, according to one or more of the preceding claims;
- at least one metal profile (50, 350), made of aluminum for example, accommodated in said seat shaped by the panel according to claim 6 or 7, and in which connecting means (70) are included connecting said panel to said metal profile.

9. The coupling system according to claim 8, including:

- two panels, according to one or more of the preceding claims from 1 to 7, arranged side by side in such a way that the respective thermally insulating components are side by side;
- the seats of said two side-by-side panels defining a single seat which contains said at least one metal profile (50, 350) which thus remains entirely covered by said two side-by-side panels;
- and wherein said metal profile (50, 350) is fixed to at least one of said two panels by means of said connecting means (70) which penetrate from the outer metal sheet until they intercept said metal profile, said connecting means preferably simultaneously also intercepting the horizontal wall (36, 336) of said profile made of thermally insulating material.

10. The coupling system according to one or more of the preceding claims, comprising two metal profiles (50) placed side by side in said seat.

11. An air treatment unit or air treatment system comprising a coupling system in accordance with one or more of the preceding claims from 8 to 10 to create the coupling of two different sections of the unit or the system or to interpose two components in the same section.

12. A method of constructing an air treatment unit or air treatment system or parts thereof and which includes:

- the construction of at least two panels intended to be placed side by side, each one of said at least two panels being formed by sheet metal walls, said walls comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance which respectively form the two front faces of the panel and a side wall (203, 204, 205, 206) of sheet metal in such a way as to internally define a containing space suitable for containing a filler material, for example a foam material such as polyurethane or a solid material such as rock wool;
- and wherein the method provides for the application of one or more profiles (30, 330) made of thermally insulating material which is/are arranged in each one of the two panels in one or more relative openings made in the metal sheet forming said two panels, in such a way as to generate a discontinuity of material in the metal sheet which creates an interruption and/or reduction of the passage of heat, preferably in both said two panels, said opening being made in at least one portion of the side wall of the two panels which are intended to face one to the other in such a way as to reduce and/or interrupt the passage of heat between the outer and inner metal sheet and vice versa.

13. The method, according to claim 12, in which said two panels are applied to cover at least one metal profile (50, 350), preferably with said metal profile (50, 350) which is inserted in a step seat formed by said two panels, so that said two panels are side by side and provided with the profile made of insulating material and in which said metal profile is fixed to at least one of said two panels.

14. The use of one or more profiles (30, 330) of predetermined longitudinal length made of thermally insulating material in a sheet metal panel, the walls shaping said panel comprising an outer metal sheet (201) and an inner metal sheet (202) laid one on top of the other at a certain distance which respectively form the two front faces of the panel and a side wall (203, 204, 205, 206), said one or more profiles being inserted in respective openings in the walls of the panel in such a way as to create discontinuity of the metal material of the wall and generate an interruption and/or reduction of the passage of heat, preferably said opening being formed in at least one part of the side wall of the panel in such a way as to prevent and/or reduce the passage of heat from one face of the panel to the other.

15. A profile (30, 330) of predetermined longitudinal length made of thermally insulating material configured to be inserted into an opening that separates at least partially the two front faces of a sheet metal panel in such a way as to prevent, through said profile, the passage of heat from one face to the other of the panel in the section in which it is inserted, said profile preferably comprising:

- a vertical wall (35, 335);
- a horizontal wall (36, 336) connected to the vertical wall;
- a vertical seat (31) made at a certain height of the vertical wall;
- a horizontal seat (32) made in a certain point of the horizontal wall.

FIG.1
(PRIOR ART)

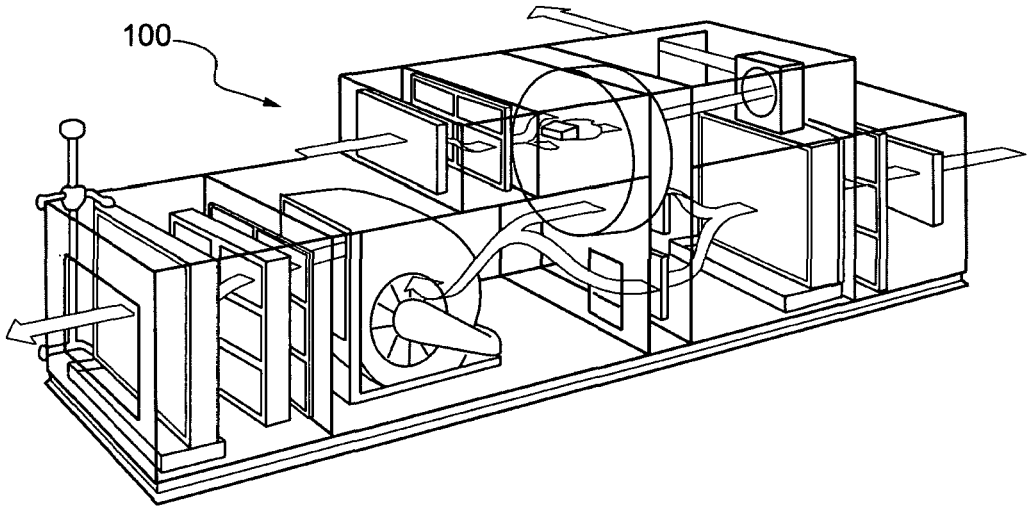


FIG.2
(PRIOR ART)

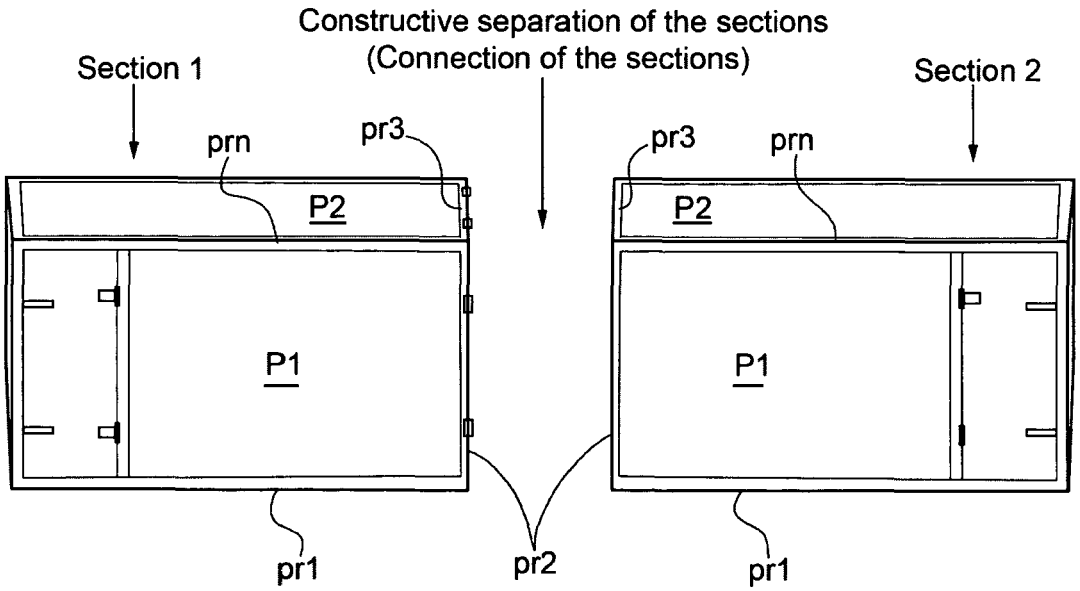


FIG.2A

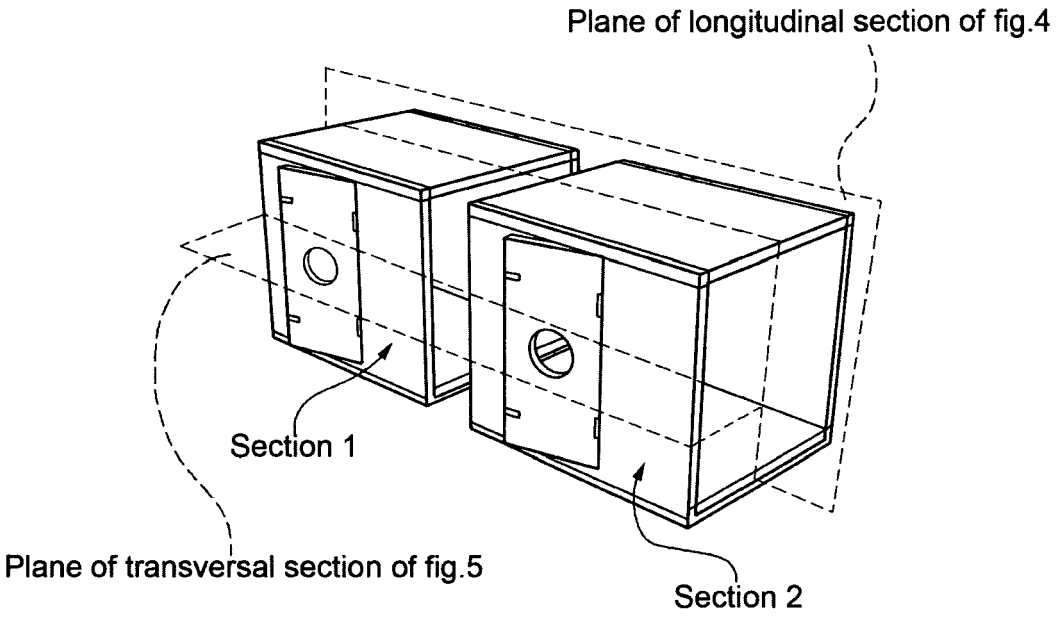


FIG.3

(PRIOR ART)

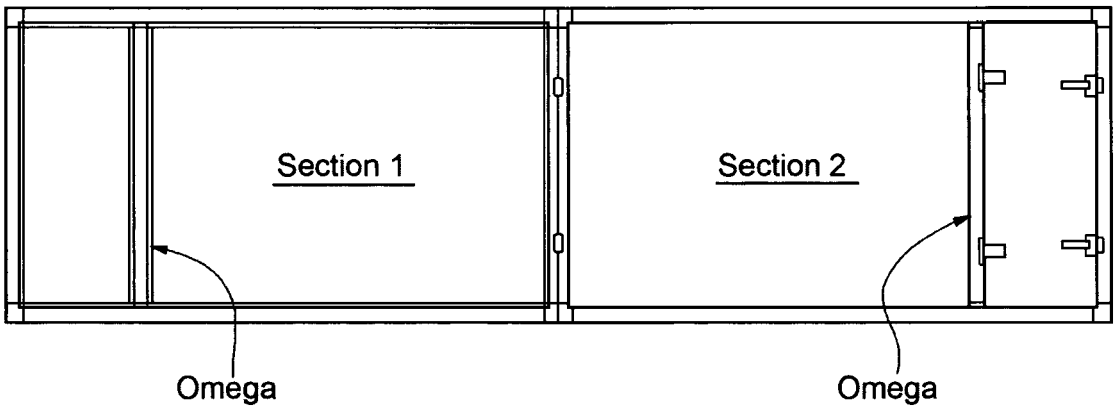


FIG.4
(PRIOR ART)

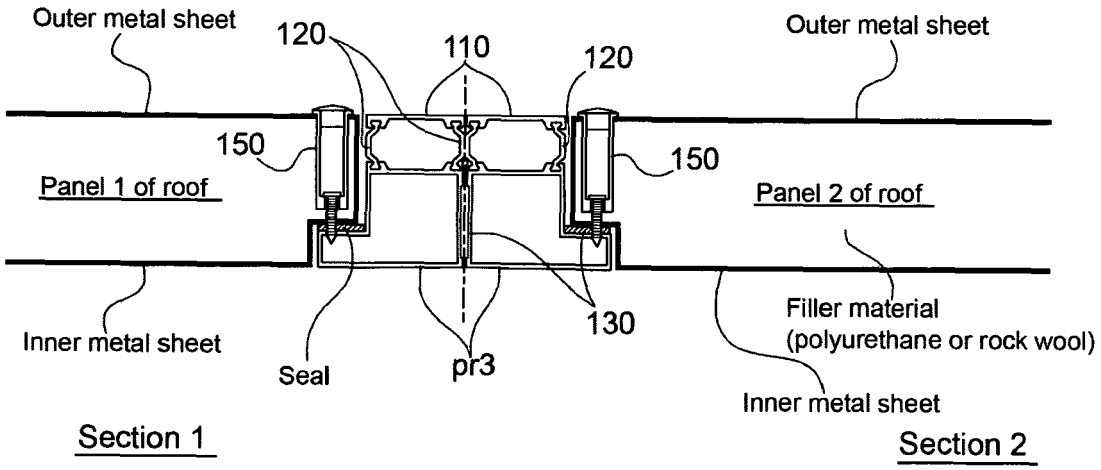


FIG.5
(PRIOR ART)
OMEGA PROFILE

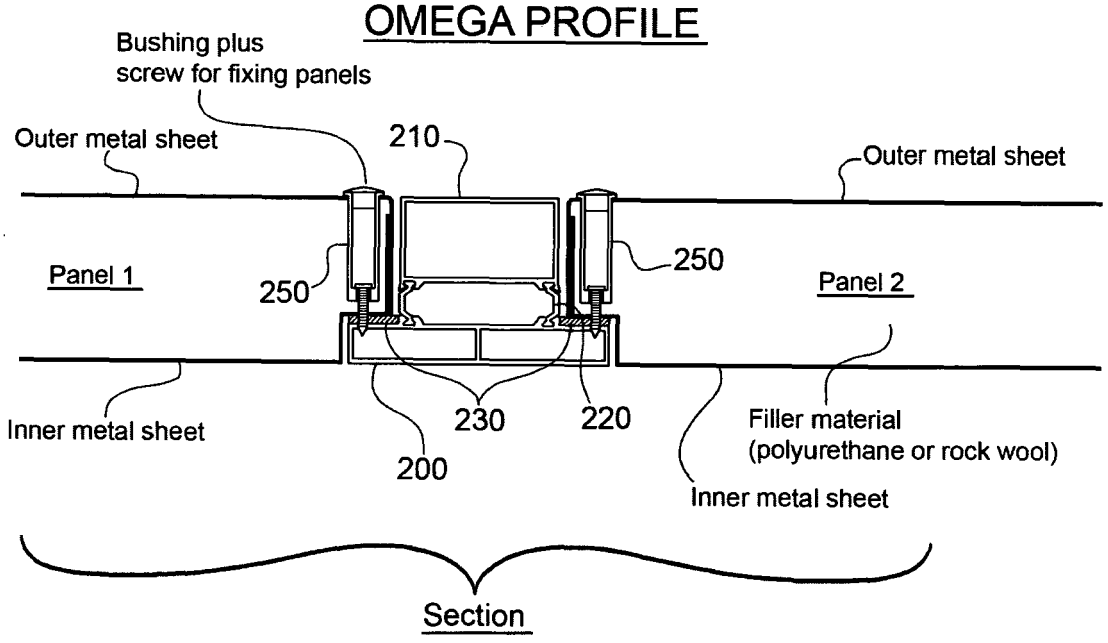


FIG.6

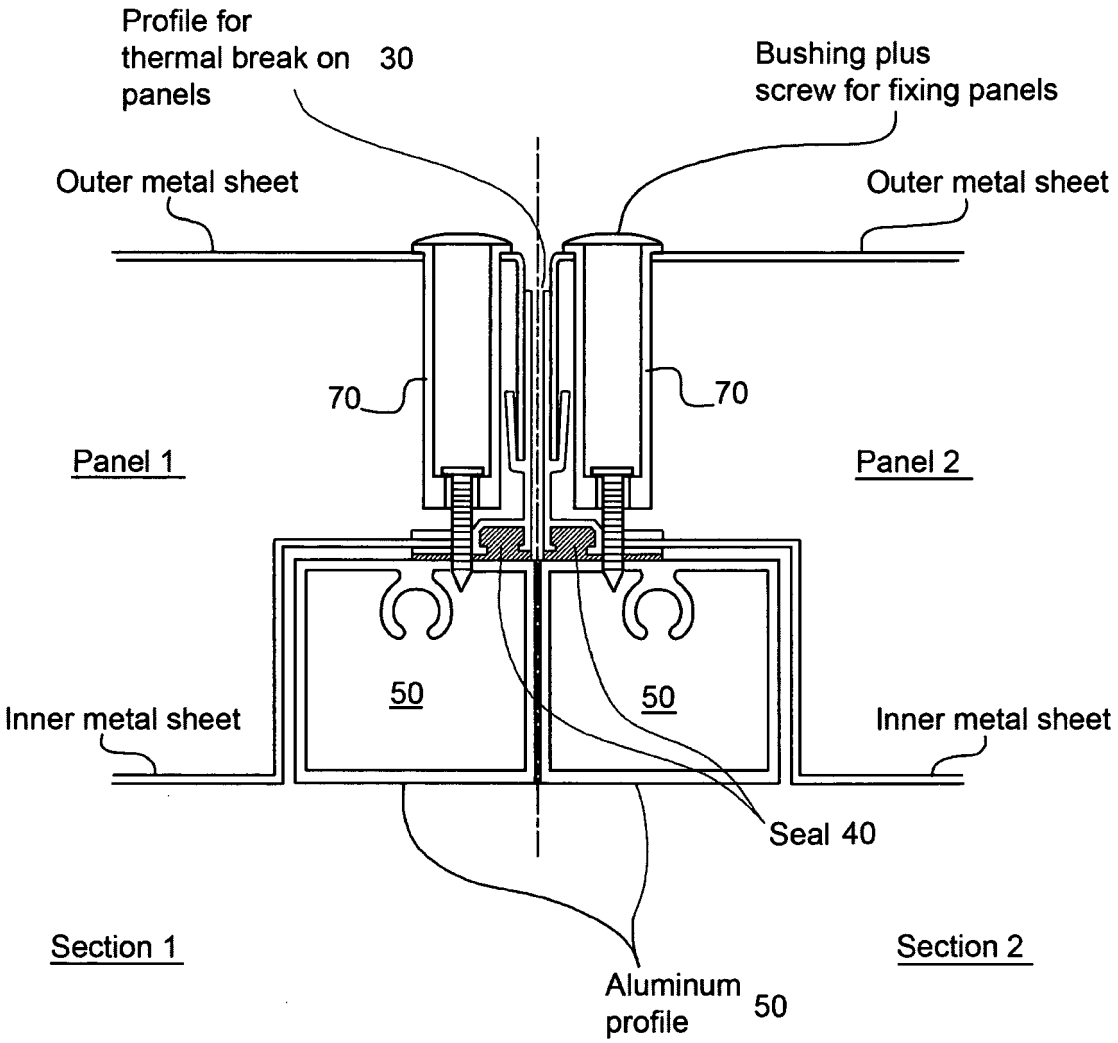

Profile for thermal break on panels 30
Bushing plus screw for fixing panels
Outer metal sheet
Outer metal sheet
70
70
Panel 1
Panel 2
50
50
Inner metal sheet
Inner metal sheet
Seal 40
Section 1
Section 2
Aluminum profile 50

FIG.6A

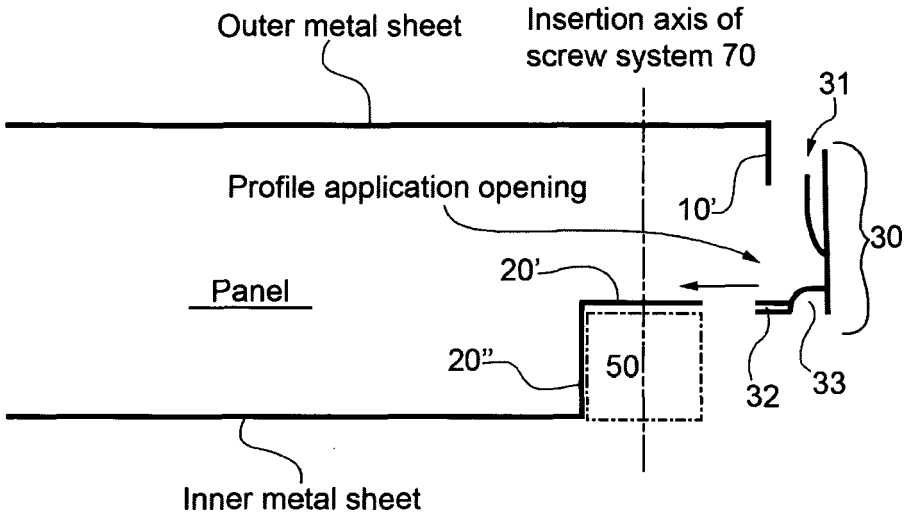

Outer metal sheet
Insertion axis of screw system 70
31
Profile application opening
10'
30
20'
Panel
20"
50
32
33
Inner metal sheet

FIG.6B

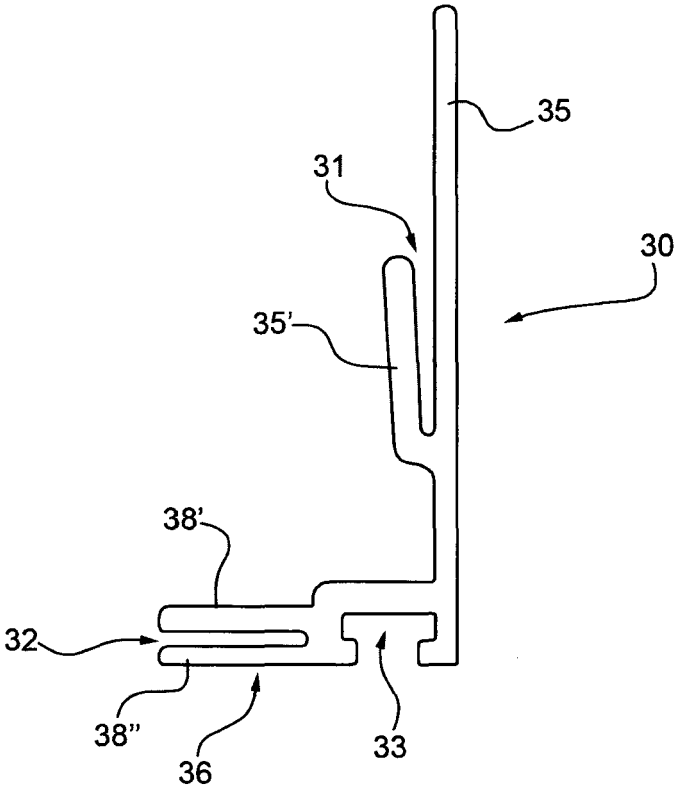

35
31
30
35'
38'
32
38"
36
33

FIG.7

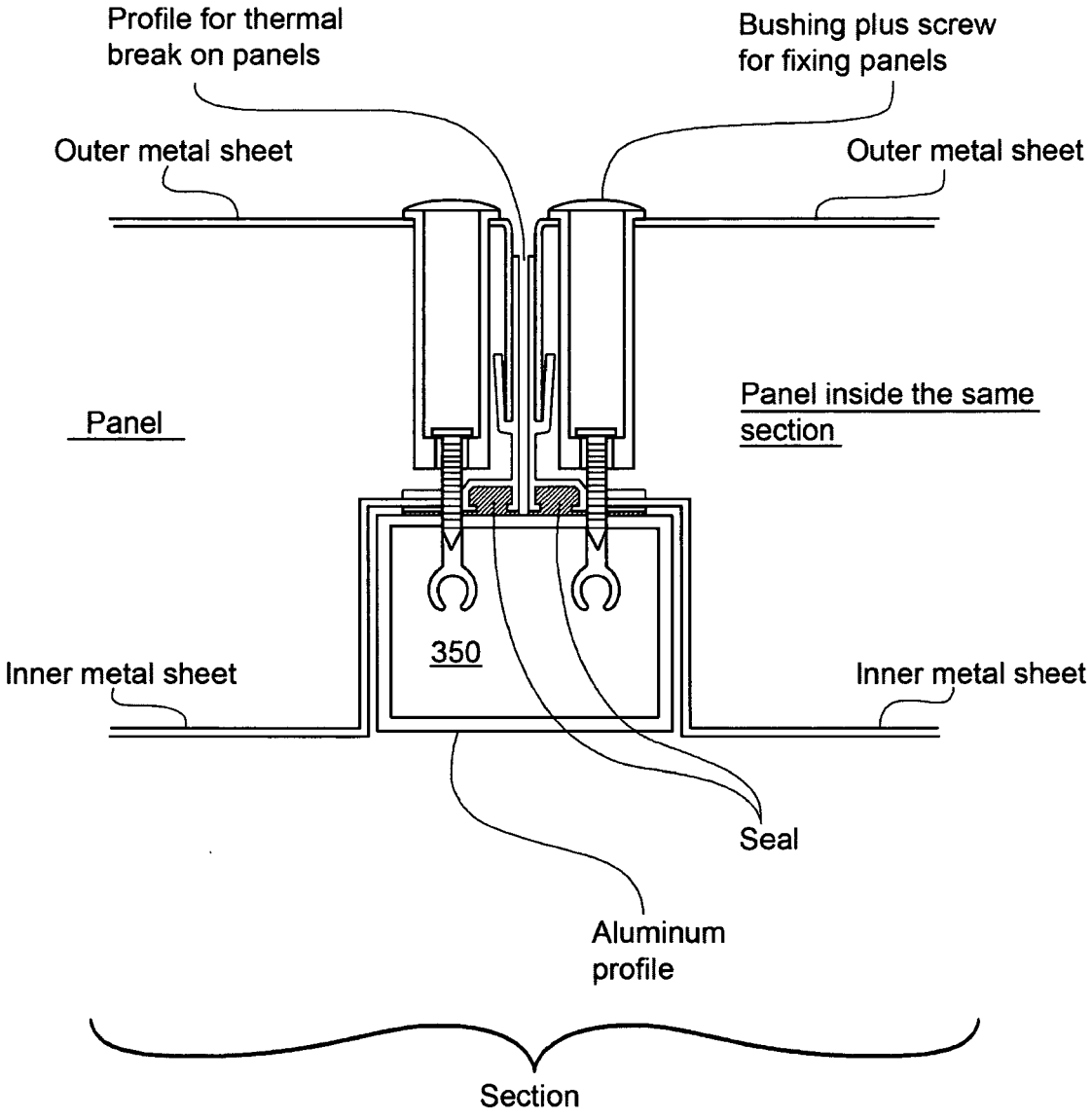

Profile for thermal break on panels
Bushing plus screw for fixing panels
Outer metal sheet
Outer metal sheet
Panel
Panel inside the same section
350
Inner metal sheet
Inner metal sheet
Seal
Aluminum profile
Section

FIG.7A

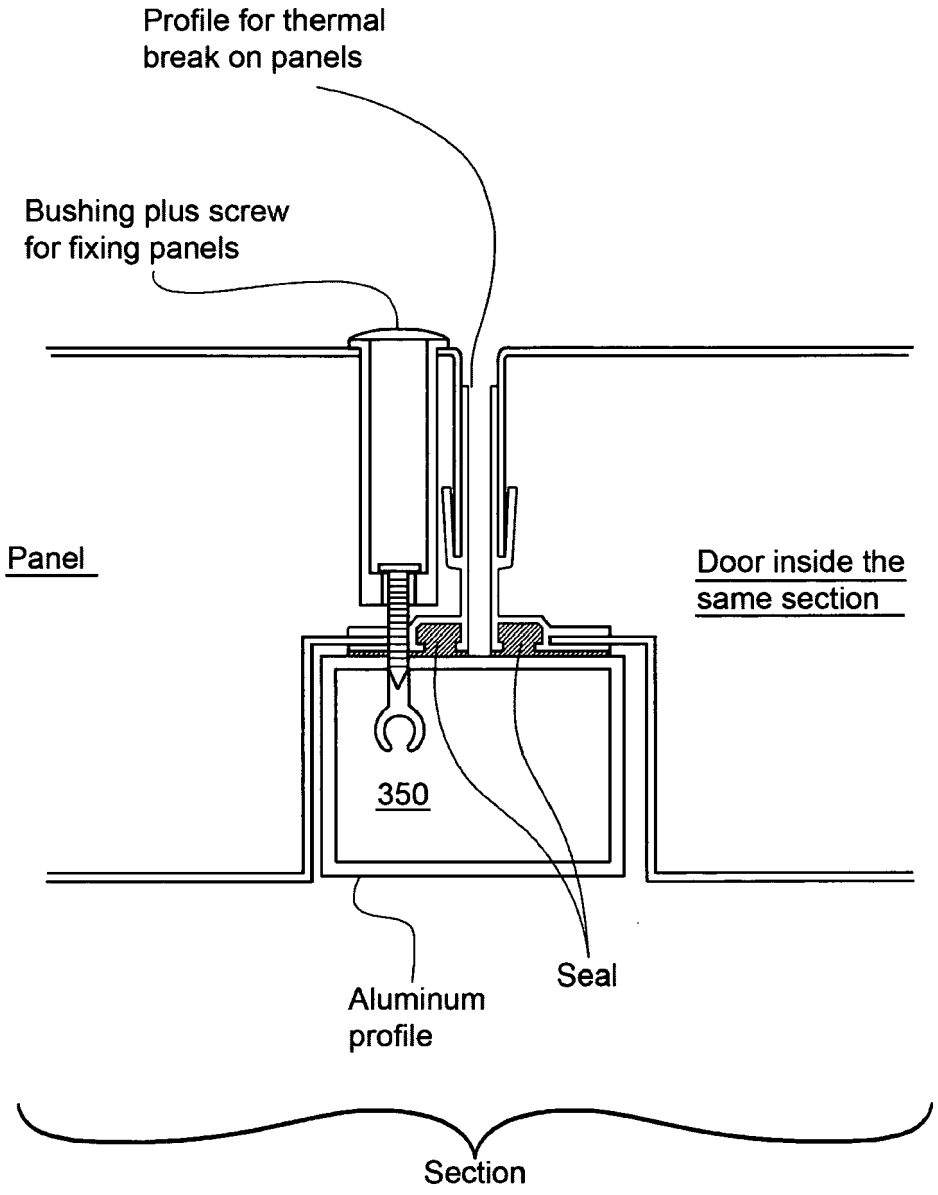

Profile for thermal break on panels
Bushing plus screw for fixing panels
Panel
Door inside the same section
350
Seal
Aluminum profile
Section

FIG.8

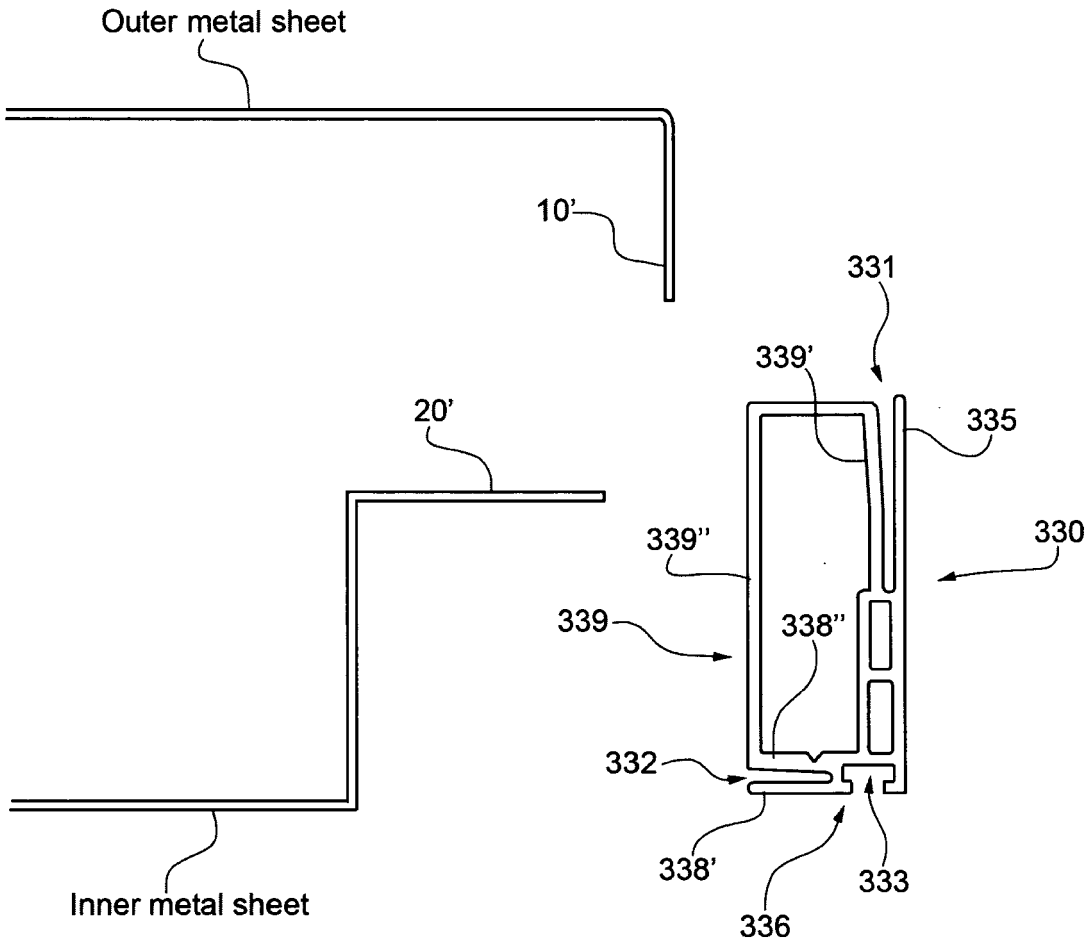

Outer metal sheet
10'
331
339'
335
20'
339''
330
339
338''
332
338'
333
336
Inner metal sheet

FIG.9

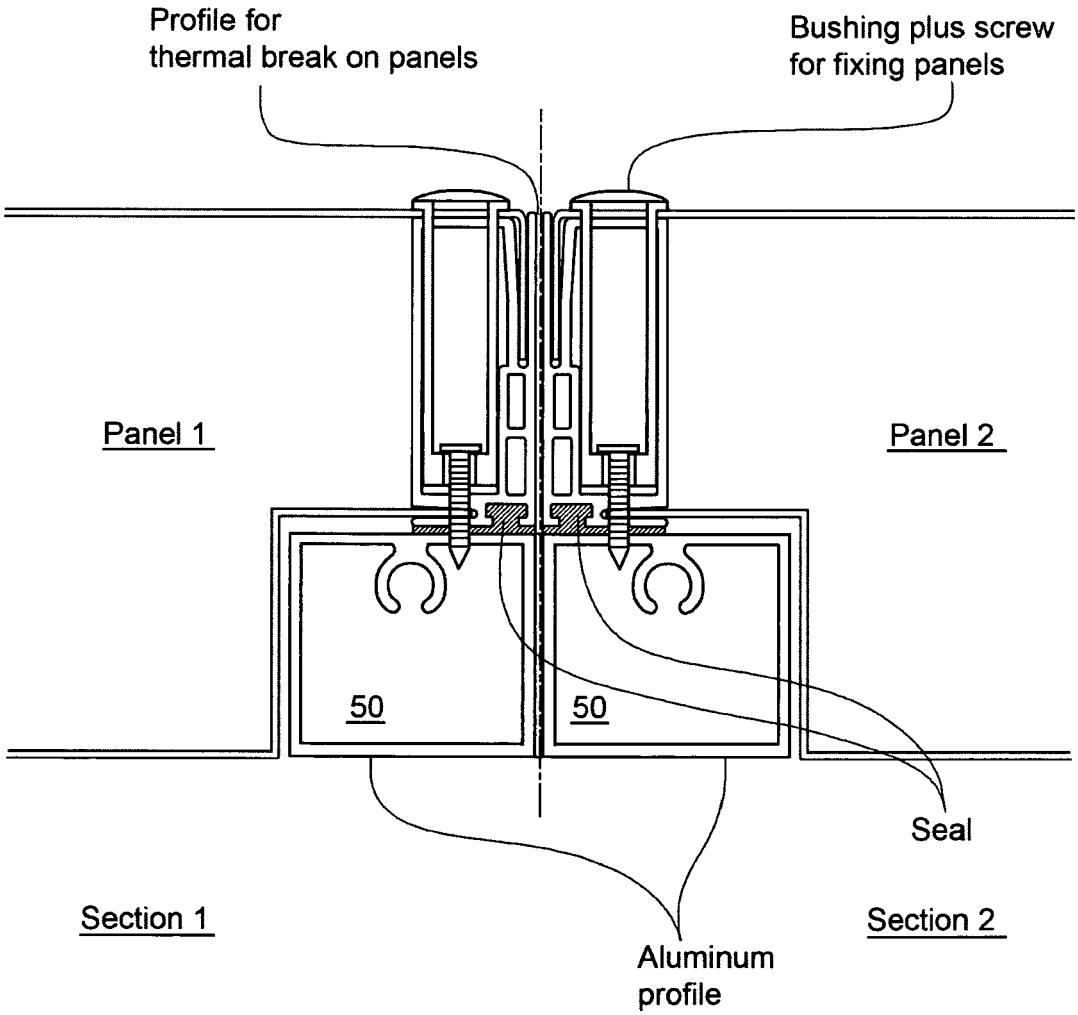

Profile for
thermal break on panels
Bushing plus screw
for fixing panels
Panel 1
Panel 2
50
50
Seal
Section 1
Section 2
Aluminum
profile

FIG.10

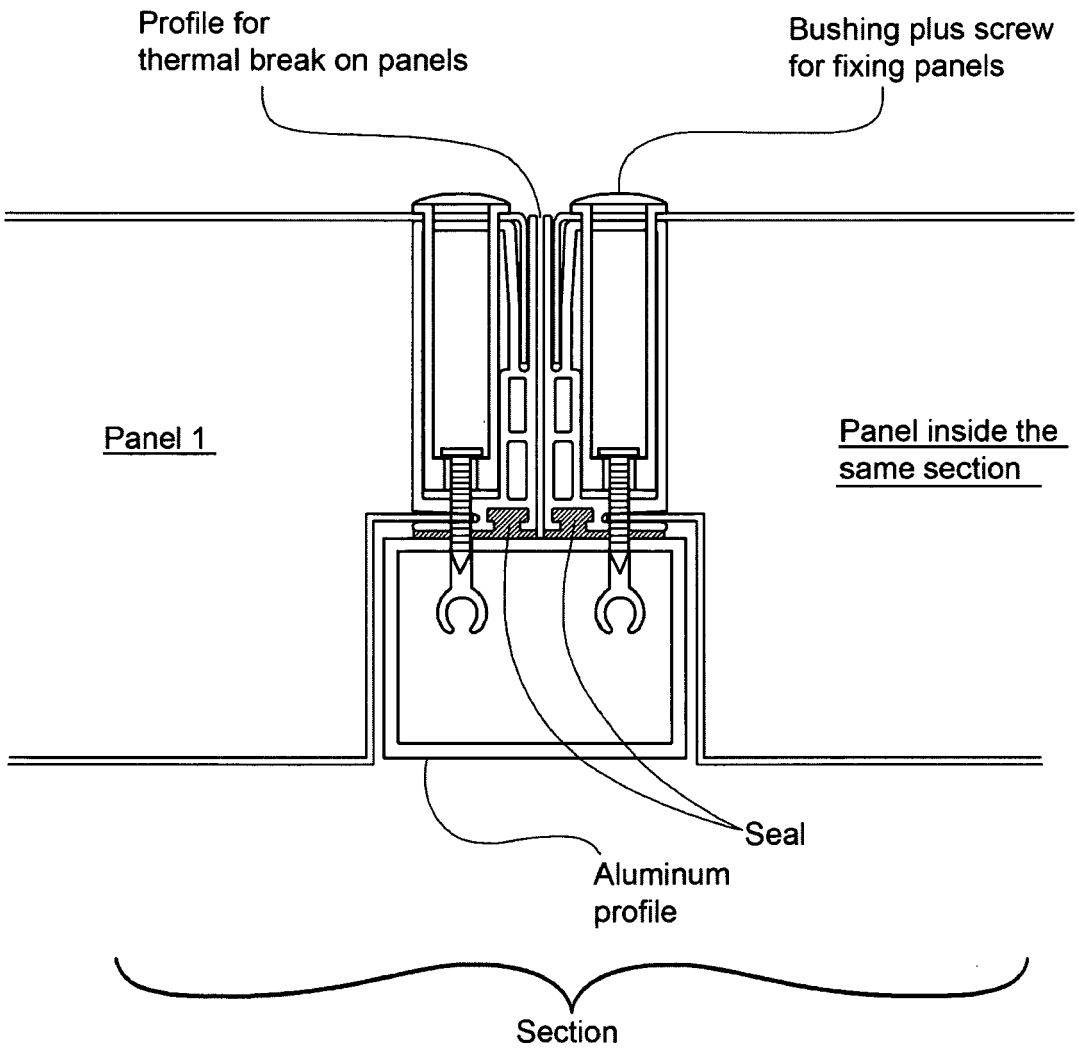

Profile for
thermal break on panels
Bushing plus screw
for fixing panels
Panel 1
Panel inside the
same section
Seal
Aluminum
profile
Section

FIG.10A

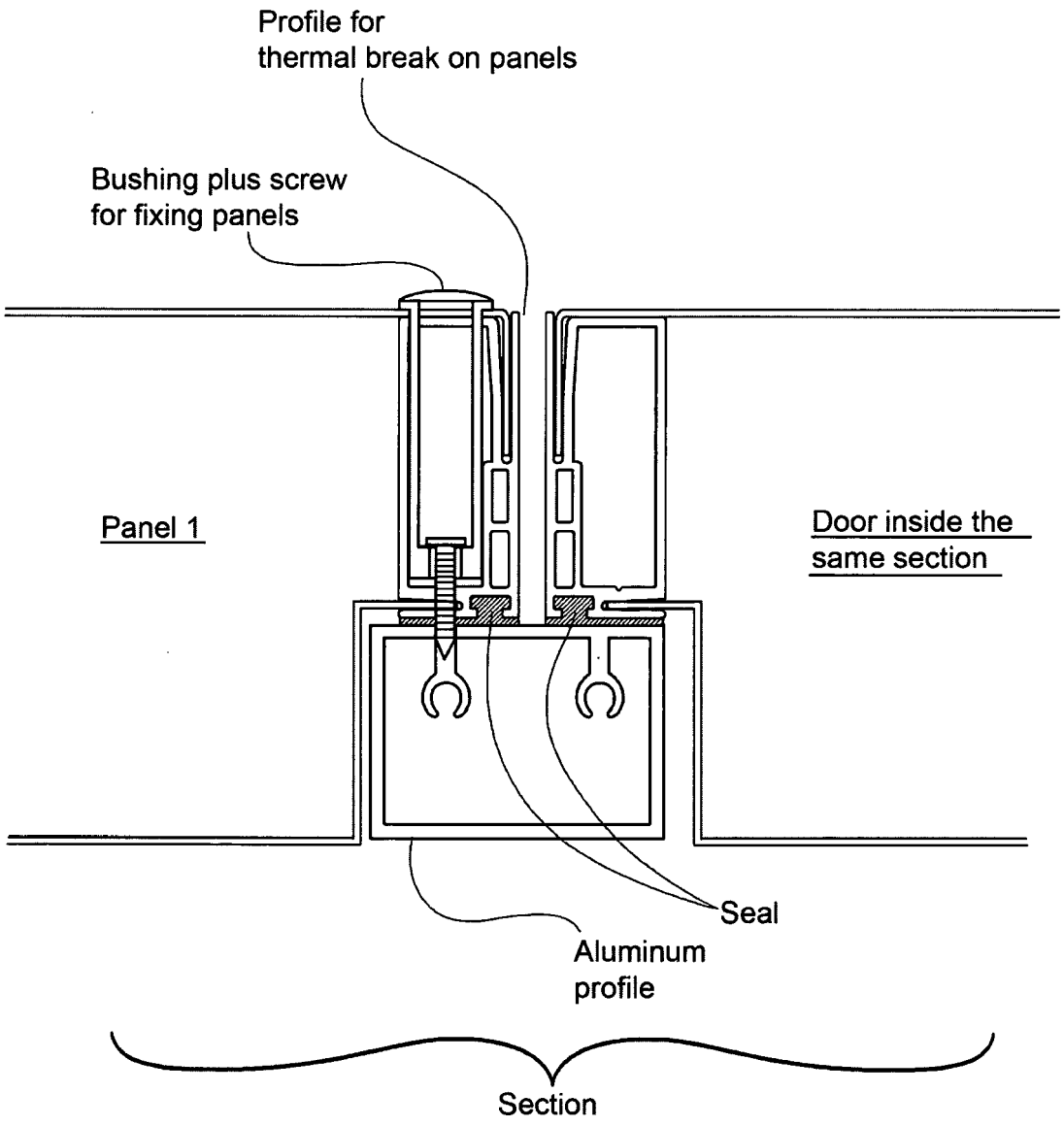

Profile for
thermal break on panels
Bushing plus screw
for fixing panels
Panel 1
Door inside the
same section
Seal
Aluminum
profile
Section

FIG.11

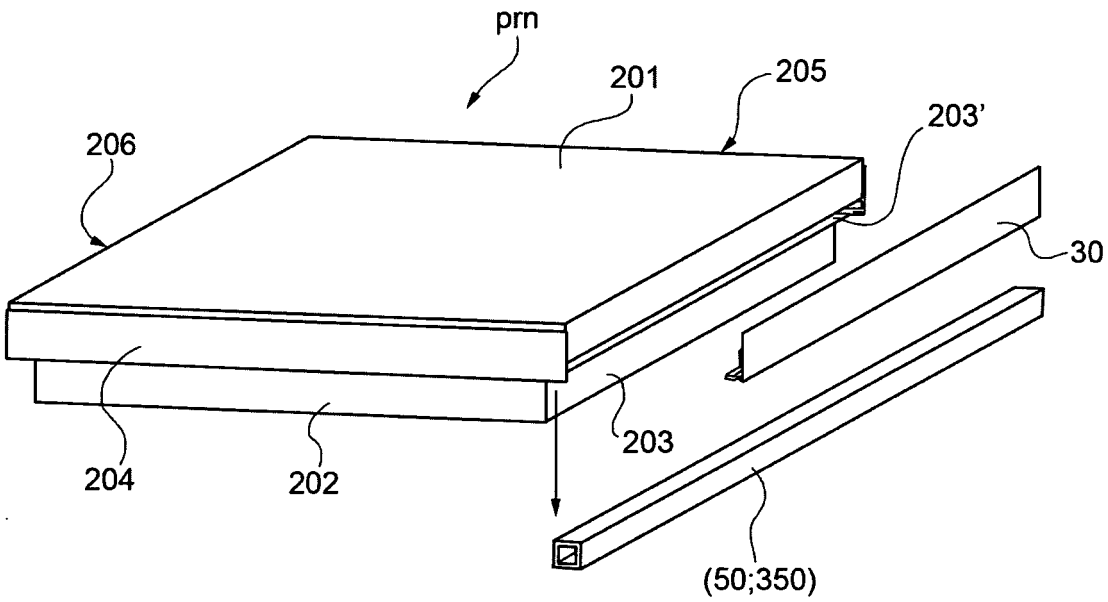


FIG.11A

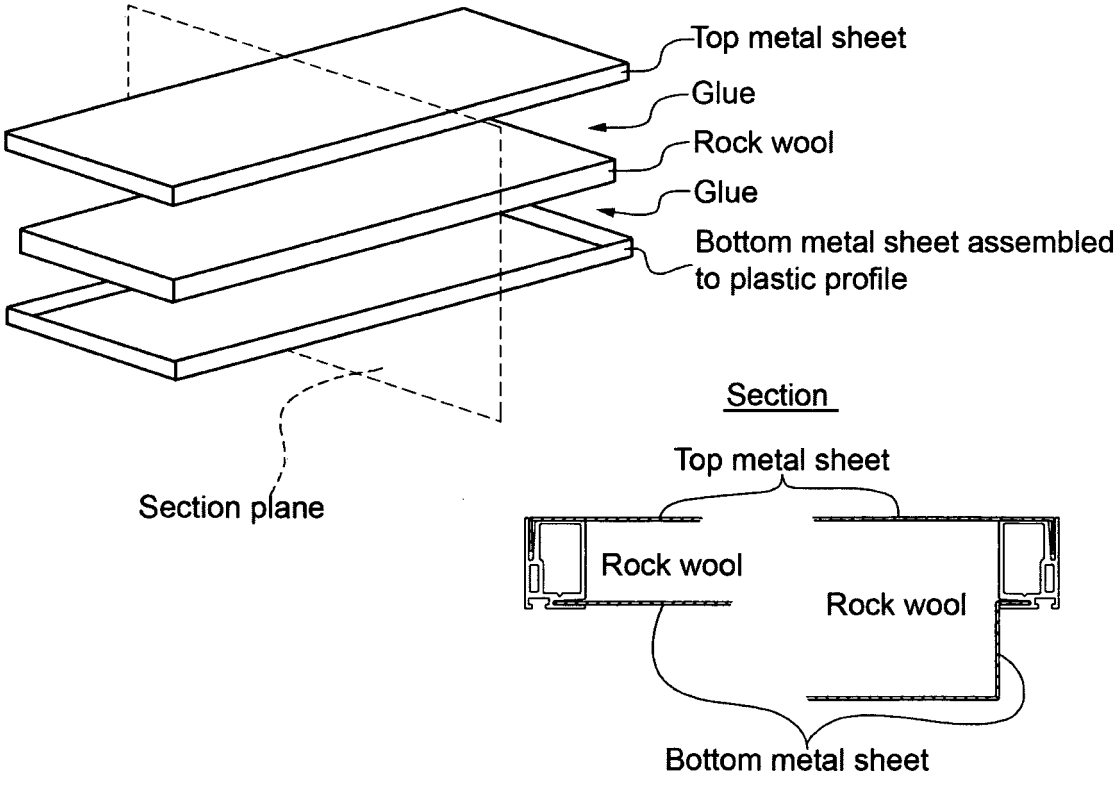
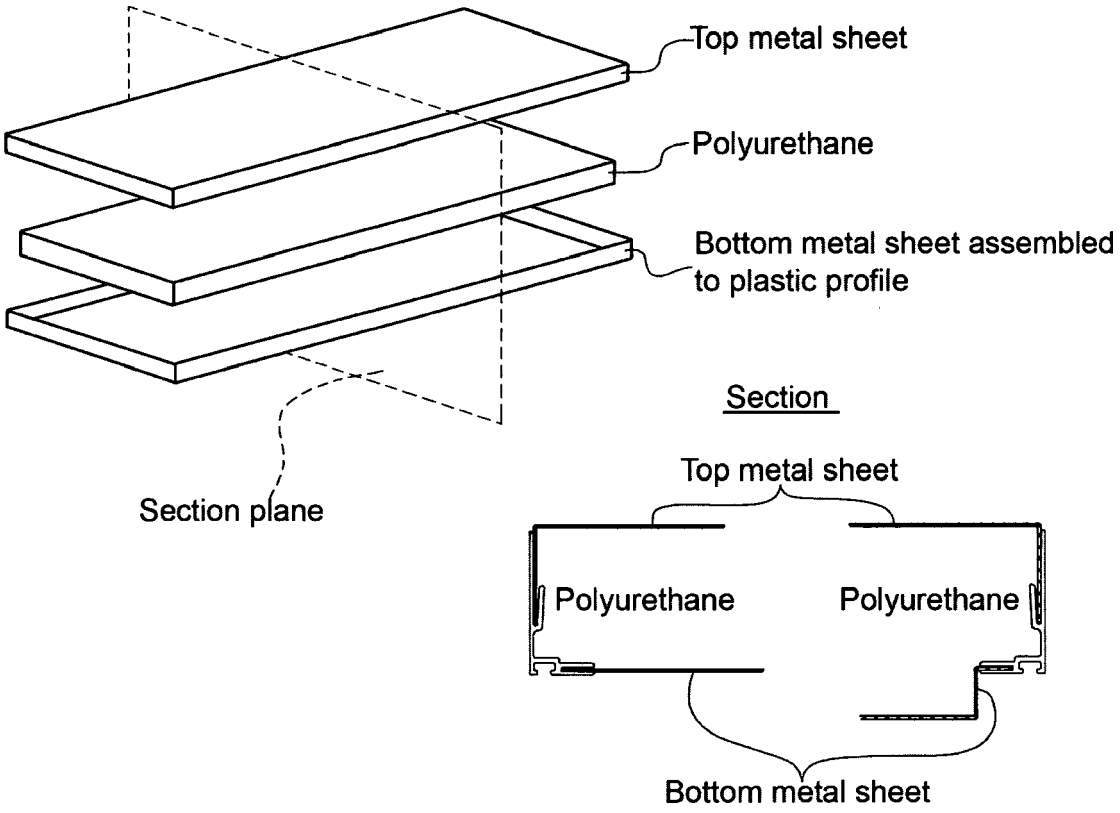


FIG.11B


Top metal sheet
Polyurethane
Bottom metal sheet assembled to plastic profile
Section plane
Section
Top metal sheet
Polyurethane
Polyurethane
Bottom metal sheet

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EUROPEAN SEARCH REPORT

Application Number
EP 21 42 5024

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	WO 2012/097908 A1 (TASSON PIETRO [CA]; TASSON ANTONIO [CA]; TASSON ROBERT PETER [CA]) 26 July 2012 (2012-07-26)	1-4,6, 8-11,13, 14	INV. F24F13/02 F24F13/20 F16L59/00 E04C2/292 E04F17/04
A	* page 4, line 11 - page 5, line 31; figures 1-5 *	5,7,15	
X	WO 94/24493 A1 (EMAIL LTD [AU]) 27 October 1994 (1994-10-27)	1-4,12, 14	
A	* abstract; figures 1-5 *	5-11,13, 15	
X	WO 2016/149390 A1 (CARRIER CORP [US]) 22 September 2016 (2016-09-22)	1-7,12, 14,15	
A	* paragraphs [0010], [0011], [0031], [0032], [0039], [0040]; figures 1-5 *	8-11,13	

TECHNICAL FIELDS SEARCHED (IPC)
F24F
F16L
E04C
E04F

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 February 2022	Degen, Marcello

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09-02-2022

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