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(54) **PANELIZED SHADOW BOX**

PANELISIERTE SCHATTENBOX

GÉNÉRATEUR D'OMBRAGE À PANNEAUX

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to architectural devices and, more specifically, a shadow box for use in various building cladding systems including but not limited to unitized and stick system curtain wall, window wall, strongback, punched windows and other framed assemblies and rain screen assemblies.

2. Description of the Related Art

[0002] A curtain wall is a non-structural outer covering of a building. A curtain wall serves to provide a desired exterior appearance and to keep exterior environmental elements (e.g., wind, rain, etc.) out of the building. While a curtain wall will impart horizontal forces, such as wind loading, to the structural elements of the building, it does not bear the vertical load of the building (except for its own dead weight). Because it is non-structural, it provides a relatively inexpensive way to finish a building's exterior.

[0003] A typical enclosure system such as a curtain wall includes an array of mullions, which are vertical and horizontal elements that hold transparent vision glass and opaque spandrel zones. A typical spandrel zone can consist of the following components: a facing material (such as, aluminum, stone, glass masonry, etc.), insulation, and an air and vapor barrier.

[0004] The requirements for thermal insulation and fire separation dictate the need for opaque spandrel panels. In addition, other elements that are not desired to be seen are typically concealed by a opaque panels that can be identical to the spandrel or made of other materials. One way to hide such elements is by substituting opaque glass over the elements to be hidden. However, this approach interrupts the visual effect of the vision glass spandrels, which can be an aesthetically undesirable effect.

[0005] To give the illusion of depth, some architects design curtain walls in which the elements to be hid are covered with shadow boxes. A shadow box is a spandrel with a vision glass exterior and an opaque back that is offset by several inches from the vision glass exterior. The documents US2004/0202803 and EP0250691 disclose such boxes. The opaque back hides the elements to be hidden, while the visual effect of the offset can appear similar to the vision glass glazing of the rest of the curtain wall.

[0006] Some shadow boxes are deliberately vented to the exterior of the building, some are inadvertently vented to the interior of the building and some are deliberately fully sealed. If they are vented to the exterior, it is possible for dust, insects and the like to enter the shadow box. It is also possible for condensation to form within the shadow box during hot and humid weather. If they are vented to the interior there may be a pathway for dust to form on the inner (#2) surface of the glazing. During cold weather, there is also a high possibility for condensation to form within the spandrel box. If they are fully sealed and moisture enters the spandrel box, either through faults in the inner or outer seals, then long-term condensation may occur. Dust and dirt collection within a spandrel box, the presence of insects and the like within a spandrel box and the presence of condensation within a spandrel box can all be considered as failures of the spandrel box. Opening an installed shadow box to clean it is not a practical solution to problems involving dirt and moisture.

[0007] Another form of shadow box uses a conventional insulating glass unit with a solid frit or coating on the innermost surface of the glass. This system addresses the visual problems of the standard spandrel box solution described above by visually blocking any dirt, dust, insects and the like, and condensation that may form in externally or internally vented or fully sealed shadow boxes. This form of shadow box does not provide the visual depth often desired by the designer. In addition, this form of shadow box may not prevent condensation formation (and it prevents the visual warning that condensation may be forming). Such condensation may lead to failures of the shadow box.

[0008] Cladding system like curtain walls can be constructed on-site (in which case they are referred to as "stick systems") or they can be assembled in panels at a unitized assembly shop as part of unitized systems such as unitized curtain walls that are shipped to the construction site. In both cases, shadow boxes are constructed as part of the construction of the panels of the curtain wall. This makes curtain wall construction a time consuming process. Also, since the shadow boxes are constructed on an *ad hoc* basis, ensuring that their seals and tolerances are suitable for long duration construction can be difficult. Multiple decades of *ad hoc* shadow box construction has demonstrated that it is hard to achieve an effective hermetic seal into a shadow box made this way. Additionally, when constructing shadow boxes on-site and at unitized assembly shops typically results in the introduction of dust and other impurities into the shadow box, which detracts from the visual effect of the shadow box.

[0009] Therefore, there is a need for a prefabricated shadow box unit that employs seals with a long lifetime.

SUMMARY OF THE INVENTION

[0010] The disadvantages of the prior art are overcome by the present invention which, in one aspect, is a method of supplying an element for covering a non-vision area in a curtain wall on an architectural structure, in which a plurality of shadow boxes is prefabricated at a location remote from both a unitized curtain wall assembly shop and the architectural structure. The shadow boxes are prefabricated by sealing, with a first airtight and moisture resistant hermetic seal and a second airtight and moisture resistant hermetic seal, an interior spacer between vision glass panel and back structure, the spacer having a length so that the vision glass panel is spaced apart from the back structure, the back structure including a first insulating material and a rigid envelope disposed around the first insulating material, the spacer disposed along a peripheral edge of the vision glass panel and along a peripheral edge of the back structure so as to hold the vision glass panel in a spaced apart relationship from the back structure, so that the first hermetic seal seals the interior spacer to the vision glass panel and so that the second hermetic seal seals the interior spacer to the back structure and so that the vision glass panel, the back structure and the interior spacer define a hermetically sealed void therein. A structural seal is applied about the interior spacer and so as to be affixed to the peripheral edge of the vision glass, the interior spacer and the back structure. The plurality of shadow boxes is then delivered to a selected one of the unitized curtain wall assembly shop and the architectural site.

[0011] In another aspect, the invention is a curtain wall system for covering an architectural structure that includes a frame structure that is configured to be affixed to an outer surface of the architectural structure. A plurality of vision glass panels are supported by the frame structure. A plurality of shadow boxes is prefabricated prior to delivery to both a unitized curtain wall assembly shop and the architectural structure. Each of the plurality of shadow boxes is configured to be affixed to the frame structure and configured to cover a non-vision area of the architectural structure. Each of the plurality of shadow boxes includes: a vision glass panel having a peripheral edge; a back structure, having a peripheral edge, the back structure including an insulating material and a rigid envelope disposed around the insulating material; an interior spacer disposed along the peripheral edge of the vision glass panel and along the peripheral edge of the back structure so as to hold the vision glass panel in a spaced apart relationship from the back structure, the interior spacer defining at least one chamber therein into which a desiccant is disposed; a first hermetic seal that seals the interior spacer to the vision glass panel and a second hermetic seal that seals the interior spacer to the back structure so that the vision glass panel, the back structure and the interior spacer define a hermetically sealed void therein; a structural seal disposed about the interior spacer and affixed to the peripheral edge of the vision glass, the interior spacer and the back structure; and a back panel disposed within the hermetically sealed void and against the back structure, the back panel including an aesthetic treatment configured to present a desired visual effect to viewers looking through the vision glass panel.

[0012] In yet another aspect, the invention is a shadow box for use with an architectural curtain wall system that includes a vision glass panel having an outside #1 surface, an opposite inside #2 surface and a peripheral edge. A back structure has a peripheral edge and includes a first insulating material and a rigid envelope disposed around the first insulating material. An interior spacer defines a plurality of chambers therein in which a desiccant is placed. The interior spacer is disposed along the peripheral edge of the inside #2 surface of the vision glass panel and along the peripheral edge of the back structure so as to hold the vision glass panel in a spaced apart relationship from the back structure. A first polyisobutylene seal seals the interior spacer to the vision glass panel and a second polyisobutylene seal seals the interior spacer to the back structure so that the vision glass panel, the back structure and the interior spacer define a hermetically sealed void therein. The spacer has a length so that the vision glass panel is spaced apart from the back structure by more than 1 inch. A silicone seal is disposed about the interior spacer and is affixed to the peripheral edge of the vision glass, the interior spacer and the back structure so as to provide structural support thereto. The shadow box has been prefabricated prior to insertion into a pre-assembled frame structure.

[0013] These and other aspects of the invention will become apparent from the following description of the preferred embodiments taken in conjunction with the following drawings. As would be obvious to one skilled in the art, many variations and modifications of the invention may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWINGS

[0014]

FIG. 1A is a front elevational view of one embodiment of a shadow box.

FIG. 1B is a cross sectional view of the embodiment shown in FIG. 1A, taken along line 1B-1B.

FIG. 2 is a cross-sectional view of a corner of a second embodiment of a shadow box.

FIG. 3 is a cross-sectional view of a corner of a third embodiment of a shadow box.

FIG. 4 is a cross-sectional view of a corner of a fourth embodiment of a shadow box.

FIGS. 5A is a cross-sectional view of a corner of a fifth embodiment of a shadow box.

FIGS. 5B is a cross-sectional view of a corner of a sixth embodiment of a shadow box.

FIGS. 5C is a cross-sectional view of a corner of a seventh embodiment of a shadow box.

FIG. 6A is a front elevational view of a portion of a curtain wall employing shadow boxes.

FIG. 6B is a cross sectional view of the portion of a curtain wall shown in FIG. 6A.

FIG. 7 is a cross-sectional view of a corner of a seventh embodiment of a shadow box.

DETAILED DESCRIPTION OF THE INVENTION

[0015] A preferred embodiment of the invention is now described in detail. Referring to the drawings, like numbers indicate like parts throughout the views. Unless otherwise specifically indicated in the disclosure that follows, the drawings are not necessarily drawn to scale. As used in the description herein and throughout the claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise: the meaning of "a," "an," and "the" includes plural reference, the meaning of "in" includes "in" and "on."

[0016] As shown in FIGS. 1A and 1B, one embodiment of a prefabricated shadow box 100 includes a vision glass panel 110 that is spaced apart from a back structure 120 so as to define a void 112 therebetween. The void 112 could include air, or it could include an inert gas (such as argon or krypton) to improve the thermal qualities of the shadow box 100. The vision glass panel 110 includes an outside (#1) surface 111 and an opposite inside (#2) surface 114. The inside (#2) surface 114 of the vision glass panel 110 can include a coating to give the glass a desired visual or thermal effect. A metal panel 126 covers the back structure 120 and can be painted, textured, or both, to give a desired visual effect.

[0017] Spacers 130 separate the vision glass panel 110 from the back structure 120, which typically would be at a distance of between 1" and 6". The spacers 130 could include multiple chambers 131 in which a desiccant 133 can be disposed so as to control humidity in the void 112. In one representative embodiment, the spacers 130 comprise extruded nylon.

[0018] The spacers 130 are sealed to the vision glass panel 110 and to the back structure 120 with a sealing material 132 that hermetically seals the void 112 from the external environment. The spacer 130 is typically desiccant filled to manage any moisture that may be in the void 112 as a result of the assembly process. In one embodiment, the sealing material 132 may comprise a polyisobutylene (PIB) sealant. This sealing material 132 greatly minimizes moisture and gasses from entering and leaving the void 112 from or to the exterior of the shadow box 100.

[0019] A silicone seal 134 holds the spacers 130 and the vision glass panel 110 in alignment with the back structure 120. In one embodiment, the structural seal 134 comprises a construction grade silicone sealant. Materials which may be used to provide the silicone elastomer are typically those which have a viscosity in the range 150 to 100,000 mm²/s at 25°C and which cure to provide elastomers of appropriate adhesive, cohesive and modulus properties. Typically these materials employ polydiorganosiloxanes in which the organic substituents attached to the silicon atoms are selected from alkyl groups having from 1 to 10 carbon atoms, for example methyl, propyl, hexyl and decyl, alkenyl groups having from 2 to 8 carbon atoms, for example vinyl, allyl and hexenyl, and aryl, alkaryl and aralkyl groups having from 6 to 8 carbon atoms, for example phenyl, tolyl and phenylethyl. At least 30 percent of the total substituents should be methyl. Preferred from an economic stand point are polydiorganosiloxanes in which substantially all of the silicon-bonded substituents are methyl. However, it has been found that the presence of larger substituents such as phenyl may contribute to a reduction in permeability. Typically these compositions contain polydiorganosiloxanes with silicon-bonded reactive groups by means of which the desired room temperature curing can be effected. Such groups may be, for example, hydroxyl, alkoxy, oximo or acyloxy and are normally attached to terminal silicon atoms of a polydiorganosiloxane.

[0020] In general the silicone compositions employ a cross-linking agent which is effective in converting the polydiorganosiloxane to the solid elastic state at normal ambient or slightly elevated temperatures, usually about 15 to 30°C. The polydiorganosiloxane and cross-linking agent may be selected to provide a room temperature vulcanising system. Examples of such compositions are:

- (i) vulcanisable organosiloxane compositions based on an organosiloxane polymer having in the molecule silicon-bonded oxime radicals, and/or a mixture of an organosiloxane polymer having silanol groups and a silane having

at least 3 silicon-bonded oxime groups. Such compositions are described for example in UK patents 975 603 and 990 107;

(ii) vulcanisable organosiloxane compositions based on an organosiloxane polymer having terminal silicon-bonded acyloxy groups, and/or a mixture of silanol-terminated organosiloxane polymer and a silane having at least 3 silicon-bonded acyloxy groups per molecule. Such compositions are described for example in UK Patents 862 576, 894 758 and 920 036;

(iii) vulcanisable compositions based on an organosiloxane polymer having terminal silicon-bonded amide or amino groups, and/or a mixture of silanol-terminated organosiloxane polymer and a silylamine or silylamide. Such vulcanisable compositions are described for example in UK Patents 1 078 214 and 1 175 794, and

(iv) vulcanisable organosiloxane compositions based on an organosiloxane polymer having in the molecule silicon-bonded alkoxy groups, and/or a mixture of an organosiloxane polymer having silanol groups with a silane having alkoxy groups or a partial hydrolysis product of said silane, for example ethyl polysilicate. Compositions of this type are described in UK Patents 957 255, 962 061 and 841 825.

[0021] The silicone composition may also comprise a catalyst such as an organo metal compound, for example stannous octoate, dibutyltin dilaurate or a titanium chelate. Although the silicone compositions used in this invention may utilise any room temperature curing reaction e.g. those of the so-called two-part type, for example those described under (iv) above which comprise a mixture of a polydiorganosiloxane having terminal silanol (SiOH) groups, an alkoxy silane or siloxane, for example methyltrimethoxysilane, ethylpolysilicate or n-propyl polysilicate and a metal salt of carboxylic acid, for example stannous octoate, dibutyltin dilaurate or dioctyltin dilaurate or a dimethyl tin carboxylate. As is well known such compositions are normally prepared and stored as two packages, the packages being mixed at the point of use.

[0022] The silicone compositions generally contain at least 5 parts by weight of a reinforcing and/or an extending filler. Examples of such fillers include fume silica, precipitated silica, crushed quartz, aluminium oxide, calcium carbonates, which may be of the ground or precipitated types, mica, microballoons and clays. The fillers, particularly those such as the reinforcing silicas and calcium carbonate may be treated, for example by coating with organosilicon compounds or calcium stearate.

[0023] In addition, these silicone compositions may comprise plasticisers such as triorganosilyl endstopped polydimethylsiloxanes, pigments such as titanium dioxide, carbon black and iron oxide, and low molecular weight polydiorganosiloxanes as *in situ* filler treatments or for modifying the elastomeric modulus.

[0024] Silicone compositions will also typically comprise an adhesion promoter effective to enhance adhesion to glass. Preferred adhesion promoters are suitable multifunctional materials such as, merely for example, those obtained by reacting (in situ or by a preliminary step) (i) alkylalkoxysilicone, (ii) aminoalkoxysilane, (iii) an epoxyalkoxysilane.

[0025] As alkylalkoxysilicone there may be employed certain silicon compounds, or mixtures thereof, having in the molecule at least three silicon-bonded alkoxy or alkoxyalkoxy groups. The silicon compound may be a silane or a siloxane. Illustrative of such silicon compounds are alkyl orthosilicates e.g. ethyl orthosilicate and propyl orthosilicate, alkyl polysilicates e.g. ethyl polysilicate and n-propyl polysilicate, monoorganotrialkoxysilanes e.g. methyl trimethoxysilane, ethyl trimethoxysilane, methyl tri n-propoxysilane, butyl triethoxysilane and phenyl trimethoxysilane. Preferred materials are alkyltrialkoxysilanes. As aminoalkoxysilane, one may employ one or more materials of the formula $\text{RHNR}'\text{Si}_a(\text{OY})_{3-a}$ having in the molecule silicon-bonded hydrocarbonoxy groups and a silicon-bonded hydrocarbon group (preferably having no more than 12 carbon atoms) containing at least one amino group. In the general formula of the silanes the substituent R may be hydrogen, lower alkyl or an aliphatic group containing at least one amino group. R may therefore represent for example H, methyl, ethyl, propyl, the group $-(\text{CH}_2\text{CH}_2\text{NH})_z\text{H}$ wherein z is an integer, preferably 1 or 2, or the group $\text{H}_2\text{NQ}-$ wherein Q is a divalent hydrocarbon group e.g. $-\text{CH}(\text{CH}_3)\text{CH}_2-$, $-(\text{CH}_2)_4-$ or $-(\text{CH}_2)_5-$. The substituent Y may be for example, methyl, ethyl or methoxyethyl. a is an integer and has a value of 0 or 1, R' represents an alkylene group having from 3 to 6 inclusive carbon atoms, X represents a monovalent hydrocarbon group having from 1 to 6 inclusive carbon atoms. Preferred aminoalkoxysilane of the above formula are compounds represented by the formulae



wherein R' represents an alkylene group having 3 or 4 carbon atoms e.g. $-(\text{CH}_2)_3-$ or $\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2-$ and each Y represents methyl, ethyl or methoxyethyl. A preferred material is K-aminopropyltriethoxysilane. As epoxyalkoxysilane one may employ one or more silanes having hydrocarbonoxy groups and an epoxy containing organic group. A preferred material is glycidoxypropyl trimethoxysilane.

[0026] Preferably the composition contains 0.1 to 15%, preferably 0.3 to 7%, more preferably 0.5 to 5% more preferably 2 to 5% by weight of the preferred adhesion promoter.

[0027] Although the silicone compositions used in this invention may utilise any room temperature curing reaction the preferred compositions are those of the so-called two-part type, for example those described under (iv) above which

comprise a mixture of a polydiorganosiloxane having terminal silanol ($^{\circ}\text{SiOH}$) groups, an alkoxy silane or siloxane, for example methyltrimethoxysilane, ethylpolysilicate or n-propyl polysilicate and a metal salt of carboxylic acid, for example stannous octoate, dibutyltin dilaurate or dioctyltin dilaurate or a dimethyl tin carboxylate and an adhesion promoter. As is well known such compositions are normally prepared and stored as two packages, the packages being mixed at the point of use.

[0028] The silicone compositions generally contain at least 5 parts by weight of a reinforcing and/or an extending filler. Examples of such fillers include fume silica, precipitated silica, crushed quartz, aluminium oxide, calcium carbonates, which may be of the ground or precipitated types, mica, microballoons and clays. The fillers, particularly those such as the reinforcing silicas and calcium carbonate may be treated, for example by coating with organosilicon compounds or calcium stearate.

[0029] In addition, these silicone compositions may comprise a variety of additives well known in the art including for example, plasticisers such as triorganosilyl endstopped polydimethylsiloxanes, pigments such as titanium dioxide, carbon black and iron oxide.

[0030] The back structure **120** includes a metal envelope **122**, which can include aluminum, with an insulation material **124** sealed therein. While the insulation material **124** could comprise such materials as mineral wool or polyisocyanurate, it could also include a newer low density silica-fume based insulation material or an aerogel. The rigid structure of the metal envelope **122** protects such fragile materials sufficiently so as to prevent damage thereto during assembly. The edges and seams of the metal envelope **122** may be sealed to provide a continuous air and vapor barrier.

[0031] Additionally, in some embodiments, items can be placed into the void **112** for specific purposes. For example, a lattice or grill can be placed against the back panel **126** to create a desired visual effect. Long lifetime LED lights could be placed into the void **112** for the purpose of creating visual effects at night. Light collectors, heat recovery panels and solar energy panels could also be coupled to the back panel **126** to harvest solar energy. Generally, to place an item inside the void **112**, it should be of a type that has a working lifespan that is equal to the projected lifespan of the building because repair or replacement would be quite difficult once the shadow box **100** has been installed.

[0032] In an alternative embodiment of a shadow box **200**, as shown in FIG. 2, the metal panel **226** that covers the back structure **120** can include an angled surface **228** so as not to form a definite corner. Use of an angled surface **228** can increase the perception of depth.

[0033] In another alternate embodiment, as shown in FIG. 3, the back structure can include a second layer of glass **310** to give the shadow box **300** a more window-like appearance. A flood coat frit **312** can be applied to the back (#4) surface to give the glazing **310** a desired effect. The spacer **130** cover **326** could be a painted metal sheet or a paint coating applied directly to the spacer **130**.

[0034] In another alternate embodiment of a shadow box **400**, as shown in FIG. 4, the back structure **420** can be offset to define an open area to accommodate the placement within certain mullion configurations. Similarly, another embodiment of a shadow box **500**, as shown in FIG. 5A, can include an extended exterior glazing **510** and an exterior spacer **512** for use with certain existing frames. As will be well understood by those of skill in the art, many combinations of these configurations, and many other configurations are possible without departing from the scope of the invention. As shown in FIG. 5B, if the spacer **130** has a desired aesthetic effect, then it can be left uncovered within the void **112**.

[0035] As shown in FIG. 5C, the exterior glazing **510** can be extended further to accommodate the spacing of an existing curtain wall mullion system (which could include, for example, metal mullion elements **514** and seals **516**). Such an embodiment would include an insulation member **512** to fill in the space between the shadow box system **500** and the mullion elements **514**. The insulation member **512** could include a block of an insulating material such as an aerogel, or one of the many other types of insulating materials commonly known in the construction arts.

[0036] As shown in FIGS. 6A and 6B, a curtain wall **600** can be formed from a plurality of vision glazing panels **610** and shadow box units **100a-c**. (For simplicity, the mullions are not shown explicitly in this drawing.) As can be seen, horizontal shadow boxes **100a** can be used to hide subfloor structures **10**. Vertical shadow boxes **100b** can be used to hide columns **12**. Several shadow boxes **100c** can be placed next to each other to hide other areas (such as data centers or utility rooms). Thus, areas are hidden while still presenting a glazed exterior appearance. In addition, this shadow box can be used in any location on a building enclosure system, including curtain walls, where solid non-transparent panels are desired.

[0037] As shown in FIG. 7, the shadow box **700** can include a triple-glazed system, in which the vision glass panel **710** can include a first vision glass pane **714** and a second glass pane **712** that are separated by a spacer **716**. The spacer **716** is hermetically sealed with a sealing material **720** and supported by a structural sealant **722**. A back panel **730** could include a third glass pane to which is applied a ceramic frit **732**.

[0038] The above described embodiment of a panelized shadow box addresses the potential technical and visual deficiencies of current state of the art shadow box construction as it provides a deep hermetically sealed shadow box cavity constructed using processes and materials as used in the manufacture of insulating glass units.

[0039] The above described embodiment of a panelized shadow box minimizes site installation works as all of the components of a shadow box are preassembled into a panel. The minimization of installation time can lead to reduced

site labor costs and increased speed of construction.

[0040] The described embodiments of a panelized shadow box improves shadow box quality as the shadow box panel is fabricated under factory conditions where better quality control than *ad hoc* site installation is possible. The improvement in shadow box quality offers the additional advantages of reducing ongoing maintenance costs and extending the service life of the shadow box.

[0041] The above described embodiments, while including the preferred embodiment and the best mode of the invention known to the inventor at the time of filing, are given as illustrative examples only. It will be readily appreciated that many deviations may be made from the specific embodiments disclosed in this specification without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is to be determined by the claims below rather than being limited to the specifically described embodiments above.

Claims

1. A method of supplying an element for covering a non-vision area in a curtain wall on an architectural structure, comprising the steps of:

(a) at a location remote from both a unitized curtain wall assembly shop and the architectural structure, prefabricating a plurality of shadow boxes by performing the following steps to assemble each of the plurality of shadow boxes:

(i) sealing, with a first airtight and moisture resistant hermetic seal and a second airtight and moisture resistant hermetic seal, an interior spacer between a vision glass panel and a back structure, the spacer having a length so that the vision glass panel is spaced apart from the back structure, the back structure including a first insulating material and a rigid envelope disposed around the first insulating material, the spacer disposed along a peripheral edge of the vision glass panel and along a peripheral edge of the back structure so as to hold the vision glass panel in a spaced apart relationship from the back structure, so that the first hermetic seal seals the interior spacer to the vision glass panel and so that the second hermetic seal seals the interior spacer to the back structure and so that the vision glass panel, the back structure and the interior spacer define a hermetically sealed void therein; and

(ii) applying a structural seal about the interior spacer and so as to be affixed to the peripheral edge of the vision glass, the interior spacer and the back structure; and

(b) delivering the plurality of shadow boxes, after being prefabricated, to a selected one of the unitized curtain wall assembly shop and the architectural site.

2. The method of Claim 1, further comprising the step of placing at least one of the plurality of shadow boxes into a pre-assembled frame structure at the selected one of the unitized curtain wall assembly shop and the architectural site.

3. The method of Claim 1, further comprising the steps of:

(a) defining a plurality of chambers in the spacer; and

(b) placing a desiccant in each of the plurality of chambers.

4. The method of Claim 1, wherein the spacer had a dimension that is selected to maintain the vision glass panel spaced apart from the back structure by at least one inch.

5. The method of Claim 1, wherein the first hermetic seal and the second hermetic seal comprise polyisobutylene.

6. The method of Claim 1, wherein the first insulating material is selected from a group of insulating materials consisting of: a mineral wool, a polyisocyanurate, a vacuum sealed fumed silica, an aerogel and combinations thereof.

7. The method of Claim 1, wherein the vision glass panel comprises at least two spaced-apart glass panes.

8. The method of Claim 1, wherein the back panel comprises a back glass layer having an interior #3 surface and a back #4 surface, an further comprising the step of applying a flood coat frit to a selected one of the interior #3 surface and the back #4 surface.

9. The method of Claim 1, wherein the back panel includes a central portion and further comprising the step of bending a peripheral portion that extends outwardly from the central portion so as to create a desired visual effect.

10. A curtain wall system for covering an architectural structure, comprising:

(a) a frame structure configured to be affixed to an outer surface of the architectural structure;
 (b) a plurality of vision glass panels supported by the frame structure; and
 (c) a plurality of shadow boxes, prefabricated prior to delivery to both a unitized curtain wall assembly shop and the architectural structure, each of the plurality of shadow boxes configured to be affixed to the frame structure and configured to cover a non-vision area of the architectural structure, each of the plurality of shadow boxes including:

(i) a vision glass panel having a peripheral edge;
 (ii) a back structure, having a peripheral edge, the back structure including an insulating material and a rigid envelope disposed around the insulating material;
 (iii) an interior spacer disposed along the peripheral edge of the vision glass panel and along the peripheral edge of the back structure so as to hold the vision glass panel in a spaced apart relationship from the back structure, the interior spacer defining at least one chamber therein into which a desiccant is disposed;
 (iv) a first hermetic seal that seals the interior spacer to the vision glass panel and a second hermetic seal that seals the interior spacer to the back structure so that the vision glass panel, the back structure and the interior spacer define a hermetically sealed void therein;
 (v) a structural seal disposed about the interior spacer and affixed to the peripheral edge of the vision glass, the interior spacer and the back structure; and
 (vi) a back panel disposed within the hermetically sealed void and against the back structure, the back panel including an aesthetic treatment configured to present a desired visual effect to viewers looking through the vision glass panel.

11. The curtain wall system of Claim 10, wherein the first airtight and moisture resistant seal and the second airtight and moisture resistant seal comprise polyisobutylene.

12. The curtain wall system of Claim 10, wherein the spacer had a dimension that is selected to maintain the vision glass panel spaced apart from the back structure by at least one inch.

13. The curtain wall system of Claim 10, wherein the vision glass panel comprises at least two spaced-apart glass panes.

14. The curtain wall system of Claim 10, wherein the insulating material is selected from a group of insulating materials consisting of: a mineral wool, a polyisocyanurate, a vacuum sealed fumed silica, an aerogel and combinations thereof.

15. The curtain wall system of Claim 10, wherein the back panel comprises a panel selected from a group of panels consisting of: a metal plate, a metal composite plate and combinations thereof.

Patentansprüche

1. Verfahren zum Zuführen eines Elements zum Abdecken eines Nichtsichtbereichs in einer Vorhangsfassade auf einer architektonischen Struktur, umfassend die folgenden Schritte:

(a) an einem Ort, der sowohl von einer modularen Vorhangfassadenmontagestätte als auch von der architektonischen Struktur entfernt ist, Vorfertigen einer Mehrzahl von Schattenboxen durch Durchführen der folgenden Schritte, um jede der Mehrzahl von Schattenboxen zusammenzubauen:

(i) Abdichten mit einer ersten luftdichten und feuchtigkeitsbeständigen hermetischen Dichtung und einer zweiten luftdichten und feuchtigkeitsbeständigen hermetischen Dichtung, einem inneren Abstandhalter zwischen einer Sichtglasscheibe und einer hinteren Struktur, wobei der Abstandhalter eine Länge aufweist, so dass die Sichtglasscheibe von der hinteren Struktur beabstandet ist, wobei die hintere Struktur ein erstes Isoliermaterial und eine starre Hülle umfasst, die um das erste Isoliermaterial herum angeordnet ist, wobei der Abstandhalter entlang einer Umfangskante der Sichtglasscheibe und entlang einer Umfangskante der

hinteren Struktur angeordnet ist, um die Sichtglasscheibe in einer beabstandeten Beziehung von der hinteren Struktur zu halten, so dass die erste hermetische Dichtung den inneren Abstandshalter an der Sichtglasscheibe abdichtet und so dass die zweite hermetische Dichtung den inneren Abstandshalter an der hinteren Struktur abdichtet und so dass die Sichtglasplatte, die hintere Struktur und der innere Abstandshalter einen hermetisch abgeschlossenen Hohlraum darin definieren; und

(ii) Aufbringen einer strukturellen Dichtung um den inneren Abstandshalter herum, um an der Umfangskante des Sichtglases, dem inneren Abstandshalter und der hinteren Struktur befestigt zu werden; und

(b) Liefern der Mehrzahl von Schattenboxen, nachdem sie vorgefertigt wurden, an eine ausgewählte der modularen Vorhangfassadenmontagegestätte und des architektonischen Standorts.

2. Verfahren nach Anspruch 1, ferner umfassend den Schritt des Anordnens von mindestens einer der Mehrzahl von Schattenboxen in eine vormontierte Rahmenstruktur an der ausgewählten der modularen Vorhangfassadenmontagegestätte und des architektonischen Standorts.

3. Verfahren nach Anspruch 1, ferner umfassend die folgenden Schritte:

(a) definieren einer Mehrzahl von Kammern in dem Abstandshalter; und

(b) platzieren eines Trockenmittels in einer jeden der Mehrzahl von Kammern.

4. Verfahren nach Anspruch 1, wobei der Abstandshalter eine Abmessung aufweist, die so ausgewählt ist, um beizubehalten, dass die Sichtglasscheibe von der hinteren Struktur um mindestens einen Zoll beabstandet ist.

5. Verfahren nach Anspruch 1, wobei die erste hermetische Dichtung und die zweite hermetische Dichtung Polyisobutylen umfassen.

6. Verfahren nach Anspruch 1, wobei das erste Isoliermaterial aus einer Gruppe von Isoliermaterialien ausgewählt ist, bestehend aus: einer Mineralwolle, einem Polyisocyanurat, einem vakuumversiegelten Silika, einem Aerogel und Kombinationen davon.

7. Verfahren nach Anspruch 1, wobei die Sichtglasscheibe mindestens zwei voneinander beabstandete Glasscheiben aufweist.

8. Verfahren nach Anspruch 1, wobei die Rückplatte eine hintere Glasschicht mit einer inneren Oberfläche #3 und einer hinteren Oberfläche #4 umfasst, ferner umfassend den Schritt des Anbringens einer Flutüberzugsfritte auf einer Auswahl der inneren Oberfläche #3 und der hinteren Oberfläche #4.

9. Verfahren nach Anspruch 1, wobei die Rückplatte einen zentralen Abschnitt aufweist und ferner den Schritt des Biegens eines Umfangsabschnitts umfasst, der sich vom zentralen Abschnitt nach außen erstreckt, um einen gewünschten visuellen Effekt zu erzeugen.

10. Vorhangwandsystem zum Abdecken einer Architekturstruktur, umfassend:

(a) eine Rahmenstruktur, die zur Befestigung an einer Außenfläche der Architekturstruktur konfiguriert ist;

(b) eine Mehrzahl von Sichtglasscheiben, die von der Rahmenstruktur gestützt werden; und

(c) eine Mehrzahl von Schattenboxen, die vor der Auslieferung sowohl an eine modulare Vorhangwandmontagegestätte als auch die architektonische Struktur vorgefertigt sind, wobei jede der Mehrzahl von Schattenboxen so ausgestaltet ist, dass sie an der Rahmenstruktur befestigt werden kann und so ausgestaltet ist, dass sie einen Nichtsichtbereich der architektonischen Struktur abdeckt, wobei jede der Mehrzahl von Schattenboxen aufweist:

(i) eine Sichtglasscheibe mit einer Umfangskante;

(ii) eine hintere Struktur mit einer Umfangskante, wobei die hintere Struktur ein Isoliermaterial und eine starre Hülle umfasst, die um das Isoliermaterial herum angeordnet ist;

(iii) einen inneren Abstandshalter, der entlang der Umfangskante der Sichtglasscheibe und entlang der Umfangskante der hinteren Struktur angeordnet ist, um die Sichtglasplatte in einer beabstandeten Beziehung von der hinteren Struktur zu halten, wobei der innere Abstandshalter mindestens eine Kammer darin definiert, in der ein Trockenmittel angeordnet ist;

(iv) eine erste hermetische Dichtung, die den inneren Abstandshalter gegen die Sichtglasscheibe abdichtet, und eine zweite hermetische Dichtung, die den inneren Abstandshalter gegen die hintere Struktur abdichtet, so dass die Sichtglasscheibe, die hintere Struktur und der innere Abstandshalter einen hermetisch abgedichteten Hohlraum darin bilden;

(v) eine strukturelle Dichtung, die um den inneren Abstandshalter herum angeordnet ist und an der Umfangskante des Sichtglases, dem inneren Abstandshalter und der hinteren Struktur befestigt ist; und

(vi) eine Rückwand, die innerhalb des hermetisch abgedichteten Hohlraums und gegen die hintere Struktur angeordnet ist, wobei die Rückwand eine ästhetische Behandlung aufweist, die so konfiguriert ist, dass sie den Betrachtern, die durch die Sichtglasscheibe blicken, einen gewünschten visuellen Effekt bietet.

11. Vorhangwandsystem nach Anspruch 10, wobei die erste luftdichte und feuchtigkeitsbeständige Dichtung und die zweite luftdichte und feuchtigkeitsbeständige Dichtung Polyisobutylene umfassen.

12. Vorhangwandsystem nach Anspruch 10, wobei der Abstandshalter eine Abmessung aufweist, die so ausgewählt ist, um beizubehalten, dass die Sichtglasscheibe von der hinteren Struktur um mindestens einen Zoll beabstandet ist.

13. Vorhangwandsystem nach Anspruch 10, wobei die Sichtglasscheibe mindestens zwei voneinander beabstandete Glasscheiben aufweist.

14. Vorhangwandsystem nach Anspruch 10, wobei das Isoliermaterial aus einer Gruppe von Isoliermaterialien ausgewählt ist, bestehend aus: einer Mineralwolle, einem Polyisocyanurat, einem vakuumversiegelten Silika, einem Aerogel und Kombinationen davon.

15. Vorhangwandsystem nach Anspruch 10, wobei die Rückplatte eine Platte umfasst, die aus einer Gruppe von Platten ausgewählt ist, bestehend aus: einer Metallplatte, einer Metallverbundplatte und Kombinationen davon.

Revendications

1. Procédé de fourniture d'un élément pour recouvrir une zone de non vision dans un mur rideau sur une structure architecturale, comprenant les étapes constituées par :

(a) au niveau d'un site qui est éloigné à la fois d'une entreprise d'assemblage de mur rideau monobloc d'un seul tenant et de la structure architecturale, la préfabrication d'une pluralité de générateurs d'ombre en réalisant les étapes qui suivent de manière à assembler chacun de la pluralité de générateurs d'ombre :

(i) le fait de rendre étanche, à l'aide d'un premier joint d'étanchéité hermétique étanche à l'air et résistant à l'humidité et d'un second joint d'étanchéité hermétique étanche à l'air et résistant à l'humidité, un espaceur intérieur entre un panneau de verre formant vitrage permettant la vision et une structure arrière, l'espaceur intérieur présentant une longueur qui est telle que le panneau de verre formant vitrage permettant la vision est espacé de la structure arrière, la structure arrière incluant un premier matériau isolant et une enveloppe rigide qui est disposée autour du premier matériau isolant, l'espaceur intérieur étant disposé le long d'un bord périphérique du panneau de verre formant vitrage permettant la vision et le long d'un bord périphérique de la structure arrière de manière à maintenir le panneau de verre formant vitrage permettant la vision selon une relation d'espacement par rapport à la structure arrière, de telle sorte que le premier joint d'étanchéité hermétique étanchéifie l'espaceur intérieur par rapport au panneau de verre formant vitrage permettant la vision et de telle sorte que le second joint d'étanchéité hermétique étanchéifie l'espaceur intérieur par rapport à la structure arrière et de telle sorte que le panneau de verre formant vitrage permettant la vision, la structure arrière et l'espaceur intérieur définissent en leur sein un vide scellé rendu hermétiquement étanche ; et

(ii) l'application d'un joint d'étanchéité structurel autour de l'espaceur intérieur et de manière à ce qu'il soit fixé sur le bord périphérique du verre formant vitrage permettant la vision, de l'espaceur intérieur et de la structure arrière ; et

(b) la livraison de la pluralité de générateurs d'ombre, après qu'ils ont été préfabriqués, au niveau d'un site sélectionné pris parmi l'entreprise d'assemblage de mur rideau monobloc d'un seul tenant et le site architectural.

2. Procédé selon la revendication 1, comprenant en outre l'étape constituée par le positionnement d'au moins l'un de

la pluralité de générateurs d'ombre à l'intérieur d'une structure de châssis préassemblée au niveau du site sélectionné pris parmi l'entreprise d'assemblage de mur rideau monobloc d'un seul tenant et le site architectural.

3. Procédé selon la revendication 1, comprenant en outre les étapes constituées par :

- (a) la définition d'une pluralité de chambres dans l'espaceur intérieur ; et
- (b) le positionnement d'un agent chimique absorbant d'humidité à l'intérieur de chacune de la pluralité de chambres.

4. Procédé selon la revendication 1, dans lequel l'espaceur intérieur présente une dimension qui est sélectionnée de manière à permettre le maintien du panneau de verre formant vitrage permettant la vision selon un espacement d'au moins un pouce par rapport à la structure arrière.

5. Procédé selon la revendication 1, dans lequel le premier joint d'étanchéité hermétique et le second joint d'étanchéité hermétique comprennent du polyisobutylène.

6. Procédé selon la revendication 1, dans lequel le premier matériau isolant est sélectionné parmi un groupe de matériaux isolants qui est constitué par : une laine minérale, un polyisocyanurate, de la silice pyrogénée ou fumée de silice scellée de façon étanche sous vide, un aérogel et des combinaisons afférentes.

7. Procédé selon la revendication 1, dans lequel le panneau de verre formant vitrage permettant la vision comprend au moins deux panneaux de verre formant vitrage espacés l'un de l'autre ou les uns des autres.

8. Procédé selon la revendication 1, dans lequel le panneau arrière comprend une couche de verre arrière qui comporte une surface intérieure #3 et une surface arrière #4, et comprenant en outre l'étape constituée par l'application d'une fritte de revêtement de flux sur une surface sélectionnée prise parmi la surface intérieure #3 et la surface arrière #4.

9. Procédé selon la revendication 1, dans lequel le panneau arrière inclut une partie centrale, et comprenant en outre l'étape constituée par le bombage par cintrage d'une partie périphérique qui s'étend vers l'extérieur depuis la partie centrale de manière à créer un effet visuel souhaité.

10. Système de mur rideau pour recouvrir une structure architecturale, comprenant :

- (a) une structure de châssis qui est configurée de manière à ce qu'elle soit fixée sur une surface externe de la structure architecturale ;
- (b) une pluralité de panneaux de verre formant vitrage permettant la vision qui sont supportés par la structure de châssis ; et
- (c) une pluralité de générateurs d'ombre, préfabriqués avant leur livraison à la fois au niveau d'un site d'une entreprise d'assemblage de mur rideau monobloc d'un seul tenant et d'un site de la structure architecturale, chacun de la pluralité de générateurs d'ombre étant configuré de manière à ce qu'il soit fixé sur la structure de châssis et étant configuré de manière à ce qu'il recouvre une zone de non vision de la structure architecturale, chacun de la pluralité de générateurs d'ombre incluant :

- (i) un panneau de verre formant vitrage permettant la vision qui comporte un bord périphérique ;
- (ii) une structure arrière, qui comporte un bord périphérique, la structure arrière incluant un matériau isolant et une enveloppe rigide qui est disposée autour du matériau isolant ;
- (iii) un espaceur intérieur qui est disposé le long du bord périphérique du panneau de verre formant vitrage permettant la vision et le long du bord périphérique de la structure arrière de manière à maintenir le panneau de verre formant vitrage permettant la vision selon une relation d'espacement par rapport à la structure arrière, l'espaceur intérieur définissant en son sein au moins une chambre à l'intérieur de laquelle un agent chimique absorbant d'humidité est disposé ;
- (iv) un premier joint d'étanchéité hermétique qui étanchéifie l'espaceur intérieur par rapport au panneau de verre formant vitrage permettant la vision et un second joint d'étanchéité hermétique qui étanchéifie l'espaceur intérieur par rapport à la structure arrière de telle sorte que le panneau de verre formant vitrage permettant la vision, la structure arrière et l'espaceur intérieur définissent en leur sein un vide scellé rendu hermétiquement étanche ;
- (v) un joint d'étanchéité structurel qui est disposé autour de l'espaceur intérieur et qui est fixé sur le bord périphérique du verre formant vitrage permettant la vision, de l'espaceur intérieur et de la structure arrière ; et

(vi) un panneau arrière qui est disposé à l'intérieur du vide scellé rendu hermétiquement étanche et contre la structure arrière, le panneau arrière incluant un traitement esthétique qui est configuré de manière à assurer un effet visuel souhaité pour des observateurs qui regardent au travers du panneau de verre formant vitrage permettant la vision.

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11. Système de mur rideau selon la revendication 10, dans lequel le premier joint d'étanchéité hermétique étanche à l'air et résistant à l'humidité et le second joint d'étanchéité hermétique étanche à l'air et résistant à l'humidité comprennent du polyisobutylène.

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12. Système de mur rideau selon la revendication 10, dans lequel l'espaceur intérieur présente une dimension qui est sélectionnée de manière à permettre le maintien du panneau de verre formant vitrage permettant la vision selon un espacement d'au moins un pouce par rapport à la structure arrière.

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13. Système de mur rideau selon la revendication 10, dans lequel le panneau de verre formant vitrage permettant la vision comprend au moins deux panneaux de verre formant vitrage espacés l'un de l'autre ou les uns des autres.

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14. Système de mur rideau selon la revendication 10, dans lequel le matériau isolant est sélectionné parmi un groupe de matériaux isolants qui est constitué par : une laine minérale, un polyisocyanurate, de la silice pyrogénée ou fumée de silice scellée de façon étanche sous vide, un aérogel et des combinaisons afférentes.

15. Système de mur rideau selon la revendication 10, dans lequel le panneau arrière comprend un panneau qui est sélectionné parmi un groupe de panneaux qui est constitué par : une plaque en métal, une plaque composite en métal et des combinaisons afférentes.

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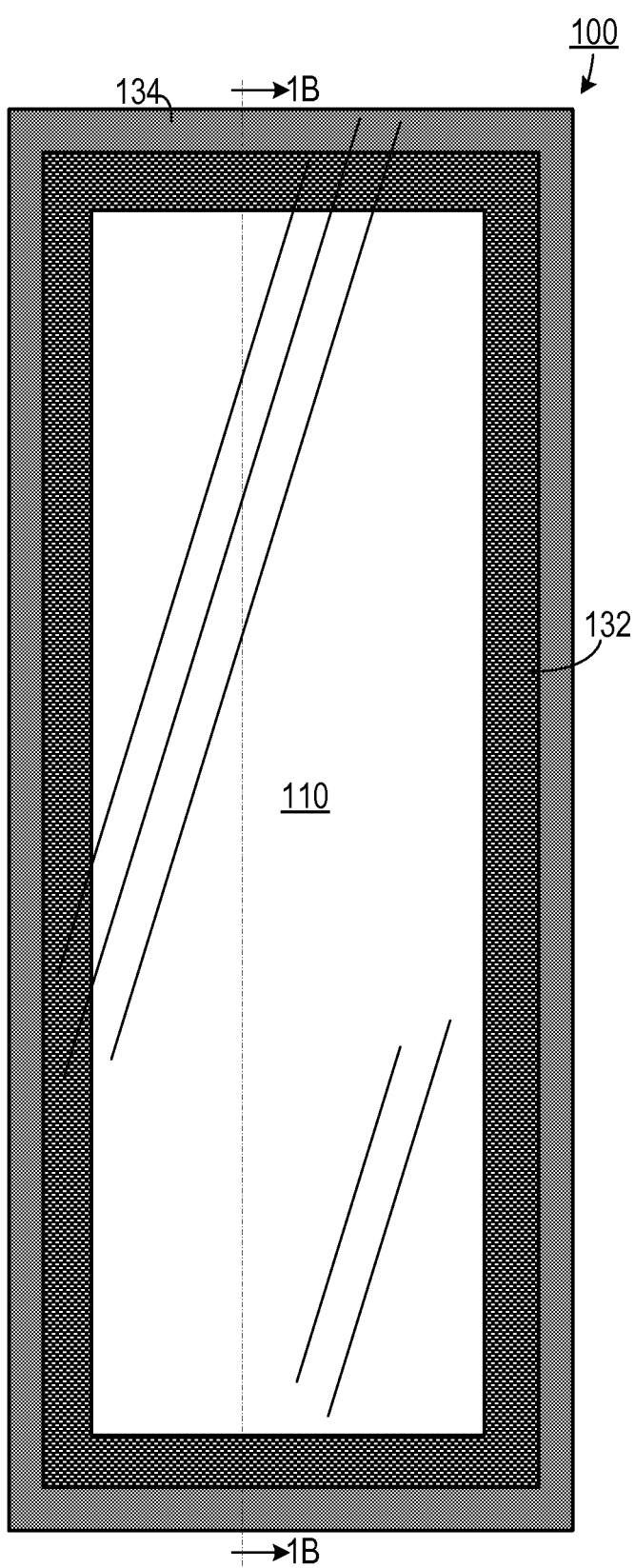


FIG. 1A

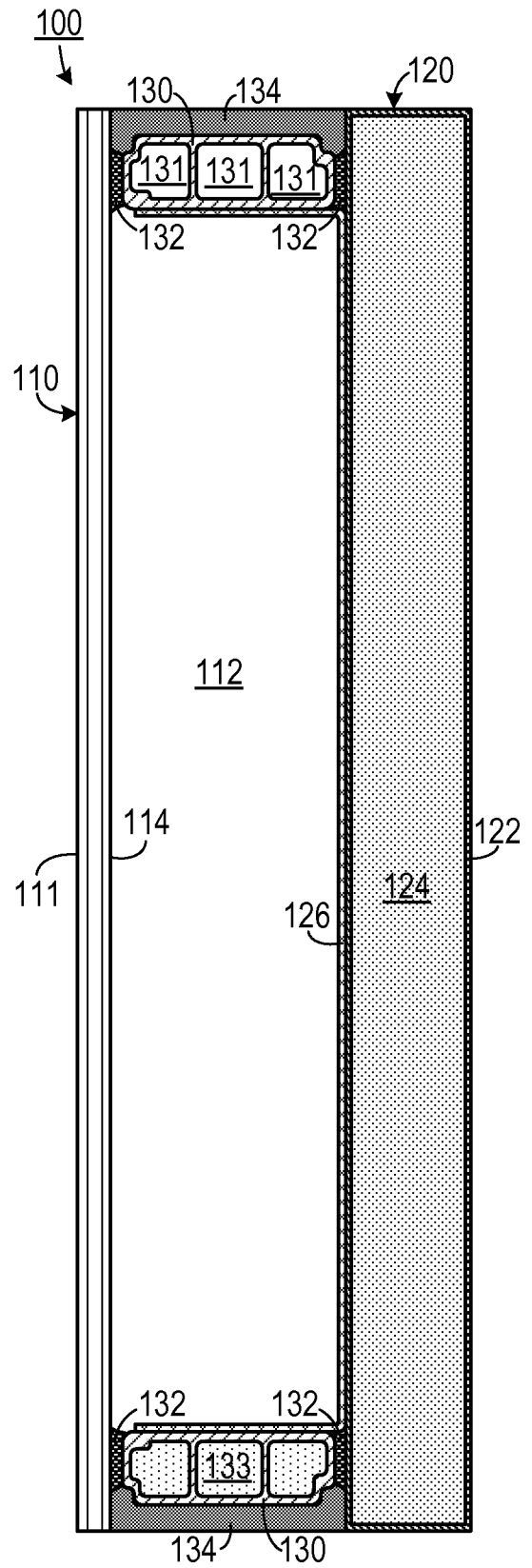


FIG. 1B

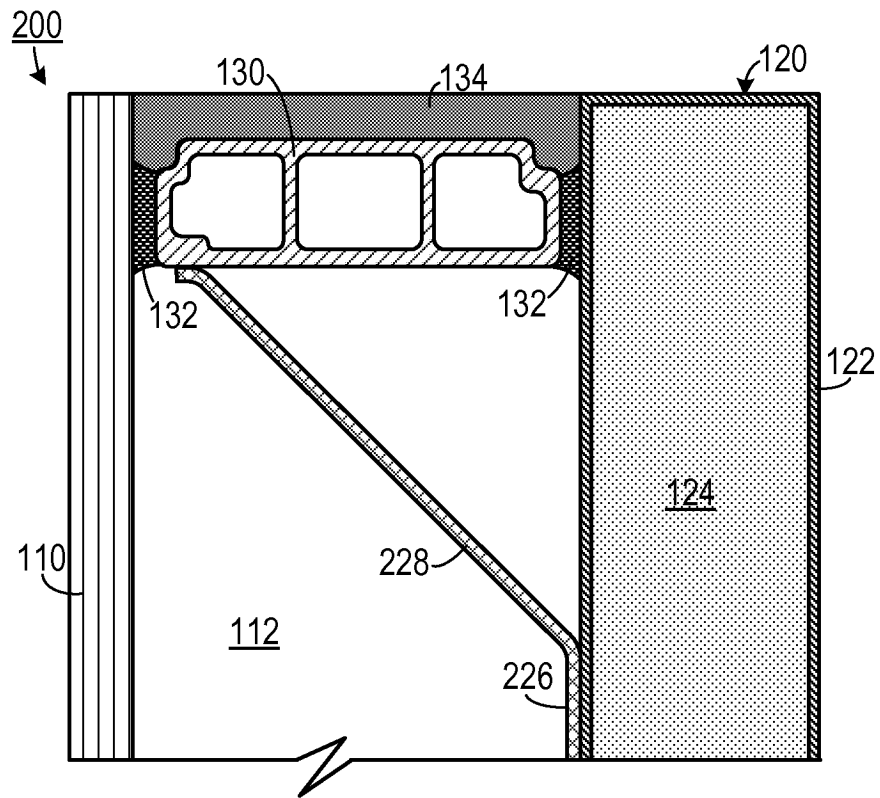


FIG. 2

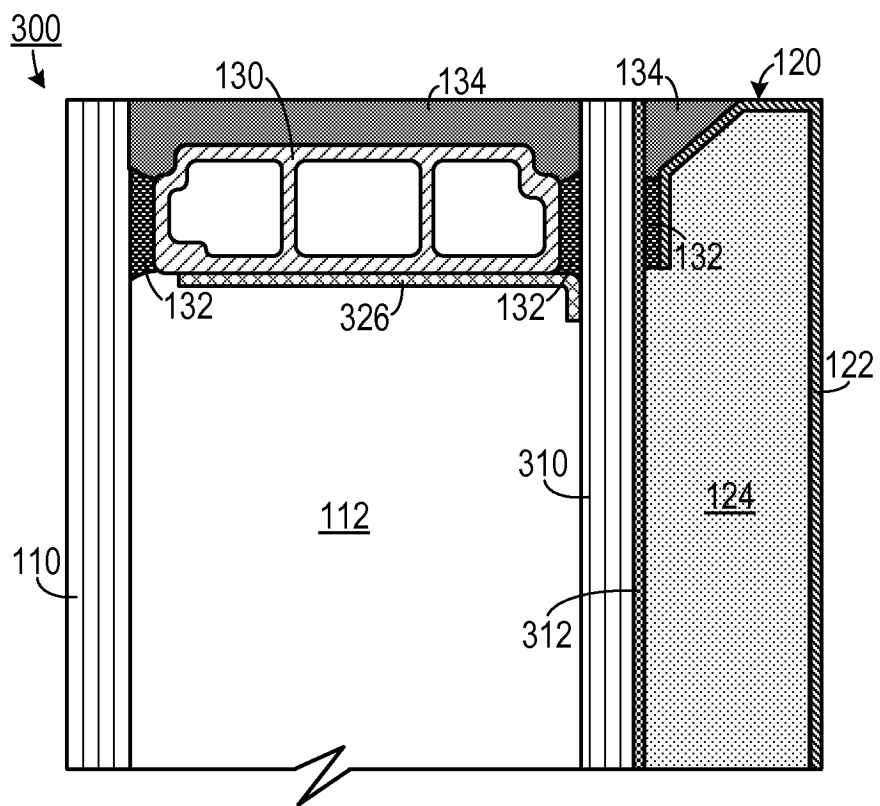


FIG. 3

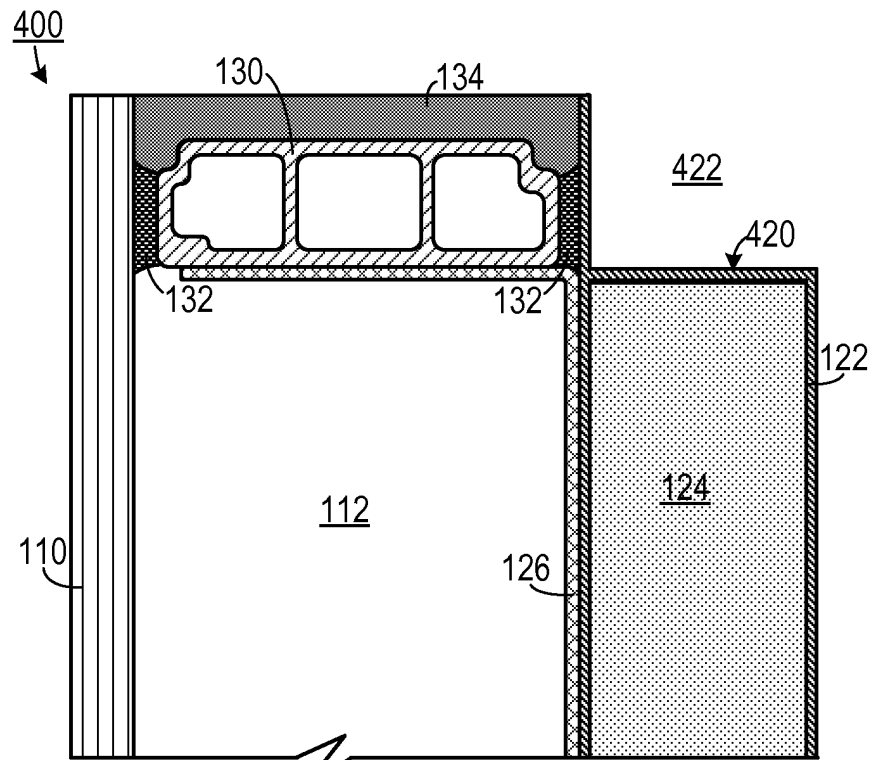


FIG. 4

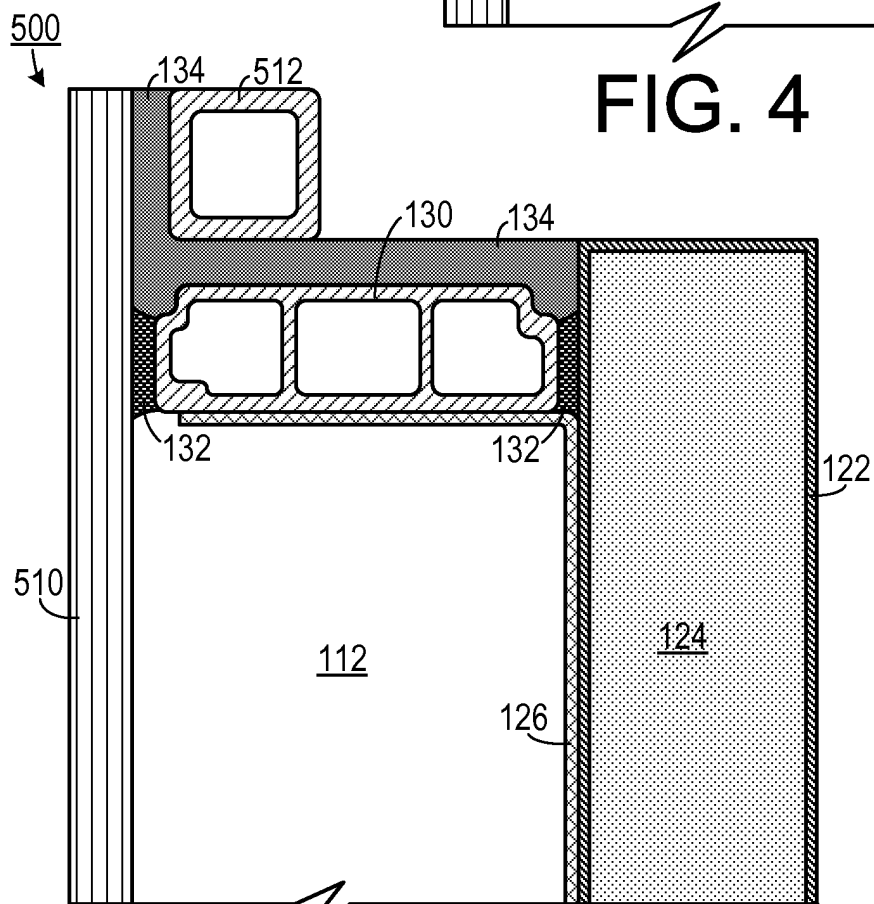


FIG. 5A

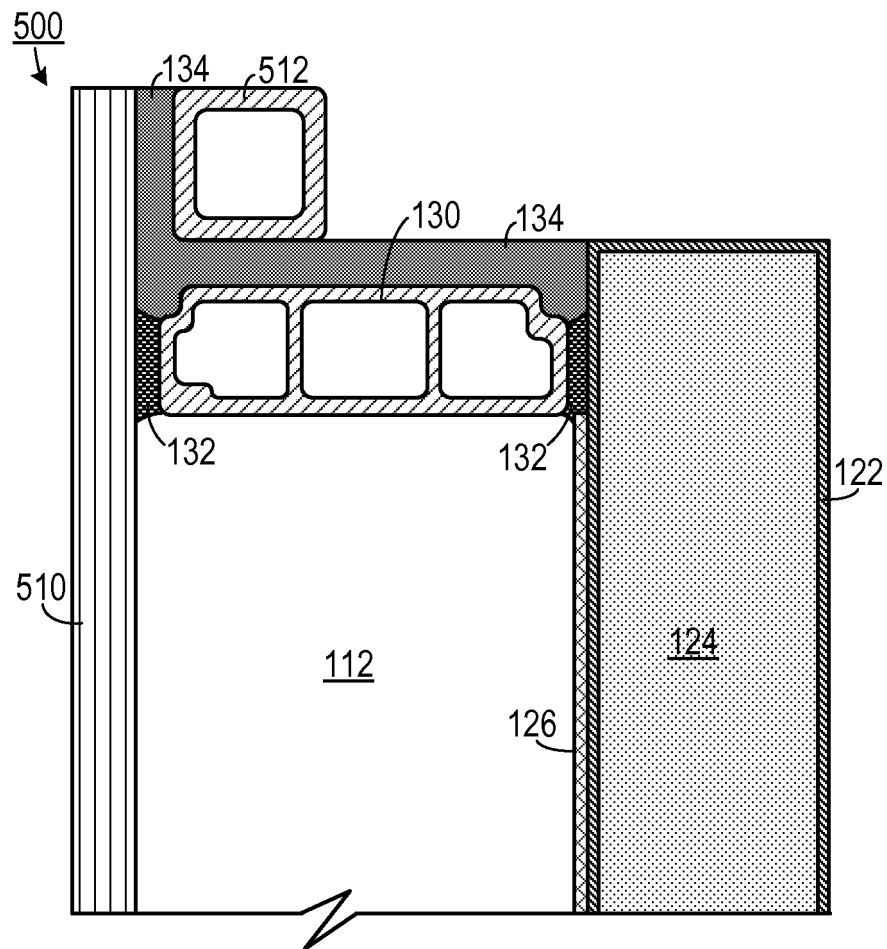


FIG. 5B

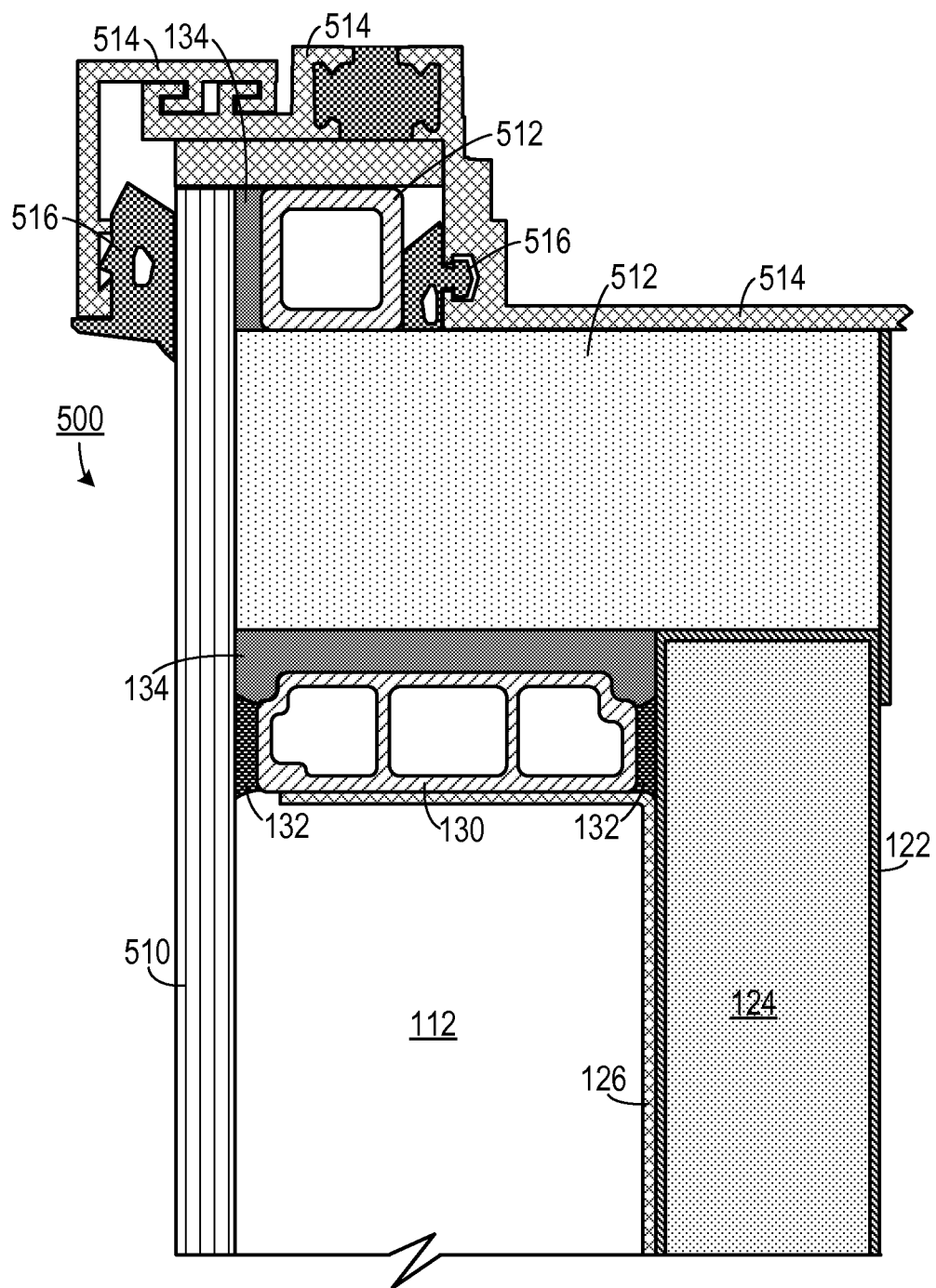


FIG. 5C

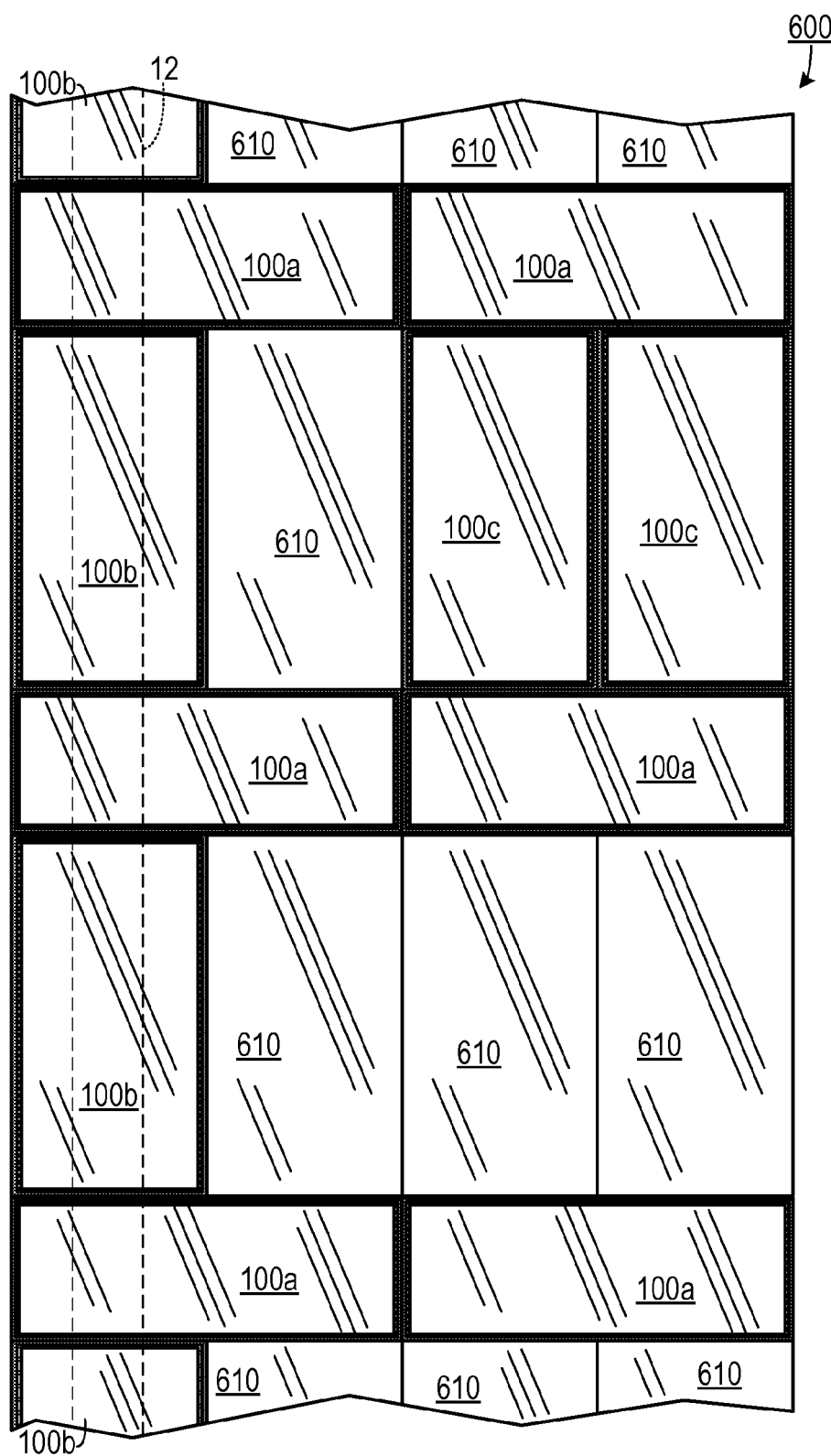


FIG. 6A

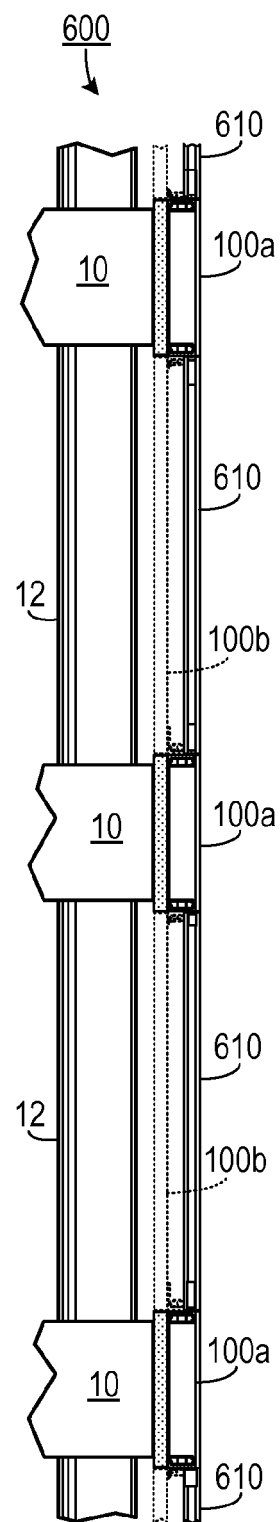


FIG. 6B

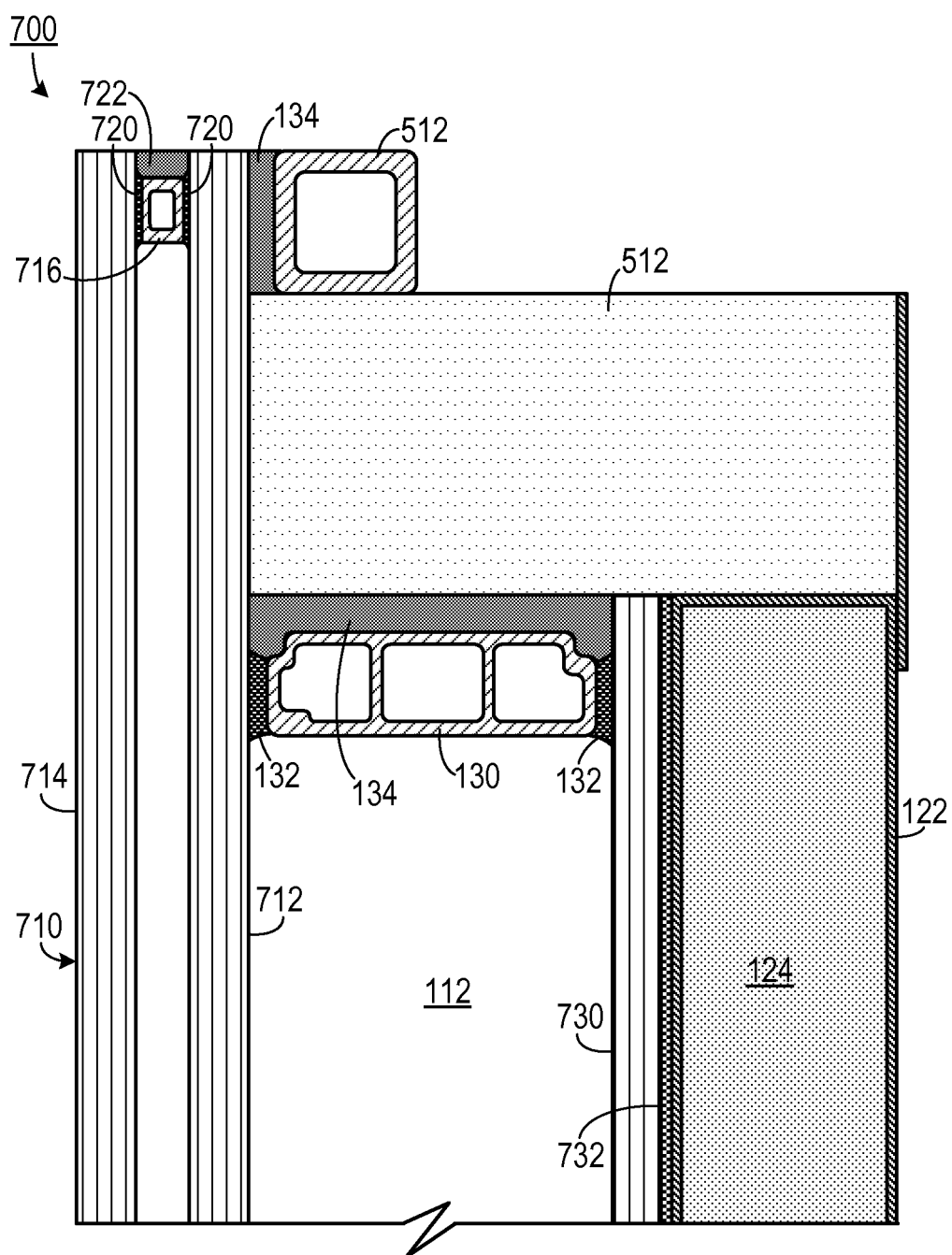


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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