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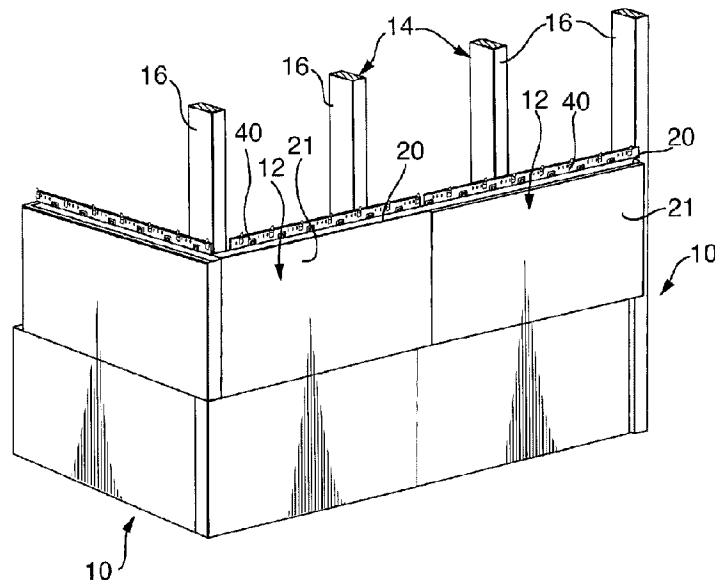
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(57) Abrégé/Abstract:

A modular siding panel for mortarless application to a building structure is disclosed, which includes a structure for capturing and draining infiltrated water within the panel. In a preferred embodiment, the siding panel includes a rigid facing panel made of weather resistant material and having a front face exposed in an installed condition of the panel and top, bottom and side edges for engagement with like panels positioned adjacent thereto; and a supporting spacer fastened to the rear surface of the facing panel, the spacer including a mounting portion for attachment of the siding panel to the building structure and a water management portion for capturing infiltrated water which has seeped past the front face along one or more of the edges and draining the captured infiltrated water within the modular siding panel or within the spacer and away from the building structure.

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ABSTRACT

A modular siding panel for mortarless application to a building structure is disclosed, which includes a structure for capturing and draining infiltrated water within the panel. In a preferred embodiment, the siding panel includes a rigid facing panel made of weather resistant material and having a front face exposed in an installed condition of the panel and top, bottom and side edges for engagement with like panels positioned adjacent thereto; and a supporting spacer fastened to the rear surface of the facing panel, the spacer including a mounting portion for attachment of the siding panel to the building structure and a water management portion for capturing infiltrated water which has seeped past the front face along one or more of the edges and draining the captured infiltrated water within the modular siding panel or within the spacer and away from the building structure.

MORTARLESS MODULAR SIDING SYSTEM

FIELD OF THE INVENTION

The invention relates to the construction field and siding systems, more particularly to mortarless masonry type siding systems.

5 BACKGROUND OF THE INVENTION

Precast siding panels are often used for the exterior finishing of residential or commercial buildings. Known siding panels generally include a facing panel with design features simulating natural stone or brick or other masonry elements commonly used for the exterior finish of buildings. The design features can be machined or cast. Cast features are more cost
10 efficiently manufactured. The facing panel is either directly mounted to the building wall or by way of stand-off or spacer elements which are mounted to the wall. The facing panels are either suspended from these elements or permanently connected therewith through embedded interlocking elements.

US 5,819,486 discloses a veneer panel with embedded mounting clips and a spacer
15 mounted to the building structure. The mounting clips extend into the spacer in the installed condition of the panel for mounting of the panel to the building. Water infiltration is prevented by sealing the joints between adjacent panels. However, sealing the joints is labor intensive and therefore uneconomical.

A cast veneer panel including a backing panel and a facing panel cast on the backing panel
20 and interlocked therewith is disclosed in US 8,042,309. The facing panel includes at least one design element. This cast veneer panel may include stand-off dimples to create a ventilation gap between the building and a back surface of the backing panel. The veneer panel can be mounted to a building with or without subsequent mortar application between the individual panels and/or the design elements. However, in the mortarless application
25 mode, infiltration of water between the individual veneer panels is possible, especially under wind pressure. Although the infiltrated water can drain off under gravity in the ventilation gap, it will nevertheless come in contact with the building structure, at least at the stand-off dimples, increasing the danger of water infiltration into the building structure through breaks in the building wrap.

CA 2,661,233 discloses a mortarless siding system of cast stone bodies with embedded mounting supports for attachment to a building structure. Water infiltrating between adjacent stone bodies is kept away from the building structure by the mounting support above and below the stone bodies. However, infiltrated water can reach the building structure at the lateral joints between the mounting supports.

US 4,553,366 discloses a mortarless siding system of cast facing plates with embedded hooks for engagement with the hooking section of a spacer for attachment to a building structure. Water infiltrating between adjacent stone bodies is drained away by oblique edges on the facing plates. However, water infiltration due to wind pressure cannot be avoided and will lead to water coming into contact with the building structure behind the hooked on facing plates.

US 2009/0193742 and US 2011/0239578 disclose prefabricated wall panels having a precast body with embedded mounting element for attachment to a building structure. The wall panel can be used for assembly of a mortarless siding. However, water infiltrated between adjacent panels can drain through the mounting element towards the building structure and come in contact with the building structure.

Numerous mortarless siding systems assembled from pre-cast siding panels including embedded supporting spacers are known. In each, the supporting spacer is embedded into a rear surface of the siding panel during casting. However, since the spacer must be embedded into the siding panel, the panels must be wet cast and must remain in the casting mold until the material of the panel is set. Thus, the manufacturing process of these siding systems is relatively slow and uneconomical. Also, the need for embedding the spacer in the facing panel significantly limits the type of facing panel which could be used.

SUMMARY OF THE INVENTION

It is an object of the invention to overcome at least one of the disadvantages found in the prior art.

In one embodiment, the invention provides a modular siding panel for mortarless application, which includes a facing panel and a spacer fastened thereto, whereby the facing panel can be of any natural cast or manufactured material which is rigid and weather resistant. The

spacer includes a water management structure for managing infiltrated water by capturing infiltrated water before it can reach the building structure and draining the captured infiltrated water. In particular, the water management portion of the spacer captures any infiltrated water which has seeped past the top edge, and preferably also water which has seeped past the side edges, and drains the captured infiltrated water sealed within the modular siding panel, in order to avoid contact of the infiltrated water with the building structure. In a preferred embodiment, the mounting and water management portions are integral portions of the supporting spacer and the captured infiltrated water is drained in a drainage conduit formed within the spacer or by the spacer in combination with the rear face of the facing panel.

In another preferred embodiment, the invention provides a modular siding panel for the assembly of a mortarless modular siding on a building structure, comprising a facing panel made of any rigid, weather resistant material and a supporting spacer mountable to the rear surface of the facing panel. The facing panel has a front face exposed in an installed condition of the panel and a rear surface directed towards the building structure in the installed condition. The facing panel further has top, bottom and side edges for proximal placement to like panels positioned adjacent thereto, in order to achieve a substantially continuous siding surface. In a preferred variant, the facing panel is made of settable material. In another variant, the facing panel is a concrete panel, preferably a dry cast concrete panel.

In another preferred embodiment, the invention provides a spacer for a modular siding panel including the spacer and a facing panel connected to the spacer, which spacer includes a mounting portion for connecting to the facing panel and for fastening the spacer with connected facing panel to a building structure. The spacer further includes a water management portion with a trough for capturing infiltrated water which has seeped past the front face of the facing panel along a top edge of the facing panel and a drainage conduit for draining the infiltrated water, while maintaining the infiltrated water away from the building structure. The trough and/or the drainage conduit can be formed completely within the spacer or formed upon connection of the spacer to the facing panel by the a section of the spacer in combination with the rear face. In a preferred embodiment, the trough is formed by an L-shaped section of the water management portion and the U-shaped trough is formed in the installed condition by the L-shaped section and the rear face of the facing panel. In the

same embodiment, the drainage conduit is formed by a U-shaped section of the water management portion and the rear face, whereby the open side of the U-shaped section is closed in the installed condition by the rear face of the facing panel. However, when the trough and drainage conduit are not formed within the spacer, a certain amount of water seepage may occur in the installed condition of the spacer on the facing panel, even when the rear face of the facing panel is flat. The inventors have now discovered, that this seepage can be minimized by providing the spacer with a pretension which will generate a contact pressure between the water management portion and the rear face in the installed condition.

In a preferred embodiment of the spacer, the spacer has a preselected curvature in at least one of its longitudinal and transverse directions for generation of a contact pressure between the spacer and the rear surface along the drainage channel, when the spacer is straightened against the facing panel during fastening of the spacer onto the rear surface. The straightening of the spacer is achieved by fastening the spacer against the rear surface at least at the longitudinal ends of the spacer, preferably at the corners of the spacer.

The mounting and water management portions are preferably integral portions of the supporting spacer.

The mounting portion in the installed condition of the siding system is fastened to the siding panel as well as the building structure. The mounting portion preferably includes a metal plate for reinforcement of the supporting spacer at the point of securement to the building structure and for providing maximum integrity of the siding system during a building fire. The metal plate is preferably protected from corrosion by an anti-corrosion finish or by embedding it into the material of the water management portion of the supporting spacer. In a further preferred embodiment, the water management portion is molded from plastics material and the metal plate of the mounting portion is fully embedded in the plastics material during molding of the spacer.

The water management portion includes a trough adjacent a top edge of the spacer for capturing and draining infiltrated water and for capturing water drained from above, for example from the drainage conduits of a modular siding panel positioned directly above. In the installed condition of the spacer, the trough engages the rear surface of the siding panel along the top edge to define a drainage groove with a trough shaped bottom for capturing the

infiltrated water. The trough preferably extends substantially over a whole width of the spacer. More preferably, the trough further extends along one of the side edges for capturing water, which has seeped past the front face of the siding panel along the side edge, in the installed condition.

- 5 In one embodiment, the trough includes a drainage opening and the water management portion further includes the drainage channel connected to the drainage opening for forming with the rear surface of the siding panel the drainage conduit for channelling water flowing through the drainage opening toward the bottom edge.

- 10 The supporting spacer preferably includes a mounting flange formed by overlapping sections of the mounting and water management portions. The mounting flange preferably extends along a top edge of the supporting spacer and the supporting spacer preferably further includes coupling elements for slidably coupling a bottom edge of the spacer with the mounting flange of a like spacer positioned immediately below.

- 15 Preferably, the mounting flange and coupling members are parallel for automatic horizontal alignment of horizontally stacked like spacers.

The invention also provides a mortarless modular siding, comprising stacked rows of the modular siding panels in accordance with the invention.

- 20 The invention further provides a method of mounting a modular siding on a building structure, including the steps of obtaining multiple modular siding panels in accordance with the invention, mounting a horizontal row of at least two side by side siding panels on the building structure; and installing subsequent rows of like siding panels by interlocking the coupling member of each siding panel with the mounting portion of the horizontal row of panels, sliding the siding panel on the horizontal row to a desired location adjacent another like panel and fastening the mounting flange of the siding panel to the building structure.

- 25 In a preferred embodiment of this method, the step of obtaining multiple modular siding panels further includes the steps of obtaining an equal number of spacers and facing panels and fastening one of the spacers to each of the siding panels to assemble the modular siding panels.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention will be further discussed in detail below with reference to the drawings, wherein

Figures 1A and 1B are perspective views of the mortarless modular siding system in accordance with the invention, using differently shaped siding panels in accordance with the invention;

Figure 2 is a front elevational view of a modular siding panel as shown in Figure 1A;

Figure 3 is a rear perspective view of the siding panel of Figure 2, showing the supporting spacer fastened to the rear face of the facing panel;

Figures 4A and 4B respectively show a partial cut-away view of the siding panel of Figure 3, exposing the mounting section embedded in the spacer, and a perspective view of the mounting portion;

Figures 5A, 5B and 5C respectively show a cross-sectional view of the supporting spacer, taken along line 5-5 in Figure 3 and a cross-sectional view of the supporting spacer as affixed to a building structure component;

Figure 6 is a partial cross-sectional view of the supporting spacer, showing the top end of Figure 5 in more detail;

Figure 7 is a rear perspective view of the supporting spacer included in the siding panel of Figures 2-4A;

Figure 8 is a side elevational view of the spacer of Figure 7;

Figure 9 is a top plan view of the spacer of Figure 7;

Figure 10 is a variant of the modular siding panel of Figure 3;

Figure 11 is a cross-sectional view of the siding panel of Figure 10, taken along line 11-11 in Figure 10;

Figure 12 is a rear perspective view of the spacer included in the siding panel of Figure 10;

Figure 13 is a rear perspective view of the facing panel of the modular siding panel of Figure 10;

Figure 14 is a cross-sectional view of a variant of the siding panel of Figure 10, showing a manner of interlocking the mounting portion of the spacer with the facing panel; and

5 Figure 15 is a rear perspective view of the facing panel of the modular siding panel of Figure 14.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Detailed embodiments of the present invention are disclosed herein. It should be understood, however, that the disclosed embodiments are merely exemplary of the invention, which may
10 be embodied in various forms. Therefore, the details disclosed herein are not to be interpreted as limiting, but merely as a basis for teaching one skilled in the art how to make and/or use the invention.

In accordance with the present invention, and with reference to Figures 1A and 1B, a modular siding system 10 is disclosed. The modular siding system 10 allows for the
15 convenient and secure attachment of modular siding panels 12 with a weather resistant facing to a static building structure 14 in a manner creating a weather resistant outer surface without the need to use mortar or sealant for sealing the siding and for holding the siding panels together. In order to minimize the chance of water damage to the building structure by water infiltrated across the siding, for example through the mortarless joints, the modular
20 siding system further allows for the management of infiltrated water away from the building structure, namely the capture of infiltrated water before it can reach the building structure and drainage of the infiltrated water sealed within the modular siding panel to avoid contact of the infiltrated water with the building structure.

In accordance with the disclosed invention, the modular siding panels 12 are stacked,
25 automatically aligned and coupled at the bottom of each siding panel 12 to a vertically adjacent siding panel 12 or a starter strip or starter rail 90 (see Figure 5B), which is attached to the building structure 14 and forms the base of the siding system 10 (see Figures 1A and 1B).

Referring to Figures 1A, 1B, 2, 3, 4A , each of the siding panels 12 is substantially planar and includes a weather resistant facing panel 20 with a facing surface 21 and a supporting spacer 40 connected with the facing panel 20 along a back surface 22 of the facing panel. The facing panel can be made of any rigid natural or manmade material which is weather resistant.

Each of the siding panels 12 includes the supporting spacer 40 fastened to the facing panel for attachment to studs 16 positioned in the back-up wall (that is, wood stud, steel stud, cement structure or other) of the static building structure 14. Any fastener type suitable for the respective facing panel material can be used for connection of the spacer 40 to the facing panel 20. Tapcon fasteners 41 are preferred for concrete facing panels. The supporting spacer 40 includes a mounting portion 42 for fastening the modular siding panel 12 to a vertical supporting surface of the building structure 14 and a water management or water evacuation portion 60 for capturing infiltrated water which has seeped past the front face before it can contact the building structure and draining the captured water sealed within the modular siding panel to avoid contact of the infiltrated water with the building structure 14. The mounting and water management portions 42, 60 can be integral portions of the supporting spacer 40, or separate elements combined into the supporting spacer 40, such as a mounting portion 42 formed as a metal plate 43 (see Figures 4A and 4B) embedded into the water management portion 60 formed as a plastics structure with fastener apertures 61 for fasteners to mount the siding panel 12 to the building structure 14 and fastener apertures 62 for the fasteners 41 (see Figure 4A) connecting the spacer 40 to the facing panel 20.

In the illustrated embodiment, the supporting spacer 40 includes a mounting flange 46 for securing of the siding panel 12 to the building structure 14, which mounting flange 46 is formed by overlapping sections of the mounting and water management portions 42, 60 (see Figure 4A), for reinforcement of the supporting spacer at the point of securement to the building structure. The individual components of the siding panels 12 will be described in more detail below.

Facing Panel

Referring now to Figures 1A, 1B, 2 and 3, the facing panel 20 includes a facing surface 21, a back surface 22, a top edge 26 extending between the front surface 21 and the back surface

22, a bottom edge 28 extending between the facing surface 21 and the back surface 22, and first and second side edges 30, 32 extending between the facing surface 21 and the back surface 22. The facing panels of the preferred embodiment illustrated in these Figures are made of a settable material, such as concrete. Most preferably, the facing panels are dry
 5 cast concrete panels with a three-dimensional structure imprinted into the facing surface, since they can be cost efficiently manufactured at high volumes and in a large variety of shapes and facing surface designs. The facing panel 20 may be made of any settable material which can be molded to achieve the desired appearance of the siding panels, especially any decorative embossment or three dimensional shaping of the facing surface 21
 10 to give the siding panel 12 the appearance of natural stone or of other masonry surfaces. Examples of settable materials are wet cast concrete, dry cast concrete, concrete mixtures including fibrous or plastic materials, resinous mixtures, etc.

The facing panel 20 may be rectangular in shape, as shown in Figure 1A, or have a Z-shape as shown in Figure 1B. Other shapes, such as square or irregular are also possible, as long
 15 as the shape can be assembled into a continuous surface covering with like siding panels of identical shape. In the Z-shaped embodiment of the facing panel 20 as illustrated in Figure 1B, the first and second side edges 30, 32, which ultimately define the first and second side edges 30, 32 of the siding panel 12, are formed with an interlocking profile. In this preferred embodiment, the first side edge 30 is provided with a protruding upper section 34 adjacent
 20 the top edge 26 of the facing panel 20 and a recessed lower section 36 adjacent the bottom edge 28 of the facing panel 20. Similarly, the second side edge 32 is provided with a protruding lower section 38 adjacent the bottom edge 28 of the facing panel 20 of the siding panel 12 and a recessed upper section 39 adjacent the top edge 26 of the facing panel 20 of the siding panel 12. The protruding upper section 34 and recessed lower section 36 of the
 25 first side edge 30 are shaped to interlock with the respective recessed upper section 39 and the protruding lower section 38 of the second side edge 32 creating an enclosed siding surface with no space between the first side edge 30 and the second side edge 32 of adjacent facing panels 20 of the siding panels 12 (Figure 1B). Preferably, the protruding and recessed sections are dimensioned such that the protrusion and/or recess is comparable in
 30 size to the thickness of the facing panel. This allows for the creation of an interlocked yet smooth corner assembly.

As discussed above, each facing panel 20 is formed with a top edge 26 and a bottom edge 28. As with the first side edge 30 and the second side edge 32, the top edge 26 and the bottom edge 28 are shaped and dimensioned to form a mating relationship when the siding panels 12 are vertically stacked and horizontally abutted (see Figures 1A and 1B). The top edge 26 and the bottom edge 28 define straight edges as they extend from the first side edge 30 to the second side edge 32. As a result, when the top edge 26 is mounted next to a bottom edge 28 of an adjacent siding panel 12 and a continuous, closed siding surface is created, very little spacing remains between the top edge 26 and the bottom edge 28. In addition, the top edge 26 and the bottom edge 28 may be sloped away from the building as they extend from the back surface 22 of the facing panel 20 to the facing surface 21 of the facing panel 20, which results in a sloping seam that counteracts the seepage of water between vertically adjacent siding panels 12 (not illustrated). However, despite the close fit between adjacent panels 12, wind pressure may push water through the seam until the infiltrated water reaches the back surface 22 of the facing panel 20. Should infiltrated water get trapped behind the siding of a building, significant, humidity related damage can occur, which is why the siding panel 12 of the invention is provided with an infiltrated water management structure for capturing and draining the infiltrated water sealed within the modular siding panel to avoid the infiltrated water reaching the building structure, as will be discussed in the following.

Supporting Spacer

As is apparent from Figures 2, 3, 4A, 5A, 5B, 5C, 6 and 7, the present modular siding system 10 employs a supporting spacer 40, preferably made of a combination of steel and plastic components, fastened to the facing panel 20 of the modular siding panels 12. The supporting spacer 40 facilitates secure attachment of the siding panels 12 to the vertical supporting surface 15. The supporting spacer 40 is fastened to each of the siding panels 12 during the manufacturing process and, as will be appreciated based upon the following disclosure, provides a water management system including a trough for capturing infiltrated water and a drainage conduit for draining the infiltrated water sealed within the siding panel.

Referring to Figures 2, 3, 4A, 5A, 5B, 5C, 6 and 7, the supporting spacer 40 is connected with the facing panel 20 to form a modular siding panel 12. As will be appreciated based upon the following disclosure, the supporting spacer 40 provides a mechanism for securing

the top edge 26 of a lower siding panel 12 to the vertical supporting surface 15, while coupling to the bottom edge 28 of a like siding panel 12 positioned directly above (Figures 5A to 5C). Even though all of the siding panels 12 are identical in a preferred embodiment of the siding system of the invention, it is also conceivable that siding panels with differently shaped facing panels can be included, as long as they combine to form a continuous siding surface. However, the supporting spacers 40 are preferably of identical construction for all siding panels and, thus, the supporting spacer 40 will be described with reference to only one of the siding panels 12.

Mounting Portion

The supporting spacer 40 is in the following described with reference to the orientation when the siding panel 12 is coupled to the vertical supporting surface 15. The supporting spacer 40 includes a mounting portion 42 for fastening the siding panel 12 to the vertical supporting surface 15 of the building structure 14 adjacent the top edge 26, and a water management portion 60 for managing infiltrated water within the siding panel to maintain the infiltrated water away from the building structure. With the water management portion 60, infiltrated water which has seeped towards the back surface 22 is captured away from the building structure 14, which means before it comes into contact with the building structure and the captured water is then drained sealed within the siding panel. The mounting and water management portions 42, 60 can be integral portions of the supporting spacer 40, or separate elements integrated into the supporting spacer 40, as illustrated in Figures 4A and 4B. In the illustrated embodiment, the mounting portion 42 includes the mounting flange 46 for fastening to the building structure and an attachment flange 50 for connecting the spacer 40 to the facing panel 20. In the preferred embodiment, the mounting portion 42 is formed as a metal plate 43 having the mounting and attachment flanges 46, 50, with fastener apertures 61 in the mounting flange for receiving fasteners 53 (see Figures 5B and 5C), which fasten the siding panel 20 to the building structure and fastener apertures 62 in the attachment flange 50 for receiving fasteners 41 which anchor the spacer 40 to the facing panel 20. By forming the mounting portion from the metal plate 43, a reliable supporting of the siding panel 12 is achieved without any sagging due to material fatigue or excessive heat. It will be appreciated by the art skilled person that the siding panel 12, depending on geographic location of the installation and color of the facing panel 20, can become heated to elevated temperatures by sun exposure, at which temperatures plastics materials may be subject to

sufficient softening to cause deformation or creep under the load of the facing panel.

Although it is desirable to prevent sagging of the siding panels at elevated temperatures, it is even more desirable to maintain the siding panels reliably attached to the building structure in the case of a fire. By using a mounting portion made of metallic material, the siding panels will remain attached to the building structure for a much longer period of time during an incendiary incident, than if they were made of other materials much more easily deformed under heat, such as plastics. The mounting portion 42 is embedded into the material of the water management portion 60 for corrosion protection (see Figure 4A). The siding panel 12 is fastened to the building structure 14 by way of a screw or bolt 53 (lag bolt for concrete structures), which tightly biases the mounting flange 46 against the supporting surface 15 of the building structure (see Figures 5B and 5C).

Water Management Portion

As is apparent from Figure 7, the supporting spacer 40 further includes the water management portion 60, which includes at least one trough 64 for capturing water which has infiltrated at the top edge 26 all the way to the back surface 22 and at least one drainage channel 66 for draining the infiltrated water from the trough 64 downward. This trough 64 is formed by a rear surface of the mounting flange 46 and a ramped shoulder 63 above the attachment flange 50. The channel 66 is formed as a U-shaped channel connected to the trough 64 and having a pair of legs 67 for engagement with the back surface 22 of the facing panel 20 to form a drainage conduit which is somewhat sealed along the rear surface. In the installed condition of the spacer, the trough 64 is U-shaped and defined by the mounting flange 46, the shoulder 63 and the back surface 22 of the facing panel 20. As is readily apparent from Figure 5C, any water which passes through the seam between the vertically stacked facing panels 20 between the top edge 26 and the bottom edge 28 and all the way to the back surface 22 will be captured in the trough 64 and maintained away from the building structure 14. As illustrated in Figure 7, the trough 64 extends completely across the spacer 40 and, thus essentially all the way across the siding panel from the first side edge 30 of the facing panel 20 to the second side edge 32 of the facing panel 20 along the top edge 26 to form a trough 64 extending substantially over the full width of the facing panel. The shoulder 63, which forms the bottom of the trough 64 is provided with at least one drainage aperture 65 connected with the drainage channel 66. Preferably, the floor of the trough 64 is inclined from horizontal to slope downward towards the drainage aperture 65, as illustrated in Figure

7. The U-shaped channel 66 extends downward towards the bottom edge of the spacer 40 and, thus, sufficiently downwards towards the bottom edge of the facing panel 28 to guide the drained water into the trough 64 of a like siding panel 12 positioned immediately below.

The drainage conduit, which in the installed condition is defined by the U-shaped drainage channel 66 and the back surface 22 of the facing panel 20 is at least partially sealed along the legs 67 to avoid lateral leakage of drained water from the conduit. In a variant of the preferred embodiment, the spacer further includes a wall upstanding from the shoulder 63 in order to form the U-shaped trough independent of the back surface 22 and the U-shaped channel 66 includes a lid or cap to form the drainage conduit independent of the back surface 22.

In the preferred embodiment illustrated in Figures 3, 4A and 7, the water management portion 60 includes a trough 64 with three drainage apertures 65 and three associated drainage channels 66 respectively placed towards the ends of the spacer 40 and at a location centrally therebetween. Most preferably, one of the U-shaped drainage channels 66 is placed directly at each of the ends of the spacer 40 in order for at least one drainage channel 66 to overlap in the installed condition the joint between the siding panel and a like siding panel placed immediately beside. This enables the capture of infiltrated water all around the facing panel in the installed condition, since the overlapping U-shaped channel 66 together with the trough 64 form a continuous trough which extends along the top edge and a side edge and therefore captures water infiltrated along the top and bottom edges 26, 28 or the side edges 30, 32 in the installed condition.

The supporting spacer 40 preferably also includes an installation aid in the form of interengageable upper and lower coupling elements for coupling of the bottom edge of one siding panel during installation to the top edge of another siding member directly below.

These upper and lower coupling elements are provided in the form of a lower coupling flange 88 extending across the bottom edge of the supporting spacer 40 and connecting the bottom ends 68 of the channels 66, and multiple upstanding upper coupling tabs 82 extending upward from the mounting flange 46 and defining a U-shaped gap 85 with the vertical supporting surface 15 for fittingly receiving the coupling flange 88 (Figure 5C). The coupling flange 88 includes a lower attachment flange 87 for securing of the bottom edge of the spacer 40 to the facing panel 20. The lower attachment flange 87 includes fastener apertures

45 for receiving a fastener 41 to connect the lower attachment flange 87 to the back surface 22 of the facing panel 20.

In a variant of the preferred embodiment, as illustrated in Figures 10-13, the lower attachment flange 87 is not connected to the facing panel 20 by fasteners, but by multiple
5 anchoring tabs 62 projecting from the lower attachment flange 87 and including an angled or hooked end 69 for retaining engagement with a lower retaining groove 70 in the back surface 22. The ends 69 and groove 70 are preferably of complementary shape and size to achieve a tightly contact between the lower attachment flange 87 and the back surface 22. A bottom edge 89 of the coupling flange 88 extends parallel to a top edge 41 of the mounting flange 46
10 and the coupling flange 88 is positioned on the rear surface 22 in proximity to the bottom edge 28, for the bottom edge 89 of the coupling flange 88 to rest in the installed condition of the siding panel 12 against the top edge 41 of the mounting flange 46. This automatically aligns vertically stacked siding panels 12 in parallel.

In another variant of the preferred embodiment, as illustrated in Figures 14-16, the lower
15 attachment flange 87 and its connection to the facing panel 20 are the same as in the variant of Figures 10-13, while the attachment flange 50 at its lower end includes one or more arrow shaped latching clips 52, which snap into an upper retaining groove 72 in the back surface 22 of the facing panel and replace the fasteners 41 used in the variant of Figures 10-13. The latching clips 52 preferably permanently interlock with the upper retaining groove 70, which is
20 flared from the rear surface inward and preferably has a dovetail cross-section 75 to accommodate the arrow shaped latching clips 52. Once inserted into the upper retaining groove 72, the removal of the latching clips 52 from the groove 72 is prevented by the narrow throat 73 of the groove. Although only a dove shaped retaining groove is illustrated, any retaining groove shape with a narrow throat close to the back surface 22 can be used, such
25 as a keyhole shaped groove, etc. Equally, although latching clips 52 with arrow shaped, enlarged ends 52 are preferred, enlarged ends of different shape may be used as long as their shape allows removal into the groove 72, while preventing removal thereafter. In general, any combination of groove and clip shapes can be used which allow for insertion of the clips into and interlocking of the clips with the retaining groove, so that the clips are
30 reliably retained in the groove and their removal from the groove is reliably prevented to ensure a permanent interlocking engagement between the spacer 40 and the facing panel 20 at the attachment flange 87 in all weather conditions and even under incendiary conditions.

Sealing Infiltrated Water within Siding Panel

Despite the close clearances between vertically adjacent siding panels 12 in the installed condition, wind pressures may force infiltration of water past the top edge 26 of the facing panels 20 and towards the back surface 22. In the illustrated embodiment of the modular siding panel of the invention, the upper and lower attachment flanges 50, 87 and legs 67 of the channels 66 form a continuous line of contact with the back surface 22 to seal the drainage conduits within the modular siding panel. However, manufacturing tolerances in the spacer 40 and slight irregularities in the respectively contacting surfaces along the line of contact may create leakage points where infiltrated water may seep from the drainage conduit. Moreover, the point form fastening of the spacer to the facing panel may generate deformations in the vicinity of the attachment locations, which may cause localized seepage. In order to reliably drain the infiltrated water sealed within the siding panel, such seepage must be counteracted. Of course, in the spacer variant including a U-shaped trough and closed drainage channels, the drainage conduits are sealed even before connection of the spacer to the facing panel and leakage of the infiltrated water from the drainage conduits is avoided regardless.

The inventors of the present application have now surprisingly discovered that this seepage can be minimized by providing the spacer with a pretension which will generate, in the installed condition of the spacer, a substantially continuous contact pressure between the water management portion and the rear face along the line of contact. This pretension is preferably achieved by providing the spacer 40 with a preselected curvature in at least one of its longitudinal and transverse directions for generation of a contact pressure between the spacer 40 and the back surface 22 along the drainage channels 66, when the spacer 40 is straightened against the facing panel 20 during fastening of the spacer 40 onto the back surface 22. The straightening of the spacer is achieved by fastening the upper and lower attachment flanges 50, 87 of the spacer 40 tightly against the rear surface 22. The pretension can be achieved by manufacturing the spacer in the curved condition or by bending a straight spacer to the desired curvature. When the spacer is made of thermoplastic material, molding the spacer in the curved condition is preferred to avoid local tension stress in the spacer which may lead to undesired deformation of the spacer at elevated ambient temperatures prior to installation of the spacer onto the facing panel.

The inventors have further discovered that independent of the material of which the spacer is manufactured, sufficient contact pressure may be achieved by providing the spacer with a constant primary curvature over the whole width of the spacer at a minimum rate of curvature of at least $1/8$ in for each 10 inches of spacer length. Even with a starting curvature of $1/4$ in / 10in spacer length and a manufacturing tolerance of $1/8$ in / 10in of curvature the minimum contact pressure of $5\text{lb} / \text{in}^2$ which was required to achieve a satisfactory sealing action along the line of contact, was achieved (see Example 1). It was even more surprising that further providing the spacer with a second, lower degree of curvature in an orthogonal direction ($1/8$ in for each 10 in of spacer length) further improved the contact pressure to generally the same degree as the larger primary curvature (see Example 2). The primary curvature can be either in the horizontal or vertical direction of the spacer, while the secondary curvature is always orthogonal to the primary curvature. The spacer materials tested were polypropylene (PP), polypropylene with talc (PP+10cc), polypropylene with added fiberglass (PP+30 fiberglass) and acrylonitrile butadiene styrene (ABS). A minimum contact pressure of 5lbs per in^2 of contact surface along the line of contact was found to yield satisfactory sealing results, regardless of the spacer material used. Tests were conducted to determine the degree of curvature required to reliably achieve that minimum contact pressure along the line of contact between the spacer and the facing panel.

EXAMPLE I

Contact pressure at the drainage channel 66 was measured for a primary curvature of $1/4\text{in} \pm 1/8\text{in}$ for each 10 in of spacer length in horizontal direction and measurements were taken along the line of contact. Minimum (MIN), average (NOM) and maximum (MAX) pressures were determined and are tabulated below. The spacers tested were made of different materials, namely polypropylene (PP), polypropylene with talc (PP+10cc), acrylonitrile butadiene styrene (ABS) and polypropylene with added fiberglass (PP+30 fiberglass).

As will be apparent, a minimum contact pressure of $5\text{lb} / \text{in}^2$ was achieved regardless of the spacer material used.

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HORIZONTAL AXE

Curve dimension is 1/4 ± 1/8

	MIN			NOM			MAX		
	on 10"	on 12.125"	lbs/in in.	on 10"	on 12.125"	lbs/in in.	on 10"	on 12.125"	lbs/in cube
PP	0.125	21.250	0.36	0.25	21.25	0.62	0.375	21.25	11.99
PP + 10cc	5.60	4.41	0.59	9.60	7.56	12.20	12.00	9.45	19.07
ABS	7.50	7.17	0.42	10.40	9.61	10.49	16.60	15.03	16.19
PP + 30 fiber glass	6.50	5.12	0.68	10.50	8.27	16.99	16.20	12.76	1.26
	10.40	8.19	10.39	17.00	13.39	1.10	19.40	15.28	

(lb/incube=lb/ in²)

EXAMPLE 1

Example 2

Contact pressure at the drainage channel 66 was measured for a primary curvature of 1/8in+/-1/8in for each 10 in of spacer length in vertical direction and measurements were taken along the line of contact. Minimum (MIN), average (NOM) and maximum (MAX) pressures were determined and are tabulated below. The spacers tested were made of different materials, namely polypropylene (PP), polypropylene with talc (PP+10cc), acrylonitrile butadiene styrene (ABS) and polypropylene with added fiberglass (PP+30 fiberglass).

As will be apparent, a minimum contact pressure of 5lb/ in² was achieved on average regardless of the spacer material used.

VERTICAL AVECurve dimension is $1/8 \pm 1/8$

	MIN			NOM			MAX		
	on 10"	on 5.443"	145.570	lbs/in in.	lbs / in cube	on 10"	on 5.443"	145.570	lbs / in cube
PP	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	17.78
PP + 10cc	0.00	0.00	0.00	0.00	0.00	5.60	8.18	14.02	1.16
ABS	0.00	0.00	0.00	0.00	0.00	7.50	10.95	15.18	1.25
PP + 30 fiber glass	0.00	0.00	0.00	0.00	0.00	6.50	9.49	15.33	1.26
	0.00	0.00	0.00	0.00	0.00	10.40	15.18	24.82	2.05

(lb/incube=lb/ in²)**EXAMPLE 2**

Wind pressure on the building structure 14 may create significant pressure differences between the exterior of the building siding and the rear of the siding. Moreover, localized pressure peaks may be created behind the siding structure during gusty wind conditions.

Therefore, steps are normally taken to equalize those pressure differences in an effort to

- 5 reduce infiltration of water through the siding and potential entrapment of the infiltrated water behind the siding. Air pockets may be created between the supporting surface 15 and the facing panel 20, which may lead to an undesirable pressure differential between the front and rear sides of the siding panels during inclement weather conditions. In order to prevent such a pressure differential, at least one of the channels 66 is provided with a pressure vent 102.
- 10 The pressure vent 102 is an opening in a sidewall of the U-shaped channel 66. Preferably, the opening is provided with an overlapping lip 104, which is upwardly inclined in the installed condition of the siding panel 12, in order to minimize the potential for leakage of the drained, infiltrated water from the vent 102.

The water management portion 60 is preferably made of a plastics material which is molded

15 as a single part including the metal plate 43, so that during the molding process the plastics material of the water management portion 60 completely surrounds the metal plate 43, interlocks the two portions of the supporting spacer 40 and effectively shields the metal plate 43 from exposure to infiltrated water, thereby potentially extending the service life of the siding panel 12.

- 20 The modular siding panel of the invention is preferably assembled by fastening the spacer 40 to a rigid facing panel of weather resistant material, either with fasteners 41 appropriate for the material of the facing panel, or by a combination of fasteners 41 and attachment tabs 62 fittingly received in a retaining groove 70 in the back surface 22 of the facing panel 20. After assembly, multiple siding panels 12 in accordance with this disclosure can be mounted to a
- 25 building structure to form a weather resistant siding.

In order to start the installation of the siding from the base of the vertical support surface, a horizontal started rail 90 is installed as shown in Figure 5B. The starter rail 90 has a U-shaped coupling member to receive the coupling flange 88 of a siding panel 12.

- In practice, the siding panels 12 are manufactured in accordance with the structure described
- 30 above. The vertical support surface 42 to which the siding panels 12 are to be secured is

identified and the studs 16 (or other support members of the vertical support surface) are identified. The starter rail 90 is secured horizontally to the vertical supporting surface 42 and siding panels 12 are placed thereon side-by-side with the downwardly extending coupling flanges 88 seated within the U-shaped coupling member 100 of the starter rail 90. The first
5 and second side edges 30, 32 of the facing panels 20 of adjacent siding panels 12 are mated and each siding panel 12 is secured in place by applying fasteners through the mounting flange and into one of the studs. Once a first row of siding panels has been installed in this manner, the next row of the siding panels 12 is installed by inserting the coupling flange 88 behind the coupling tabs 82 of the mounting flange 46 of the row of panels immediately
10 below. This process is repeated for subsequent rows until the siding surface is completed.

With the foregoing in mind, the present self-supporting modular siding system 10 allows quick, easy and economical installation. Each siding panel 12 is fully supported by its own mounting flange. No mortar is required for installation. A lightweight concrete mix is preferably used in the manufacture of the siding panels 12 to allow for easy handling of the
15 various side panels 12. In addition, profiles of the first and second side edges allow building interlocking corners using the same unit. The side face of the module is preferably textured similar to the facing surface 21 to imitate the face of the module for all corners.

While the preferred embodiments have been shown and described, it will be understood that there is no intent to limit the invention by such disclosure, but rather, is intended to cover all
20 modifications and alternate constructions falling within the spirit of and scope of the invention.

CLAIMS:

1. A modular siding panel for the assembly of a mortarless modular siding on a building structure, comprising

5 a facing panel made of rigid, weather resistant material and having a front face exposed in an installed condition of the panel, a rear surface facing the building structure in the installed condition, and top, bottom and side edges for proximal placement to like panels positioned adjacent thereto; and

10 a supporting spacer fastened to the rear surface of the facing panel, the spacer including a mounting portion for attachment of the modular siding panel to the building structure and a water management portion for capturing any infiltrated water which has seeped past the top edge and draining the captured infiltrated water, the water management portion engaging the rear surface for draining the infiltrated water out of contact with the building structure and away from the building structure, within the modular siding panel, between the rear surface and the water management portion.

15 2. The modular siding panel of claim 1, wherein the mounting and water management portion are integral portions of the supporting spacer and the captured infiltrated water is drained in a drainage conduit, the drainage conduit formed within the spacer or by sealing contact of a drainage recess in the spacer with the rear surface of the facing panel.

20 3. The modular siding panel of claim 2, wherein the mounting portion is a metal plate connected by fasteners to the facing panel and the water management portion is a plastics structure connected by fasteners to the facing panel.

4. The modular siding panel of claim 3, wherein the water management portion engages the rear surface along the top edge to define a trough for capturing the infiltrated water.

25 5. The modular siding panel of claim 4, wherein the trough extends substantially over a whole width of the facing panel.

6. The modular siding panel of claim 5, wherein the trough further extends along one of the side edges for capturing water which has seeped past that side edge.

7. The modular siding panel of any one of claims 4-6, wherein the trough includes a drainage opening connected to the drainage conduit for channelling water flowing through the drainage opening toward the bottom edge of the siding panel.

5 8. The modular siding panel of claim 3, wherein the water management portion defines a U-shaped trough together with the rear surface of the facing panel, for capturing infiltrated water and water drained from the drainage conduit of a siding panel positioned directly above.

10 9. The modular siding panel of claim 1, wherein the supporting spacer includes a mounting flange formed by overlapping sections of the mounting and water management portions, for reinforcement of the supporting spacer at the point of securement to the building structure.

10. The modular siding panel of claim 9, wherein the mounting flange is made of metal for improved fire resistance of the modular siding panel and the mounting flange is embedded into the water management portion for corrosion protection.

15 11. The modular siding panel of claim 9, wherein the mounting flange extends along a top edge of the siding panel and the supporting spacer further includes coupling elements for slidably coupling the bottom edge of the siding panel with the mounting flange of a like siding panel positioned immediately below.

20 12. The modular siding panel of claim 10, wherein the coupling elements include a lower coupling element positioned at a bottom end of the supporting spacer for engaging a top edge of the mounting flange of a like siding panel placed immediately below, and an upper coupling element extending upward from the mounting flange for gripping around the lower coupling element of another like panel placed immediately above.

25 13. A modular siding panel for the assembly of a mortarless modular siding on a building structure, comprising

a facing panel made of rigid, weather resistant material and having a front face exposed in an installed condition of the panel, a rear surface facing the building structure in the installed condition, and top, bottom and side edges for proximal placement to like panels positioned adjacent thereto; and

a supporting spacer fastened to the rear surface of the facing panel, the spacer including a mounting portion for attachment of the modular siding panel to the building structure and a water management portion for capturing any infiltrated water which has seeped past the top edge and draining the captured infiltrated water sealed within the modular siding panel, wherein

the supporting spacer includes a mounting flange formed by overlapping sections of the mounting and water management portions, for reinforcement of the supporting spacer at the point of securement to the building structure,

the mounting flange extends along a top edge of the siding panel and the supporting spacer further includes coupling elements for slidably coupling the bottom edge of the siding panel with the mounting flange of a like siding panel positioned immediately below, and

the modular siding panel comprises a plurality of upper coupling elements, wherein the lower coupling element is a coupling flange integrated into the water management portion for placement onto an upper edge of the mounting flange of a like siding panel placed immediately below and the upper coupling elements are coupling tabs evenly spaced along the mounting flange for slidably gripping the coupling flange of a like siding panel placed immediately above.

14. The modular siding panel of claim 11, wherein the mounting flange and coupling flange are parallel for automatic horizontal alignment of horizontally stacked like panels.

15. The modular siding panel of claim 1, wherein the facing panel is made of settable material.

16. The modular siding panel of claim 15, wherein the facing panel is a dry cast concrete panel.

17. A mortarless siding, comprising stacked rows of modular siding panels as defined in claim 1.

18. The siding of claim 17, further comprising a starter rail for supporting a lowermost horizontal row of the modular siding panels.

19. The siding of claim 18, wherein the starter rail includes a U-shaped supporting flange for receiving the coupling flange of the modular siding panels in the lowermost row.

20. The siding of claim 17, wherein the modular facing panels have a rectangular outline, or a Z-shaped outline with interlocking end portions.

5 21. The modular siding of claim 17, wherein the side edges of the modular facing panels tightly abut the side edges of laterally adjacent panels, while the top edges of each facing panel is closely spaced from the bottom edge of a like facing panel immediately above for generating an intermediate pressure equalization gap extending from the front surface to the back surface for each individual siding panel.

10 22. A spacer for placement between a building structure and a facing panel, the spacer comprising

a body having a building side and a panel side and including a mounting portion and a water management portion,

15 the mounting portion including a mounting flange for connection to the building structure on the building side and an attachment flange for connection to the facing panel on the panel side; and

20 the water management portion including a trough on the panel side for capturing infiltrated water which has seeped past a top edge of the facing panel, and a drainage conduit for draining the infiltrated water from the trough on the panel side of the spacer body, the facing panel having a rear surface, the water management portion configured to engage the rear surface for draining the infiltrated water out of contact with the building structure and away from the building structure, between the rear surface and the water management portion.

25 23. The spacer of claim 22, wherein the trough and/or the drainage conduit is formed completely within the spacer.

24. The spacer of claim 22 wherein the trough and/or drainage conduit is formed for contacting a back surface of the facing panel when the spacer is connected to the facing panel by the attachment flange.

25. The spacer of claim 22, wherein the mounting portion is a metal plate for providing a heat resistant connection of the spacer to the building structure and the facing panel.
26. The spacer of claim 25, wherein the water management portion is made of thermoplastic material and the mounting portion is embedded into the water management
5 portion.
27. The spacer of claim 25, wherein the mounting portion includes an aperture for receiving a fastener for connecting the spacer to the building structure.
28. The spacer of claim 27, wherein the attachment flange includes an aperture for receiving a fastener for connecting the spacer to the facing panel.
- 10 29. The spacer of claim 28, wherein the trough is formed by shoulder on the mounting flange on the panel side of the spacer, which shoulder is ramped for collecting the infiltrated water at a drainage location.
30. The spacer of claim 29, wherein the drainage conduit is a channel formed in the panel side of the spacer and connected to the trough at the drainage location for draining
15 infiltrated water collected at the drainage location.
31. The spacer of claim 30, wherein the drainage conduit is formed as a U-shaped channel connected to the trough and having a pair of legs for engagement with a back surface of the facing panel, when the spacer is connected to the facing panel, to form a closed conduit.
- 20 32. The spacer of claim 22, wherein the trough extends completely across a length of the spacer.
33. The spacer of claim 32, wherein the length of the spacer is substantially equal to a length of the facing panel.
34. The spacer of claim 30, wherein the trough includes multiple drainage locations and
25 the water management portion includes a separate drainage conduit connected to each drainage location.

35. The spacer of claim 31, wherein the trough includes multiple drainage locations and the water management portion includes a separate drainage conduit connected to each drainage location and at least one of the U-shaped drainage channels is placed directly at an end of the spacer in order for the at least one drainage channel to overlap in the installed condition, when the spacer is connected to the building structure, a joint between the siding panel connected to the spacer and a like siding panel place immediately beside.

36. The spacer of claim 29, wherein the attachment flange includes an aperture for receiving a fastener for connecting the spacer to the facing panel at an upper edge thereof.

37. The spacer of claim 36, wherein the ramped shoulder is formed above the attachment flange.

38. The spacer of claim 35, wherein the body further includes a connecting flange connecting drainage ends of the drainage conduits.

39. The spacer of claim 38, wherein the connecting flange includes an attachment portion for connection to the facing panel at a lower edge thereof.

40. The spacer of claim 39, wherein the attachment portion includes an aperture for receiving a fastener for connecting the spacer to the facing panel.

41. The spacer of claim 40, wherein the attachment portion includes a protruding tab with an interlocking end for interlocking engagement with a retaining groove formed in the back surface of the facing panel.

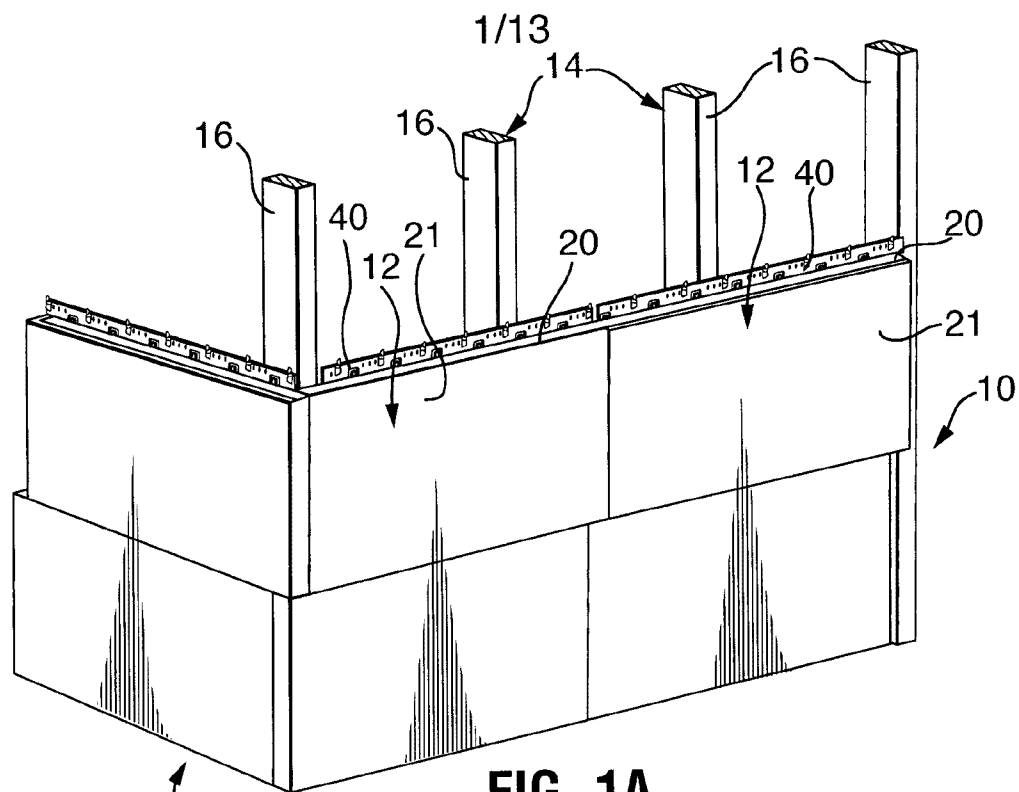
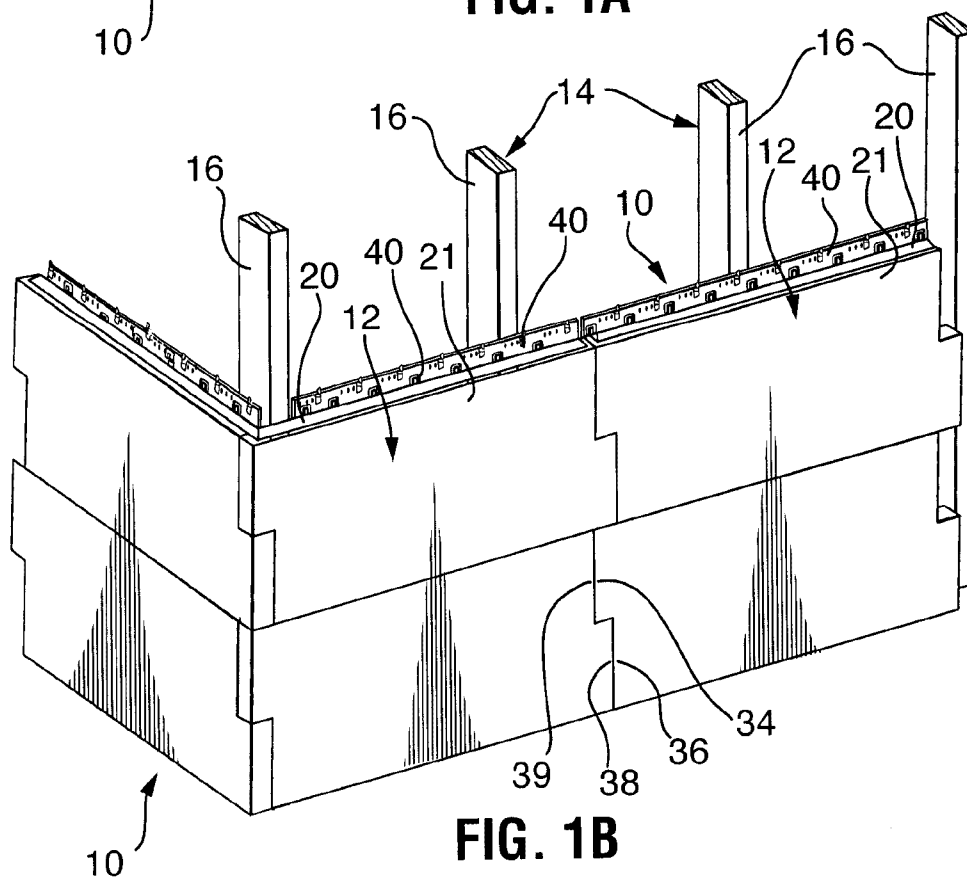
42. The spacer of claim 22, wherein the body has a curvature for generating a contact pressure between the spacer and a back surface of the facing panel when the spacer is connected to the facing panel.

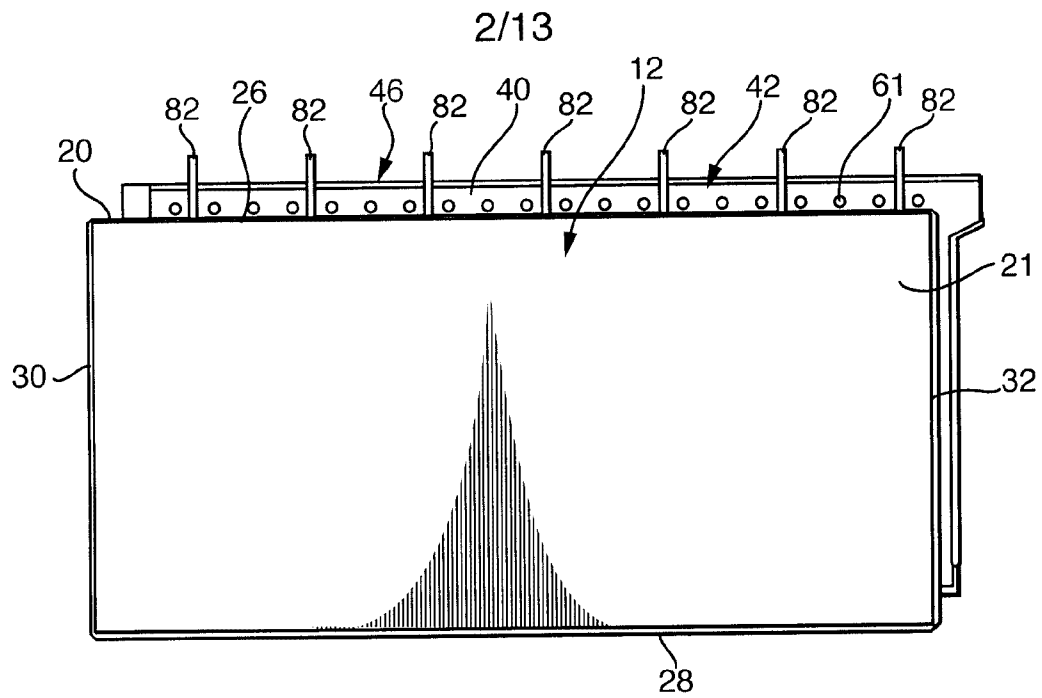
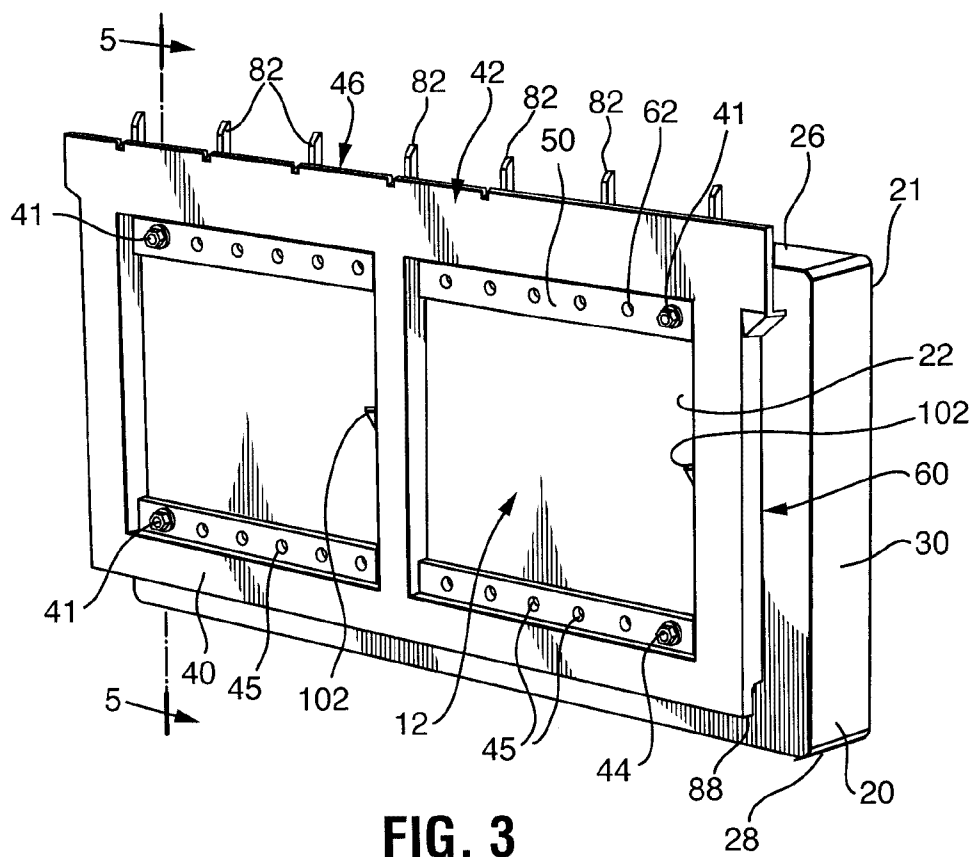
43. The spacer of claim 42, wherein the curvature extends over the whole length of the spacer.

44. The spacer of claim 43, wherein the body is curved by at 1/8in for each 10in of length.

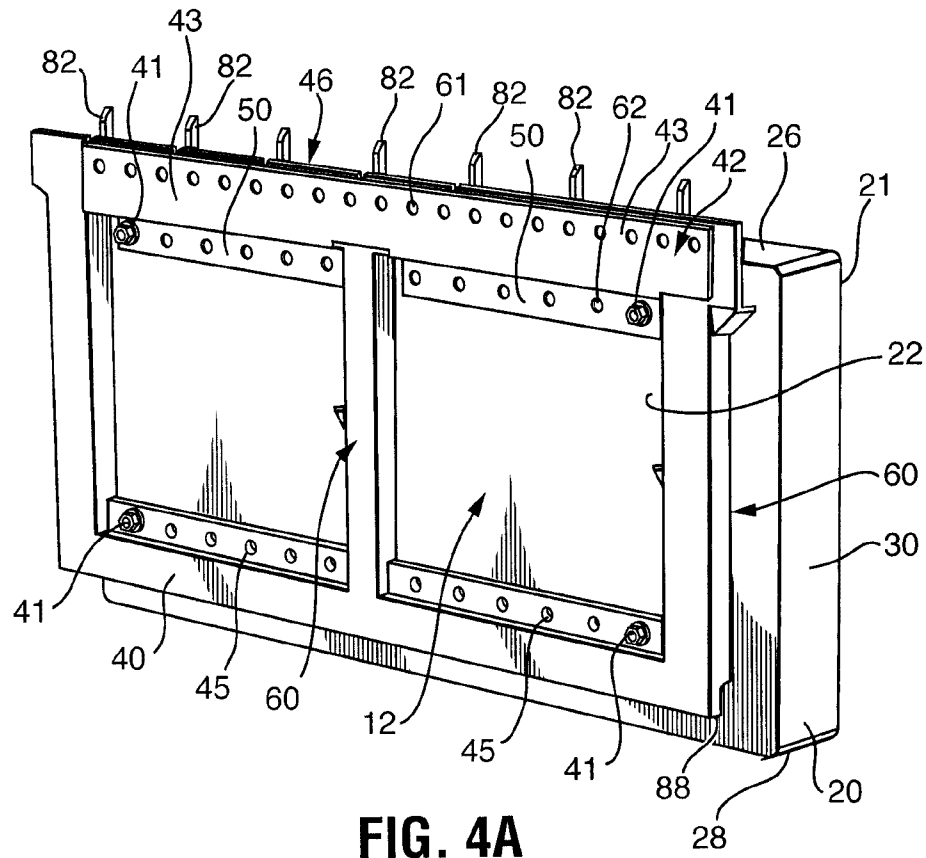
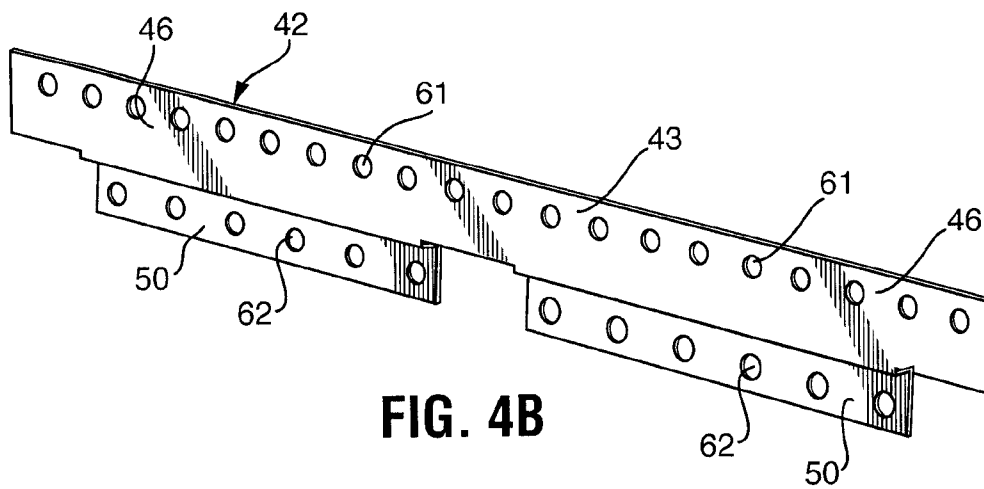
45. The spacer of claim 44, wherein the body includes two curvatures orthogonal to one another.

46. The spacer of claim 45, wherein the curvatures are selected for generating a contact pressure of at least 5lb/ in².

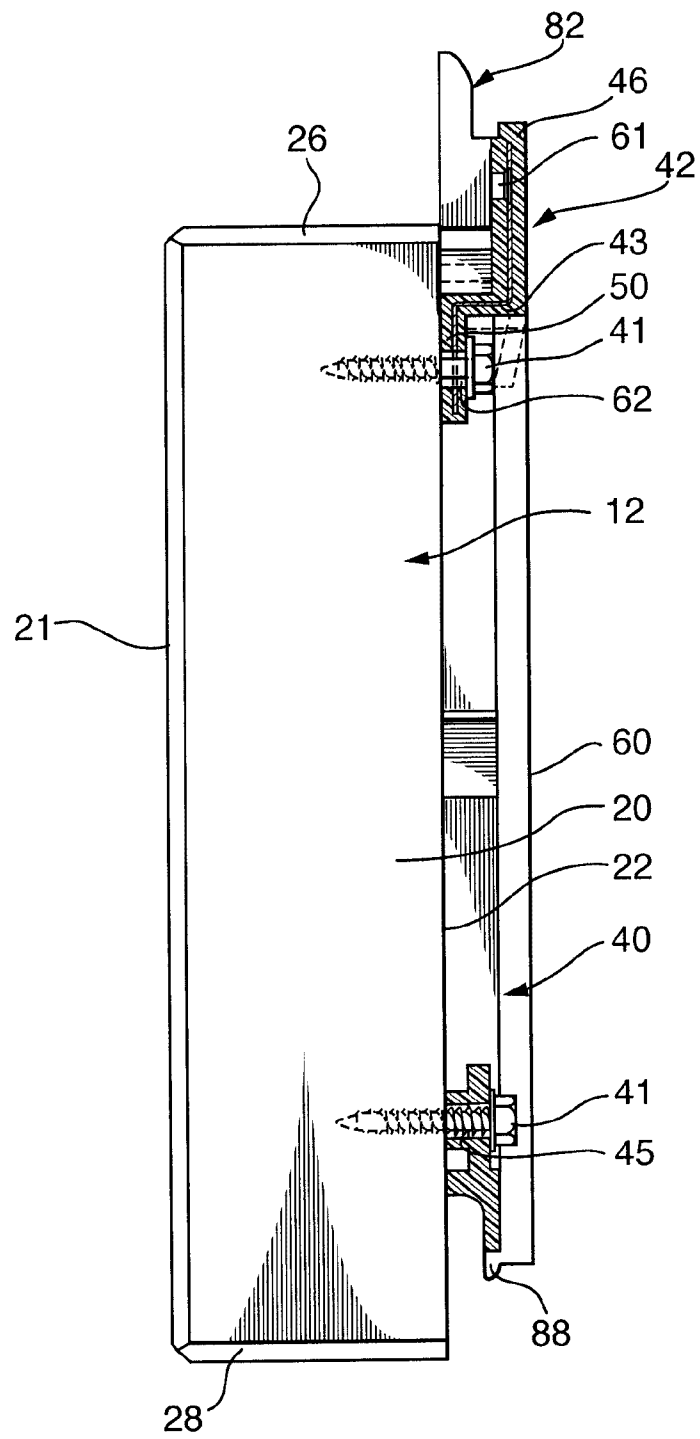
**FIG. 1A****FIG. 1B**

**FIG. 2****FIG. 3**

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**FIG. 4A****FIG. 4B**

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**FIG. 5A**

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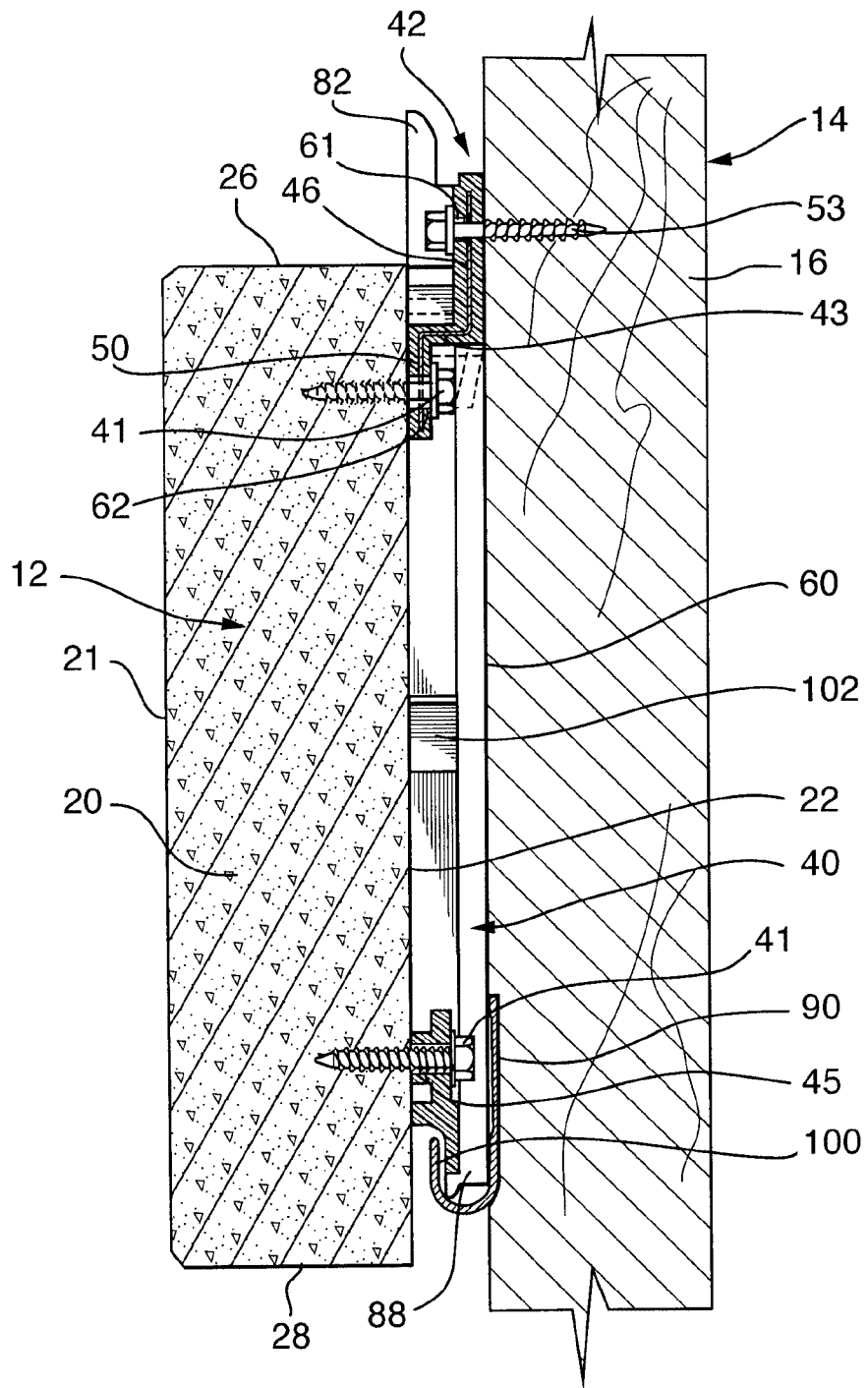
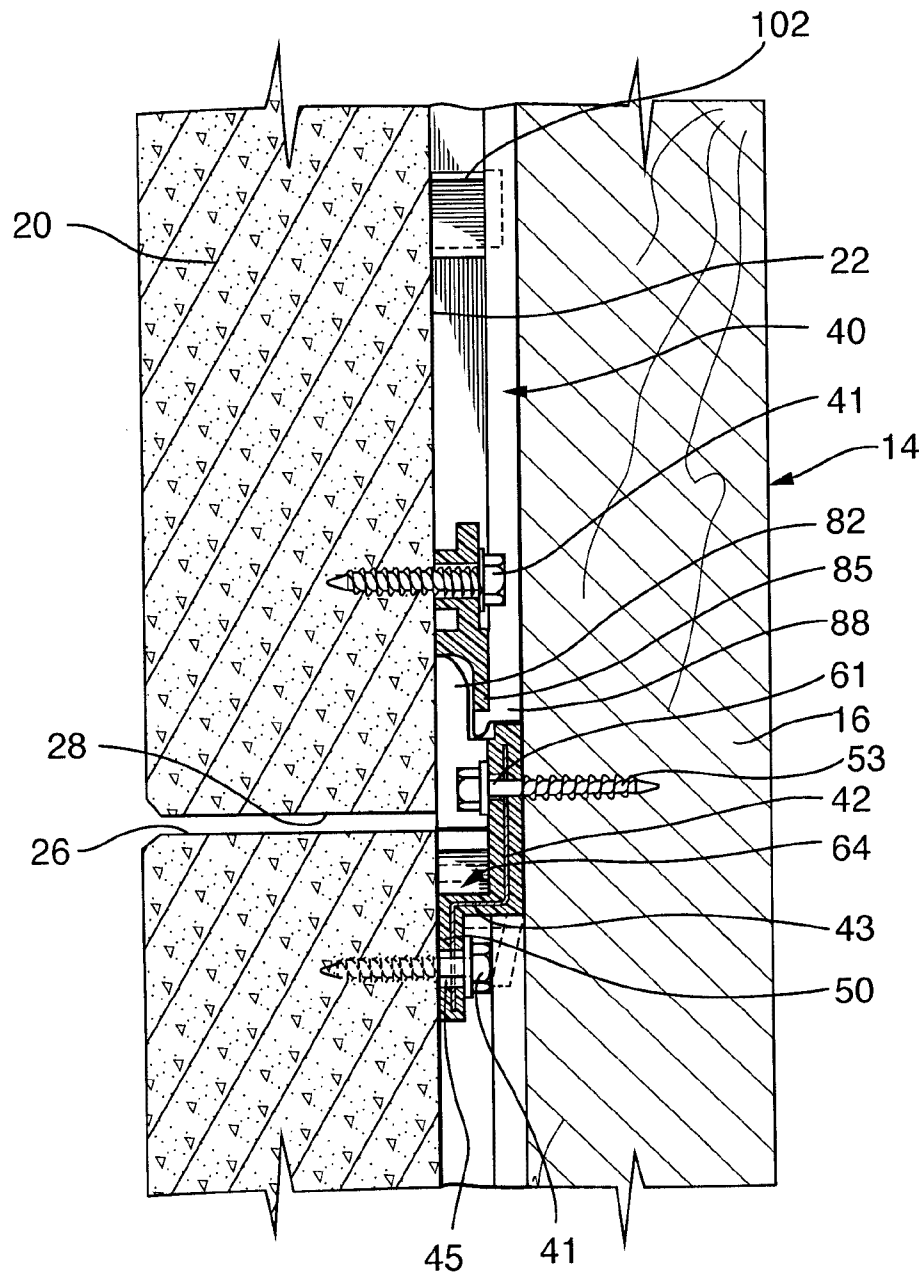


FIG. 5B

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**FIG. 5C**

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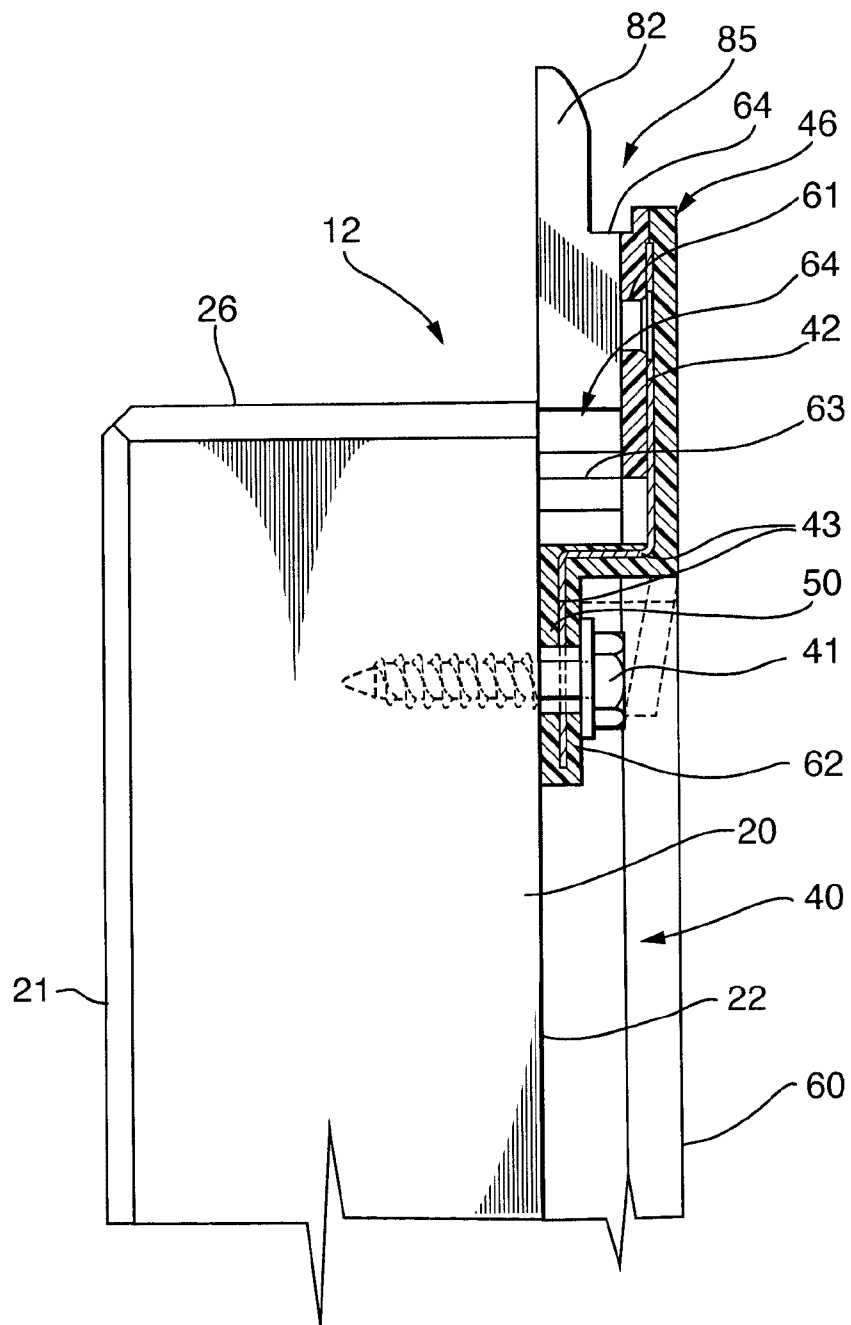
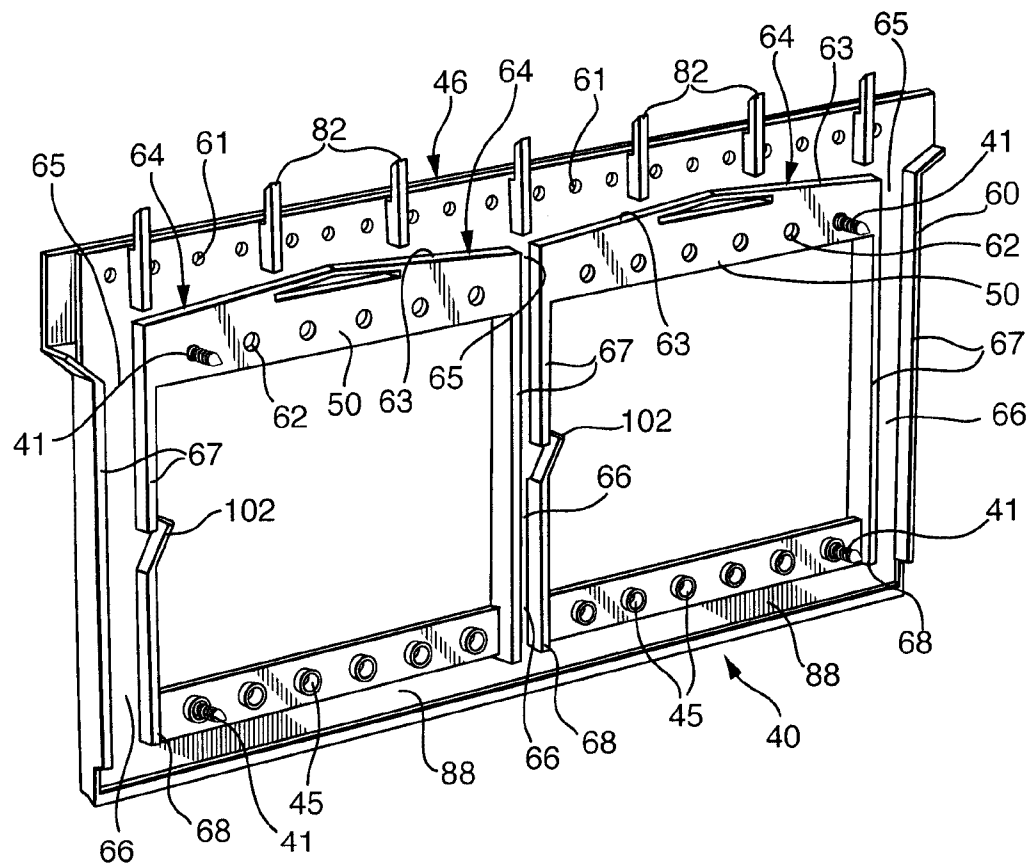
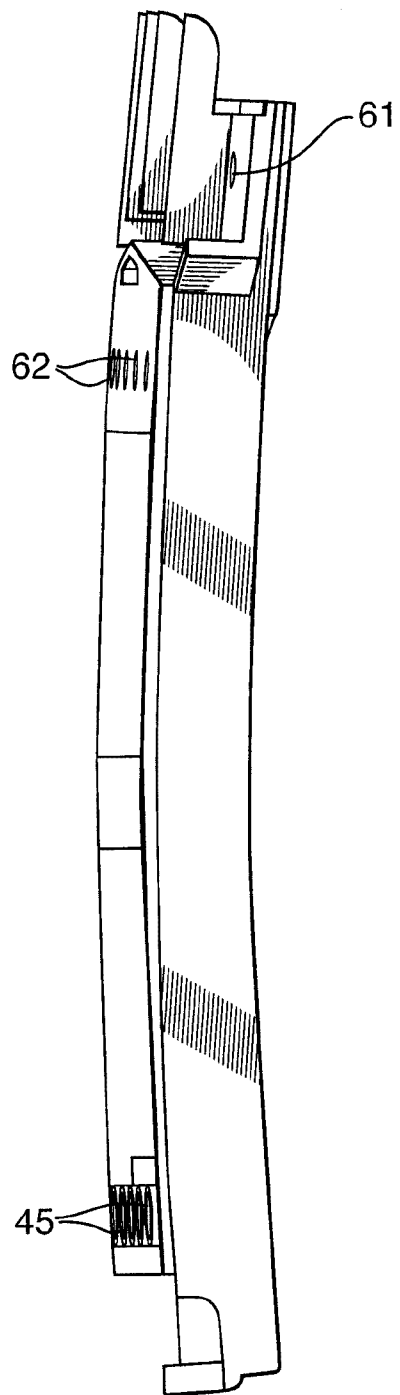
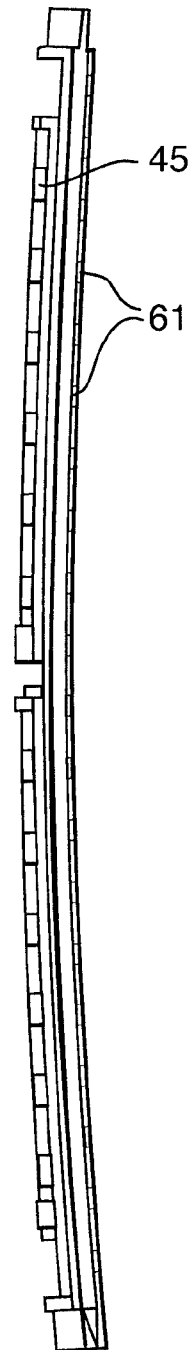


FIG. 6

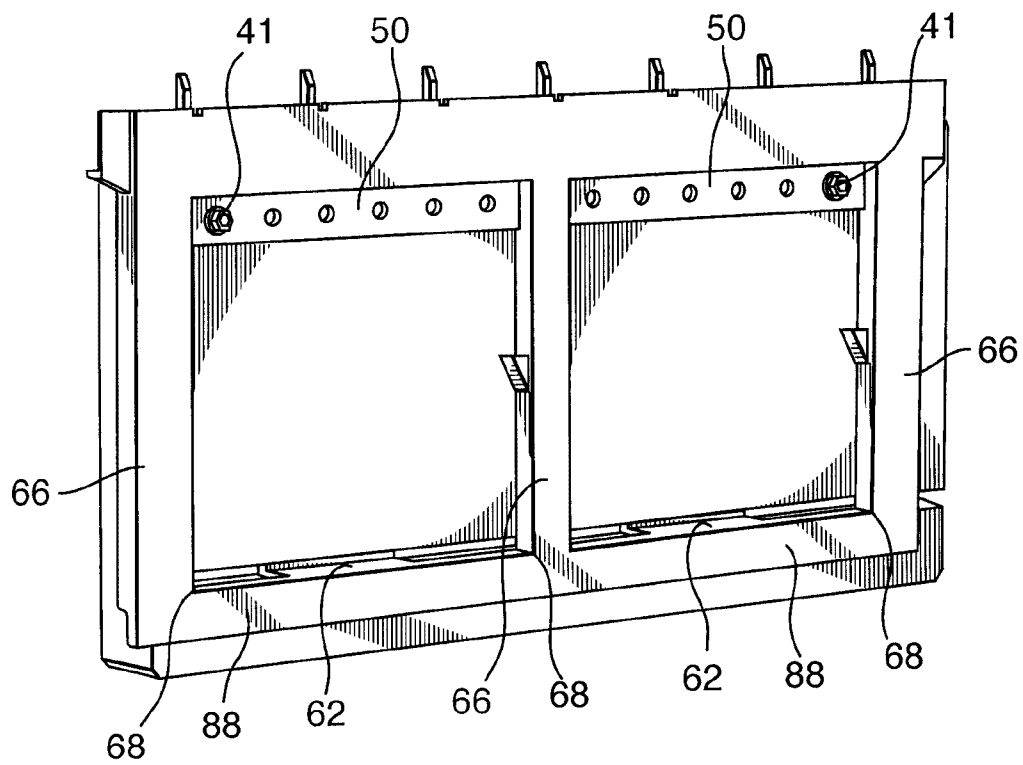
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**FIG. 7**

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**FIG. 8****FIG. 9**

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**FIG. 10**

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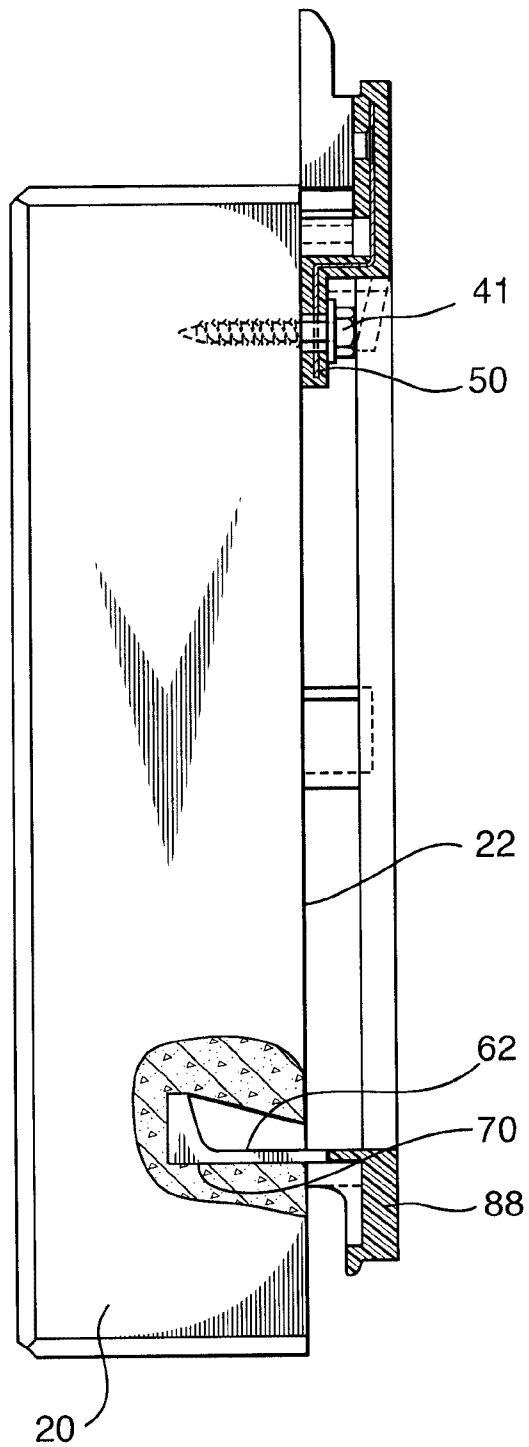
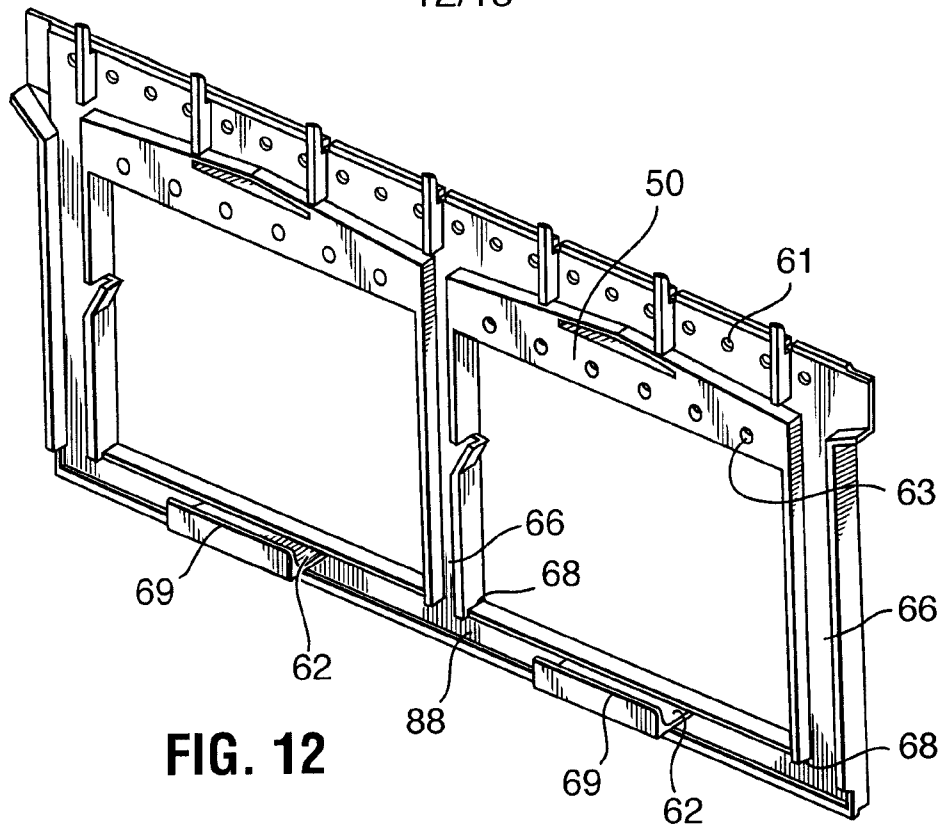
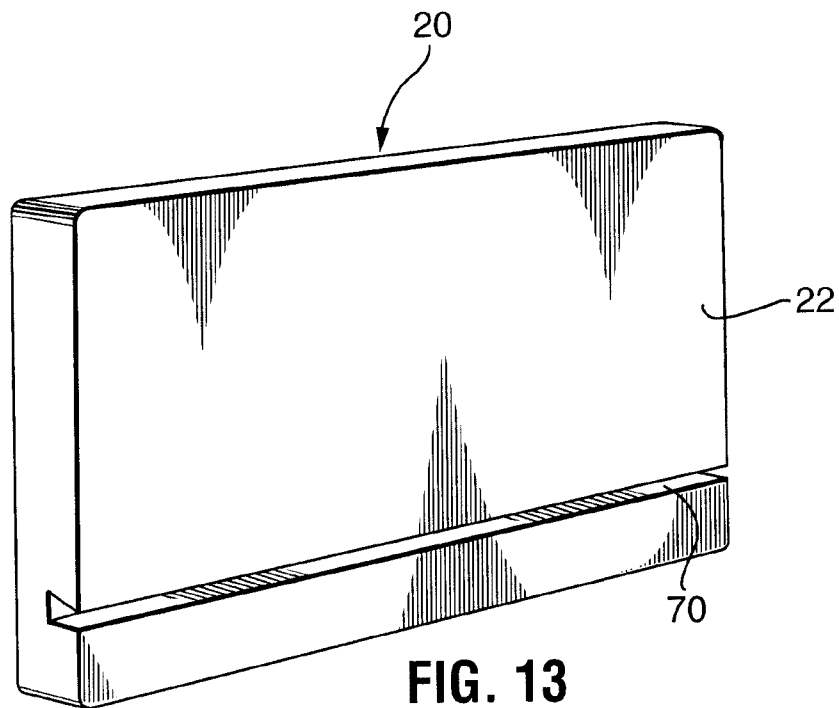


FIG. 11

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**FIG. 12****FIG. 13**

