



- (51) **International Patent Classification:**
E04D 13/03 (2006.01) *E04D 13/147* (2006.01)
- (21) **International Application Number:**
PCT/US2016/043412
- (22) **International Filing Date:**
21 July 2016 (21.07.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
- | | | |
|------------|------------------------------|----|
| 62/195,151 | 21 July 2015 (21.07.2015) | US |
| 62/242,732 | 16 October 2015 (16.10.2015) | US |
| 62/277,922 | 12 January 2016 (12.01.2016) | US |
| 62/324,239 | 18 April 2016 (18.04.2016) | US |
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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** ROOF CURB SYSTEM AND METHOD OF INSTALLING

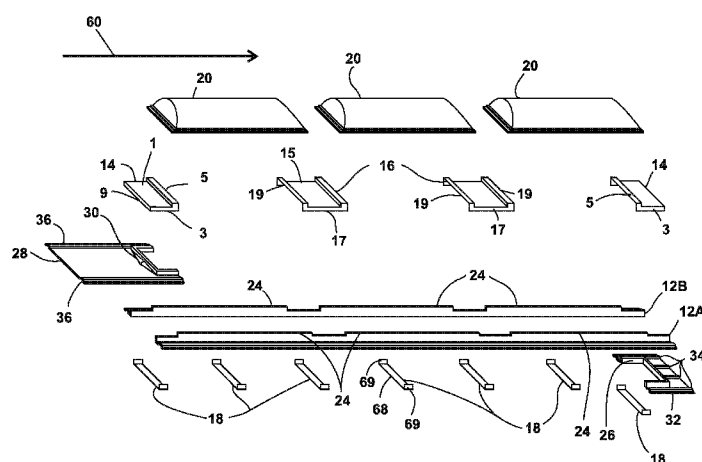


FIG. 1

(57) **Abstract:** The present invention is a curb assembly system for modifying a metal building. The apparatus comprises a plurality of mounting brackets, at least two caps, at least two side rails, at least two end panels, and a plurality of screws. The mounting brackets are placed on support structure of the building, one of the at least two end panels is placed at the low point of the building, one of the at least two side rails is placed on the edge of an existing building panel, the at least two caps are placed a determined distance from each other, another of the at least two side rails is placed parallel to the first side rail, and another of the at least two end panels is placed at the high point of the building, such that there is created a "curb" comprised of the side rails and caps which can support an device or feature that is secured thereon.



PATENT APPLICATION

TITLE OF THE INVENTION

5 "Roof Curb System and Method of Installing"

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CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of: United States Provisional Patent Application
Serial Number 62/195,151, filed 21 July 2015; United States Provisional Patent
Application Serial Number 62/242,732, filed 16 October 2015; United States Provisional
15 Patent Application Serial Number 62/277,922, filed 12 January 2016; and United States
Provisional Patent Application Serial Number 62/324,239, filed 18 April 2016; all of
which are incorporated herein by reference and priority of/to which are hereby claimed.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
DEVELOPMENT

20 Not applicable

REFERENCE TO A "MICROFICHE APPENDIX"

Not applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

25 The present invention relates to an in-line roof curb system that is primarily for roof
mounted skylights. More particularly, the present invention relates to a unique roof curb
system to be installed on metal buildings.

2. General Background of the Invention

There are almost 56 billion square feet (~5202.57 square kilometers) of R-panel roofs
30 being used in the United States with all other type metal roofs making up an estimated 20%
of the remaining market of metal roofs. The typical domed skylight and metal curb is used
almost exclusively on the smaller share of the metal roof market.

Almost all R-panel roofs utilize the same type of skylight. This type of skylight is not a curb mounted design, but is rather a translucent fiberglass panel that matches the profile of the R-panels and installed among the runs of metal R-panel. These R-panel skylights are typically 12 feet (3.6576 meters) long and 3 feet (91.44 centimeters) wide. Once installed, the R-panel skylight has an exposed surface of approximately 10 feet (3.048 meters) x 3 feet (91.44 centimeters) and is fastened in the same manner as the R-panels, which is in a through-fastened nature utilizing self-tapping screws with rubber washers.

Due to the low cost nature of an R-panel roof, domed skylights have not been utilized because of the expense to custom manufacture and install a metal curb to fit on an R-panel roof that doesn't hinder water flow while housing a domed skylight. Even with the other type of metal roofs, which are more costly than R-panel roofs, this drawback of expense for manufacture and installation has limited the opportunity to install large numbers of domed skylights on metal roofs.

The system of the present invention solves this problem by providing an affordable roof curb system for installing domed skylights on R-panel and other metal roof types that does not hinder water flow.

The following US Patents are incorporated herein by reference: 4,559,753; 4,649,680; 4,860,511; 5,323,576; 6,532,877; 6,775,951; 7,043,882; 8,713,864; 8,438,801; 8,763,324; and 8,438,798.

BRIEF SUMMARY OF THE INVENTION

This present invention is a unique roof curb system to be installed on metal buildings. It is anticipated that the largest use of the in-line roof curb system will be on through-fastened R-panel roofs. Other types of metal roofs can also use this roof curb system such as corrugated, standing seam, and other suitable roof types. Additionally, with some slight modifications, the in-line roof curb system of the present invention could also be installed on other types of low-slope roofing such as Modified Bitumen, TPO (thermoplastic polyolefin), PVC (polyvinyl chloride), and/or EPDM (ethylene propylene diene terpolymer).

The in-line roof curb system is primarily for roof mounted skylights, but can be used for virtually any roof top equipment, for example roof-top HVAC units. The roof curb system allows easy installation of one or more skylights onto metal roofs of metal and other buildings. The roof curb system may be installed running with the slope of the roof system,

for example.

The skylights that are to be mounted to the in-line roof curb system can be of any size, type or manufacturer, but it is anticipated that most will be of a dome type skylight with single, double or triple lens. It is also anticipated that prismatic domed skylights will make up a significant amount of the domed skylights installed.

The in-line roof curb system, with some small modifications may also be configured to allow for venting of plumbing stacks, furnace flues and interior building ventilation, and may also serve as a parapet wall when installed on the outer perimeter of the building's roof system. In some embodiments the curb system has conduits to allow for wiring or tubing to be incorporated into the structure. The curb system may also be used for installing other features such as HVAC, lighting, sensors, or other devices.

Additionally, the curb system of the present invention may be installed in the walls of the building.

The apparatus of the present invention is an in-line roof curb system, comprising: one or more skylights; two side rails configured to receive the skylights, wherein the side rails have grooves for mating with the grooves of an existing metal roofing system and raised portions configured to receive the skylights, a first end cap, one or more middle caps (when there is more than one skylight), and a second end cap; a plurality of mounting brackets configured to attach to an existing metal roofing system and to attach to the side rails; a starter panel having grooves for mating with the grooves of the side rails, a coupler configured to receive an end cap, and a cricket to deflect water towards one or more valleys of the grooves of the side rails; a first end cap, configured to mate with an under surface of a skylight, the two side rails, and the coupler of the starter panel; optionally one or more middle caps, wherein the middle caps are placed between the skylights; an eave panel having grooves for mating with the grooves of the side rails, a coupler configured to receive an end cap; and a second end cap, configured to mate with an under surface of a skylight, the two side rails, and the coupler of the eave panel.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figure 1 is an exploded view of a preferred embodiment of the system of the present invention;

Figure 2 is a perspective view of one bay of a building prior to installation of roof panels;

Figure 3 is a perspective view of the roof bay of Figure 2 with the roof panels in place
5 prior to skylight installation;

Figure 4 is a perspective view of the bay of Figures 2 and 3 with the center R-panels removed prior to skylight installation;

Figures 5-6 are close up views of the insulation being cut and folded back prior to skylight installation;

10 Figure 7 is a perspective view of the bay of Figures 2-4 showing the insulation folded back;

Figure 8 is a perspective view of the bay of Figures 2-4 and 7 showing installation of the mounting brackets of the present invention;

Figure 9 is a close up view of the installation of mounting brackets shown in Fig. 8;

15 Figure 10 is a perspective view of the bay of Figures 2-4 and 7-8 showing the next step in installation of a preferred embodiment of the system of the present invention wherein the insulation is folded back over the mounting brackets;

Figure 11 is a perspective view of the bay of Figures 2-4, 7-8, and 10 showing the next step in installation of a preferred embodiment of the system of the present invention wherein
20 the eave panel is installed;

Figure 12 is a perspective view of the bay of Figures 2-4, 7-8, and 10-11 showing the next step in installation of a preferred embodiment of the system of the present invention wherein a side rail is installed;

Figure 13 is a perspective view of the bay of Figures 2-4, 7-8, and 10-12 showing the next step in installation of a preferred embodiment of the system of the present invention wherein the thermal breaks are installed;

Figure 14 is a close up view of the installation of thermal breaks shown in Figure 13;

Figure 15 is a perspective view of the bay of Figures 2-4, 7-8, and 10-13 showing the next step in installation of a preferred embodiment of the system of the present invention wherein the second side rail is installed;

30 Figure 16 is a perspective view of the bay of Figures 2-4, 7-8, 10-13, and 15 showing the next step in installation of a preferred embodiment of the system of the present invention

wherein the ridge or starter panel is installed;

Figure 17 is a perspective view of the bay of Figures 2-4, 7-8, 10-13, and 15-16 showing the next step in installation of a preferred embodiment of the system of the present invention wherein the middle and end caps are installed;

5 Figure 18 is a perspective view of the bay of Figures 2-4, 7-8, 10-13, and 15-17 showing the next step in installation of a preferred embodiment of the system of the present invention wherein the skylights are installed;

Figure 19 is a close up perspective view of the skylight installation of Figure 18;

10 Figure 20 is a perspective view of the end cap of a preferred embodiment of the curb system of the present invention;

Figure 21 is a perspective view of the middle cap of a preferred embodiment of the curb system of the present invention;

Figure 22 is a perspective view of a preferred embodiment of the curb system of the present invention as installed with skylights;

15 Figure 23 is a perspective view of a preferred embodiment of the curb system of the present invention without skylights installed;

Figure 24 is an exploded view of a preferred embodiment of the curb system of the present invention used with a skylight;

20 Figures 25-29 are profile views of various embodiments of the side rail of the present invention as it mates with a building panel;

Figures 30-31 are additional profile views of different embodiments of the side rail of the present invention;

Figure 32 is a profile view of an alternate embodiment of a side rail and whip connector of the present invention prior to the whip being crimped to the side rail;

25 Figure 33 is a profile view of an alternate embodiment of a side rail and whip connector of the present invention after the whip has been crimped to the side rail;

Figure 34 is a perspective view of a preferred embodiment of the side rail of the present invention;

30 Figure 35 is an exploded view of a preferred embodiment of the side rail of the present invention with two possible clips;

Figure 36 is a side perspective view showing the side rail and hidden clip of Figure 35 as installed on a purlin with a panel;

Figure 37 is a cut away view of the side rail and exposed clip of Figure 35 as installed on a purlin with a panel;

Figure 38 is a perspective view of the side rail and hidden clip of Figure 35 as installed on a purlin with a panel;

5 Figures 39-40 are views of a preferred embodiment of the block head of the present invention;

Figure 41 is a perspective view of a preferred embodiment of the eave panel of the present invention;

10 Figure 42 is an exploded view of a preferred embodiment of the mounting bracket and screws of the present invention as installed on a purlin;

Figure 43 is a profile view of preferred embodiments of the mounting bracket and side rail of the present invention as installed on a purlin and panel;

Figure 44 is a perspective view of a preferred embodiment of the ridge or starter panel of the present invention;

15 Figures 45-50 show various embodiments of the thermal breaks of the present invention;

Figures 51-52 and 54 are profile views of different embodiments of the vent system of the present invention;

Figures 53 and 55 are perspective views of different embodiments of the vent rail of the present invention;

20 Figure 56 is an exploded side view of an alternate embodiment of the ridge or starter panel and cap of the present invention;

Figure 57 is an exploded top perspective view of the embodiment of the ridge or starter panel and cap of the present invention shown in Figure 56; and

25 Figure 58 is an exploded view of a preferred embodiment of the side rail and mounting bracket of the present invention having conduits.

DETAILED DESCRIPTION OF THE INVENTION

30 The in-line curb system 10 is designed to be economical and easy to install. Domed skylights 20 can easily be retrofitted into existing metal roofs using the unique designed curb system 10 and even easier to add to new metal roof applications. In addition, the curb system of the present invention can be adapted for use with other types of skylights, and other types of equipment to be installed.

In a preferred embodiment, the present design can house one, two, three or more domed

skylights 20 in a single in-line curb or multiple curbs can be over-lapped at the ends to provide for extra-long panel runs. The design can accommodate any size skylights while easily integrating into the typical metal panel profile. Multiple in-line curbs may be installed across an entire roof system without adjusting adjoining metal panels.

5 For R-panel applications, it is expected that a typical installation will utilize domed skylights 20 of approximately 2 feet (60.96 centimeters) wide x 8 feet (2.4384 meters) long each. The skylights 20 are expected to be spaced from each other by approximately 2 feet (60.96 centimeters), but the distribution pattern can be altered to match a desired internal lighting requirement.

10 Figure 1 shows a preferred embodiment of an in-line curb system 10 with three domed skylights 20 attached and spaced accordingly. Figure 23 shows the same in-line curb system 10 without the 3 domed skylights attached. Figure 24 shows a preferred embodiment of a single skylight in-line curb system 10 along with mounting brackets 18.

15 The following describes an exemplary method to implement the present invention as shown in Figures 2-19. This example shows installation of skylights on an R-panel roof. It is noted that this method and equipment can be used for installing other types of equipment, on other types of buildings including the walls or roofs of the buildings. For reference, Figure 2 shows one bay 2 of a metal building with no panels attached. Figure 3 shows this same bay 2 with insulation 13 and panels 8 on half of the bay 2. Typically metal buildings
20 consist of many of these bays 2 connected together.

To install an in-line curb on an existing R-panel roof, an R-panel 8 from a desired location is removed as shown in Figure 4. If there is batt insulation 13 present, then it is cut down the middle for the entire length of the open space (see Figs. 5-6). Both halves of the insulation 13 are folded over onto the existing metal panels 8 as shown in Figure 8. The
25 mounting brackets 18 are screwed onto each roof purlin 22 as shown in Figures 8-9. After mounting brackets 18 are installed, the insulation 13 is folded back over onto the mounting brackets 18 as shown in Figure 10. The eave panel 32 is installed and fastened to its mounting bracket 18 as shown in Figure 11. A first side rail 12A is installed with the "panel interface legs" 38 placed either over or under the existing R-panel side seams as shown in
30 Figure 12. The system of the present invention may be installed so that the rails and thus the curb sits above the existing panels or below. It is preferred in most instances, to install the rail 12 and curb above the existing panels 18, but either installation is available. The batt

insulation 13 is rolled and held in place by the side rail 12 and mounting bracket 18. Thermal breaks 152, 154 are installed next at the low points in the installed rail 12A as shown in Figures 13 and 14. Then the second side rail 12B is installed as shown in Figure 15. Both side rails 12A, 12B are attached to the mounting brackets 18. If a run requires additional side rails 12, then the additional rails are installed over-lapping the fastened side rails. Once the rails 12 reach a desired point, the starter panel 28 is positioned and then fastened to its mounting bracket 18 as shown in Figure 16. The end caps 14 and middle caps 16 are installed and fastened to the side rails 12 or starter/eave panel 28/32 as shown in Figure 17. Finally, the skylights 20 are mounted and fastened to the completed assembly as seen in Figures 18-19.

For new metal roof installations, the same procedure is followed once the desired run location has been reached by the install crew as they install the new panels.

The in-line curb system 10, 110 of a preferred embodiment may comprise 5 major components; the rails 12, the caps 14, 16, starter panel 28, eave panel 32 and mounting brackets 18, for example.

The side rails 12 of the in-line curb system may be made of 18 gauge steel, for example, but other gauges can be utilized as well as other type of materials such as aluminum and stainless steel. The side rails 12 can be made to any length, but 11 feet (3.3528 meters), 21 feet (6.4008 meters) and 31 feet (9.4488 meters) are expected to be standard lengths. The side rails 12 can be over-lapped to accommodate longer runs. A preferred embodiment of the present invention may comprise four major parts to the side rail 12 (see Figure 34): the panel interface leg 38, the valley 39, the vertical wall 37, and the top flange 35, for example. In some embodiments, the rail 12, 41, 341, 412 may further comprise vent holes as seen in Figures 51-55 and/or a conduit as shown in Figure 58. The vertical wall 37 of the side rail 12 preferably has a raised portion 24 for accepting a skylight 2 or other device, and lower portions for accepting the thermal breaks 152, 154 and/or caps 14, 16.

The panel interface leg 38 preferably matches the cross-section of whichever type of metal panel is being used on the roof (see Figures 24-31). The roof panel interface leg 38 preferably may go over or under the side seams of the existing roof's panels. The interface leg and panel's side seam may then be "stitched" together using typical roofing screws 55 or standing seam lock, for example. Alternatively, clips or fasteners 31, 33 may be used for securing the rail 12 to the panels 8 as seen in Figures 35-38. At each purlin 22 location, both

the roof panel side seam and interface leg are fastened down to the purlin using a typical roofing screw or standing seam clip, for example. The interface leg can be configured during manufacturing to match the side seam of any panel profile.

5 The valley 39 area of the side rail 12 allows water to flow down the slope of the curb system 10, 110 without impeding the water flow. The width of the valley 39 may be decreased or increased depending on the size requirement of the skylight 20. As the width of the skylight 20 increases, the valley width preferably decreases to assure that the roof panel interface leg always is positioned correctly underneath the existing roof panel side seam. Since the trapezoidal ribs of an R-panel are 12 inches (30.48 centimeters) apart in
10 certain embodiments, the valley widths gets less than an 1 inch (2.54 centimeters) due to increase in skylight width, the valley width will preferably jump to the next increase of 6 inches (15.24 centimeters) (two rails at 6 inches (15.24 centimeters) equals 12 inches (30.48 centimeters) overall), for example.

The vertical wall 37 of the side rails may be adjusted to meet any height requirements,
15 but is expected to be approximately 6 inches (15.24 centimeters) tall. The side walls 12 may be attached to the mounting brackets 18 via self-tapping roofing screws (see Figure 18). The frame of the domed skylight 20 is preferably also attached to the side walls 12 using self-tapping screws with washers, for example. Where the end 14 and middle caps 16 are positioned, the vertical wall 37 may be cut down by approximately 2 inches (5.08
20 centimeters) to facilitate the proper seating of the caps 14, 16 in certain embodiments, for example.

The top flange 35 of the side rail 12 provides a flat surface for sealing the bottom of the skylight frame to the curb. Most domed skylights 20 have an insulated thermal break via gasket material. This gasket material would sit on the top flange 35 of the side rail 12.

25 Both the end caps 14 and middle caps 16 attach to the side rails 12 in a preferred embodiment. Preferably, the sides 3, 17 of the caps 14, 16 are designed to mate with the bottom flange 29 of the side rail 12. The rails 5, 19 of the caps 14, 16 are designed to mate with the skylight 20 or other device. The rails 5, 19 of the caps 14, 16 preferably continue the top flange 35 of the side rails 12A, 12B such that there is a generally continuous curb for
30 mating with and supporting the skylight 20 or other device to be installed. The caps 14, 16 have middle sections 1, 15 that appear generally flat in the figures, but may be any design or shape as needed for the installation. Preferably, the end caps 14 have a coupler 9 that mates

with the coupler 26 of the eave panel 32 and/or the coupler 27 of the starter panel 28. Both caps 14, 16 serve a similar purpose: they complete the enclosure of the end of the curb as it relates to the bolting of the skylight frame to the curb. The side rails 12 create the sides of the skylight curb and the caps 14, 16 create the front and back portions of the skylight curb in a preferred embodiment. There are two end caps 14 per in-line curb run in a preferred embodiment, for example. One end cap 14 is fastened to the eave panel 32 making up the back wall of the last skylight 20 and the second end cap 14 is fastened to the starter panel 28 making up the front wall of the first skylight 20. The middle cap or caps 16 may be installed between all skylights 20 creating the back wall of one skylight and the front wall of the next skylight. If there is only one skylight, then both end caps 14 will be used however no middle cap 16 will be used. The top portion of the caps mimics the top flange 35 of the side rail 12 providing a flat surface for sealing of the bottom of the skylight frame. See Figures 20-24.

The starter panel 28 may be made of 20 gauge (approximately 0.953 millimeters thick) steel, for example, but can be made of different gauges (millimeters thick) of steel and different materials. The starter panel 28 ties in the top of the roof system 10, 110 to the side rails 12. The starter panel 28 may be positioned under the ridge cap 50 or, if used as a single skylight 20 system further down the slope, then the starter panel 28 will preferably be positioned under the R-panel coming from the ridge 6. The starter panel 28 may also have a small metal cricket 30 at the base of the end cap 14 housing to deflect water towards the valleys 39 of the side rails 12 (see Figure 44). The starter panel 28 preferably has the same side seam roof panel interface legs 36 as the side rails 12 which allows for over-lapping of the starter panel 28 and the side rails 12. The starter panel 28 also houses the end cap 14 for the first skylight 20, which are joined by a coupler 27 on the starter panel 28 that mates with the coupler 9 and sides 3 of the end cap 14. This panel is fastened to the mounting brackets 18 and interface legs in a preferred embodiment.

The eave panel 32 may be designed just like the starter panel 28, but without the metal cricket 30, for example. It functions in the same way as the starter panel 28 and is attached in the same manner. The eave panel 32 houses the end cap 14 for the last skylight 20. Preferably, the eave panel 32 has a coupler 28 that mates with the coupler 9 and sides 3 of the end cap 14.

The mounting bracket 18 is expected to be made from 16 gauge (approximately 1.59

millimeters thick) steel, but can be made of different gauges (millimeters thick) of steel and different materials based on the requirements of each location. The mounting brackets 18 may be screwed to each purlin 22 that is covered by the in-line curb system 10. Preferably, the mounting bracket has a middle section 68 that engages the purlin 22 between two generally parallel sides 69 that engage the rails 12A, 12B as shown in Figures 42-43. As shown, the mounting bracket 18 appears generally flat in the middle portion 68; however the shape of the bracket 18 may be altered depending on the needs of a particular installation. The mounting bracket 18 is designed to be attached to both the top flange of a roof's purlin 22 and the purlin's side wall using, for example self-tapping roofing screws (see Figures 42-43). The in-line curb system 10, 110 may attach to the mounting brackets 18, 118 via screws through the vertical walls. The dimensions of the mounting bracket 18 can be altered to accommodate different size and width requirements as well as panel profiles.

Most interior spaces of metal buildings are vented through vents placed along the ridge line. Equipment exhaust is usually directed through metal roofs requiring the penetration to be flashed to prevent leaks. Most of the time, these flashed penetrations block water flow leading to premature rusting and failure of the roof system.

The roof vent system 40 of the present invention allows for better venting of the interior space as well as plumbing vents, furnaces and other equipment. Instead of mounting the vents across the ridge, the vents of the present invention are mounted along the line of the slope of the roof (from ridge to eave). When the vent system 40 is mounted along the front and back of the building following the slope of the roof line, then the side rail walls act as a parapet wall lowering the overall roof attachment requirements. On most metal buildings, running the vents along the slope will increase the amount of venting capacity when compared to a single line of ridge vents. If additional venting is desired, then another run of vents can be added to the midline of the building's roof.

The roof vent system 40 of the present invention also eliminates plumbing and equipment pipes from penetrating the roof system. By routing the exhaust piping 48 into one of the curb vents, the gases are dissipated through the vent holes 44 running along the entire length of the curb rail 41 (see Figs. 51-55). This vent system may also be installed in the walls of the building. When installed in this way, the direction of the vent holes 44 is altered to prevent weather from allowing water to enter the building. Additionally, when installed in the wall of the building, the vents provide gutter support, which allows the gutter to be

installed at an angle rather than horizontal, further improving water flow away from the building interior.

In a preferred embodiment, the same base components as the in-line curb system outlined above are used in the venting system design 210. There may be a couple of modifications to the side rails 212 and the cap 214.

The flange 235 of the side rails 212 are turned out towards the valley 239 in a preferred embodiment. This outturning of the flange 235 prevents wind-driven rain from entering the vent holes 244 and also allows attachment of a one-piece cap 242. If any piece of equipment's exhaust needs to extend higher, then it can be plumbed through the cap 242 and flashed accordingly. The side rails 212 may also have vent holes 244 running along the top of the vertical wall 243.

An alternative embodiment of the present in-line curb system is for low-slope applications. The in-line curb system will allow multiple skylights to be attached to the curb while also facilitating roof drainage and minimizing the taper requirements of open, large-area roof designs. When multiple in-line curb systems are installed in a grid like pattern on a large area roof, the tapered insulation required to adequately remove rain water will be reduced due to shorter runs of overall slope. The in-line curb system for low-slope applications incorporates the same components as that of the R-panel design.

The material used to form the side rails and caps is expected to be stainless steel, but other metals can be used as well as any combinations of non-metal materials. The side rails and caps could have modifications from the R-panel design to allow installation and enhancements geared to the low-slope market.

With respect to low-slope side rails, the interface leg may be designed to allow the low-slope membrane to be easily attached to it. The interface leg will be sloped to match the level of insulation layer. The valley area of the side rail will preferably be deeper set when compared to the interface leg and vertical wall creating a gutter effect. The valley area will also be increased to a width to adequately accommodate water drainage from the roof area. The vertical wall height will preferably be increased to allow for an 8 inches (20.32 centimeters) height above the top layer of the roof membrane, for example. In heavy snow areas, electric heating elements can be added to the interior side of the vertical wall allowing the side rail walls to be kept above a freezing level.

The skylights typically used on low-slope applications are wider than those typically used

on metal roofs. Therefore, it is expected that the caps for the side rails will match the wider requirements. The caps may also be shaped to allow plumbing vents to be exhausted through them.

The thermal break panels 152, 154 are preferably installed beneath all of the caps 14, 16 when the application calls for insulated units. The thermal break panels 152, 154 provide an insulating air gap separating the exterior-exposed cap metal from interior building temperatures. The thermal break panels 152, 154 also act as a catch basin for any minor water leaks coming from the cap seals if a high negative-pressure is experienced inside the building. Additionally, the thermal break panels 152, 154 hold the batt insulation 13 in place against the rail's vertical wall 37. The thermal break panels 152, 154 are expected to be made from 26 gauge (approximately 0.478 millimeters thick) sheet steel, but other materials and/or thicknesses can be used to make the thermal break panel. For example, steel often catches and/or rips the insulation 13. Therefore, various types of plastics are often used for thermal breaks 152, 154. However, plastics often cost more than steel; thus, as an alternative, the thermal breaks 252, 254 may be made with steel and also include a gasket 253 for preventing catching and tearing of insulation 13. See for example, figures 47-48.

If a starter panel 28 or eave panel 32 has to be cut short to accommodate more skylights 20 than a limited run would allow, then for example two 6-foot (1.8288 meters) lengths of roof panel interface leg 38 can be used beneath the short starter or eave panel's interface leg to provide support to the short panels. This length of interface leg 38 is called a "bridge" 160 (not shown in drawings). The bridge 160 is preferably about six feet (1.8288 meters) long and they span from one of the building's Z purlin to the next Z purlin (not shown). The bridges 160 are expected to be made from 18 gauge (approximately 1.27 millimeters thick) sheet steel, but other metals and thicknesses could be used.

In other embodiments, when the Starter 28 and/or Eave Panels 32 are cut shorter than the span of the roof supports (Z-purlin and/or web joist), Bridges 160 will have to be installed on both sides of the Panel's interface legs to provide panel support. The Bridges 160 span the roof supports reinforcing the shorter Starter/Eave Panels 28/32. The Bridges 160 will have the same shape as the interface leg sections 36/34 of the Starter/Eave Panels 28/32 and is expected to be made out of the same type and gauge of metal as that of the in-line curb system 10. The lengths of the Bridges 160 are preferably about 12 inches (30.48

centimeters) longer than the span of the roof supports.

Buildings with a roof system that have a curve to the field of the roof from the ridge line to the eave are considered radius roof systems. With some modifications to the in-line curb system, a radius curb system can be added to a radius roof. This may include modifications to the end panels, side rails, caps, thermal breaks and mounting brackets.

Figure 2 shows the skeleton of one bay of a metal-roof building prior to installation of the roof and curb apparatus which is designated generally by the numeral 10 in other figures. In figure 2, one bay 2 is the section from one main building support 4 to the next main building support 4. Skylights 20 are typically positioned in the middle of the bay 2 between the ridge 6 and eave 7. Purlins 22 are spaced between the main roof supports 4 with the eave purlin 21 closest to the eave 7 and the ridge purlin 23 closest to the ridge 6. The purlins 22 shown can be Z-purlins, however other suitable purlins may be used.

Figure 3 shows the roof bay 2 of Figure 2 with the R-panels 8 in place. These figures show a roof panel such as an R-panel 8 though other roofing panels or options may be used with the apparatus of the present invention 10. R-panels have highs 9, and lows 11. R-panels 8 are typically 3-foot (91.44 centimeters) panels with a 12-inch (30.48 centimeters) span from center of one high 9 to center of next high 9. It should be understood that the roof components seen in figures 2-6 are known and commercially available.

The roof system 10 of the present invention is considered a “through screw” attachment meaning that the screws (not shown) used to attach the R-panels 8 to the purlins 22 go through the panel 8, insulation 13, and purlin 21, 22, 23. However, this system 10 is different than other roofs in the industry in that there are preferably no screws in the lows 11 of the R-panels 8. Screws can be used in the tops of the highs 9 and in the side walls of the brackets 18, preventing a common leaking cause among prior art roof systems. Insulation 13 is draped across the purlins 21, 22, 23 as shown in figure 2.

To install skylights 20 using the preferred embodiment of the apparatus/curb system of the present invention 10, R-panels 8 in the center of a bay 2 are removed to provide a “cut-out” and revealing the draped insulation 13, as shown in Figure 4. The insulation 13 is then cut down the center as shown in Figures 5-6 and pulled away from the center of the bay 2, and over the remaining r-panels 8 as shown in Figure 7.

Mounting brackets 18 are installed over the purlins 22 as shown in Figures 8-9 (figure 8 does not show both the mounting brackets 18 and the purlins 22 as they would not both be visible; however, Figure 9 shows where both brackets 18 and purlins 22 would be located at this stage in an installation).

5 After mounting brackets 18 are installed, the insulation 13 that was folded over the R-panels 8 is then folded back over the mounting brackets 18 as shown in Figure 10. The insulation that is exposed below the “cut-out” will be covered by the eave panel 32 as shown in Figure 11. Eave panel 32 can be a shorter section of R-panel 8. The folded insulation 13 will be folded into a first side rail 12A when it is installed as shown in Figure 10 12.

The preferred embodiment (apparatus and method) of the present invention 10 uses thermal breaks 152, 154 under preferably metal caps 14, 16 to help prevent condensation from forming on the skylights 20 and roof system components. The thermal breaks 152, 154 will also serve to catch any condensation that does form before it drips into the roof structure and/or building. Thermal breaks 152, 154 are installed after installation of eave panel 32 and first side rail 12A as shown in Figures 13-14. A thermal break end 152 is installed at the eave 7 end and ridge 6 end of the roof and thermal break middles 154 are installed in the remaining spaces between skylight openings.

20 A second side rail 12B is installed, spaced from first rail 12A. The remaining insulation 13 is folded inside it as shown in Figure 15. A ridge and/or starter panel 28 is then installed over the exposed insulation remaining at the ridge 6 as shown in Figure 16. Starter panel 28 can be a shorter section of R-Panel 8. The ridge/starter panel 28 preferably has a cricket 30 for drainage of water and condensation, and does not need to have intermediate ribs (highs 9 and lows 11 like the R-panels 8) in order to prevent damming of water and/or condensation as is found in other skylight systems.

25 End caps 14 are installed at the ridge 6 and eave 7 ends of the skylight openings. Middle caps 16 are installed in spaces between skylight openings as shown in Figure 17. The end caps 14, middle caps 16, and side rails 12 create the “curb” system that the skylights 20 attach to as shown in Figure 18.

30 The present invention includes a roof apparatus 10, comprising a roof framework

including multiple roof supports 4, purlins 22 that span between said supports 4, roof panels 8 covering the purlins 22 and roof supports 4, wherein the roof has an uppermost ridge portion 6 and a lower eave portion 7; a plurality of skylights 20 mounted to said roof framework; an interface that is supported by the roof framework and that supports the skylights 20 at positions spaced above the framework. The interface preferably comprises two side rails 12A, 12B, each having grooves 38 for mating with the grooves of the roof panel 8; a first end cap 14, one or more middle caps 16, and a second end cap 14; a plurality of mounting brackets 18 configured to attach to the side rails 12A, 12B; a starter panel 28 having grooves 36 for mating with the grooves 38 of the side rails and the existing roof panels 8 and a coupler configured to receive an end cap 14; an eave panel 32 having grooves for mating with the grooves 38 of the side rails and the existing roof panels 8 and a coupler configured to receive an end cap 14; and a second end cap 14 configured to mate with an under surface of a said skylight 20, the two side rails 12A, 12B, and the coupler of the eave panel 32. Preferably, the starter panel 28 has a cricket 30 to deflect water towards the grooves 38 of the side rails. The first end cap 14 is configured to mate with an under surface of a skylight 20, the two side rails 12A, 12B, and the coupler. The middle caps 16 are placed between two of said skylights 20;

The roof apparatus 10 of the present invention preferably is incorporated into an existing metal building having a roof framework including multiple roof supports 4, multiple purlins 22 that span between said roof supports 4, a ridge portion 6, an eave portion 7, and multiple roof panels 8 supported by the roof support 4 and purlins 22. Preferably, the panels of the metal building are R-panels; however, the present invention may be used on any type of metal building supplies. The apparatus 10 may include one or more skylights 20 supported by an interface in between the skylights 20 and the roof framework 4. The interface preferably includes two side rails 12A, 12B configured to receive the one or more skylights 20, wherein the side rails 12A, 12B preferably have grooves 38 for mating with the grooves of the roof panels 8. The interface preferably includes first and second end caps 14. The interface also includes a plurality of mounting brackets 18 configured to attach to the purlins 22 and to the side rails 12A, 12B. The interface also preferably includes starter panel 28 that is placed near the ridge portion 6 of the roof and has grooves 36 for mating with the grooves 38 of the side rails 12A, 12B. The first end cap 14 is preferably configured to mate with an under surface of skylight

20, the two side rails 12A, 12B, and the starter panel 28. The interface also preferably includes an eave panel 32 that has grooves 34 for mating with the grooves 28 of the side rails 12A, 12B, and a second end cap 14 configured to mate with an under surface of a skylight 20, the two side rails 12A, 12B, and the eave panel 32.

5 Alternatively, the starter panel 28 may be replaced with a ridge side rail 312 as shown in Figures 56-57. In this embodiment, the first end cap is replaced with a ridge cap.

Additionally, the figures show and the above description discusses an installation including a skylight; however, any other roof top equipment could be installed such as an HVAC, lighting units, or ventilation systems. Furthermore, the present invention
10 may also be installed in the walls of a metal building instead of or in addition to on the roof.

In a preferred embodiment, the roof apparatus 10 also includes thermal break panels 152, 154 installed beneath one or more of the caps 114, 116, as shown in Figures 13-16 and 45-50. The thermal break panels 152, 154 may provide an insulating air gap separating the
15 interface from interior building temperatures. In some embodiments, the thermal breaks 152, 154 are made of plastic in order to prevent tearing or catching on the insulation 13. In an alternate embodiment, the thermal breaks 252, 254 are made of aluminum, and further comprise a gasket 253 to prevent the tearing and catching of the insulation 13.

In a preferred embodiment, the roof apparatus 10 also includes one or more vent systems
20 40. The vent system 40 may be installed in the roof panels or wall panels of the building. The vent system 40 preferably includes two vent rails 41, the vent rails 41 to be placed parallel to one another on either side of, for example, an exhaust pipe 48. The pipe 48 and rails 41 are preferably covered with a cap 42. Preferably, the roof rails 41 have grooves 46 for mating with an existing metal roof system similar to the grooves 38 of the side rails 12A, 12B in prior embodiments, a vertical wall 43 that runs parallel to the pipe 48, a flange 45 at
25 the top of the vertical wall 43, and vent holes 44 that are at the top of the vertical wall 43 just before the flange 45. Preferably, the cap 42 is configured to attach to the flanges 45 of the vent rails 41. See for example Figures 51-55.

Preferably, when the vent systems 40 are placed on the roof of the building, they are
30 placed along the line of the slope of the roof from ridge 6 to eave 7 on the front and back of the building.

The present invention includes an apparatus 10 for modifying an existing metal

building to include an additional device or feature. The feature may be installed on the roof or side walls of the building. The device or feature of be installed may include a skylight, lighting panel, electronic equipment, HVAC or other air filtration system, or ventilation systems. The metal building is preferably comprised of a series of metal panels. Most often, R-panels are used; however, the present invention may be adapted for use with any metal panel. The apparatus 10 comprises a plurality of mounting brackets 18, at least two caps 14, 16, at least two side rails 12A, 12B, at least two end panels 28, 32, and a plurality of screws 55.

Preferably the apparatus of the present invention is a “screw through” system meaning that the apparatus is attached to the metal building using screws that go all the way through the building. This means that water flow and deflection are important for preventing leaks in the building.

The existing building to be modified has a support structure 4 and the area of the building to be modified has a high point and a low point. For roof installations, the high point is the ridge 6, and the low point is the eave 7. For wall installations, the high point is the roof line, and the low point is the ground or foundation. The mounting brackets 18 are placed on support structure of the existing building. In a roof installation the mounting brackets are placed on the purlins 22 as shown in Figures 2-24. The end panel 32 to be placed at the low point or eave 7 preferably has interface legs or grooves 34 for mating with the existing panels 8 and end panels. The starter panel 28 for the high point or ridge 6 preferably includes a cricket for directing water flow into the valleys 39 of the side rails 12A, 12B. End caps 14 are preferable placed at both ends of the installation and middle caps 16 are placed in between at a pre-determined distance from each other. The distance is determined by what is being installed. For example, for a skylight installation as shown in Figures 2-24, the distance between the caps is the length needed for the skylight 20. The side rails 12A, 12B are placed parallel to each other, the interface 38 of the rail mating with the ridge of the existing panels. The rails 12A, 12B create a curb with the caps 14, 16 for supporting the installation, e.g. skylight 20.

The “curb” created with the present invention may also be used to support a light fixture, an HVAC unit, or other equipment.

The side rails 12A, 12B have a horizontal section or valley 39 that is generally perpendicular to a generally vertical wall 37. Preferably, the vertical wall 37 has a top

flange 35 and a raised section in the middle of the rail 12A, 12B that supports the device to be installed. The rails 12A, 12B have shorter sections on the ends that also have a flange 29. Preferably, the horizontal section of the side rail 12A, 12B has at least one interface leg or ridge 38 that is capable of matching the ridges of the panels 8 of the existing metal building.

The present invention may also be installed on buildings that have insulation 13 under the metal panels. Preferably, when installed on an insulated building, the apparatus 10 further comprises at least two thermal break panels 152, 154, which are placed under the caps 14, 16.

Preferably, the apparatus 10 further comprises clips or fasteners 31, 33 for connecting the side rails 12A, 12B to the mounting brackets 18 and existing metal panels 8. The clips or fasteners 33 may be placed over the side rail leaving them exposed. Alternatively, the clips or fasteners 31 may be placed under the side rail leaving them hidden.

The present invention includes a variety of interface legs 38 of the side rails 12A, 12B, examples of which are shown in figures 25-29. Preferably, the interface legs 38 are placed over the existing metal building panels, to best prevent water build-up from leaking into the building. However, the legs may also be placed under the existing metal building panels.

In some embodiments, the side rails 12 further include ventilation holes 44 in the vertical wall 43. This ventilation system may also include a secondary vent wall 342 as shown in Figures 51-55. The angle θ between the vertical vent wall and secondary wall is preferably between 10 and 90 degrees as shown in Figure 52. However, in some embodiments the secondary wall is parallel to the vertical wall as shown in Figure 51.

The apparatus 10 of present invention may be adapted for use on a variety of metal buildings. In some embodiments, the side rails 12 have a horizontal section that is generally perpendicular to a generally vertical wall, the horizontal section having a flange opposite the vertical wall, and the vertical wall having a flange opposite the horizontal section, the vertical wall having shorter sections on the ends and a raised section in the middle. The apparatus further comprises at least two adapters or whips 65 for connecting the side rails 12 to the existing metal building panels 8 as shown in figures 32-33. The whips 65 have a flange for crimping with the flange on the horizontal section of the side rail 12. Figure 32 shows the connection before crimping and Figure

33 shows the connection after crimping.

A preferred embodiment includes a conduit 410 on the side rail 412 and a corresponding conduit 415 on the mounting bracket 418. When installed the conduits 410, 415 mate to form a conduit channel running generally parallel to the horizontal section and extending the entire length of the side rail 412. The conduit may be used for housing wiring or tubing as needed.

In an alternate embodiment, the starter panel 28 is replaced with a ridge side rail as shown in Figures 56-57. The ridge side rail 312 mates with the existing panels and the side rails 12A, 12B and allows the device installed closer to the ridge 6 of the roof. In this embodiment, the end cap is replaced with a ridge cap 310.

The present invention also includes a tool, called a block head 200 for aiding in the installation of the apparatus of the present invention. The block head 200 as shown in Figures 39-40, preferably has a handle, an interface leg, and a mounting bracket guide. The tool 200 is sized so that when the interface leg of the tool is placed on the ridge of the existing R-panel, the mounting bracket guide of the tool is located where the mounting bracket should be installed.

The Block Head 200 is a tool to help install the in-line curb system. There is an Interface Leg notch at the bottom of the Block Head 200 that, when positioned over the side lap of an adjacent R-panel 8, provides proper alignment for the mounting bracket 18 on the roof support system 22. Lines on the Block Head 200 give quick positioning indications for the placement of the Eave Panel 32 on the roof support system. Preferably, there is a knob on the end of the Block Head 200 that can be used to push the bottom side of the side lap of an R-panel 8 up to engage the stitch screws 55 of the in-line curb system 10.

The present invention also includes a method of installing the apparatus 10.

Preferably, the method comprises the steps of:

(a) removing the existing panels 8 from the metal building in the area to be modified (Fig. 3);

(b) cutting the middle section of insulation 13 and removing it, leaving a portion of exposed insulation 13 on either side of the remaining panels 8 (Figs. 4-5);

(c) rolling the remaining exposed insulation 13 back over the remaining panels 8 exposing the support structure 21, 22, 23 for the building (Figs. 6-7);

(d) placing mounting brackets 18 over each of the exposed support structures 21, 22,

23 (Figs. 8-9);

(e) folding the exposed insulation 13 back over the mounting brackets 18 (Fig. 10);

(f) placing an end panel at the end of the exposed area that is at the low point of the building (Fig. 11);

5 (g) placing one or more side rails 12A on one side of the exposed area such that the interface leg 38 of the side rail(s) 12A matches with the ridge of the existing panel 8 and rolling the remaining insulation 13 on the side where the side rail 12A is placed so that it is covered by the side rail 12A (Fig. 12);

10 (h) placing thermal break panels 152, 154 at each of the shorter sections of the side rail 12A (Figs. 13-14);

(i) placing one or more side rail 12Bs on the opposite side of the exposed area and rolling the insulation 13 on that side so that it is covered by the side rail 12B (Fig. 15);

(j) placing a second end panel 28 at the end of the exposed area that is at the high point of the building (Fig. 16);

15 (k) placing caps 14, 16 over the thermal break panels 152, 154 (Fig. 17);

(l) placing the device or feature in the area now framed by the caps 14, 16 and side rails 12A, 12B (Figs. 18-19); and

(m) using the screws 55 to secure the apparatus to the building.

20 When the apparatus 10 of the present invention is installed on a roof, the support structure is preferably purlins 21, 22, 23.

The panels could be any type of metal building materials. Preferably, R-panels are used.

25 The method of the present invention may be used for installing skylights 20 as shown. Alternatively the apparatus and method of the present invention can be used to install or incorporate lighting, sensors, wiring and controls in any number of configurations into the system.

Lights – the lights could be LED, OLED, Florescent or any other type of light source. It is expected that the light fixtures would be added to the thermal breaks 152, 154 to light the interior of the building, but these items could also be added to any other of the in-line curb system's components.

30 Sensors – sensors measuring any internal or external parameters could be added to any of the in-line curb systems' components. Fire monitors, poisonous gas sensors, and

light meters are some examples of the types of sensors that could be installed into the in-line curb system.

Wiring – wiring harnesses can be added to the in-line curb system to provide power and or control signals to the lights and sensors. Heated wiring harnesses and other types of wiring systems could be installed into the curb system.

Controls – wired and wireless controls can be added to the curb system. The controllers can monitor and control the lights and sensors installed into the curb system.

To provide easy roof-top access to the internal components, watertight hatches and closures could be added to the caps 14, 16 of the in-line curb system 10.

Additionally, the side rails 412 and mounting brackets 418 can include conduits 410, 415 to allow for wiring to be safely included in the structure. See Fig. 58.

Large Roof-top Equipment - To allow large roof-top equipment such as large HVAC units to be installed on metal roofs while spreading out the dead load of such equipment, a third and/or forth side rail 12 can be installed in the in-line curb system 10. The top-flange 35 of the additional rails 12 can be oriented in different directions to support the units while facilitating the use of different middle/end cap 14, 16 designs.

An alternate method wherein the building is not an R-panel building comprises the following steps:

(a) removing the existing panels from the metal building in the area to be modified exposing the support structures of the building;

(b) placing mounting brackets 18 over each of the exposed support structures;

(c) placing an end panel at the end of the exposed area that is at the low point of the building;

(d) placing one or more side rails 12A, 12B on one side of the exposed area such that the flange of the horizontal section of the side rail is adjacent to the existing panel;

(e) placing a whip 65 over the side rail flange and the existing panel (see Fig. 32);

(f) crimping the whip 65 to the side rail 12 so it secures the side rail to the existing panel (see Fig. 33);

(g) placing one or more side rails on the opposite side of the exposed area such that the flange of the horizontal section of the side rail is adjacent to the existing panel;

(h) placing a whip 65 over the side rail flange and the existing panel;

(i) crimping the adapter so it secures the side rail to the existing panel;

(j) placing a second end panel at the end of the exposed area that is at the high point of the building;

(k) placing caps at each of the shorter sections of the side rails;

(l) placing the device or feature in the area now framed by the caps and side rails; and

5 (m) using the screws 55 to secure the apparatus to the building.

PARTS LIST:

10	1	top of end cap 14
	2	bay
	3	side of end cap 14
	4	main roof support
	5	rail of end cap 14
15	6	ridge
	7	eave
	8	building panel
	9	coupler of end cap 14
	10	roof apparatus
20	12	side rail
	12A	side rail
	12B	side rail
	13	insulation
	14	end cap
25	15	middle portion of middle cap 16
	16	middle cap
	17	side of middle cap 16
	18	mounting brackets
	19	rails of middle cap 16
30	20	skylights
	21	eave purlin
	22	purlin

	23	ridge purlin
	24	raised portion of side rail for accepting skylight
	26	coupler of eave panel 32
5	27	coupler of starter panel 28
	28	ridge/starter panel
	29	bottom flange of side rail 12
	30	cricket
	31	exposed clip/fastener
10	32	eave panel
	33	hidden clip/fastener
	34	interface legs of eave panel 32 for mating with interface legs of side rail/roof panel
	35	top flange of side rail
15	36	interface legs of starter panel 28 for mating with interface legs of side rail/roof panel
	37	vertical wall of side rail 12
	38	interface legs of side rail 12
	39	valley of side rail 12
20	40	vent system
	41	vent rail
	42	cap for vent system
	43	vertical wall of vent rail
	44	vent holes
25	45	top flange of vent rail
	46	grooves of vent rail (panel interface)
	48	pipe
	50	ridge cap
	55	screws
30	60	arrow showing water flow
	65	whip - preferably 24-gauge metal
	68	middle of mounting bracket

	39	sides of mounting bracket
	152	thermal break end
	154	thermal break middle
	160	bridge (not shown)
5	200	block head
	202	handle of block head
	204	interface leg of block head
	206	mounting bracket guide of block head
10	210	alternate embodiment of the system of the present invention with venting system
	212	side rail
	214	end cap
	216	middle cap
	218	mounting brackets
15	220	skylights
	228	starter panel
	230	cricket
	232	eave panel
20	234	interface legs of eave panel for mating with interface legs of side rail
	236	interface legs of starter panel for mating with interface legs of side rail
	238	interface legs of side rail
	242	cap for roof vent
25	243	vertical wall of side rail with vents
	244	vent holes in side rail
	245	top flange of side rail with vents
	246	interface legs of side rail with
	248	exhaust pipe
30	252	thermal break end with gasket
	253	gasket
	254	thermal break middle with gasket

	300	alternate ridge set-up
	310	alternate ridge cap
	312	alternate side rail for ridge
	340	alternate vent system
5	341	vent rail
	342	secondary vent rail
	343	vertical wall of vent rail
	344	vertical wall of secondary vent rail
	345	interface legs of vent rail
10	346	interface of secondary vent rail
	410	alternate side rail conduit
	412	alternate side rail with wiring conduit
	415	alternate mounting bracket conduit
	418	alternate mounting bracket with wiring
15		conduit
	429	bottom flange of alternate side rail
	435	top flange of alternate side rail
	437	vertical wall of alternate side rail
	438	interface (grooves of alternate side rail)
20	439	valley of alternate side rail

25 All measurements disclosed herein are at standard temperature and pressure, at sea level on Earth, unless indicated otherwise. All materials used or intended to be used in a human being are biocompatible, unless indicated otherwise.

The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims.

CLAIMS

1. A roof apparatus, comprising:

- a) a roof framework including multiple roof supports, purlins that span between said supports, roof panels covering the purlins and roof supports, wherein the roof has an uppermost ridge portion and a lower eave portion;
- b) a plurality of skylights mounted to said roof framework;
- c) an interface that is supported by the roof framework and that support the skylights at positions spaced above the framework, said interface comprising:
 - two side rails, each having grooves for mating with the grooves of a said roof panel,
 - i- a first end cap, one or more middle caps, and a second end cap;
 - ii- a plurality of mounting brackets configured to attach to the side rails;
 - iii- a starter panel having grooves for mating with the grooves of the side rails and a first coupler configured to receive an end cap,
 - iv- a cricket to deflect water towards the grooves of the side rails;
 - v- an eave panel having grooves for mating with the grooves of the side rails and a second coupler configured to receive an end cap; and
 - vi - the second end cap configured to mate with an under surface of a said skylight, the two side rails, and the second coupler;
- d) wherein the first end cap is configured to mate with an under surface of a skylight, the two said side rails, and the first coupler; and
- e) wherein the middle caps are placed between two of said skylights.

2. A roof apparatus, comprising:

- a) a roof framework including multiple roof supports, multiple purlins that span between said roof supports, a ridge portion, an eave portion, and multiple roof panels supported by the roof support and purlins;
- b) one or more skylights supported by an interface in between the skylights and the roof framework;
- c) the interface including two side rails configured to receive the one or more skylights, wherein the side rails have grooves for mating with the grooves of the roof panels;
- d) an open space or gap in between two of said roof panels;

- e) the interface including first and second end caps;
- f) the interface including a plurality of mounting brackets configured to attach to the purlins and to the side rails at the said open space or gap;
- g) the interface including a starter panel having grooves for mating with the grooves of the side rails;
- h) the first end cap configured to mate with an under surface of a said skylight, the two side rails and the starter panel;
- i) the interface including an eave panel having grooves for mating with the grooves of the side rails; and
- j) the second end cap configured to mate with an under surface of a skylight, the two side rails, and the eave panel.

3. The roof apparatus of claims 1 or 2, further comprising thermal break panels installed beneath one or more of the caps.

4. The roof apparatus of claim 3, wherein the thermal break panels provide an insulating air gap separating the interface from interior building temperatures.

5. The roof apparatus of claims 3 or 4, further comprising one or more roof vent systems, wherein the roof vent system comprises:

two roof vent rails, the roof vent rails to be placed parallel to one another on either side of an exhaust pipe; and,

a cap, wherein the cap is placed over the pipe and roof vent rails; wherein the roof vent rails have grooves for mating with an existing metal roof system, a vertical wall that runs parallel to the pipe, a flange at the top of the vertical wall, and vent holes that are at the top of the vertical wall just before the flange; and, wherein the cap is configured to attach to the flanges of the roof vent panels.

6. The invention of claim 5 wherein the roof vent systems are placed along the line of the slope of the roof from ridge to eave on the front and back of the building.

7. A method of installing the apparatus of claims 1-6.

8. A roof apparatus, comprising:

- a) multiple roof supports;
- b) multiple purlins that span between said supports;
- c) multiple roof panels covering the purlins and roof supports, wherein the roof has an uppermost ridge portion and a lower eave portion;

- d) a plurality of skylights mounted on the roof supports, purlins and panels;
- e) an interface that is supported by the roof supports, purlins and panels and that supports the skylights at positions spaced above the roof panels;
- f) the interface attached to the roof supports, purlins and panels at a gap or open space between two of said panels, said interface comprising:
 - i- two side rails, each having grooves for mating with the grooves of a said roof panel,
 - ii- a plurality of caps that each attach to the side rails;
 - iii – a plurality of mounting brackets configured to attach to the side rails and to the purlins;
 - iv- a starter panel having grooves for mating with the grooves of the side rails, said starter panel terminating at said open space or gap,
 - v- an eave panel having grooves for mating with the grooves of the side rails, the eave panel termination at said open space or gap; and
- g) wherein a said cap is configured to mate with an under surface of a skylight and the two said side rails;
- h) wherein a said cap is placed between two of said skylights.

9. An apparatus for modifying an existing metal building to include an additional device or feature, the existing metal building comprising metal panels, and the apparatus replacing one or more of the panels of the metal building, the apparatus comprising a plurality of mounting brackets, at least two caps, at least two side rails, and at least two end panels, and a plurality of screws;

wherein the existing building has a support structure and the area of the building to be modified has a high point and a low point; and,

wherein the mounting brackets are placed on the support structure of the existing building, one of the at least two end panels is placed at the low point of the metal building, one of the at least two side rails is placed on the edge of an existing building panel, the at least two caps are placed a determined distance from each other, another of the at least two side rails is placed parallel to the first side rail, another of the at least two end panels is placed at the high point of the existing metal building, and the additional device or feature is placed on the side rails and caps;

wherein the mounting brackets, side rails, end panels, and existing metal building panels

are connected using the screws.

10. The apparatus of claim 9 wherein the device or feature is a skylight.

11. The apparatus of claims 9 wherein the device or feature is a light fixture.

12. The apparatus of claim 9 wherein the device or feature is a HVAC unit.

5 13. The apparatus of claim 9 wherein the device or feature is added to a roof of the existing metal building.

14. The apparatus of claim 9 wherein the device or feature is added to a side wall of the existing metal building.

10 15. The apparatus of claim 9 wherein the side rails have a horizontal section that is generally perpendicular to a generally vertical wall, the vertical wall having a flange and having shorter sections on the ends and a raised section in the middle, wherein the horizontal section of the side rail has at least one interface leg or ridge that is capable of matching the ridges of the panels of the existing metal building.

15 16. The apparatus of claim 15 wherein the panels of the existing metal building are standard R-panels.

17. The apparatus of claims 9 or 15 wherein the end panel that is at the high point has a cricket to help direct water flow.

20 18. The apparatus of claims 9 or 15 wherein the existing building has insulation under the metal panels, and the apparatus further comprises at least two thermal break panels, the thermal break panels placed under the caps.

19. The apparatus of claims 9 or 15 further comprising clips of fasteners for connecting the side rails to the mounting brackets and existing metal panels.

20. The apparatus of claim 19 wherein the clips or fasteners are placed over the side rail leaving them exposed.

25 21. The apparatus of claim 19 wherein the clips or fasteners are placed under the side rail leaving them hidden.

22. The apparatus of claim 15 wherein the interface legs of the side rails are placed over the existing metal building panels.

30 23. The apparatus of claim 15 wherein the interface legs of the side rails are placed under the existing metal building panels.

24. The apparatus of claim 15 wherein the end panels also include interface legs or ridges that are capable of matching the ridges of the panels of the existing metal

building.

25. The apparatus of claim 22 wherein the side rails further include ventilation holes in the vertical wall.

26. The apparatus of claim 25 further comprising a cap for protecting the ventilation
5 holes from the external environment.

27. The apparatus of claim 9 the side rails have a horizontal section that is generally perpendicular to a generally vertical wall, the horizontal section having a flange opposite the vertical wall, and the vertical wall having a flange opposite the horizontal section, the vertical wall having shorter sections on the ends and a raised section in the middle;
10 wherein, the apparatus further comprises at least two adapters for connecting the side rails to the existing metal building panels, the adapters having a flange for crimping with the flange on the horizontal section of the side rail.

28. The apparatus of claim 25 wherein the side rail further comprises a second vertical section that is at an angle of between 10 and 90 degrees from the vertical wall, the
15 second vertical section having vent holes.

29. The apparatus of claim 25 wherein the side rail further comprises a second vertical section that is parallel to the vertical wall, the second vertical section having vent holes.

30. The apparatus of claim 22 wherein the side rails have a conduit on the vertical wall, the conduit running generally parallel to the horizontal section and extending the entire
20 length of the side rail; and wherein the mounting brackets have a horizontal section and two vertical walls, the vertical walls having a corresponding conduit for matching with the conduit on the side rails.

31. The apparatus of claim 13 wherein the end panel that is placed at the high point of the metal building is replaced with a ridge cap and a ridge side rail, the ridge side rail
25 being shaped to conform to the existing ridge of the roof of the metal building, and having an interface leg or ridge for conforming to the existing panel, and the ridge cap being shaped to be placed over the ridge side rail, and under the device or feature to be added.

32. A tool for aiding in the installation of the apparatus of claim 16, the tool having a
30 handle, an interface leg, and a mounting bracket guide, wherein the tool is sized so that when the interface leg of the tool is placed on the ridge of the existing R-panel, the mounting bracket guide of the tool is located where the mounting bracket should be

installed.

33. A method of installing the apparatus of claim 18 comprising the steps of:

(a) removing the existing panels from the metal building in the area to be modified;

(b) cutting the middle section of insulation and removing it, leaving a portion of
5 exposed insulation on either side of the remaining panels;

(c) rolling the remaining exposed insulation back over the remaining panels exposing
the support structure for the building;

(d) placing mounting brackets over each of the exposed support structures;

(e) folding the exposed insulation back over the mounting brackets;

(f) placing an end panel at the end of the exposed area that is at the low point of the
10 building;

(g) placing one or more side rails on one side of the exposed area such that the
interface of the side rail(s) matches with the ridge of the existing panel and rolling the
remaining insulation on the side where the side rail is placed so that it is covered by the
15 side rail;

(h) placing thermal break panels at each of the shorter sections of the side rails;

(i) placing one or more side rails on the opposite side of the exposed area and rolling
the insulation on that side so that it is covered by the side rail;

(j) placing a second end panel at the end of the exposed area that is at the high point
20 of the building;

(k) placing caps over the thermal break panels;

(l) placing the device or feature in the area now framed by the caps and side rails; and

(m) using the screws to secure the apparatus to the building.

34. The method of claim 33 wherein the support structures are roof purlins

25 35. The method of claim 33 wherein the existing panels are R-panels.

36. The method of claim 35 wherein the mounting brackets are installed using the tool of
claim 32.

37. The method of claim 34 wherein the device or feature is a skylight.

38. The method of claim 33 wherein the end panels installed also include interface legs
30 or ridges that are capable of matching the ridges of the panels of the existing metal
building.

39. The method of claim 33 wherein the side rails installed further include ventilation

holes in the vertical wall.

40. A method of installing the apparatus of claim 27 comprising the steps of:

(a) removing the existing panels from the metal building in the area to be modified exposing the support structures of the building;

5 (b) placing mounting brackets over each of the exposed support structures;

(c) placing an end panel at the end of the exposed area that is at the low point of the building;

(d) placing one or more side rails on one side of the exposed area such that the flange of the horizontal section of the side rail is adjacent to the existing panel;

10 (e) placing one of the adapters over the side rail flange and the existing panel;

(f) crimping the adapter so it secures the side rail to the existing panel;

(g) placing one or more side rails on the opposite side of the exposed area such that the flange of the horizontal section of the side rail is adjacent to the existing panel;

(h) placing one of the adapters over the side rail flange and the existing panel;

15 (i) crimping the adapter so it secures the side rail to the existing panel;

(j) placing a second end panel at the end of the exposed area that is at the high point of the building;

(k) placing caps at each of the shorter sections of the side rails;

(l) placing the device or feature in the area now framed by the caps and side rails; and

20 (m) using the screws to secure the apparatus to the building.

41. The method of claim 33 wherein the side rails installed have a conduit on the vertical wall, the conduit running generally parallel to the horizontal section and extending the entire length of the side rail; and wherein the mounting brackets have a horizontal section and two vertical walls, the vertical walls having a corresponding conduit for matching with the conduit on the side rails, the method further comprising a step of placing wiring or other necessary tubing or piping in the conduit before completing the installation.

42. A method of installing the apparatus of claim 18 comprising the steps of:

(a) removing the existing panels from the metal building in the area to be modified;

30 (b) cutting the middle section of insulation and removing it, leaving a portion of exposed insulation on either side of the remaining panels;

(c) rolling the remaining exposed insulation back over the remaining panels exposing

the support structure for the building;

(d) placing mounting brackets over each of the exposed support structures;

(e) folding the exposed insulation back over the mounting brackets;

(f) placing an end panel at the end of the exposed area that is at the low point of the building;

(g) placing one or more side rails on one side of the exposed area such that the interface of the side rail(s) matches with the ridge of the existing panel and rolling the remaining insulation on the side where the side rail is placed so that it is covered by the side rail;

(h) placing thermal break panels at each of the shorter sections of the side rails;

(i) placing one or more side rails on the opposite side of the exposed area and rolling the insulation on that side so that it is covered by the side rail;

(j) placing a ridge side rail being shaped to conform to the existing ridge of the roof of the metal building at the end of the exposed area that is at the high point of the building, the ridge side rail having an interface leg or ridge for conforming to the existing panel and placing a ridge cap over the ridge side rail;

(k) placing caps over the thermal break panels;

(l) placing the device or feature in the area now framed by the caps and side rails; and

(m) using the screws to secure the apparatus to the building.

43. A kit for attaching a device to a metal roof, the roof having a roof framework including multiple roof supports, purlins that span between said supports, and roof panels covering the purlins and roof supports, wherein the roof has an uppermost ridge portion and a lower eave portion, and the roof panels have grooves, the kit comprising:

an interface that is to be supported by the roof framework and when so supported supports the device at a position spaced above the framework, said interface comprising:

two side rails, each side rail having grooves for mating with the grooves of a said roof panel,

a first end cap and a second end cap;

a plurality of mounting brackets configured to attach to the side rails;

a ridge panel having grooves for mating with the grooves of the side rails and a first coupler on the ridge panel configured to receive an end cap,

an eave panel having grooves for mating with the grooves of the side rails and

a second coupler configured to receive an end cap; and

wherein the first end cap is configured to mate with said device, the two side rails, and the second coupler; and

wherein the second end cap is configured to mate with said device, the two said side rails, and the first coupler.

44. The kit of claim 43, further comprising:

a cricket to deflect water towards the grooves of the side rails.

45. The kit of claim 43 for attaching at least a second device to the roof, further comprising:

a middle cap for placement between the first device and the second device.

46. The kit of claim 44 for attaching multiple devices to the roof, further comprising: middle caps for placement between the devices.

47. The kit of claim 43, wherein the first end cap is configured to mate with an under surface of said device, and wherein the second end cap is configured to mate with an under surface of said device.

48. The kit of claim 43, further comprising the device to be mounted to said roof framework.

49. The kit of any one of claims 43-48, wherein the device is a skylight.

50. The kit of any one of claims 45 and 46, wherein the devices are skylights.

51. The kit of claim 44, wherein the cricket is integral with the ridge panel.

52. A method of attaching a device to a metal roof, the roof having a roof framework including multiple roof supports, purlins that span between said supports, and roof panels covering the purlins and roof supports, wherein the roof has an uppermost ridge portion and a lower eave portion, and the roof panels have grooves, the method comprising:

providing an interface that is to be supported by the roof framework and when so supported supports the device at a position spaced above the framework, said interface comprising:

two side rails, each side rail having grooves for mating with the grooves of a said roof panel,

a first end cap and a second end cap;

a plurality of mounting brackets configured to attach to the side rails;

a ridge panel having grooves for mating with the grooves of the side rails and a first coupler on the ridge panel configured to receive an end cap,

an eave panel having grooves for mating with the grooves of the side rails and a second coupler configured to receive an end cap; and

5 wherein the first end cap is configured to mate with said device, the two side rails, and the second coupler; and

wherein the second end cap is configured to mate with said device, the two said side rails, and the first coupler;

placing mounting brackets over exposed roof supports;

10 attaching the eave panel such that its grooves mate with the grooves of two adjoining but spaced apart roof panels;

attaching the side rails to the brackets after mating the grooves of the side rails with the grooves of the two adjoining but spaced apart roof panels and with the grooves of the eave panel;

15 attaching the ridge panel such that its grooves mate with the grooves of two adjoining but spaced apart roof panels and with the grooves of the side rails;

attaching the first end cap to the first coupler and the side rails;

attaching the second end cap to the second coupler and the side rails;

attaching the device to the first and second end caps and to the side rails.

20 53. The method of claim 52, further comprising removing an existing roof panel from the metal building to expose the roof supports.

54. The method of claims 52 or 53, wherein screws are used to secure the interface to the building.

55. The method of claims 52 or 53, wherein the device is a skylight.

25 56. The method of claim 54, wherein the device is a skylight.

57. The method of claim 52, wherein the device is a skylight and is attached over the end caps and side rails.

58. The invention(s) substantially as shown and/or described herein.

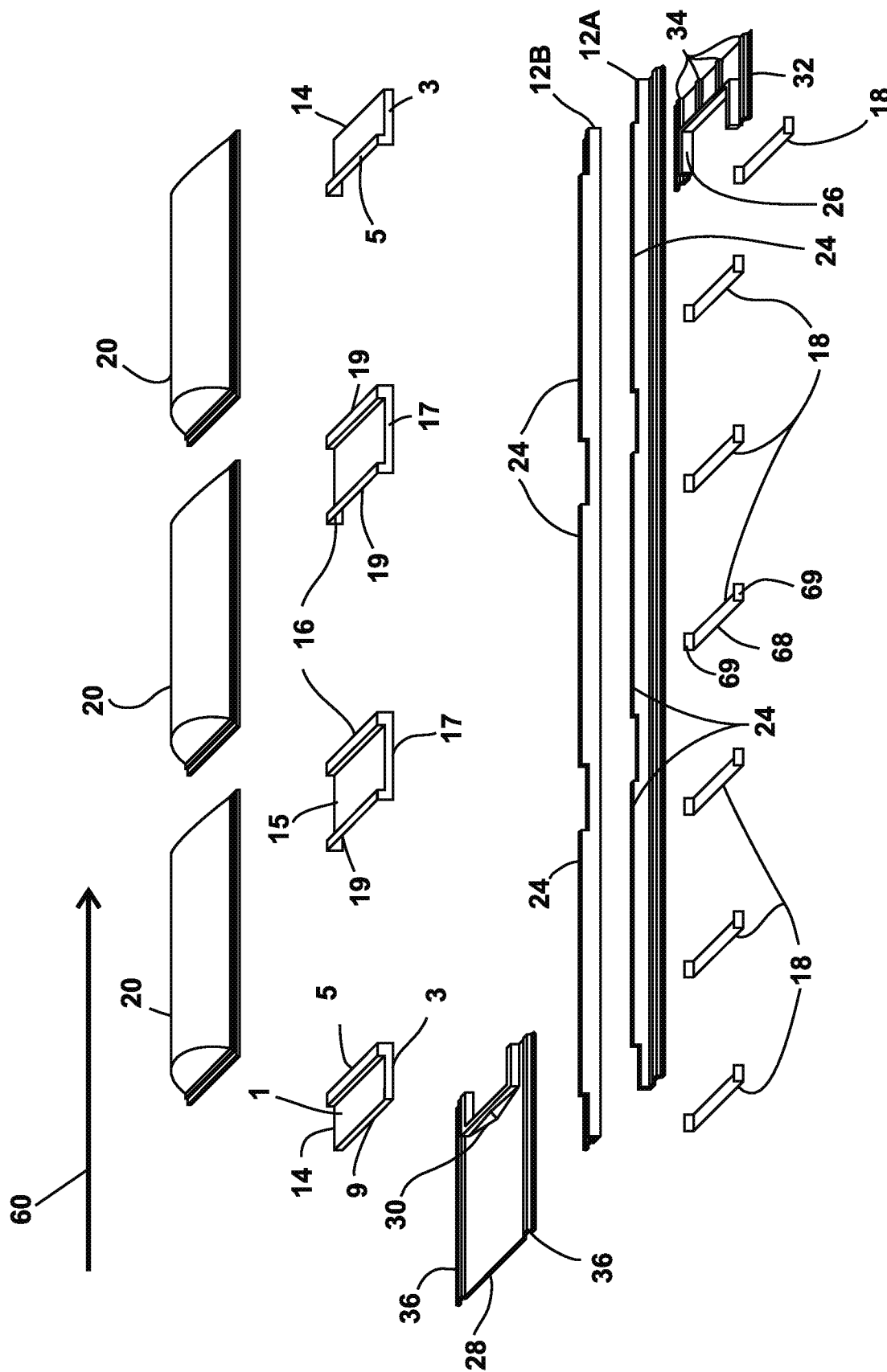
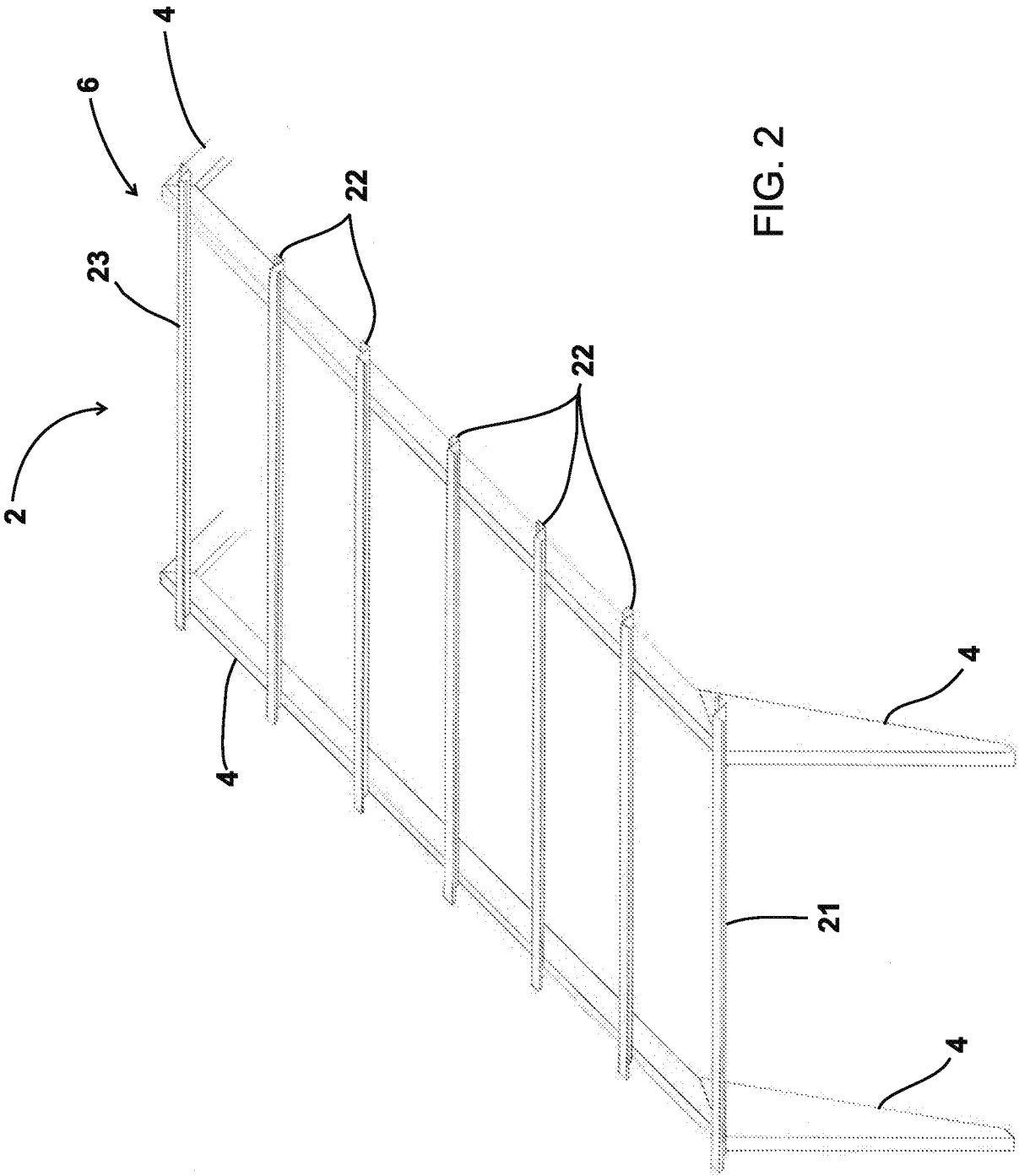


FIG. 1



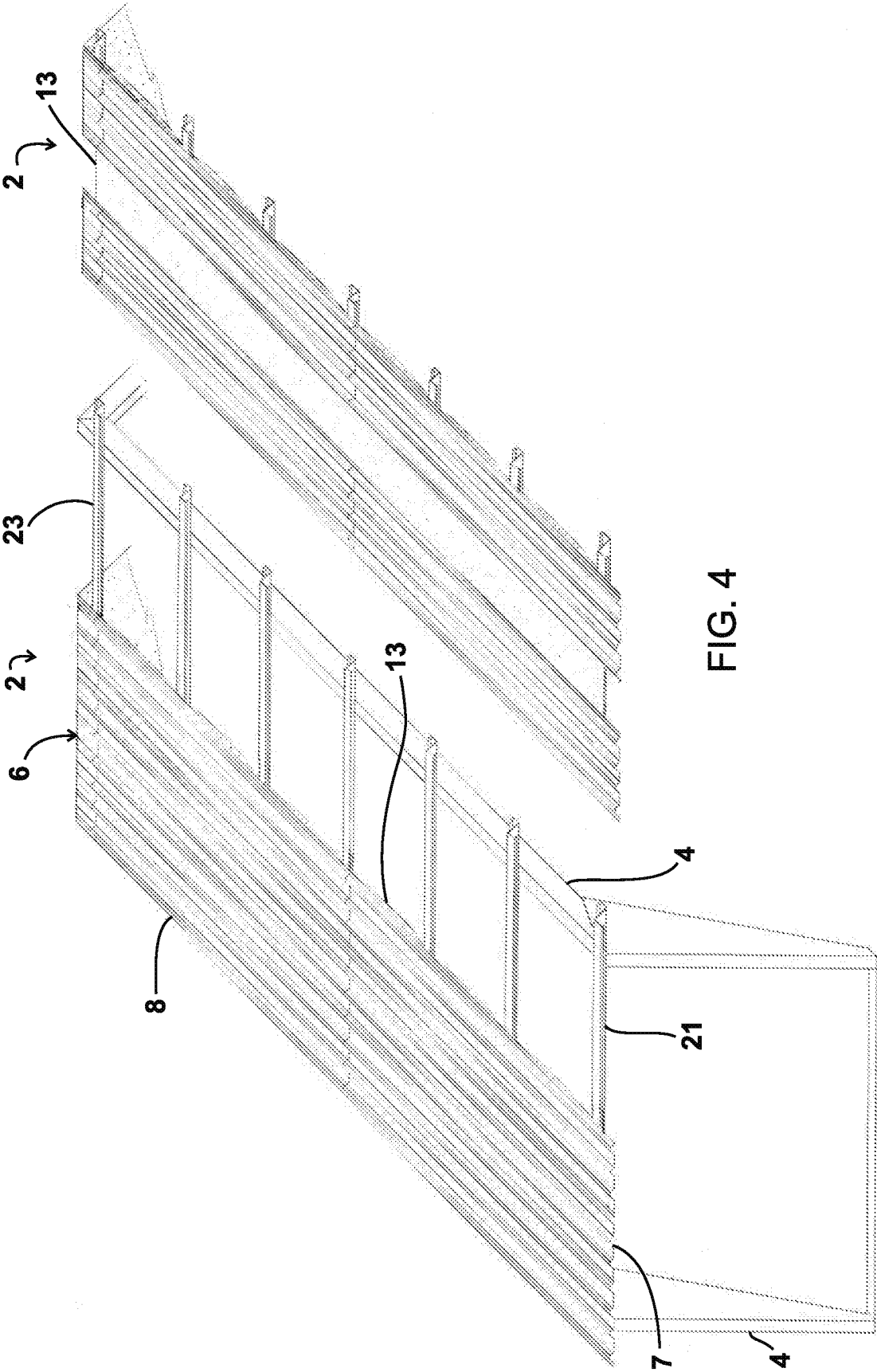


FIG. 4

FIG. 3

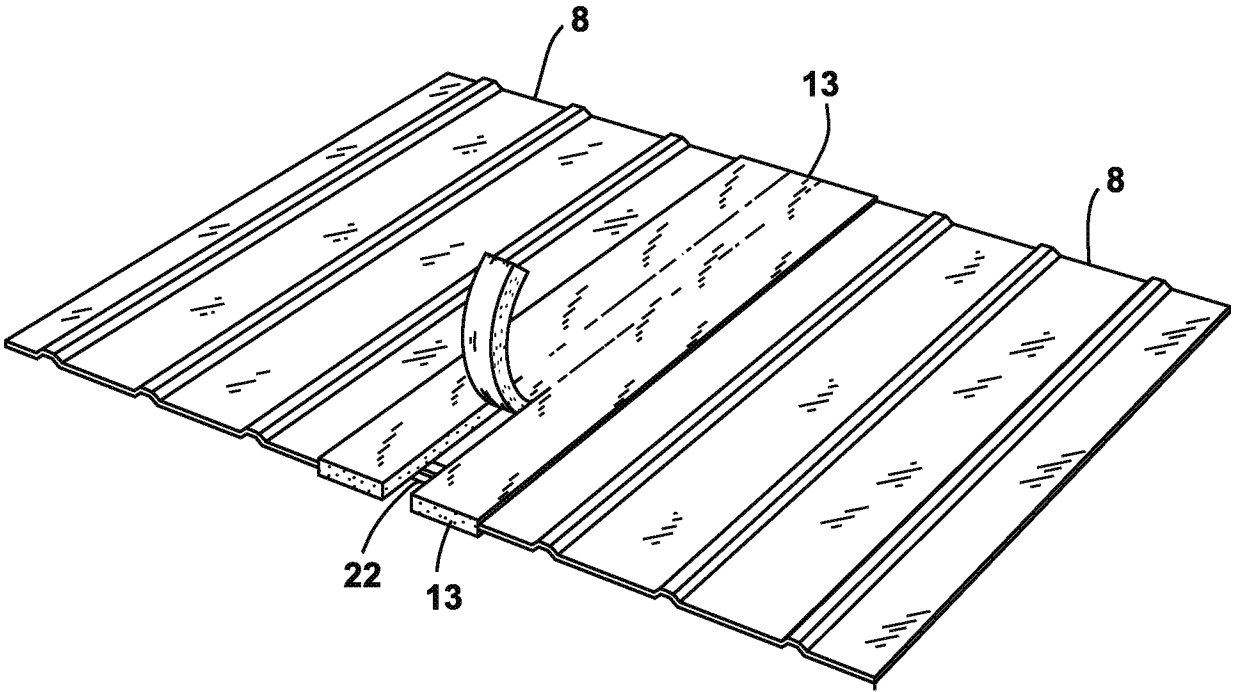


FIG. 5

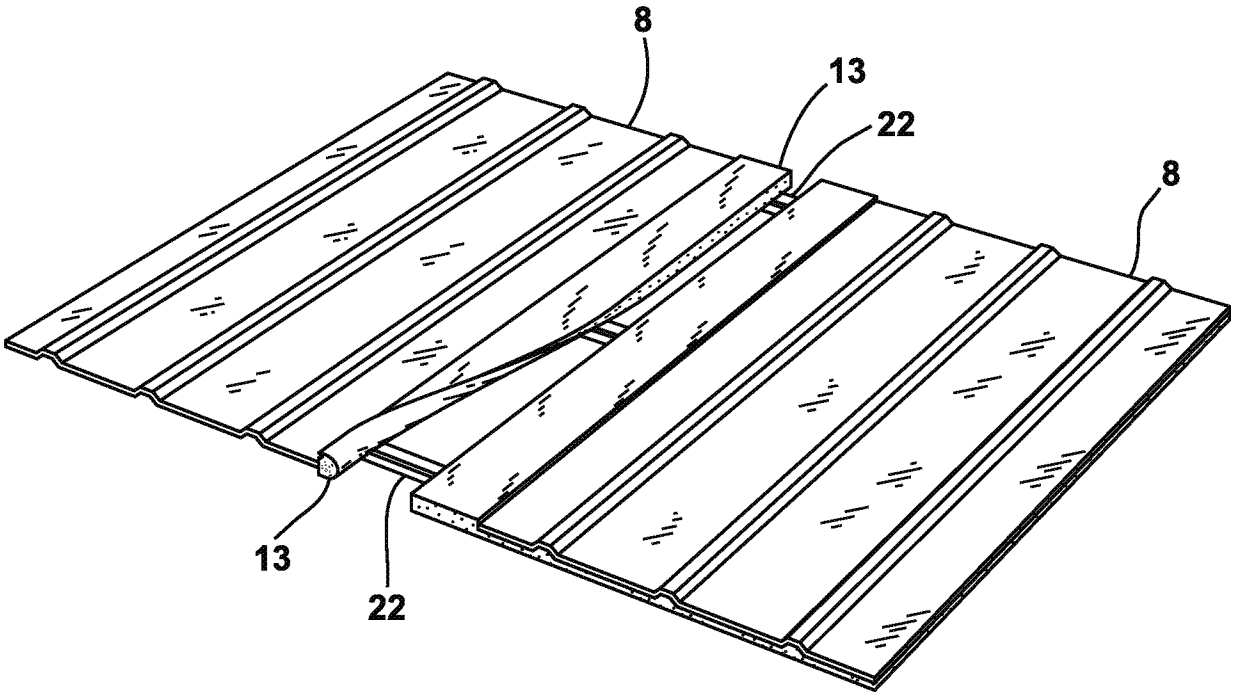


FIG. 6

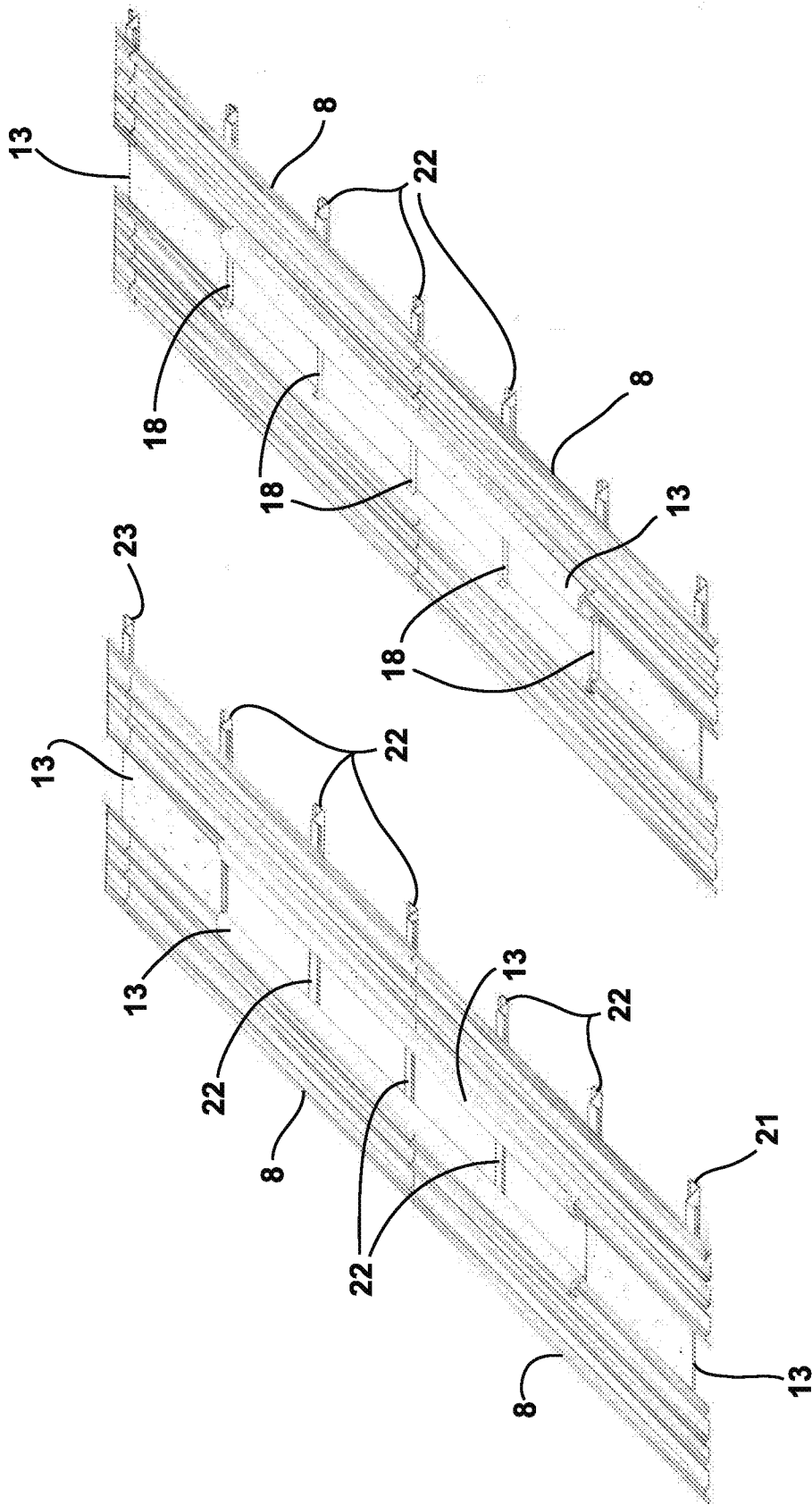


FIG. 7

FIG. 8

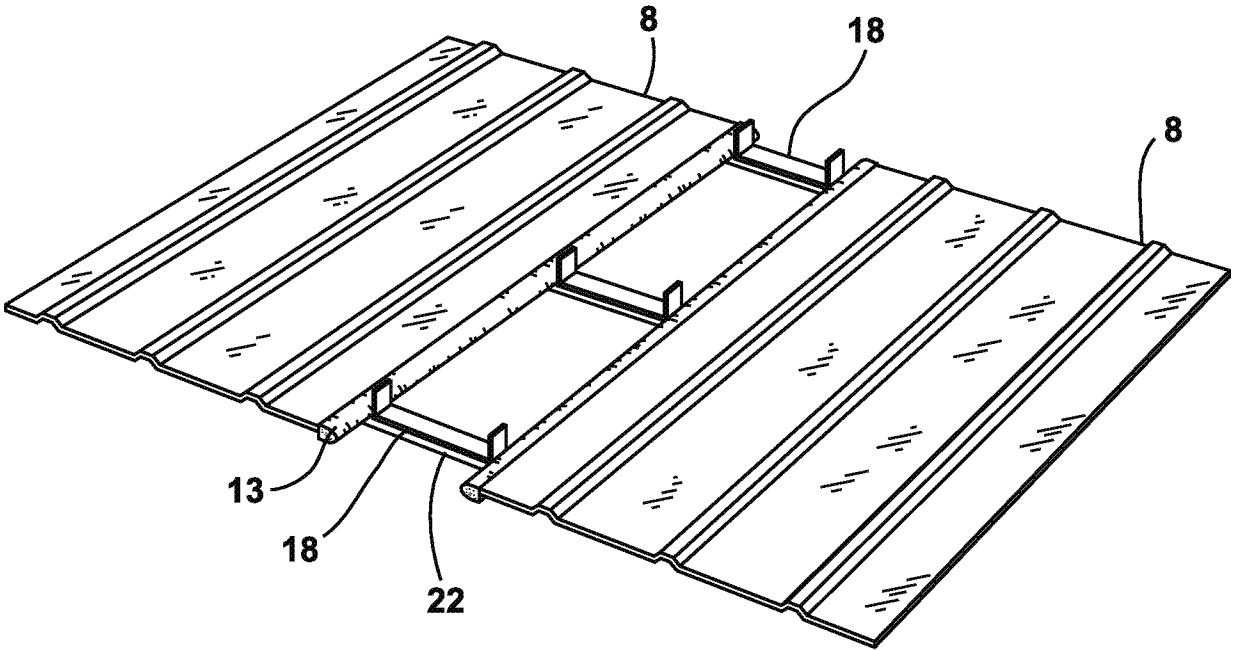


FIG. 9

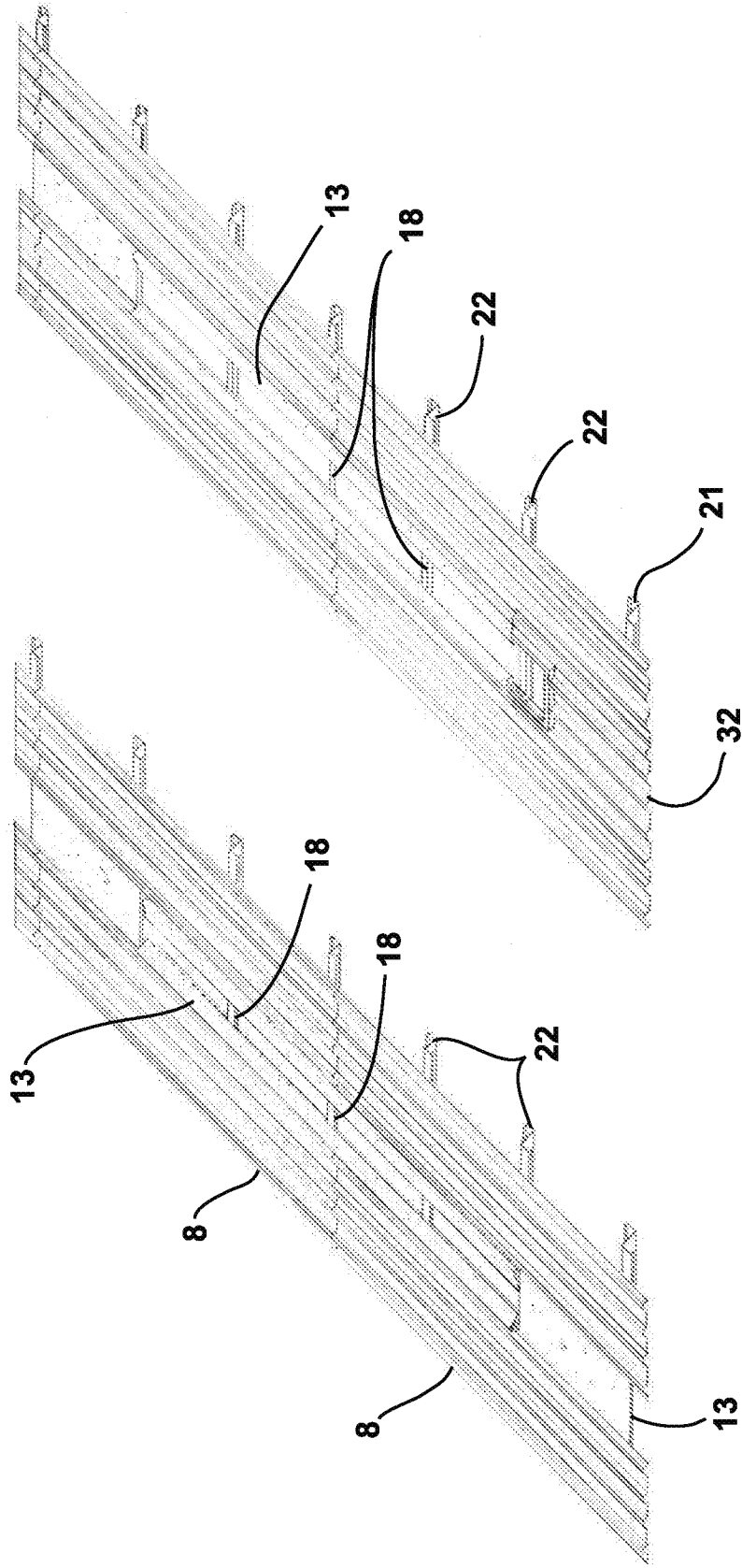


FIG. 10

FIG. 11

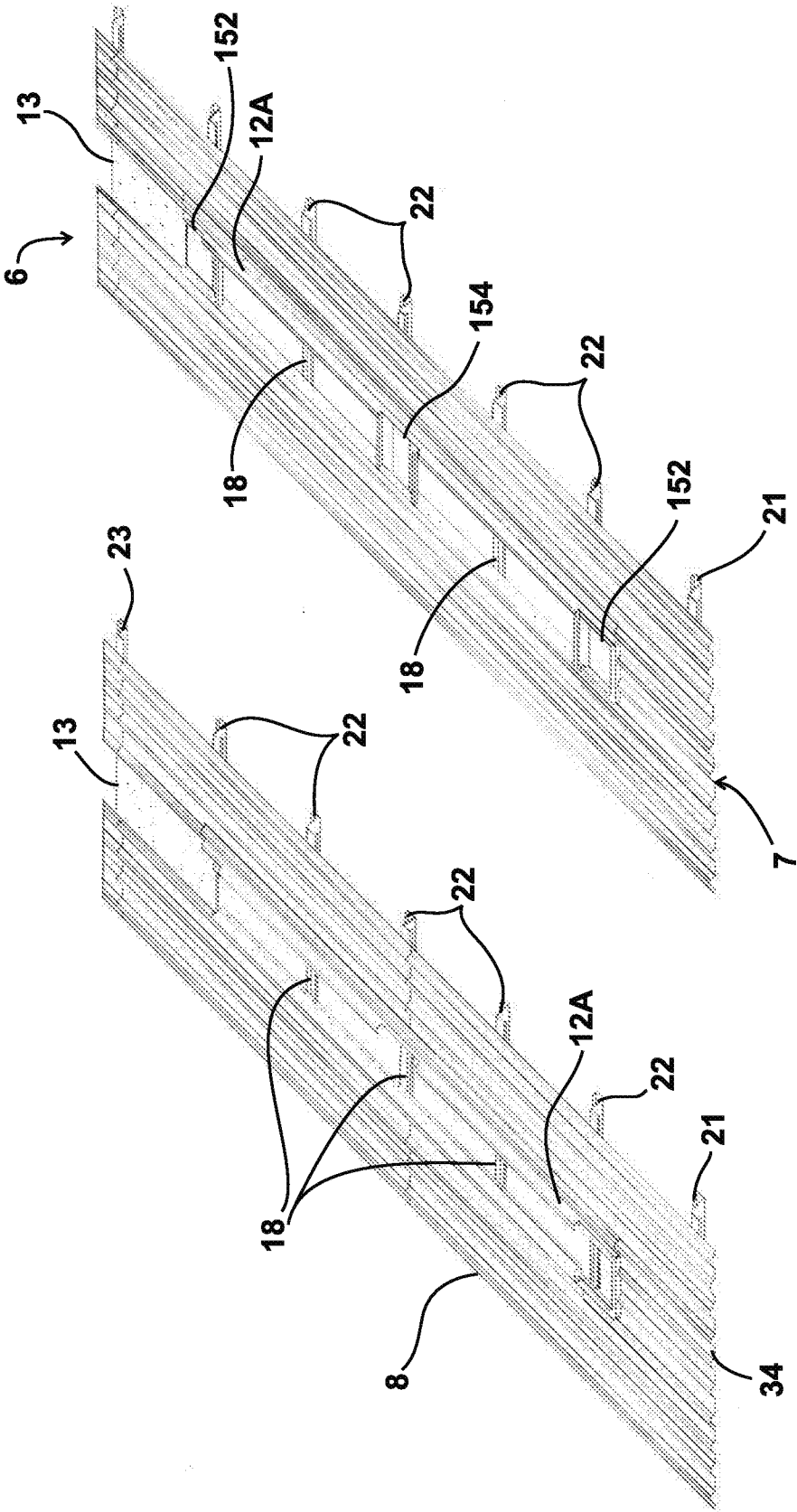


FIG. 13

FIG. 12

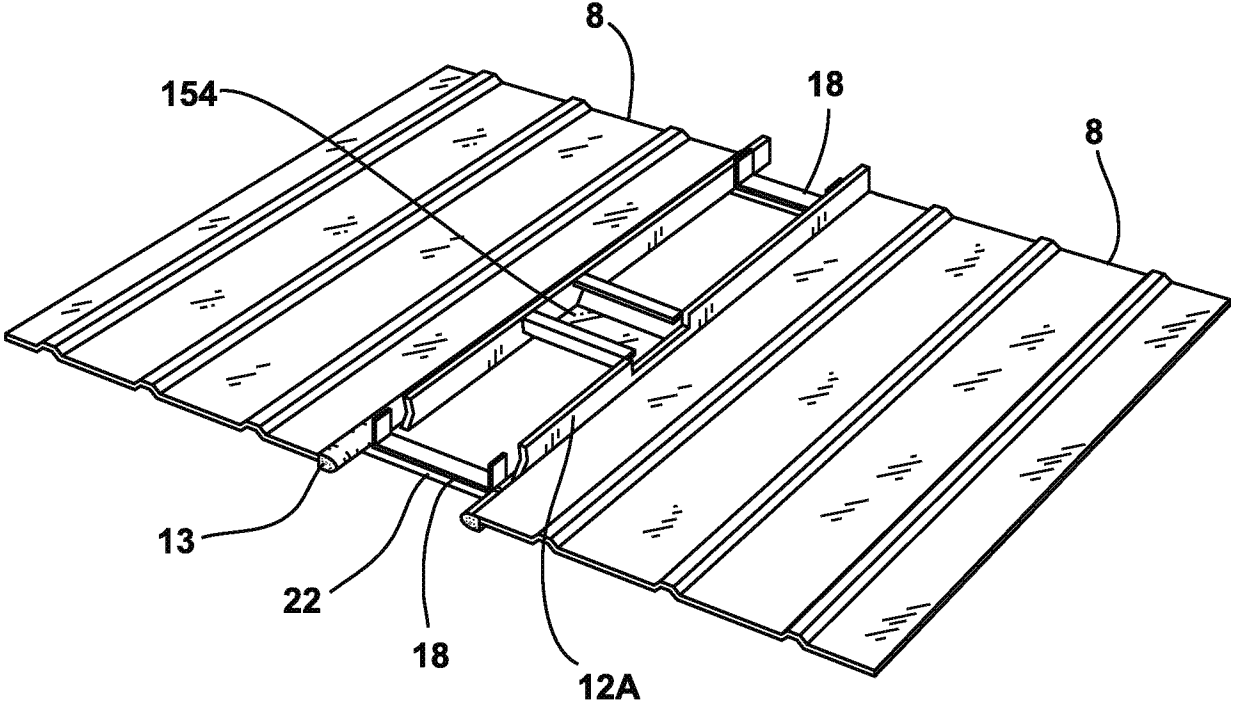


FIG. 14

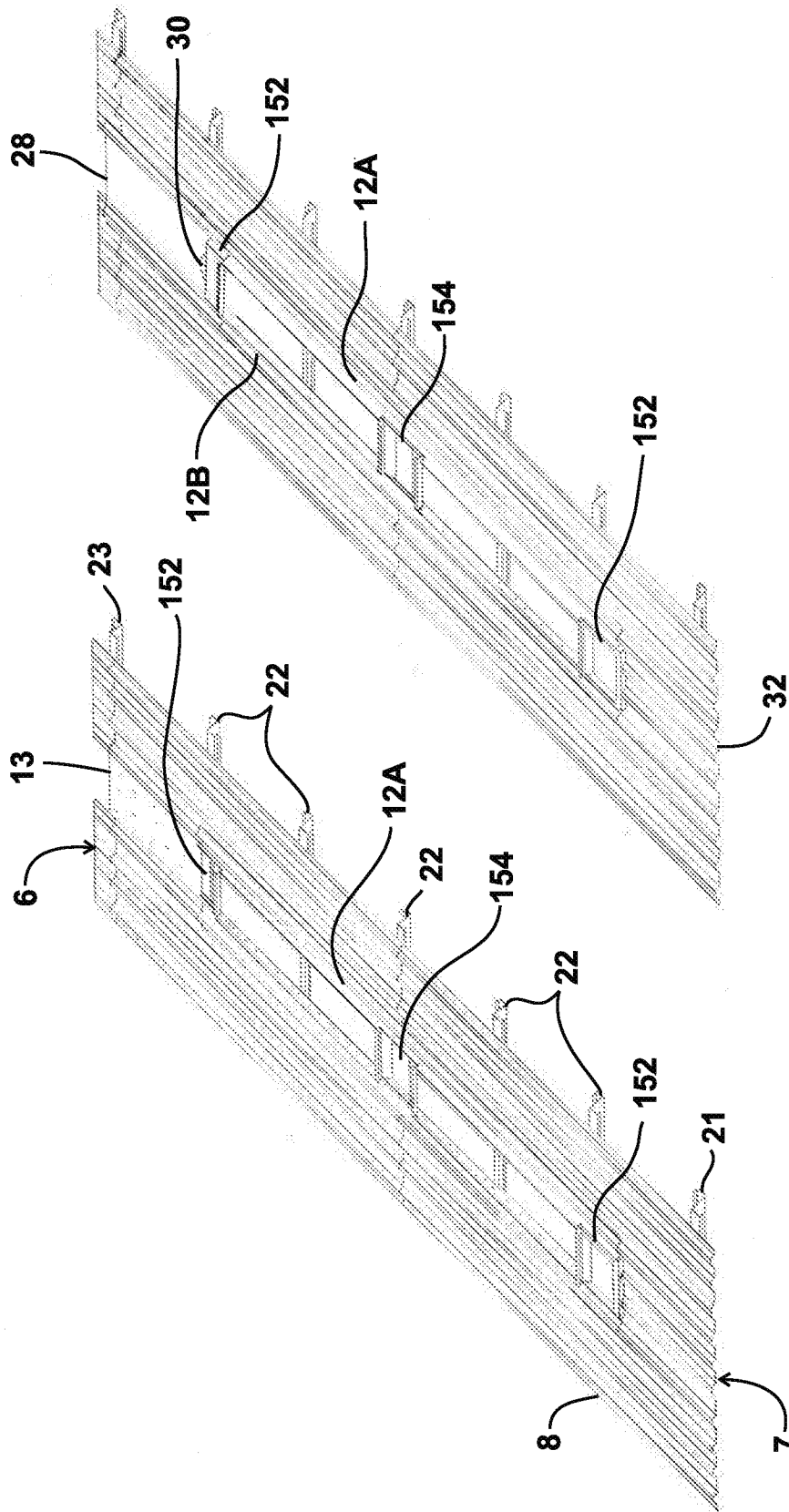
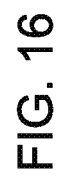


FIG. 15



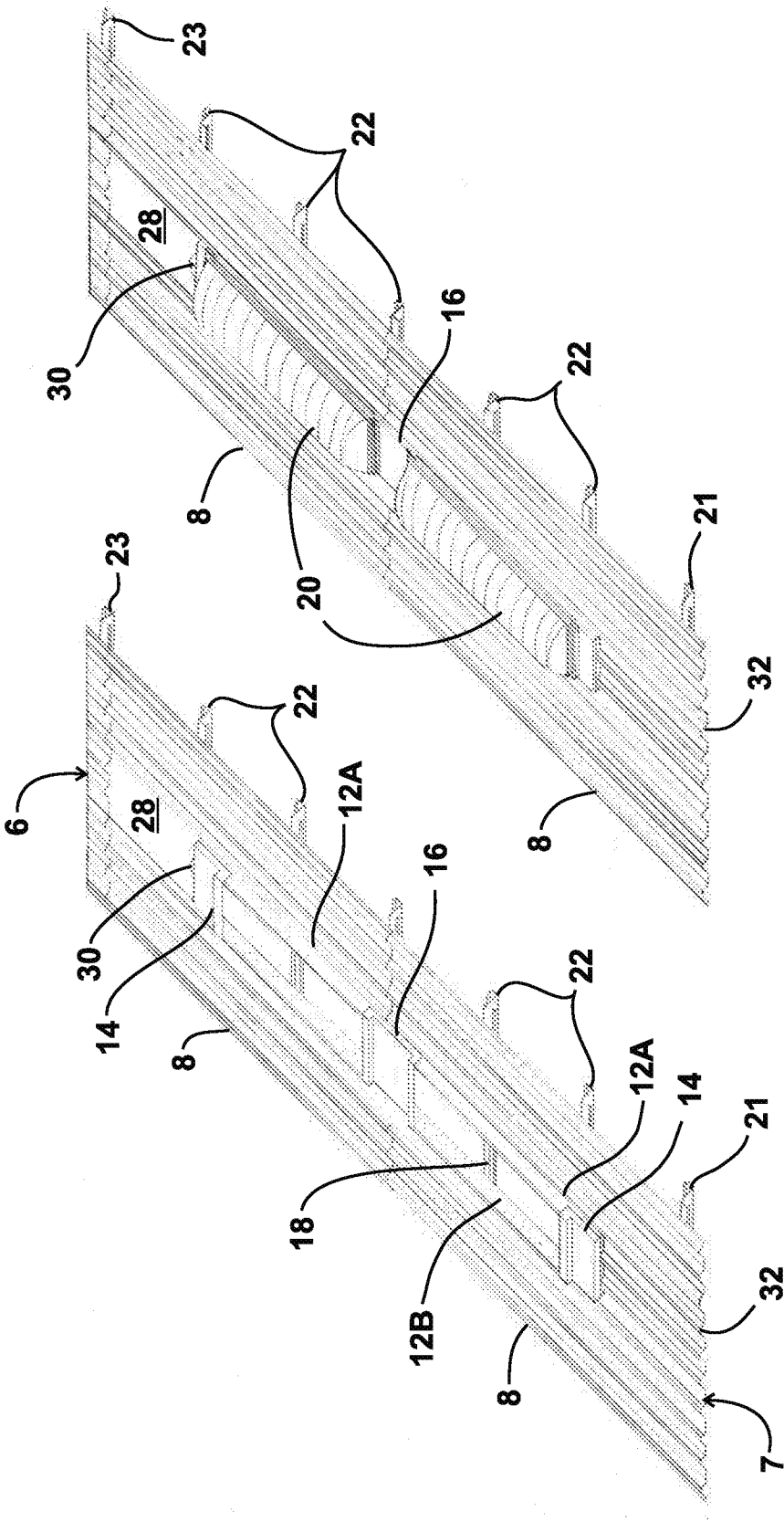


FIG. 18

FIG. 17

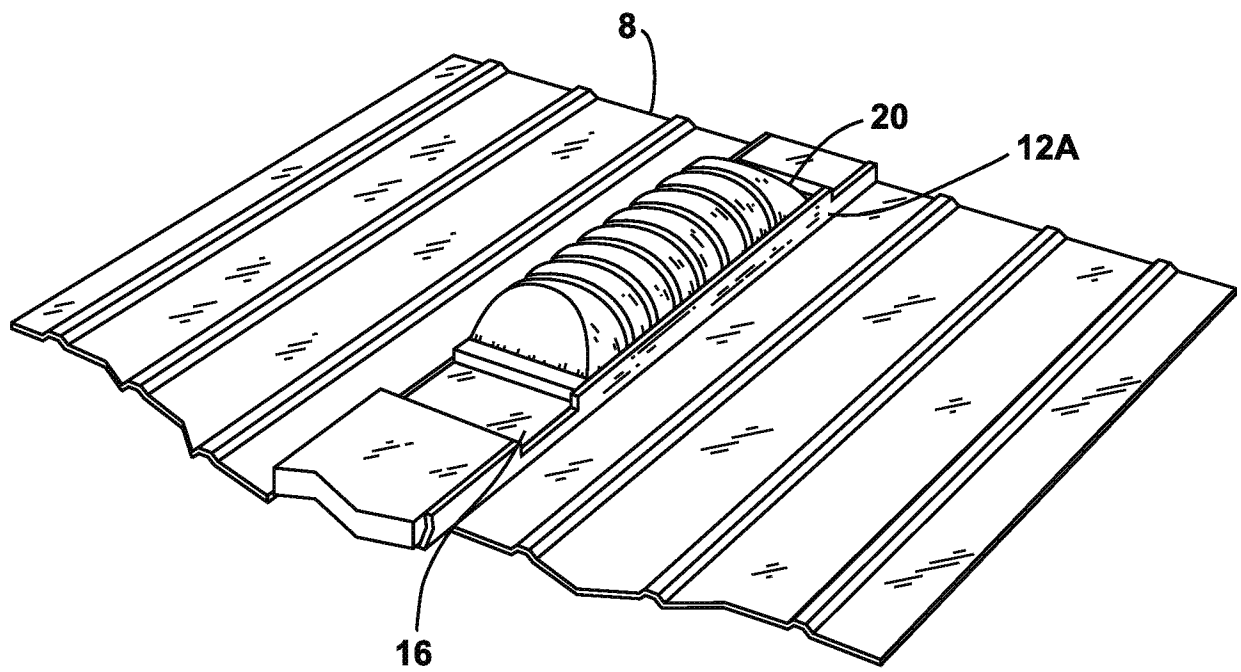
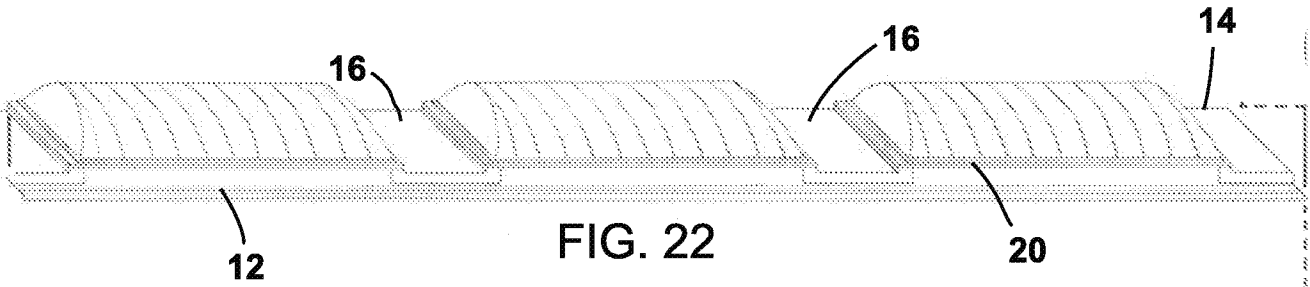
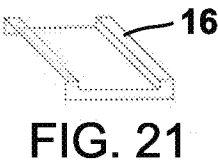
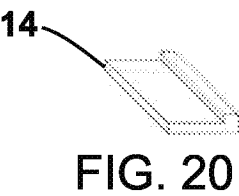


FIG. 19



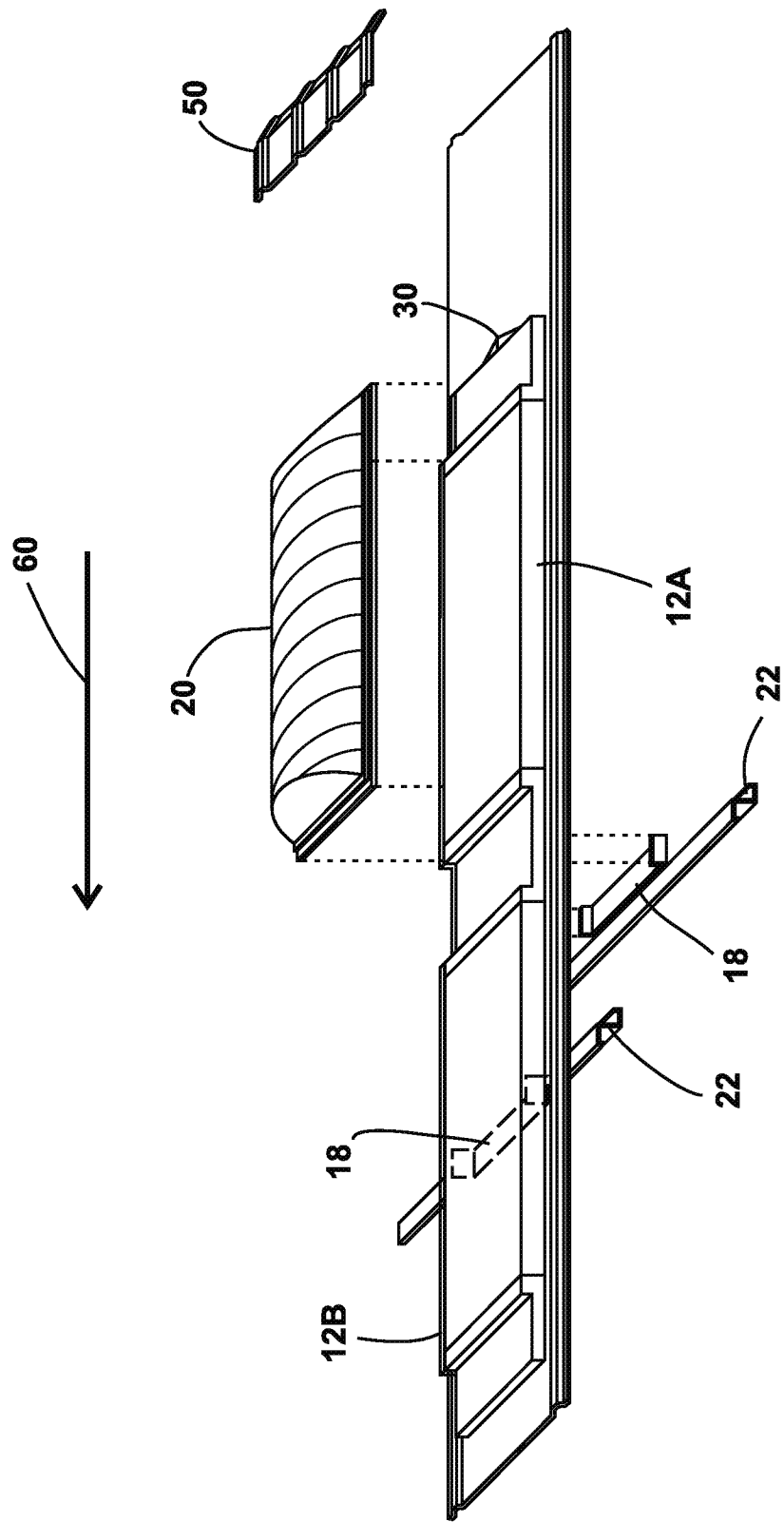


FIG. 24

FIG. 25

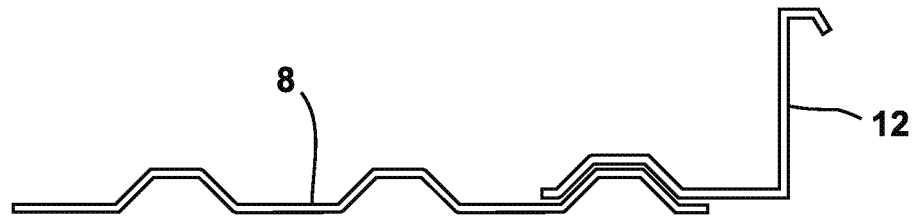


FIG. 26

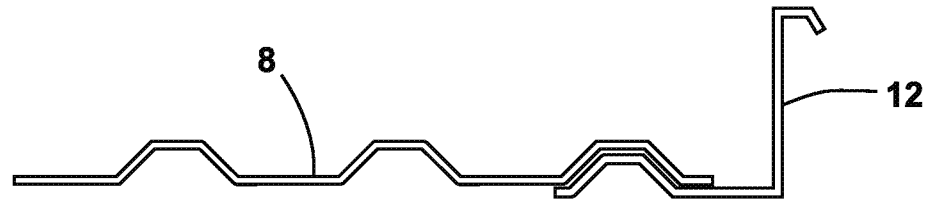


FIG. 27

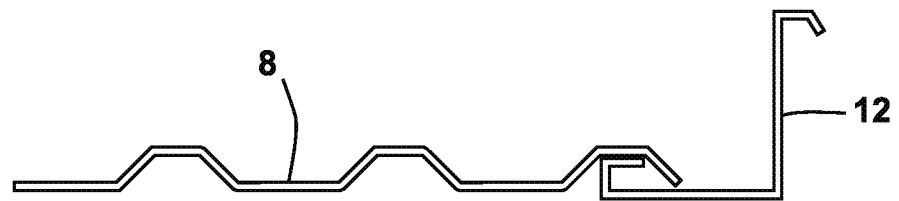


FIG. 28

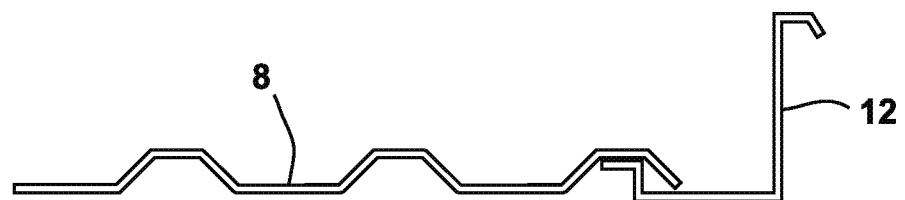
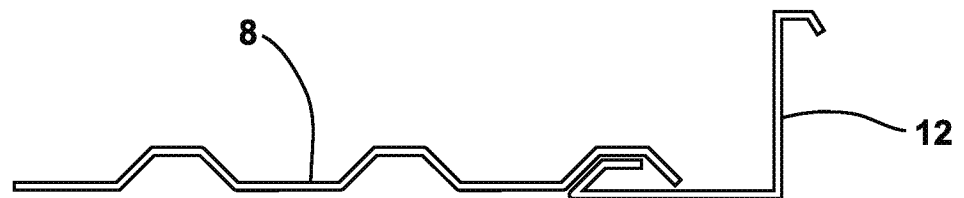


FIG. 29



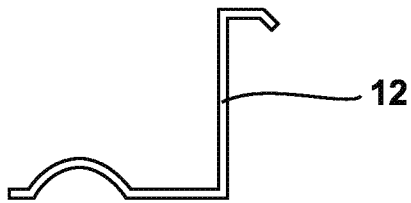


FIG. 30

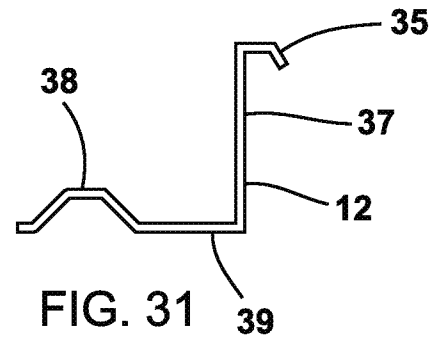


FIG. 31

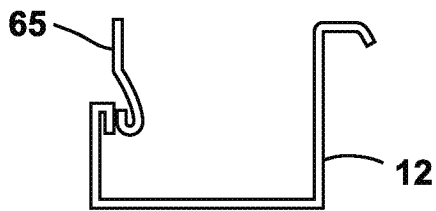


FIG. 32

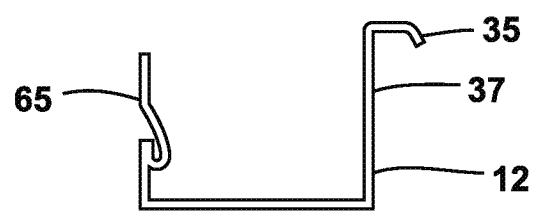


FIG. 33

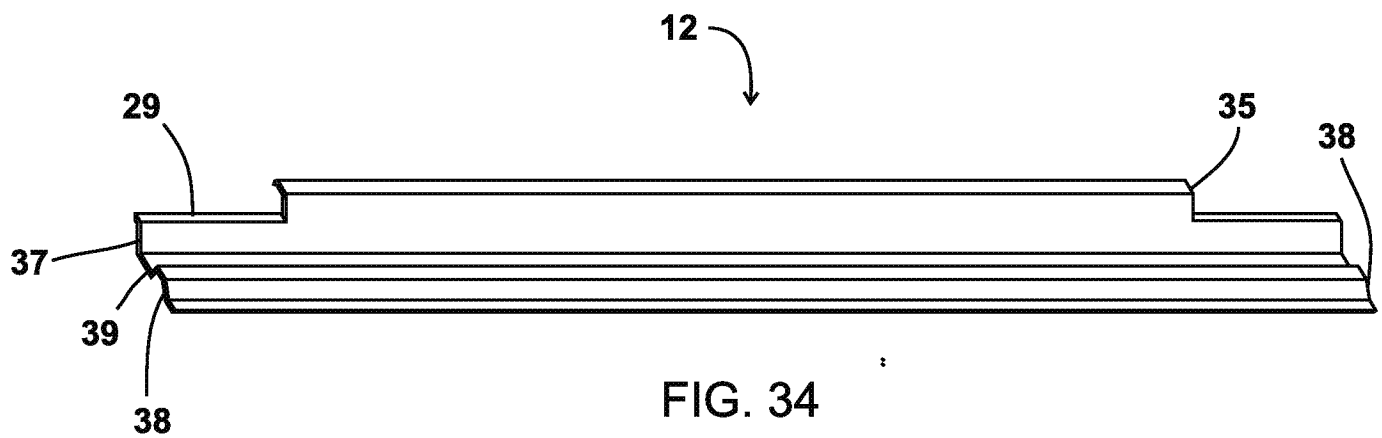
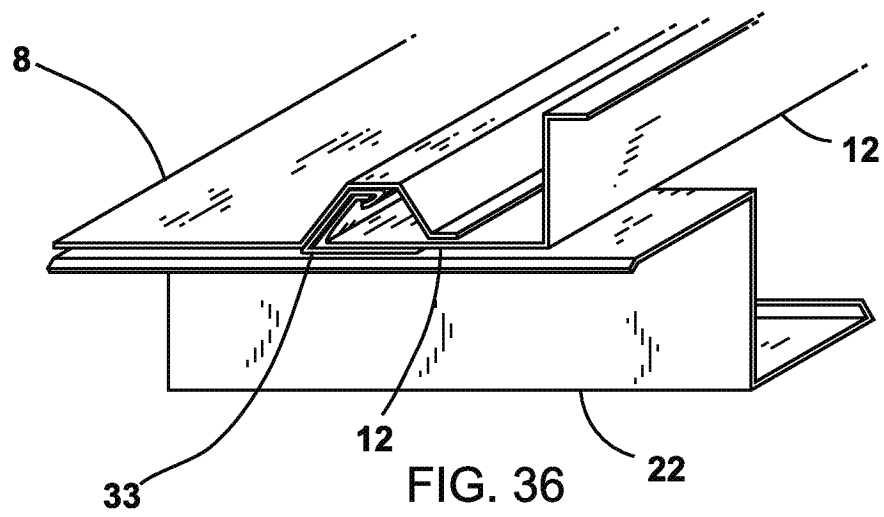
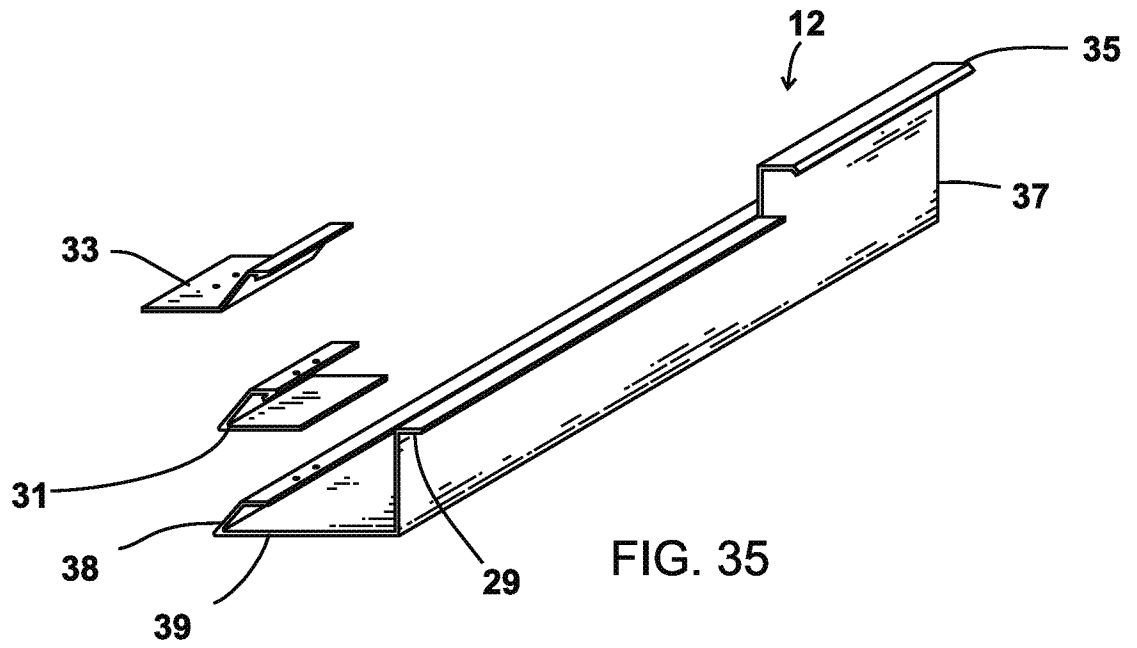


FIG. 34



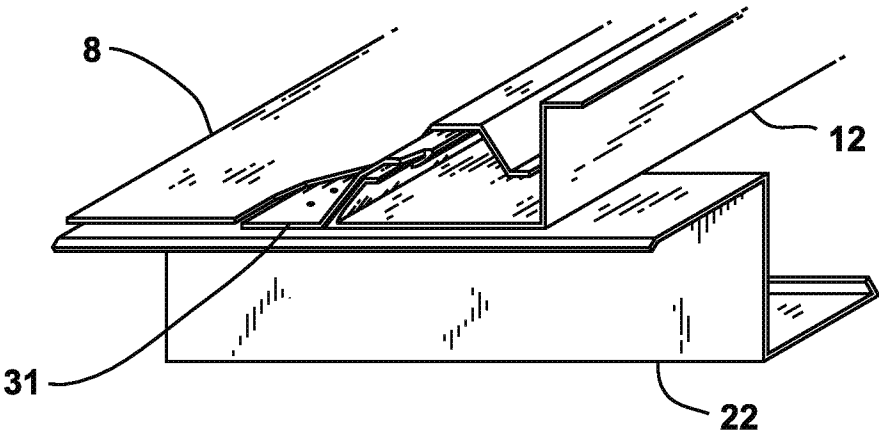


FIG. 37

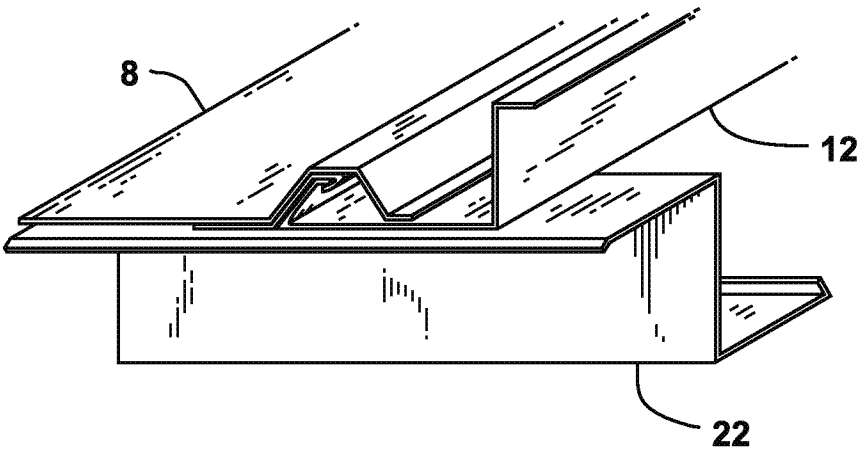
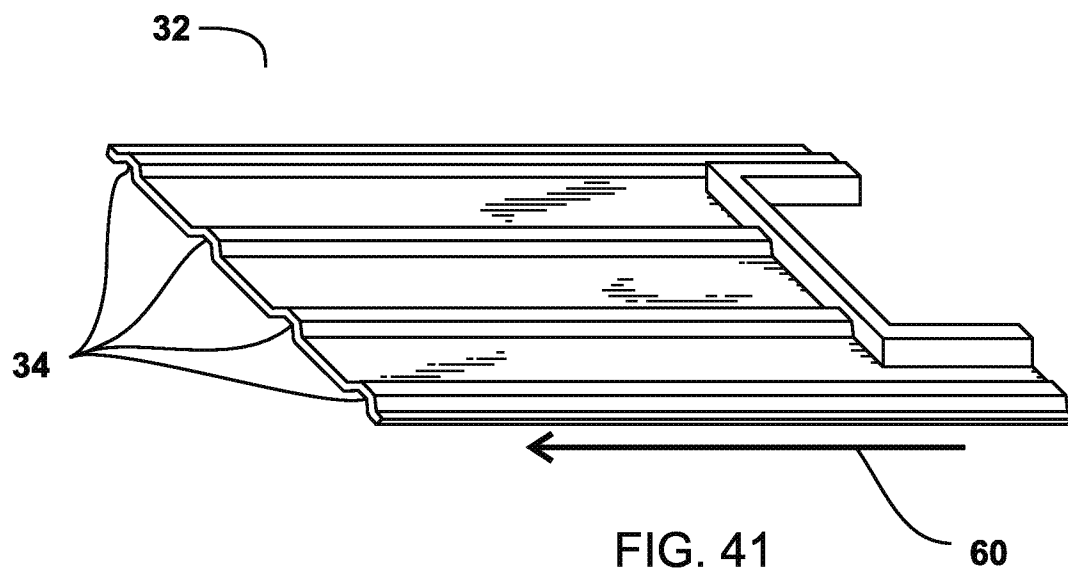
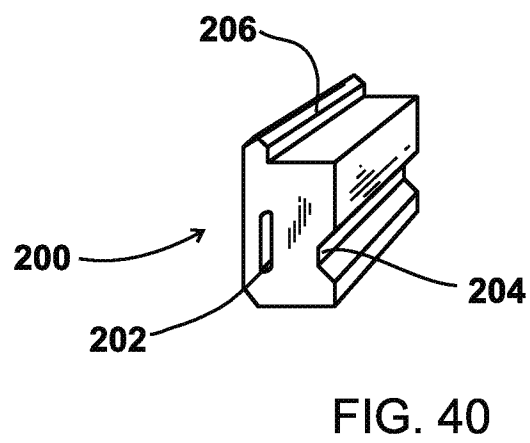
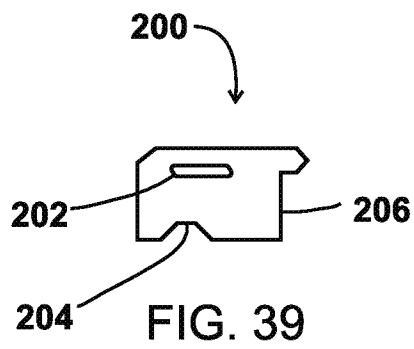


FIG. 38



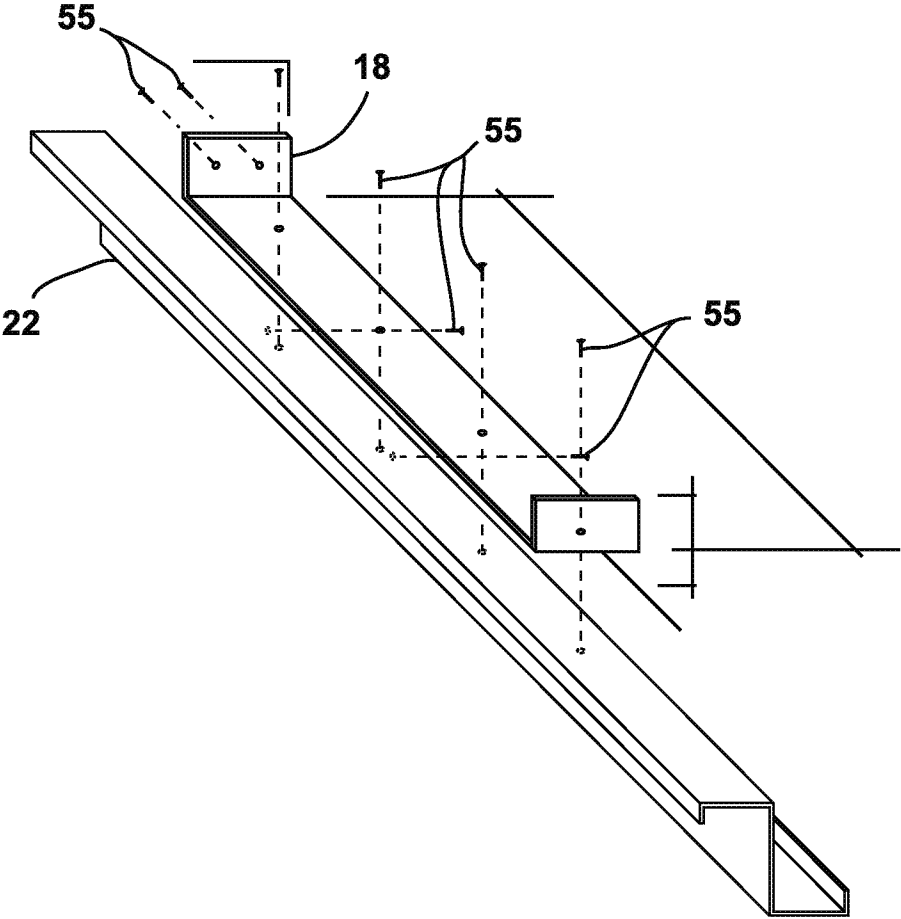


FIG. 42

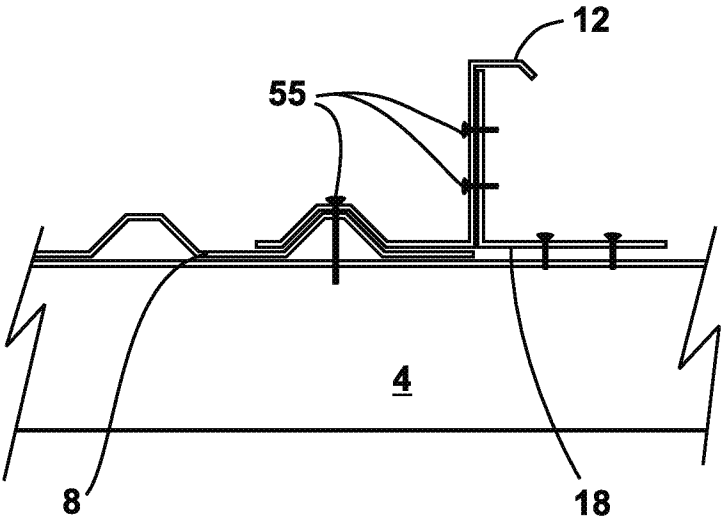


FIG. 43

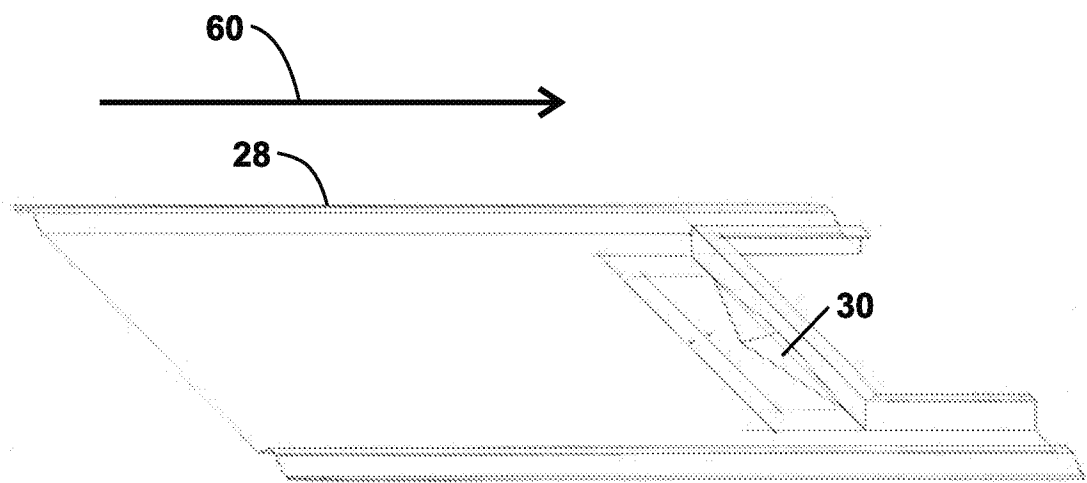


FIG. 44

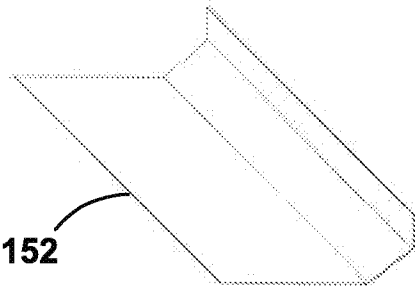


FIG. 45

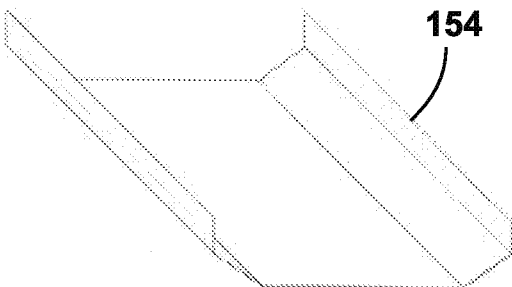


FIG. 46

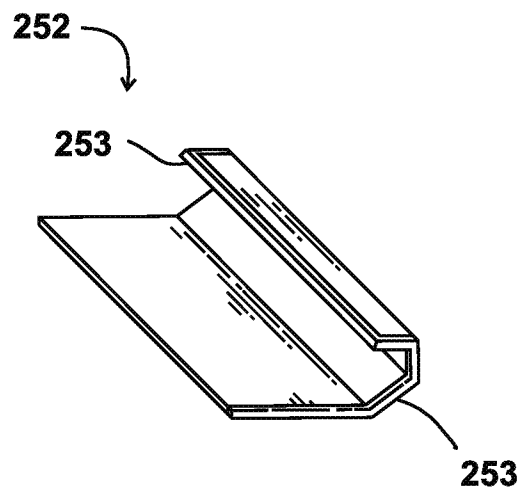


FIG. 47

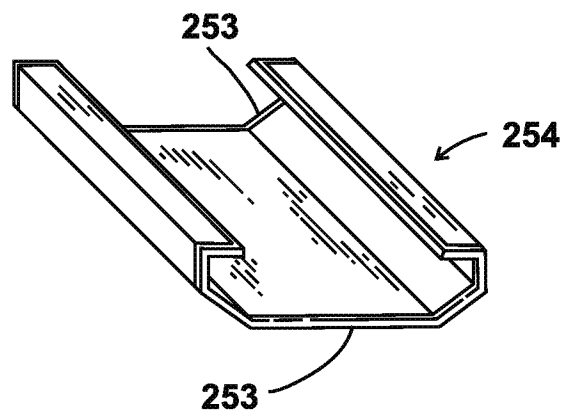


FIG. 48

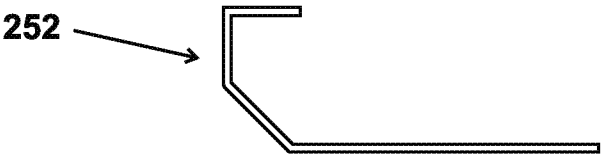


FIG. 49

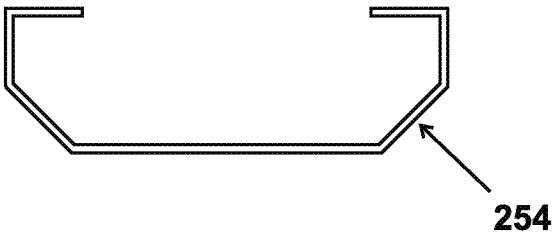


FIG. 50

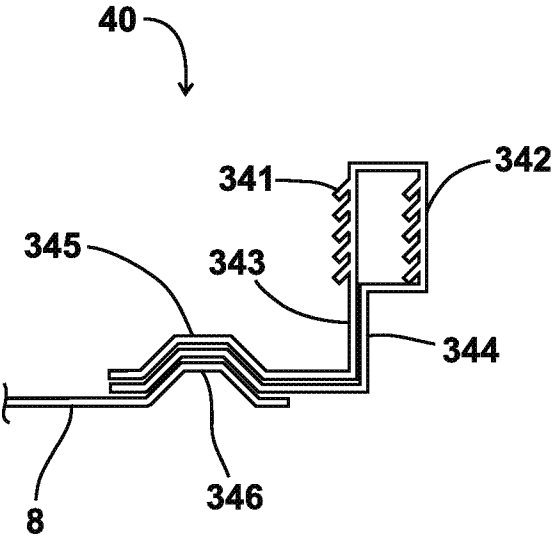


FIG. 51

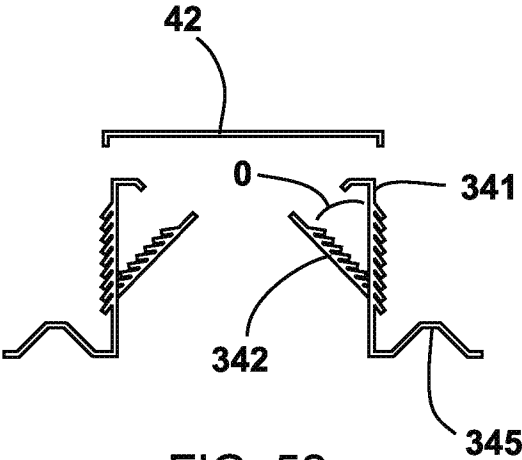


FIG. 52

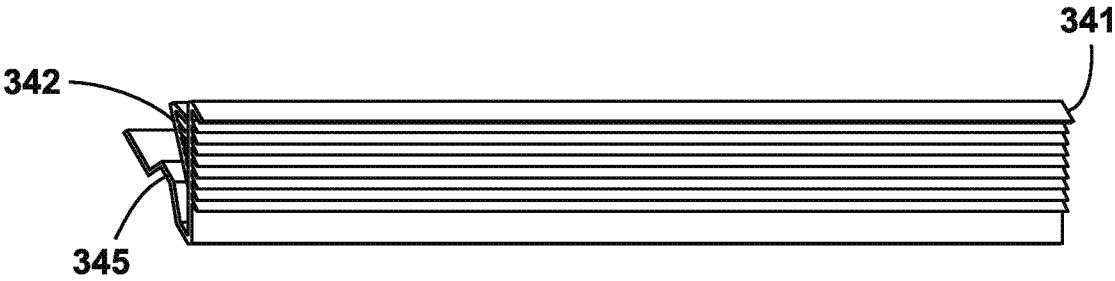


FIG. 53

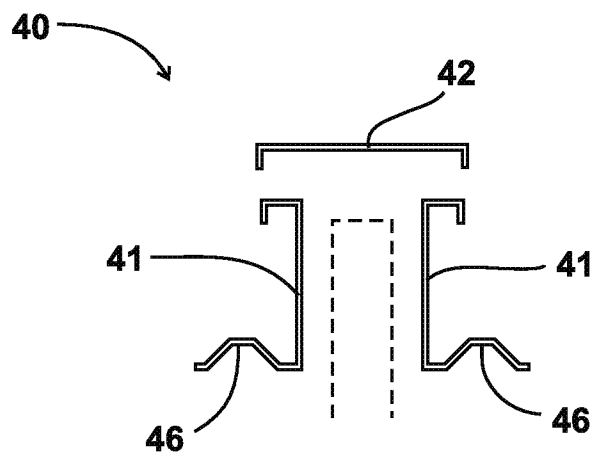


FIG. 54

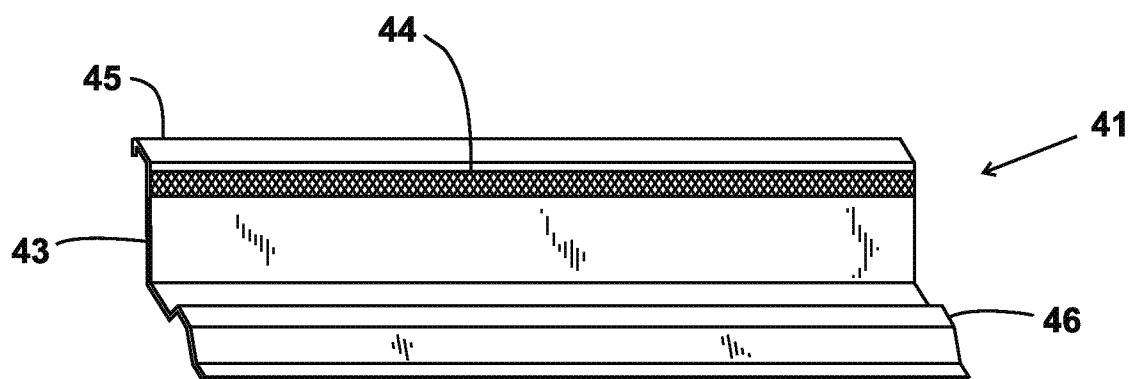
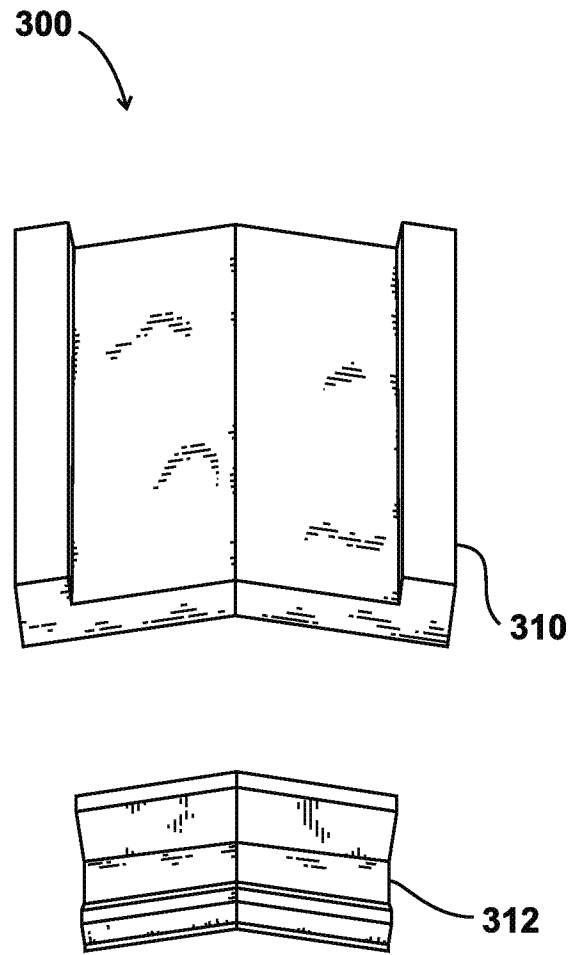
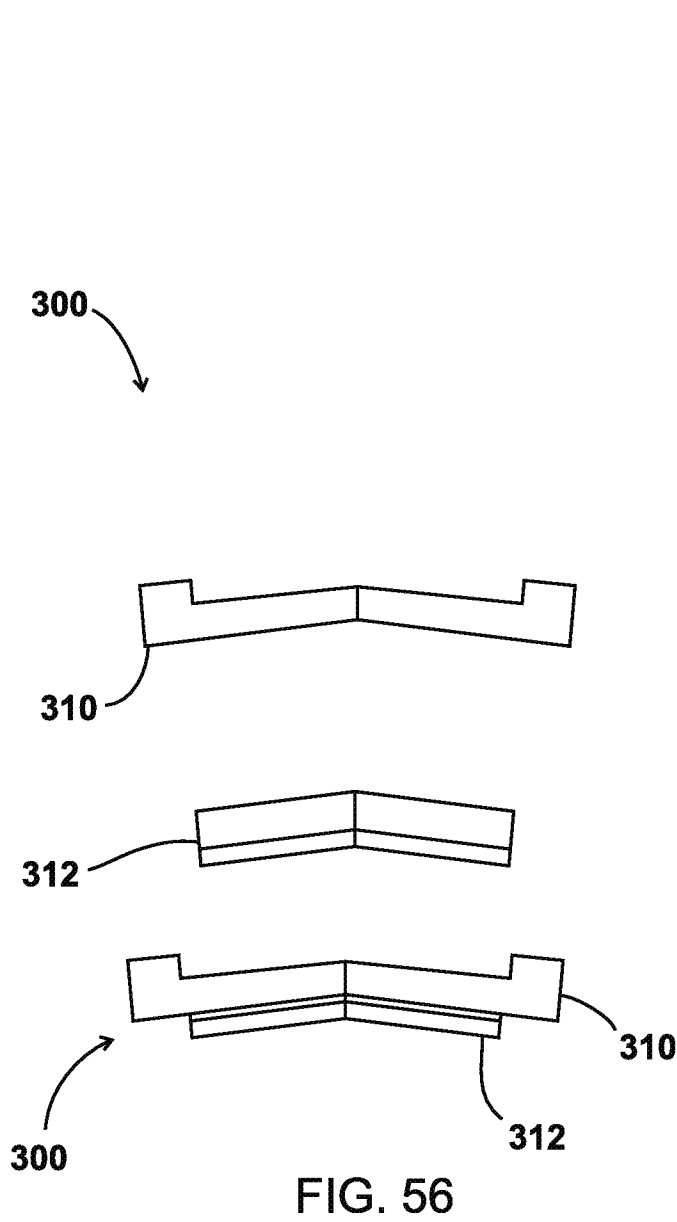
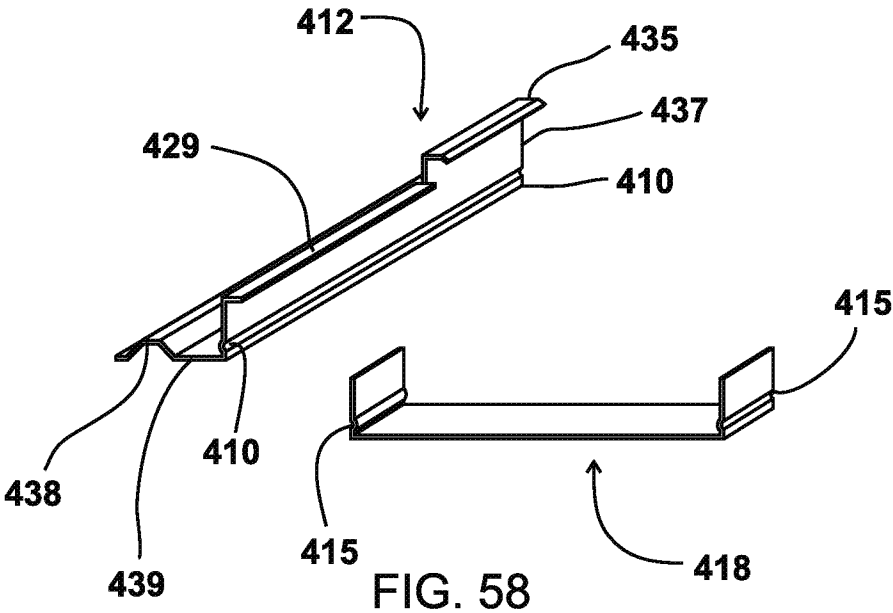


FIG. 55





INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/043412

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 7,32,58
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
See extra sheet.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/043412

A. CLASSIFICATION OF SUBJECT MATTER IPC (2016.01) E04D 13/03, E04D 13/147 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC (2016.01) E04F 13/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Databases consulted: Esp@cenet, Google Patents, FamPat database		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6151838 A GOLDEN EAGLE BUILDING PRODUCTS [US] 28 Nov 2000 (2000/11/28) Entire document	1-6,8-31,33-57
A	US 2007094984 A1 BUTLER MANUFACTURING CO [US] 03 May 2007 (2007/05/03) Entire document	1-6,8-31,33-57
A	US 6729083 B1 JACO ARF LLC [US] 04 May 2004 (2004/05/04) Entire document	1-6,8-31,33-57
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 22 Nov 2016		Date of mailing of the international search report 24 Nov 2016
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616		Authorized officer ORGAD Yaniv Telephone No. 972-2-5651787

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US2016/043412

Patent document cited search report			Publication date	Patent family member(s)			Publication Date
US	6151838	A	28 Nov 2000	US	6151838	A	28 Nov 2000
				CA	2261441	A1	24 May 2000
				CA	2261441	C	31 Jan 2006
US	2007094984	A1	03 May 2007	US	2007094984	A1	03 May 2007
				US	7712279	B2	11 May 2010
				CA	2580450	A1	06 Apr 2006
				CA	2580450	C	31 Aug 2010
				CN	101052771	A	10 Oct 2007
				CN	101052771	B	22 Jun 2011
				JP	2008513640	A	01 May 2008
				JP	4805937	B2	02 Nov 2011
				US	2006070315	A1	06 Apr 2006
				WO	2006036161	A1	06 Apr 2006
US	6729083	B1	04 May 2004	US	6729083	B1	04 May 2004

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/043412

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet):

* Claims Nos.: 7,32,58

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claims 7, 32 and 58 are unsearchable for the following reasons:

Regarding claim 7, this claim relate to a method claim without any stating any steps to be made, this claim is practically a preamble of a method claim.

Regarding claim 32, this claim relate to a tool of aiding the installation of a roof apparatus, however description is too vague in the matter of how the tool interface with the roof apparatus, to allow a meaningful search to be conducted.

Regarding claim 58, this omnibus claim is too broad and vague to be given a "definite construction" in the sense of PCT GL clause 16.30.