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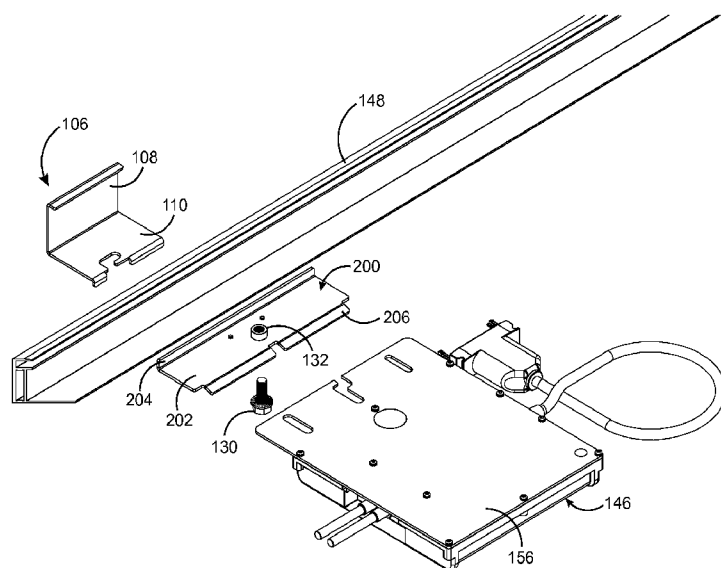


FIG. 9A

(57) **Abstract:** A bracket assembly for mounting a plurality of photovoltaic (PV) accessories, the bracket assembly comprises a first bracket and a second bracket. The first bracket comprises a first clamp member and a second clamp member attached by means of a tightening means. The first clamp member includes a first plate and a second plate with an opening having a pair of first flanges being attached to form an angle therebetween. The second clamp member includes a clamp plate with a slot and a pair of second flanges. The second bracket comprises an attachment structure having a pair of outer channels with a structural member connected therebetween and a middle channel attached and positioned at a lower plane with the structural member, a pair of arms and a plurality of flanges attached to a distal end of the pair of outer channels, the middle channel and the pair of arms.

PHOTOVOLTAIC MODULE ACCESSORY CLAMP

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BACKGROUND OF THE DISCLOSURE**TECHNICAL FIELD OF THE DISCLOSURE**

10 [0001] The present embodiment relates in general to bracket assemblies. More specifically, the present disclosure relates to a bracket assembly for mounting solar panel accessories to a photovoltaic (PV) system and a method for mounting the bracket assembly.

DESCRIPTION OF THE RELATED ART

15 [0002] Solar photovoltaic (PV) systems require installation of some type of solar accessories to control the flow of energy within the system. In the most common PV systems, the PV array is connected directly to a micro inverter that converts the DC energy produced by the PV array into AC energy that is directly connected to an electric utility. These inverters are typically connected to a single PV module via connecting
20 wires and junction boxes that convert the module's DC power directly into AC. These inverters are connected together to parallel the AC output. With the increased use of photovoltaic (PV) systems, bracket assemblies that will attach the solar accessories like micro-inverters, connecting wires, junction boxes etc. with the solar panel or rails have been developed. In recent years, various kinds of bracket assemblies are in use which
25 provide for the installation of solar accessories with the rail of the PV module. Bracket assemblies come in a variety of sizes and patterns to meet installation purposes. However, most of the bracket assemblies penetrate through the rail or the PV module and can damage the expensive module which reduces the overall efficiency of the PV system.

30 [0003] Conventional bracket assemblies for attaching PV module accessories with the rail have considerable drawbacks. For example, many bracket assemblies utilize screws, bolts, washers, and nuts to secure the PV accessories with the rail/module by

inserting these bracket assemblies through the pre-drilled holes on the rail/module. Such bracket assemblies are difficult to use and can require additional manpower to install. Also, such devices penetrate through the rail/module and can cause damage to the rail/module, decreasing the overall efficiency of the PV system. The wires must be
5 secured to the rail and free from potential damage. The traditional bracket assemblies can abrade the wires against the roof surface, leading to potential faults. In areas of high snow and ice events, loose wiring can get pulled, damaging connection points and module junction boxes.

[0004] One of the existing bracket assemblies comprises a first bracket part with
10 a first spherical surface, a second bracket part with a second spherical surface and a fastening element for fastening the first bracket part movably to the second bracket part. The second bracket part comprises a groove and the fastening element is at least partly placed in the groove. However, this bracket due to its spherical geometry can be employed solely for holding spherical or circular objects. Further, this bracket cannot
15 directly attach/clip the PV accessories with the rail of the photovoltaic system and requires a fastening element.

[0005] Another existing bracket assembly discloses a support member that includes a plurality of support joists and support rails braced at an incline. Each support rail is tubular and generally rectangular, having a lower wall section with a T-slot channel
20 for acceptance of the head of a bolt for adjustable attachment with the support joist. Also, the support rail may have a C-slot channel for retaining electrical wires. Clips are used to secure each panel to upper wall portions of the underlying support rails. Each clip has a generally U-shaped gasket and is connected to a corresponding support rail through a threaded hole in the top wall of the support rail that receives a bolt or similar threaded
25 fastener. Even though this support member can secure each panel to upper wall portions of underlying support rails, it cannot be utilized for holding the accessories of the PV system.

[0006] Various other bracket assemblies currently available are impossible to retrofit and snap firmly to existing rails without penetrating the modules. One bracket
30 assembly provides an electronics module docking system having a docking member removably coupled to a photovoltaic module. The docking system includes a housing to enclose an electronics module. The power electronics module and the photovoltaic cells

are electrically coupled to one another upon selective engagement of the connector ports. However, the process of attaching the electronics module to the photovoltaic module is difficult and requires a corner mounting which can result in re-work, increasing labor and material costs.

5 [0007] Therefore, there is a need for a bracket assembly that provides a bracket to attach solar accessories with the rail of the PV module. Such a bracket assembly would provide an efficient means of installation that does not penetrate through the solar module or the rail of the PV module. Such a bracket assembly would be capable of holding various PV accessories such as inverters, inverter trunk cable connectors etc. Such a
10 needed device would provide a forked connection that separates via leverage as it slides over the PV module or the rail resulting in a squeezing grip. Such a bracket assembly would be designed for installation without the need for additional hardware and corner support. This bracket assembly would also provide wire management resulting in less abrasion of the wires against the roof surfaces thereby eliminating potential faults. This
15 bracket assembly would directly attach to the solar module without penetrating it, thereby increasing the efficiency of the PV module. Finally, such a needed bracket assembly would simply wrap around a module frame with the capability to hold a variety of PV accessories.

20 SUMMARY OF THE DISCLOSURE

[0008] To minimize the limitations found in the prior art, and to minimize other limitations that will be apparent upon the reading of the specifications, preferred embodiment of the present invention provides a bracket assembly for mounting a plurality of photovoltaic (PV) accessories to a photovoltaic (PV) system, and a method for mounting the bracket assembly. The bracket assembly comprises a first bracket and a second bracket that attach the plurality of photovoltaic (PV) accessories with the PV system without penetrating through the rail/module.

[0009] The first bracket comprises a first clamp member, a second clamp member and a tightening means. The first clamp member includes a first plate, a second plate with an opening and a pair of first flanges. The first plate and the second plate are attached to form an angle therebetween. Each of the pair of first flanges is attached to an outer end of the first plate and the second plate. The second clamp member includes a

clamp plate having a slot and a pair of second flanges with each of the pair of second flanges being attached to a pair of opposite edges of the clamp plate. The tightening means is adaptable to slide through the opening on the second plate and the slot on the clamp plate and tightened to form the first bracket.

5 **[00010]** The second bracket comprises an attachment structure, a pair of arms and a plurality of flanges. The attachment structure has a pair of outer channels with a structural member connected therebetween and a middle channel attached and positioned at a lower plane with respect to the structural member. The pair of arms is attached to the attachment structure for holding the solar panel accessories. The plurality
10 of flanges is attached to a distal end of the pair of outer channels and the middle channel to snap firmly with the rail and the plurality of flanges on the pair to hold the PV accessory firmly.

[00011] A first objective of the present invention is to provide a bracket assembly that mounts a plurality of PV accessories to the PV system without penetrating the
15 rail/module.

[00012] A second objective of the present invention is to provide an efficient mounting means that does not require any additional material or corner mount for attaching the plurality of PV accessories to the PV module.

[00013] A third objective of the present invention is to provide a bracket
20 assembly that can be directly mounted on the rail/module of the PV system.

[00014] A fourth objective of the present invention is to provide a forked connection that separates via leverage as it slides over the PV module/rail resulting in a squeezing grip

[00015] Another objective of the present invention is to provide wire management
25 resulting in less abrasion of the wires against the roof surfaces thereby eliminating potential faults.

[00016] Yet another objective of the present invention is to provide a bracket assembly that simply wrap around a module frame with the capability to hold a variety of PV accessories.

30 **[00017]** These and other advantages and features of the present invention are described with specificity so as to make the present invention understandable to one of ordinary skill in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[00018] Elements in the figures have not necessarily been drawn to scale in order to enhance their clarity and improve understanding of these various elements and
5 embodiments of the invention. Furthermore, elements that are known to be common and well understood to those in the industry are not depicted in order to provide a clear view of the various embodiments of the invention, thus the drawings are generalized in form in the interest of clarity and conciseness.

[00019] FIG. 1 illustrates a perspective view of a first bracket utilized for
10 mounting a plurality of photovoltaic (PV) accessories to a rail of a photovoltaic (PV) module in accordance with the preferred embodiment of the present invention;

[00020] FIG. 2 illustrates an exploded view of the first bracket in accordance with the preferred embodiment of the present invention;

[00021] FIG. 3A illustrates a perspective view of a first clamp member of the
15 first bracket in accordance with the preferred embodiment of the present invention;

[00022] FIG. 3B illustrates a perspective view of a second clamp member of the first bracket in accordance with the preferred embodiment of the present invention;

[00023] FIG. 3C illustrates a perspective view of the second clamp member of the first bracket in accordance with one embodiment of the present invention;

20 [00024] FIG. 3D illustrates a rear perspective view of a first clamp member of the first bracket in accordance with one embodiment of the present invention;

[00025] FIG. 3E illustrates a front perspective view of the first clamp member of the first bracket in accordance with one embodiment of the present invention;

[00026] FIG. 4 illustrates a perspective view of a second bracket employed for
25 mounting the plurality of photovoltaic (PV) accessories to the rail/module of a photovoltaic (PV) system in accordance with the preferred embodiment of the present invention;

[00027] FIG. 5 illustrates a perspective view of the second bracket in accordance with one embodiment of the present invention;

30 [00028] FIGS. 6A-6B illustrate perspective views of the first bracket utilized for mounting the photovoltaic (PV) accessory such as a micro-inverter to the rail/module of

the photovoltaic (PV) system in accordance with the preferred embodiment of the present invention in use;

[00029] FIG. 7 illustrates a perspective view of the second bracket mounting the photovoltaic (PV) accessory to the rail of the photovoltaic (PV) module in accordance with the preferred embodiment of the present invention;

[00030] FIG. 8 illustrates a perspective view of the second bracket mounting the photovoltaic (PV) accessory to the rail of the photovoltaic (PV) module in accordance with one embodiment of the present invention;

[00031] FIGS. 9A-9B illustrate a perspective view of the first bracket utilized for mounting the plurality of photovoltaic (PV) accessories to the rail of the photovoltaic (PV) module in accordance with one embodiment of the present invention in use; and

[00032] FIG. 10 illustrates a perspective view of a first bracket having a second clamp member integrated with the photovoltaic (PV) accessory as a single piece in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[00033] In the following discussion that addresses a number of embodiments and applications of the present invention, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and changes may be made without departing from the scope of the present invention.

[00034] Various inventive features are described below that can each be used independently of one another or in combination with other features. However, any single inventive feature may not address any of the problems discussed above or only address one of the problems discussed above. Further, one or more of the problems discussed above may not be fully addressed by any of the features described below.

[00035] The present invention provides a bracket assembly 102, 104 and a method for mounting a plurality of photovoltaic (PV) accessories to a photovoltaic (PV) system. The bracket assembly 102, 104 may be mounted in a generally horizontal orientation, or in other orientations, such as a generally vertical orientation. Examples of the plurality of photovoltaic (PV) accessories include micro-inverters, wire management

for micro-inverters, junction boxes, security devices and the like. The bracket assembly **102, 104** can be mounted on a rail/module of the PV system without penetrating through it. The bracket assembly **102, 104** comprises a first bracket **102** and a second bracket **104** that snaps easily with the rail **148** of a PV module **602** (see **FIG. 6A**).

5 **[00036]** Turning to **FIGS. 1** and **2**, a perspective view and an exploded view of the first bracket **102** in accordance with the preferred embodiment of the present invention is illustrated. The first bracket **102** comprises a first clamp member **106**, a second clamp member **118** and a tightening means **128** for attaching the first clamp member **106** and the second clamp member **118** to the rail **148** along with a PV accessory
10 **146** (see **FIG. 6B**). The first clamp member **106** includes a first plate **108**, a second plate **110** having an opening **112** and a pair of first flanges **114**. The first plate **108** and the second plate **110** are attached to form an angle therebetween. Each of the pair of first flanges **114** is attached to an outer end **116** of the first plate **108** and the second plate **110**. The second clamp member **118** includes a clamp plate **120** having a slot **122** and a pair of
15 second flanges **124** with each of the pair of second flanges **124** being attached to a pair of opposite edges **126** of the clamp plate **120**. The tightening means **128** is a screw **130** and a nut **132**. Typically, the tightening means **128** is a serrated flange cap screw made of special stainless steel to provide high corrosion resistance. For example, the screw **130** has a 5/16 inch nominal diameter with 24 UNF-2A threads. The tightening means **128** is
20 adaptable to slide through the opening **112** on the second plate **110** and the slot **122** on the clamp plate **120** and tightened to form the first bracket **102**. A plurality of grounding pins **150** is present on the second clamp member **118**. The PV accessory **146** is placed between the first clamp member **106** and the second clamp member **118** and tightened with the tightening means **128** to the rail **148** of the PV module **602** (see **FIG. 6A**).

25 **[00037]** Referring to **FIGS. 3A-3C**, the first clamp member **106** of the first bracket **102** is illustrated in **FIG. 3A**. The first clamp member **106** is positioned and held firmly around the rail **148** of the PV module **602** (see **FIG. 6A**) by the pair of first flanges **114**. The pair of first flanges **114** and the angular geometry of the first clamp member **106** enable it to fix firmly with the rail **148**. The second clamp member **118** as
30 illustrated in **FIG. 3B** is positioned over the first clamp member **106** in such a way that the opening **112** on the second plate **110** coincides with the slot **122** on the clamp plate **120**. The first clamp member **106** and the second clamp member **118** are held by the

tightening means **128** (see **FIG. 2**). **FIG. 3C** illustrates one embodiment of a second clamp member **200** having a clamp plate **202** with a first flange **204** attached perpendicular with the clamp plate **202** and a second flange **206** attached in the same plane with the clamp plate **202**. The clamp plate **202** has an opening **208** that coincides with the slot **122** on the clamp plate **120** of the first clamp member **106** through which the tightening means **128** (see **FIG. 2**) is inserted to hold the PV accessory. The method of attaching various accessories remains the same whereas the selection of various embodiments of the second clamp member **118** depends on the accessory to be held.

[00038] Referring to **FIGS. 3D** and **3E**, a rear perspective view and a front perspective view of a first clamp member **400** in accordance with one embodiment of the present invention are illustrated respectively. The first clamp member **400** includes a first plate **402**, a second plate **404** having an opening **406**, a pair of first flanges **408** and a plurality of ribs **410**. The first plate **402** and the second plate **404** are attached to form an angle therebetween. Each of the plurality of ribs **410** includes a cavity **412** and a protrusion **414** that provides structural support. The plurality of ribs **410** run from the first plate **402** to the second plate **404** to provide additional structural support. Each of the pair of first flanges **408** is attached to the first plate **402** and the second plate **404**.

[00039] **FIG. 4** illustrates a perspective view of a second bracket **104** in accordance with the preferred embodiment of the present invention. The second bracket **104** for holding the PV accessory **146** comprises an attachment structure **134**, a pair of arms **142** and a plurality of flanges **144**. Preferably, the second bracket **104** can be utilized for holding PV accessories such as trunk cable connectors and the like. The attachment structure **134** has a pair of outer channels **136** with a structural member **138** connected therebetween and a middle channel **140** attached and positioned at a lower plane with respect to the structural member **138**. The pair of arms **142** is attached to the attachment structure **134** for holding the solar panel accessories. The plurality of flanges **144** is attached to a distal end **152** of the pair of outer channels **136** and the middle channel **140** to snap firmly with the rail **148**. The plurality of flanges **144** on the pair of arms **142** holds the PV accessory **146** firmly.

[00040] **FIG. 5** illustrates a perspective view of one embodiment of a second bracket **300** in accordance with of the present invention. The second bracket **300** comprises an attachment structure **302**, a holding structure **310** and a pair of arms **316**

for holding the PV accessory 146. The attachment structure 302 includes a pair of outer channels 304 with a structural member 306 connected therebetween and a middle channel 308 attached and positioned at a lower plane with the structural member 306. A plurality of flanges 318 is attached to a distal end 320 of the pair of outer channels 304 and the middle channel 308 so as to snap firmly with the rail 148 of the PV module 602 (see FIG. 6A). The holding structure 310 has a first holding member 312 and a second holding member 314 attached to form an angle therebetween. The first holding member 312 is attached with the structural member 302 and the second holding member 314 is attached with the pair of arms 316. The PV accessory 146 is positioned between the holding structure 310 and the pair of arms 316.

[00041] Referring to FIGS. 6A-6B, the first bracket 102 utilized for mounting the photovoltaic (PV) accessory 146, for example, a micro-inverter 156 to the rail 148 of the photovoltaic (PV) module 602 in accordance with the preferred embodiment of the present invention is illustrated. The method for mounting the PV accessory 146 to the rail 148 utilizing the first bracket 102 includes positioning the second clamp member 118 of the first bracket 102 and the PV accessory 146 such that the slot 122 on the clamp plate 120 and an opening on the PV accessory 146 coincide. Insert the tightening means 128 through the slot 122 on the clamp plate 120. Positioning the first clamp member 106 over the rails 148 of the PV module 602 and aligning the second clamp member 118 such that the tightening means 128 engages with the opening 112 on the second plate 110. Tightening the tightening means 128 so that the first bracket 102 snaps to the rail 148 and holds the PV accessory 146 firmly is illustrated in FIG. 6B. The first bracket 102 allows clipping around and locking the plurality of accessories 146 with the rail 148 without penetrating.

[00042] In FIG. 7, the photovoltaic (PV) accessory 146 mounted to the rail 148 of the photovoltaic (PV) module 602 (see FIG. 6A) utilizing the second bracket 104 in accordance with the preferred embodiment of the present invention is illustrated. The method includes positioning the PV accessory between the pair of arms 142 of the second bracket 104 and snapping the attachment structure 134 (see FIG. 4) to the rail 148 of the PV module 602 (see FIG. 6A) such that the pair of outer channels 136 and the middle channel 140 separates via leverage as it slides over and fix firmly with the rail 148 of the PV module 602 (see FIG. 6A).

[00043] FIG. 8 illustrates one embodiment of the second bracket 300 utilized for mounting the photovoltaic (PV) accessory 146. The photovoltaic (PV) accessory 146 is positioned on the holding structure 310 as illustrated in FIG. 8. The first holding member 312 and the second holding member 314 form an angle therebetween and
5 secure the PV accessory along with the pair of arms 316.

[00044] Referring to FIGS. 9A-9B, a perspective view of one embodiment of the first bracket in accordance with of the present invention in use is illustrated. In this embodiment of the present invention, the second clamp member 200 has a clamp plate 202 with a first flange 204 attached perpendicular with the clamp plate 202 and a second
10 flange attached in the same plane with the clamp plate 202. The PV accessory 146 is positioned between the second clamp member 200 and the first clamp member 106 and attached to the rail 148 by tightening the tightening means 128.

[00045] FIG. 10 illustrates a perspective view of a first bracket 500 having a second clamp member 504 integrated with the photovoltaic (PV) accessory 506 as a
15 single piece in accordance with one embodiment of the present invention. In this embodiment, the second clamp member 504 and the photovoltaic (PV) accessory 506 are fused together to form a single piece. The photovoltaic (PV) accessory 506 includes a micro-inverter 508 which is fused with the second clamp member 504 as illustrated in FIG. 10. The first clamp member 502 is positioned and held around the rail 148. The
20 single piece second clamp member 504 with the photovoltaic (PV) accessory 506 is attached to the rail 148 by means of the tightening means 510.

[00046] The present invention is preferably positioned under the solar panel and allows for easy connection of various PV accessories such as micro inverters, wire management for micro inverters, trunk cable connectors, junction boxes, security devices,
25 fire repression equipment etc. The presently disclosed bracket assembly 102, 104 is advantageous as it allows the clipping of the PV accessory 146 directly to the side of the module/rail and does not penetrate through them. The present invention is preferably made from an alloy of aluminum and more particularly from 5052-H32 aluminum. The pair of outer channels 136 and the middle channel 140 forms a forked connection that
30 separates via leverage as it slides over the rail 148 of the PV module 602 (see FIG. 6A) and snaps into place without any corner support. The bracket assembly 102, 104 can be squeezed into the rail 148 to grip the PV accessory 146 without utilizing any additional

hardware. The bracket assembly **102, 104** can be simply wrapped around the rail **148** with or without the tightening means **128** and is available in different sizes for the variety of solar panel frame thickness.

[00047] The foregoing description of the preferred embodiment of the present
5 invention has been presented for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teachings. It is intended that the scope of the present invention not be limited by this detailed description, but by the claims and the equivalents to the claims appended hereto.

10

WHAT IS CLAIMED IS:

1. A bracket assembly for mounting a plurality of photovoltaic (PV) accessories to a photovoltaic (PV) system, the bracket assembly comprising:

5 a first bracket for attaching a PV accessory to a rail of the photovoltaic (PV) module, the first bracket comprising:

a first clamp member having a first plate, a second plate with an opening and a pair of first flanges, the first plate and the second plate being attached to form an angle therebetween;

10 a second clamp member having a clamp plate with a slot and a pair of second flanges, each of the pair of second flanges being attached to a pair of opposite edges of the clamp plate; and

a tightening means for attaching the first clamp member and the second clamp member to the rail along with the PV accessory, the tightening means
15 being adaptable to slide through the opening on the second plate and the slot on the clamp plate; and

a second bracket for holding a PV accessory, the second bracket comprising:

an attachment structure having a pair of outer channels with a
20 structural member connected therebetween and a middle channel attached and positioned at a lower plane with the structural member;

a pair of arms attached to the attachment structure for holding the solar panel accessories; and

a plurality of flanges attached to a distal end of the pair of outer
25 channels, the middle channel and the pair of arms;

whereby the first bracket and the second bracket snap firmly with the rail of the PV module and hold the PV accessory without penetrating through the rail or the solar module of the PV system.

30 2. The bracket assembly of claim 1 wherein each of the pair of first flanges is attached to an outer end of the first plate and the second plate.

3. The bracket assembly of claim 1 wherein the pair of first flanges, the pair of second flanges and the plurality of flanges are adapted to snap firmly with the edges of the rail of the PV module.
- 5 4. The bracket assembly of claim 1 wherein the second clamp member includes a plurality of grounding pins.
5. The bracket assembly of claim 1 wherein the second clamp member is adaptable to be integral with the PV accessory.
- 10 6. The bracket assembly of claim 1 wherein the middle channel is attached to the structural member at a lower plane with the pair of outer channels to snap easily with the rail of the PV module.
- 15 7. The bracket assembly of claim 1 wherein the tightening means includes a screw and a nut.
8. The bracket assembly of claim 6 wherein the screw is slid through the opening on the second clamp plate and the slot on the clamp plate and tightened with the nut to
20 form the first bracket.
9. The bracket assembly of claim 1 wherein the pair of arms are designed to hold the PV accessory firmly.
- 25 10. The bracket assembly of claim 1 wherein the first bracket and the second bracket hold the PV accessory without penetrating through the rail or solar module of the PV system.
11. The bracket assembly of claim 1 is configured to clip to the side of the solar
30 module or the rail of the PV module.

12. A clamping assembly utilized in a photovoltaic (PV) system, the clamping assembly comprising:

a first bracket for holding a photovoltaic (PV) accessories, the first bracket comprising:

5 a first clamp member having a first plate attached to a second plate having an opening, the first plate and the second plate being attached to form an angle therebetween with a pair of first flanges attached to an outer end of the first plate and the second plate;

a second clamp member having a clamp plate with a slot and a
10 pair of second flanges, each of the pair of second flanges being attached to a pair of opposite edges of the clamp plate; and

a tightening means adaptable to slide through the opening on the second plate and the slot on the clamp plate for attaching the first clamp member, the second clamp member and the PV accessory to the rail of the PV module; and

15 a second bracket for holding the PV accessory, the second bracket comprising:

an attachment structure having a pair of outer channels with a structural member connected therebetween and a middle channel attached and positioned at a lower plane with the structural member;

20 a pair of arms attached to the attachment structure for holding the solar panel accessories; and

a plurality of flanges attached to a distal end of the pair of outer channels, the middle channel and the pair of arms;

whereby the first bracket and the second bracket holds the PV accessory
25 firmly without penetrating through the rail or the solar module of the PV system.

13. The clamping assembly of claim 12 goes under the solar panel and allows for the easy connection of the PV accessory.

30 14. The clamping assembly of claim 12 is configured to clip to the side of the solar module and not penetrate the solar module.

15. The clamping assembly of claim 12 is configured to clip around and lock with the rail without penetrating the rail.

16. The clamping assembly of claim 12 wherein the second clamp member is
5 adaptable to be integral with the PV accessory.

17. The clamping assembly of claim 12 wherein the tightening means includes a screw and a nut.

10 18. The clamping assembly of claim 17 wherein the screw is a cap screw.

19. The clamping assembly of claim 17 wherein the nut is a self-clinching nut.

15 20. The clamping assembly of claim 12 wherein the pair of outer channels and the middle channel separates via leverage as it slides over and snaps easily with the rail of the PV module.

21. A method for mounting a photovoltaic (PV) accessory to a PV system comprising the steps of:

- 20 a) providing a bracket assembly comprising a first bracket and a second bracket, the first bracket comprises a first clamp member having a first plate, a second plate with an opening and a pair of first flanges; a second clamp member having a clamp plate with a slot and a pair of second flanges and a tightening means for attaching the first clamp member and the second clamp member to the rail along with the PV
25 accessory; and the second bracket comprises an attachment structure with a pair of outer channels with a structural member connected therebetween and a middle channel attached and positioned at a lower plane with the structural member; a pair of arms attached to the attachment structure and a plurality of flanges attached to a distal end of the pair of outer channels, the middle channel and the pair of arms;
- 30 b) positioning the second clamp member of the first bracket and the PV accessory such that the slot on the clamp plate and an opening on the PV accessory coincide;

- c) inserting the tightening means through the slot on the clamp plate;
 - d) positioning the first clamp member over the rails of the PV module and aligning the second clamp member such that the tightening means engages with the opening on the second plate;
 - 5 e) tightening the tightening means so that the second clamp member, the PV accessory and the first clamp member snap firmly to the rail of the PV module;
 - f) positioning the PV accessory between the pair of arms of the second bracket; and
 - g) snapping the attachment structure to the rail of the PV module
 - 10 such that the pair of outer channels and the middle channel fix firmly with the rail of the PV module;
- whereby the first bracket and the second bracket hold the PV accessory firmly without penetrating through the rail or the solar module of the PV system.
- 15 22. The method of claim 21 wherein the tightening means includes a screw and a nut.
23. The method of claim 21 wherein the pair of outer channels and the middle channel separates via leverage as it slides over and snaps easily with the rail of the PV
- 20 module.
24. The method of claim 21 allows clipping around and locking the plurality of accessories with the rail without penetrating.
- 25 25. The method of claim 21 wherein the pair of first flanges, the pair of second flanges and the plurality of flanges are adapted to snap firmly with the edges of the rail of the PV module.

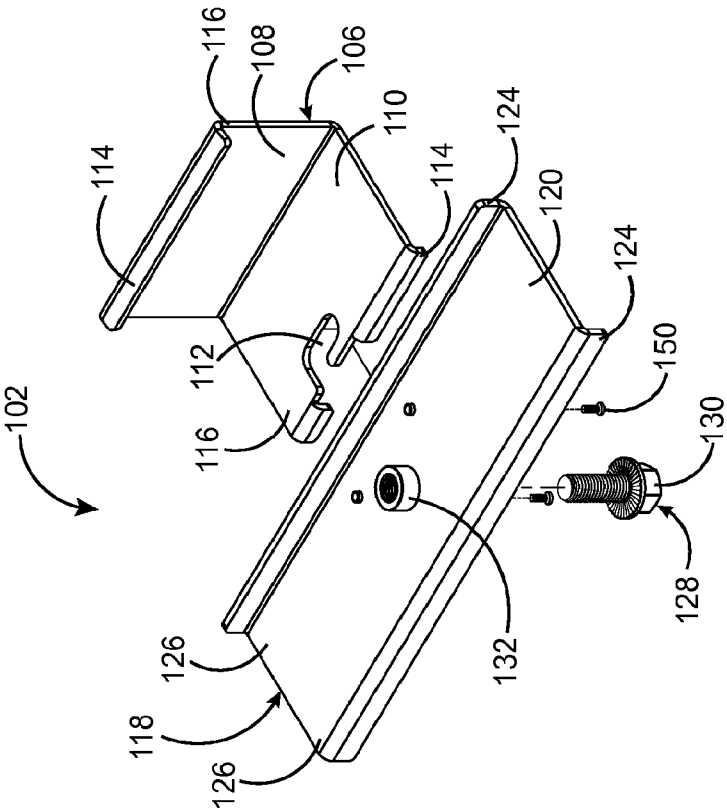


FIG. 1

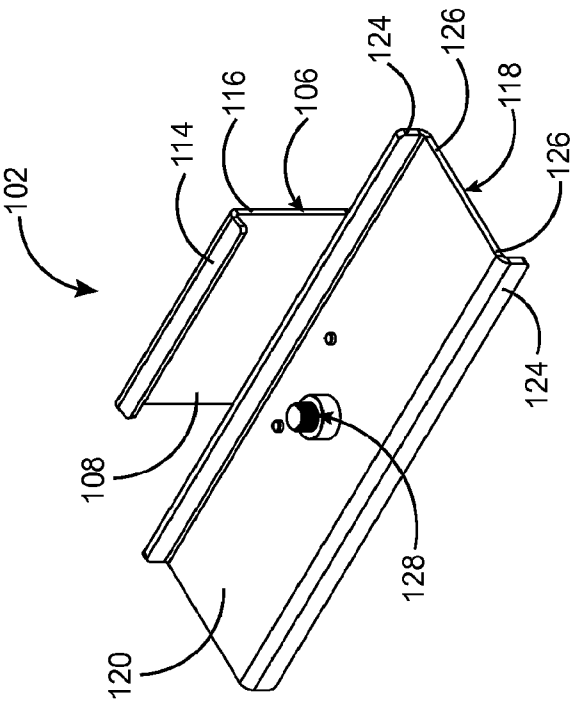


FIG. 2

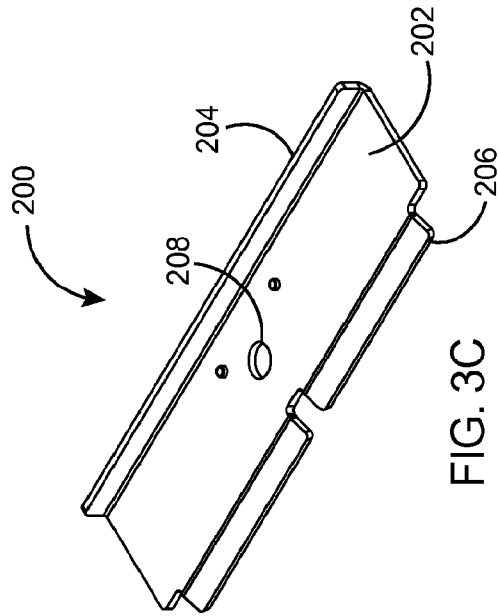


FIG. 3C

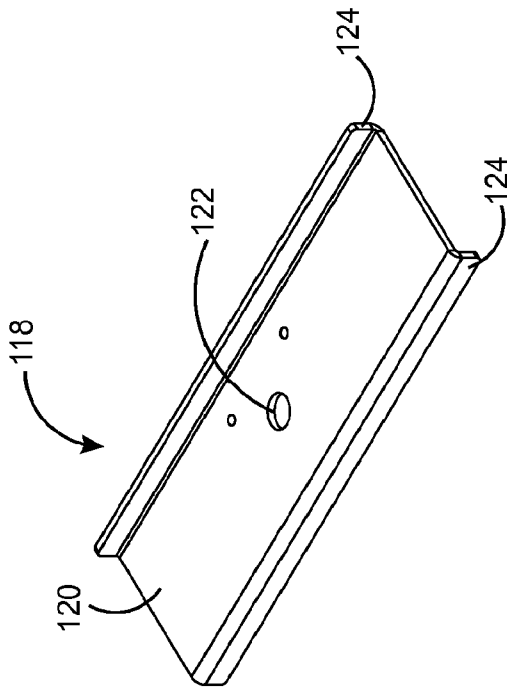


FIG. 3B

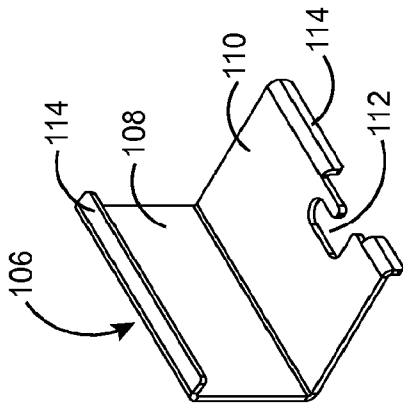


FIG. 3A

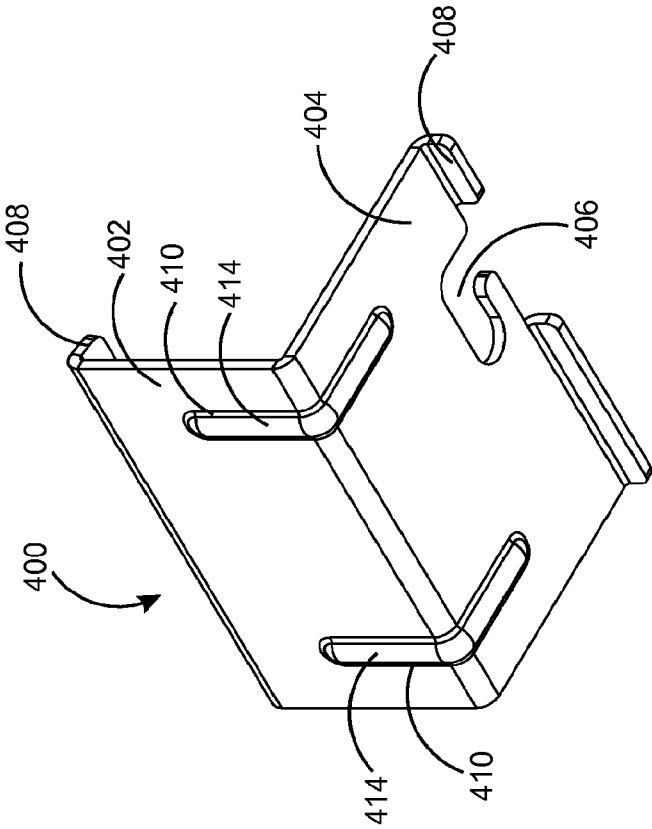


FIG. 3D

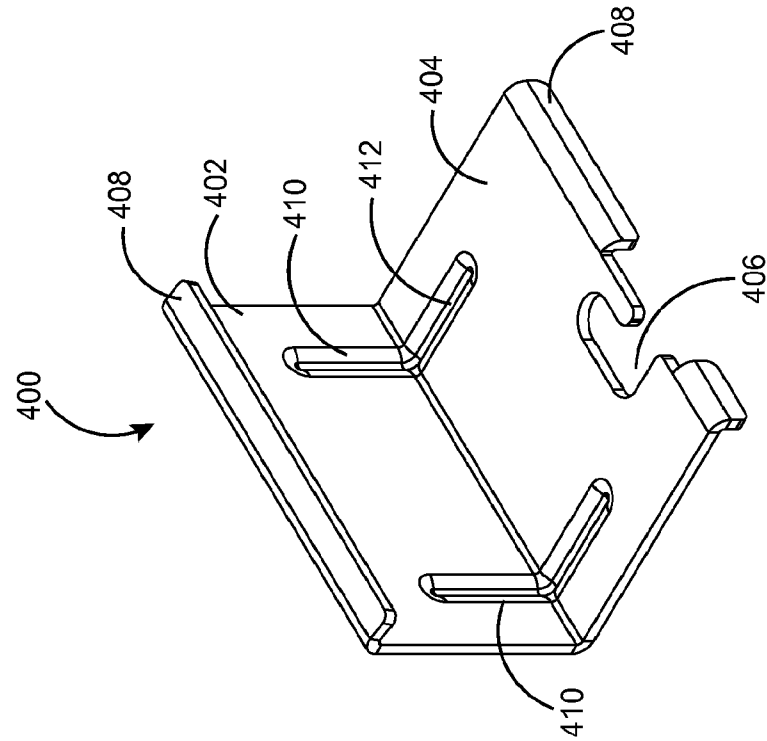
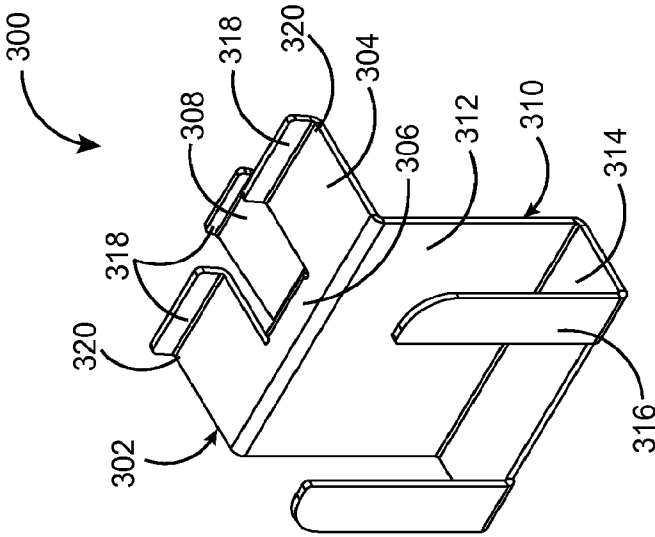
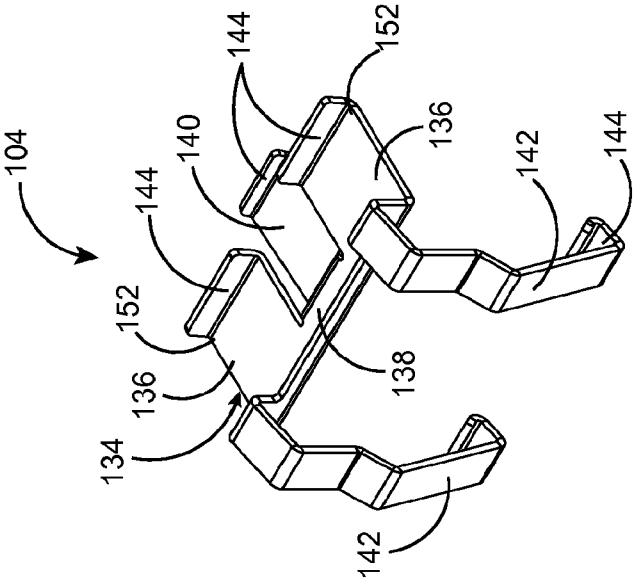


FIG. 3E



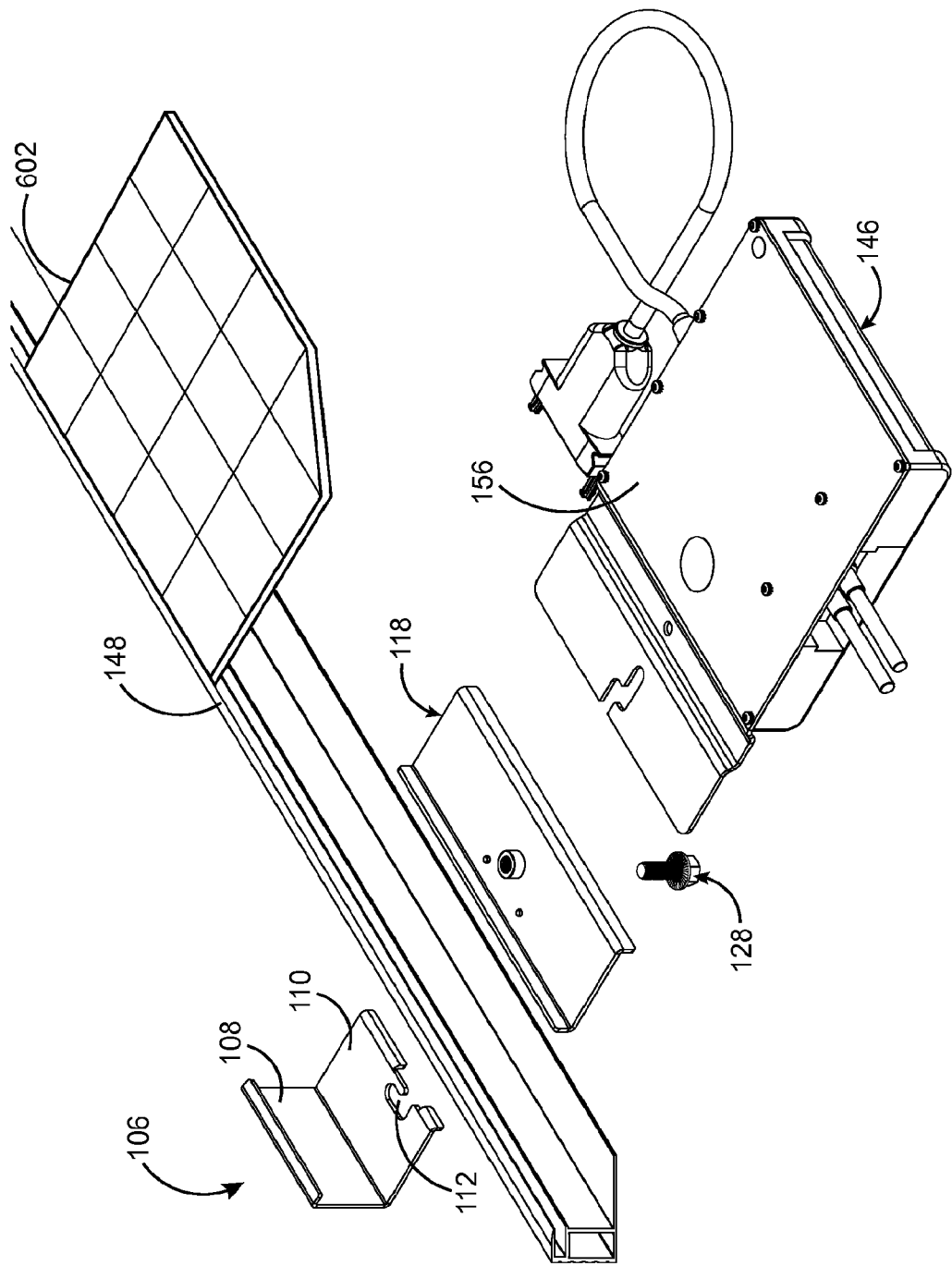


FIG. 6A

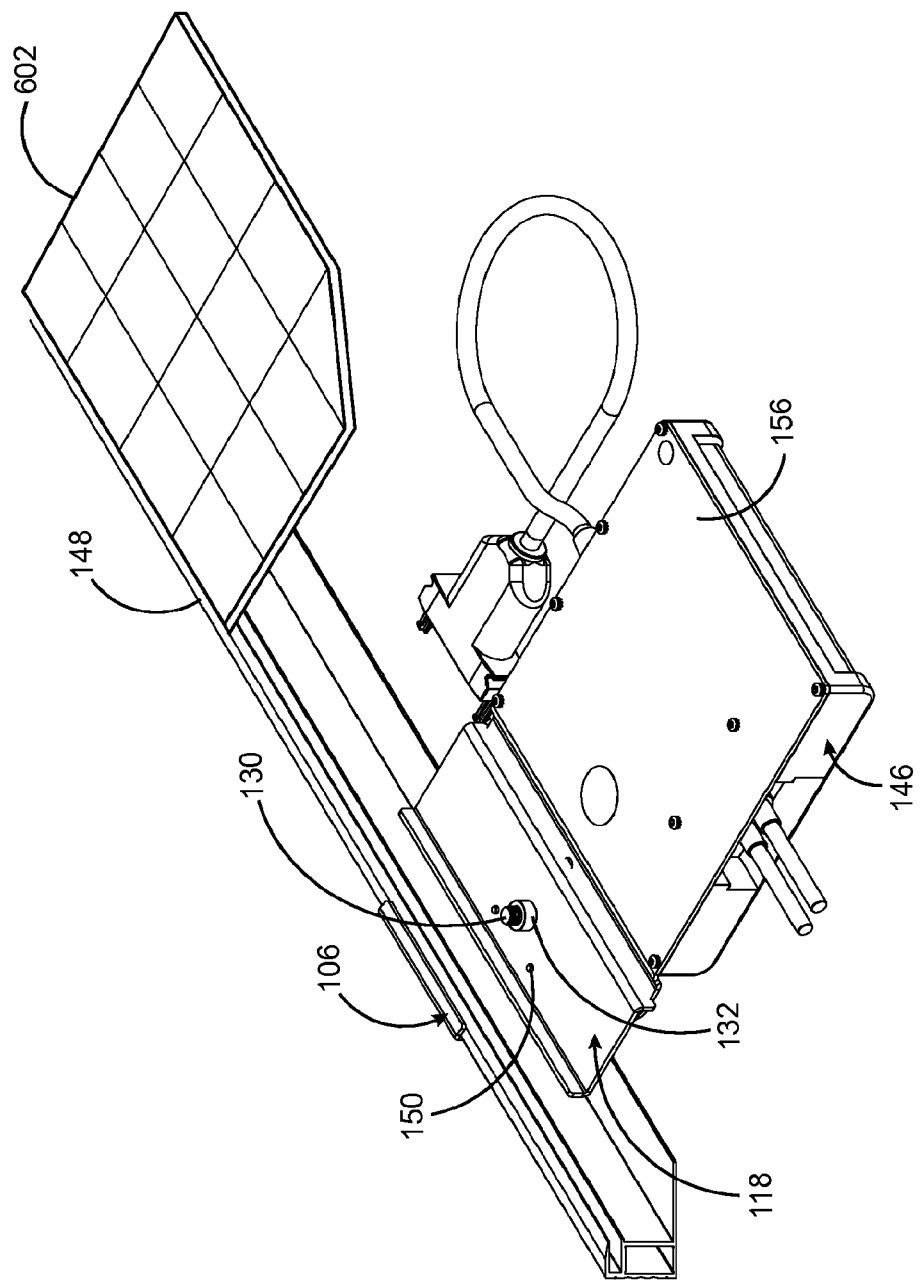
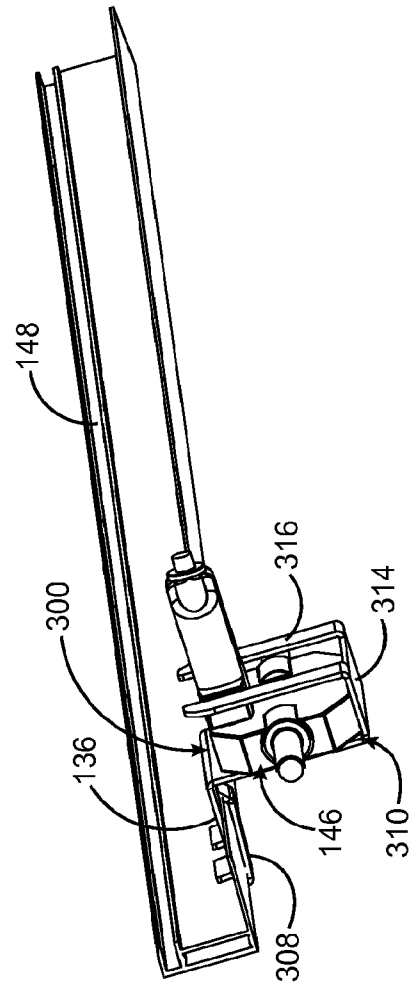
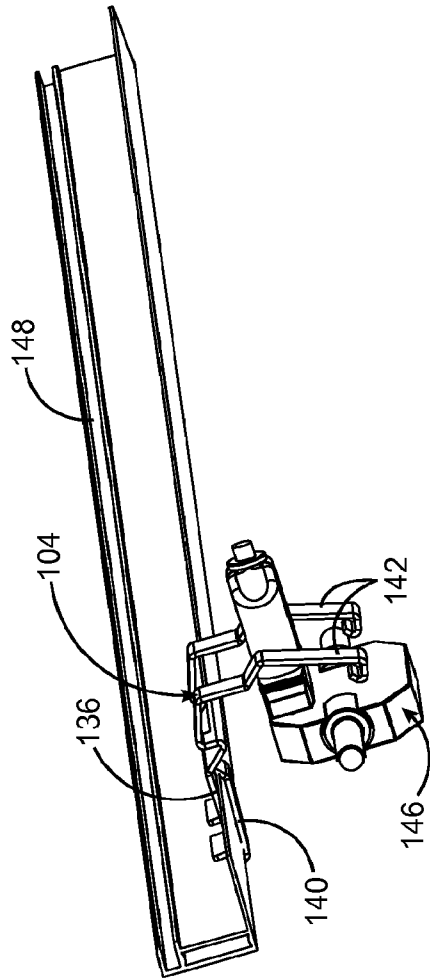


FIG. 6B



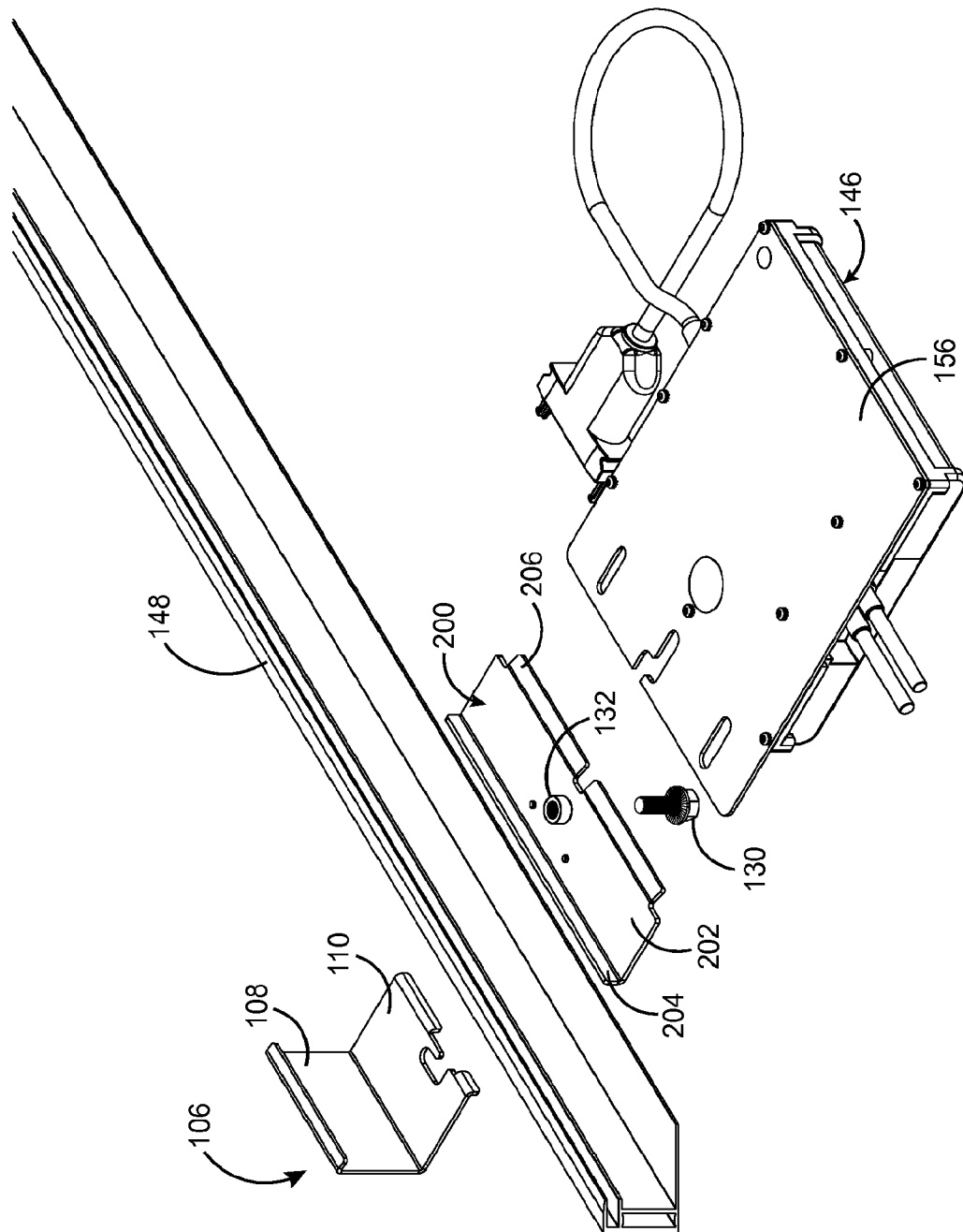


FIG. 9A

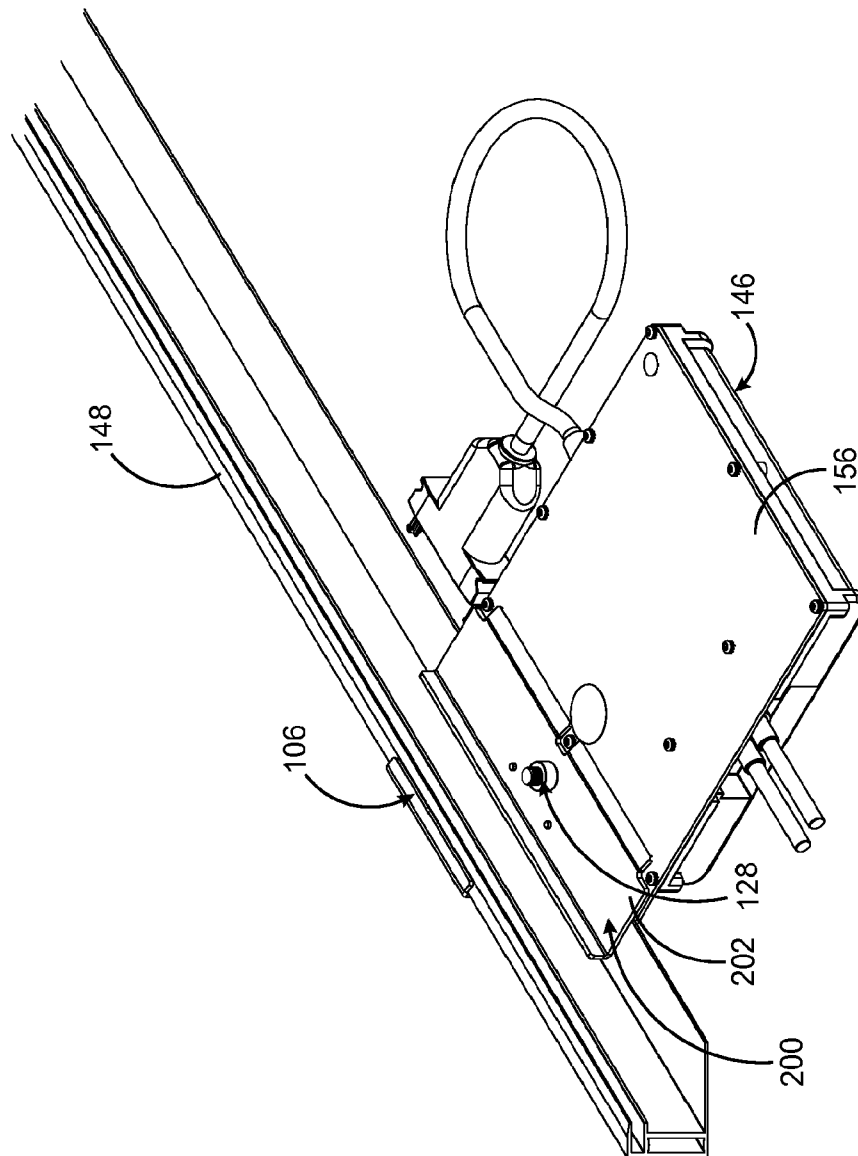


FIG. 9B

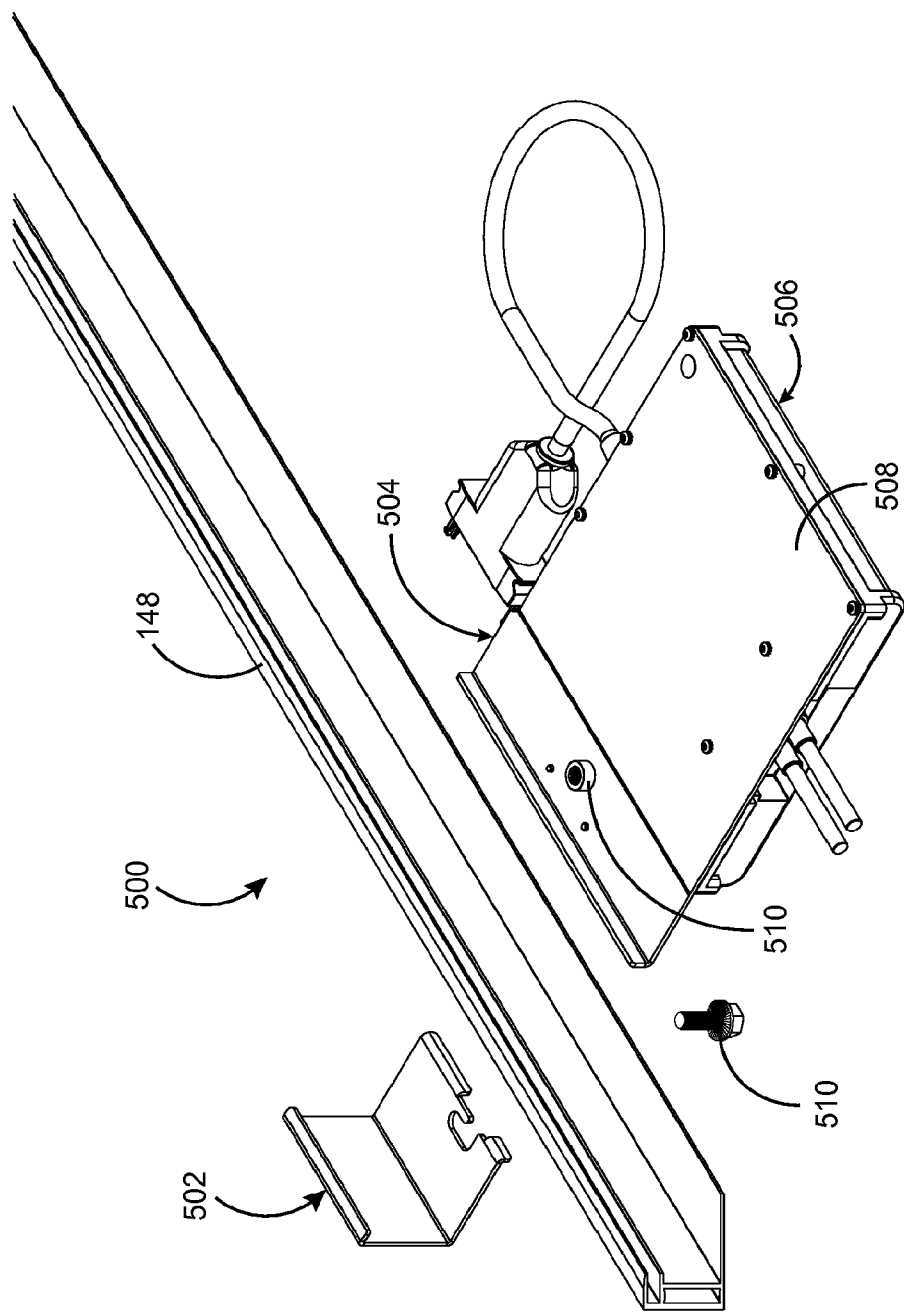


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/047693

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H02S 20/00 (2014.01)

CPC - H02S 20/00 (2014.10)

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(8) - F16B 1/00; F24J 2/00, 2/46, 2/52; H01L 31/042; H02S 20/00 (2014.01)

CPC - F16B 1/00; F24J 2/00, 2/46, 2/52, 2/5201, 2/5203; H01L 31/042; H02S 20/00 (2014.10)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 24/457; 52/173.3; 248/200.1, 201, 214, 220.21, 220.22, 221.11

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Orbit, Google Patents, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/0019116 A1 (CHRISTEN) 28 January 2010 (28.01.2010) entire document	1-25
A	US 2014/0110543 A1 (ALIABADI et al) 24 April 2014 (24.04.2014) entire document	1-25
A	US 2009/0166494 A1 (BARTLET-MUSZYNSKI et al) 02 July 2009 (02.07.2009) entire document	1-25
A	US 2009/0114269 A1 (FLETCHER et al) 07 May 2009 (07.05.2009) entire document	1-25
A	US 8,505,864 B1 (TAYLOR et al) 13 August 2013 (13.08.2013) entire document	1-25

☐ Further documents are listed in the continuation of Box C.

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"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

20 October 2014

Date of mailing of the international search report

13 NOV 2014

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