



(43) International Publication Date
2 August 2012 (02.08.2012)

(10) International Publication Number
WO 2012/103122 A2

- (51) International Patent Classification: Not classified
- (21) International Application Number:
PCT/US2012/022407
- (22) International Filing Date:
24 January 2012 (24.01.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/436,189 25 January 2011 (25.01.2011) US
- (71) Applicant (for all designated States except US): **SOLAR NATION, INC.** [US/US]; 318 Parker Place, Oswego, IL 60543 (US).
- (72) Inventor; and
- (71) Applicant : **TOMASO, Paul, A** [US/US]; 5907 17116 NE Sandy Blvd, Portland, OR 97230 (US).
- (74) Agent: **RIES, Michael**; 318 Parker Place, Oswego, IL 60543 (US).
- (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, 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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

Published:

- without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: ROOF MOUNT BALLAST SOLAR RACKING SYSTEM

(57) Abstract: The present invention is a roof mount ballast solar racking system that includes a plurality of tri-member assemblies that form a plurality of U-shaped channels to receive and hold a plurality of solar panels, a plurality of wind screens attached onto the back of the tri-member assemblies to assist in preventing uplift of the system and the tri-member assemblies during high wind conditions and a plurality of channel connecting components that connect the tri-member assemblies and form a plurality of horizontal rows of the tri-member assemblies. The system also has plurality of heavy duty strut connections that connect the plurality of horizontal rows together, a plurality of ballast trays that are placed between two tri-member assemblies that serve as a ballast and a plurality of fasteners that are utilized to secure one or more components of the system together and to secure the system to the roof.



WO 2012/103122 A2

ROOF MOUNT BALLAST SOLAR RACKING SYSTEM

This application claims priority to U.S. Provisional Application 61/436,189 filed on 01/25/2011, the entire disclosure of which is incorporated by reference.

5

TECHNICAL FIELD & BACKGROUND

The present invention generally relates to a roof mounted racking system. More specifically, the invention is a roof mount ballast solar racking system.

10

It is an object of the invention to provide a roof mount ballast solar racking system that supports a plurality of photovoltaic modules that are installed on a flat roof top utilizing a top down process.

15

It is an object of the invention to provide a roof mount ballast solar racking system that is easy and quick to install without using heavy equipment or cumbersome component attachments.

20

It is an object of the invention to provide a roof mount ballast solar racking system that utilizes relatively light-gauge galvanized sheet metal formed into a plurality of U-shaped channels making the roof mount ballast solar racking system light weight and strong.

What is really needed is a roof mount ballast solar racking system that supports a plurality of photovoltaic modules that are installed on a flat roof top utilizing a top down process that is easy and quick to install without using heavy equipment or a plurality of cumbersome component attachments that utilizes relatively light-gauge galvanized

metal formed into a plurality of U-shaped channels making the roof mount ballast solar racking system light weight and strong.

BRIEF DESCRIPTION OF THE DRAWINGS

5

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawing in which like references denote similar elements, and in which:

Figure 1 illustrates a top perspective view of a roof mount ballast solar racking system, in accordance with one embodiment of the present invention.

10

Figure 2 illustrates an exploded side perspective view of a tri-member assembly of a roof mount ballast solar racking system, in accordance with one embodiment of the present invention.

15

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Various aspects of the illustrative embodiments will be described using terms commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. However, it will be apparent to those skilled in the art that the present invention may be practiced with only some of the described aspects. For purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the illustrative embodiments. However, it will be apparent to one skilled in the art that the present invention may be practiced

20

without the specific details. In other instances, well-known features are omitted or simplified in order not to obscure the illustrative embodiments.

Various operations will be described as multiple discrete operations, in turn, in a manner that is most helpful in understanding the present invention. However, the order of description should not be construed as to imply that these operations are necessarily
5 order dependent. In particular, these operations need not be performed in the order of presentation.

The phrase "in one embodiment" is used repeatedly. The phrase generally does not refer to the same embodiment, however, it may. The terms "comprising", "having"
10 and "including" are synonymous, unless the context dictates otherwise.

Figure 1 illustrates a top perspective view of a roof mount ballast solar racking system 100, in accordance with one embodiment of the present invention.

The system 100 includes a plurality of tri-member assemblies 110, a plurality of wind screens 120, a plurality of channel connecting components 130, a plurality of strut
15 connections 140, a plurality of ballast trays 150 and a plurality of fasteners 160. The plurality of tri-member assemblies 110 forms the framing of each horizontal row 112 of the system 100. The tri-member assemblies 110 form a plurality of U-shaped channels 114 to receive and hold a plurality of solar panels. The wind screens 120 are
20 perpendicularly removably attached onto the horizontal row 112 of the tri-member assemblies 110 to assist in preventing uplift of the system 100 and the tri-member assemblies 110 during high wind conditions. The channel connecting components 130 connect each of the tri-member assemblies 110 together forming the horizontal row 112. The strut connections 140 are relatively heavy duty and connect one horizontal row

112 to another horizontal row 112. The ballast trays 150 are placed between two tri-member assemblies 110 at calculated locations within the system 100. The ballast trays 150 are made from a high molecule weight polymer such as polyethylene that is UV light resistant and serves as a ballast for the system 100. The ballast trays 150 also
5 hold the workers and concrete pavers while they work and secure the horizontal rows 112 of the tri-member assemblies 110 to the roof 105 that the system 100 is being secured to. The ballast trays 150 hook over a plurality of tri-member edges 152 and resist wind uplift. The fasteners 160 are utilized to secure any components of the system 100 together and to secure the system 100 to the roof 105. The fasteners 160
10 can be a plurality of pop rivets 162, a plurality of nuts and bolts 164 or other suitable fastener and are made of stainless steel but can be made of other suitable material. The system 100 and its components that include the plurality of tri-member assemblies 110, the plurality of channel connecting components 130 and the plurality of strut connections 140 are all made of relatively light-gauge galvanized metal but can be
15 made from any other suitable material as well.

Figure 2 illustrates an exploded side perspective view of a tri-member assembly 200 of a roof mount ballast solar racking system, in accordance with one embodiment of the present invention. The tri-member assembly 200 illustrated in Figure 2 is similar to the tri-member assembly 110 illustrated in and described in Figure 1 and its description.

20 The tri-member assembly 200 includes a tri-member top 210, a tri-member bottom 220, a tri-member back 230 and a front bracket 240. The tri-member top 210 is an inverted linear track 212 with a proximal end 214 and a distal end 216 that forms an adjustable top portion 218 of the tri-member assembly 200. One or more panel clamp

brackets 211 are attached to the tri-member top 210 with a plurality of press nut inserts 213. The tri-member bottom 220 is an elongated linear track 222 with a proximal end 224 and a distal end 226 that forms a bottom 228 of the tri-member assembly 200. The tri-member bottom 220 includes a bridge bracket 221 to self-align and assemble the tri-member assembly 200 and is attached to the tri-member bottom 220 with a press nut 223. The tri-member bottom 220 also includes a plurality of obround apertures 225 to allow for water drainage within the tri-member bottom 220. The tri-member back 230 adjustably attaches the distal end 226 of the tri-member bottom 220 to the distal end 216 of the tri-member top 210 to raise the tri-member top 210. The tri-member top 210 is raised at a plurality of deflection angles to determine an optimal installation angle to reduce wind loads exerted on the tri-member assembly 200. The tri-member back 230 also includes a back bracket 232 to provide additional support and strength to the tri-member back 230. The tri-member back 230 can also receive a windscreen (Figure 1, 120) that can be attached to the tri-member back 230. The front bracket 240 pivotally attaches the proximal end 224 of the tri-member bottom 220 to the proximal end 214 of the tri-member bottom 220. The front bracket 240 pivotally attaches the proximal end 224 of the tri-member bottom 220 to the proximal end 214 of the tri-member bottom 220 with a blind rivet 242, although any other suitable pivotal fastener can be used.

The tri-member assembly creates a top down installation process. The panel clamp bracket has one or more press nut inserts and nests within the tri-member assembly top and is attached with two stainless steel pop rivets. The tri-member assembly has a top down assembly approach that does not require relatively equipment

or hardware as the photovoltaic panels are being installed, which saves time and money on installation.

The roof mount ballast solar racking system supports a plurality of photovoltaic modules (not shown) that are installed on a flat roof top or a roof up to an approximate
5 10 degree pitch that is relatively easy and quick to install without using heavy equipment or a plurality of cumbersome component attachments that utilizes relatively light-gauge galvanized sheet metal formed into a plurality of U-shaped channels making the roof mount ballast solar racking system relatively light weight and strong.

The roof mount ballast solar racking system was developed in order to support
10 photovoltaic modules that are installed on flat roof tops and is intended to make installation relatively quick and easy without the use of heavy equipment or cumbersome component attachments. Also, costly roof penetrations are not needed to secure the structure to the roof. 16 lbs. concrete pavers are used to secure the structure instead, making any roof penetrations unnecessary for installation. Light-gauge
15 galvanized sheet metal is formed into a plurality of U-shaped channels making the system relatively light weight and strong. Assembly of the components is relatively fast and easy with all fastening requirements occurring on the top of the roofing structure without having an assembler to position their body in an awkward position to install the system.

20 The roof mount ballast racking system can be used on the top of buildings of any height with a flat roof or a slightly pitched roof. The racking system supports a plurality of mono crystalline solar modules or other suitable solar modules at a tilt of approximately 10 degrees to optimize solar production in a confined space or any other

suitable type of solar modules. There are several components that make up the racking structure. The components are formed into a plurality of tri-member assemblies that make up the frame of the structure. These tri-member assemblies are formed using a plurality of channel components. A wind screen is attached to the back of the tri-member assemblies to help prevent uplift of the structure during high wind conditions. Connecting channel components span from tri-member assembly to tri-member assembly to help support the structure. A heavy duty strut connection is made at calculated locations that connect one row of tri-member assemblies to another. A ballast tray is placed between two tri-member assemblies at calculated locations throughout the system. These ballast trays are made from a high-molecular weight polyethylene that is UV resistant. The ballast tray holds any concrete pavers and secures the system to the roof. All hardware used for the assembly is made of stainless steel, including the plurality of pop rivets and nuts and bolts utilized to secure the system.

The ballast trays hook over a plurality of tri-member edges and resists wind uplift to the roof mount ballast solar racking system. The large foot print of the ballast tray allows for installing large ballast pavers thereby reducing labor man hours. The ballast trays are made of plastic and are inert to the paver calcium and lime content which eliminates corrosion. Installation of brick pavers in the tri-member channels causes a relatively large amount of corrosion that the plastic ballast tray eliminates. The ballast tray was designed to be mobile such that it can be located on the tri-member to avoid building roof top obstructions and/or be positioned so that the weight can be distributed over the building structure. The ballast tray has a plurality of drain apertures that allow water drainage and not holding water. The four sides, corners, and bottom of the ballast

trays are a single contiguous piece of plastic with the sides and corners reinforced with a stiffening flange that builds strength and durability. The ballast trays are designed and constructed to nest so it is stackable for ease of compatibility for shipping and handling.

The tri-member assembly creates a top down installation process. The panel
5 clamp bracket has one or more press nut inserts and nests within the tri-member assembly top and is attached with two stainless steel pop rivets. The tri-member assembly has a top down assembly approach that does not require relatively heavy equipment or hardware as the photovoltaic or solar panels are being installed, which saves time and money on installation expenses.

10 The panel clamp bracket is located strategically at the Standard Test Conditions locations of the panel manufacturer. The panel clamp bracket is made of 18 gauge galvanized steel to resist the structural reactions and distribute the load to both side flanges and web of the tri-member top. The panel clamp bracket also allows for all installation to be done without creating any new screw apertures in the field installation
15 preventing rust and corrosion.

The bridge bracket is a strategically located fastener to be offset from the tri-member. In addition, the bridge bracket utilizes a press nut to eliminate field hardware. The bridge bracket works with the bridge (SN1201-07FD) to self-align and self-space the tri-member assemblies by having custom -drilled apertures at one or more specific
20 locations that match the spacing required by the photovoltaic module manufacturer. The bridge bracket doubles as a support mechanism for strengthening the flanges and web of the tri-member bottom adjacent to the ballast tray connection.

The tri-member back and windscreen have multiple deflection angles that are wind tunnel tested to determine optimum installation angle to reduce wind loads. The tri-member back utilizes press nuts to eliminate field hardware required to fasten the wind screen to the tri-member assembly.

5 Tri-member bottom includes a plurality of obround apertures that are located throughout the base of the web and fold lines to allow for water drainage. The back bracket (part # SN1201-10FD) was implemented to connect to the inter-row strut. Utilizing the back bracket also prevents the need for creating any new screw apertures in the field installation, thus preventing rust and corrosion.

10 While the present invention has been related in terms of the foregoing embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. Thus, the description is to be regarded as illustrative instead of restrictive on the present invention.

15

CLAIMS

1. A roof mount ballast solar racking system, comprising:

a plurality of tri-member assemblies that include a tri-member top, a tri-member bottom, a tri-member back and a front bracket that form a plurality of U-shaped channels to receive and hold a plurality of solar panels;

a plurality of wind screens that are perpendicularly removably attached onto said back of said tri-member assemblies to assist in preventing uplift of said system and said tri-member assemblies during high wind conditions;

a plurality of channel connecting components that connect said tri-member assemblies and form a plurality of horizontal rows of said tri-member assemblies;

a plurality of heavy duty strut connections that connect said plurality of horizontal rows together forming said system;

a plurality of ballast trays that are placed between two said tri-member assemblies at one or more calculated locations within said system that serve as a ballast; and

a plurality of fasteners that are utilized to secure one or more components of said system together and to secure said system to said roof.

2. The system according to claim 1, wherein said wind screen is made of light-gauge galvanized sheet metal.

3. The system according to claim 1, wherein said channel connection components

are made of light-gauge galvanized metal.

4. The system according to claim 1, wherein said strut connectors are made of light-gauge galvanized metal.

5

5. The system according to claim 1, wherein said ballast trays secure said horizontal rows of said tri-member assemblies to said roof that said system is secured to.

10 6. The system according to claim 1, wherein said ballast trays are made from a high molecule weight polymer.

7. The system according to claim 6, wherein said ballast trays are made from a high molecule weight polymer that is UV light resistant.

15

8. The system according to claim 1, wherein said fasteners are made of stainless steel.

9. The system according to claim 1, wherein said fasteners are a plurality of pop
20 rivets.

10. The system according to claim 1, wherein said fasteners are a plurality of nuts and bolts.

11. The system according to claim 1, wherein said system solar modules are disposed on a flat said roof.

5 12. A roof mount ballast solar racking system, comprising:

a plurality of tri-member assemblies that include a tri-member top, a tri-member bottom, a tri-member back and a front bracket that form a plurality of U-shaped channels to receive and hold a plurality of solar panels;

10 a plurality of wind screens that are perpendicularly removably attached onto said back of said tri-member assemblies to assist in preventing uplift of said system and said tri-member assemblies during high wind conditions;

a plurality of channel connecting components that connect said tri-member assemblies and form a plurality of horizontal rows of said tri-member assemblies;

15 a plurality of heavy duty strut connections that connect said plurality of horizontal rows together forming said system;

a plurality of ballast trays made from a high molecule weight polymer that are placed between two said tri-member assemblies at one or more calculated locations within said system that serve as a ballast; and

20 a plurality of fasteners that include a plurality of pop rivets or a plurality of nuts and bolts that are utilized to secure one or more components of said system together and to secure said system to said roof.

13. The system according to claim 12, wherein said wind screen is made of light-

gauge galvanized sheet metal.

14. The system according to claim 12, wherein said channel connection components are made of light-gauge galvanized metal.

5

15. The system according to claim 12, wherein said strut connectors are made of light-gauge galvanized metal.

16. The system according to claim 12, wherein said ballast trays secure said
10 horizontal rows of said tri-member assemblies to said roof that said system is secured to.

17. The system according to claim 12, wherein said ballast trays are made from a high molecule weight polyethylene polymer that is UV light resistant.
15

18. The system according to claim 12, wherein said fasteners are made of stainless steel.

19. The system according to claim 12, wherein said system solar modules are
20 disposed on a flat said roof.

20. The system according to claim 12, wherein said system solar modules are disposed on said roof at a tilt of approximately 10 degrees.

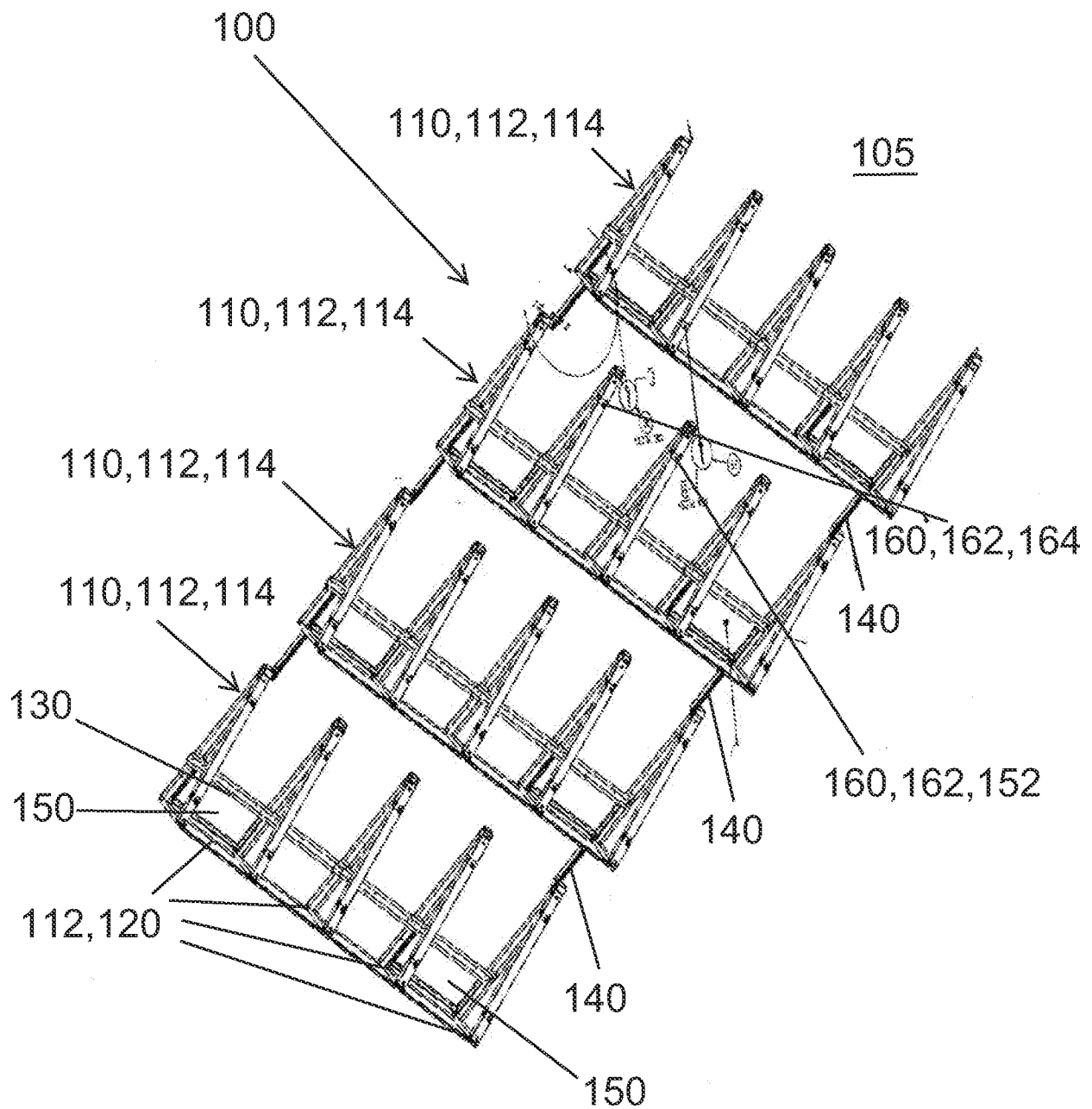


Figure 1

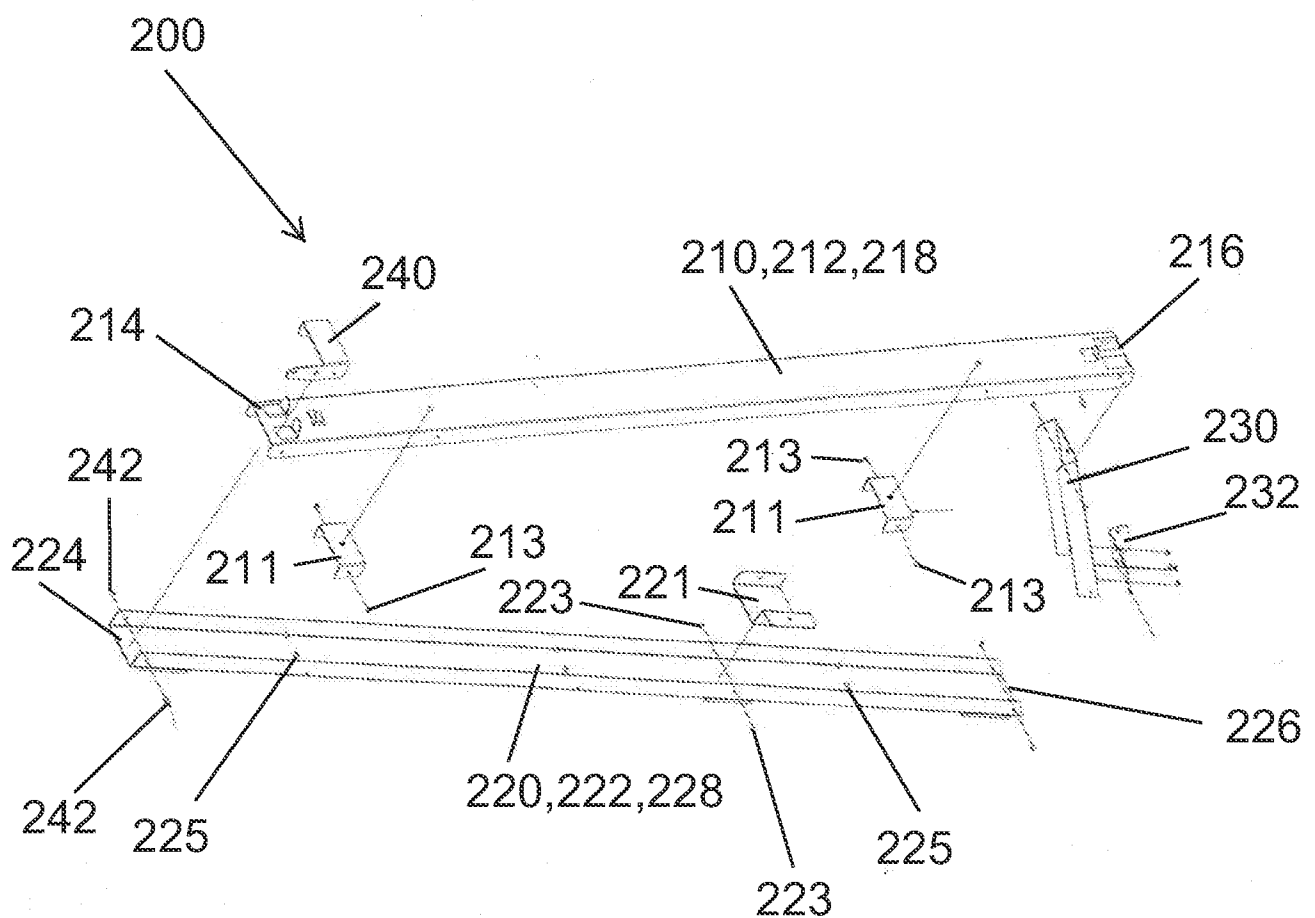


Figure 2