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(54) **ROOF MOUNT BALLAST SOLAR RACKING SYSTEM**

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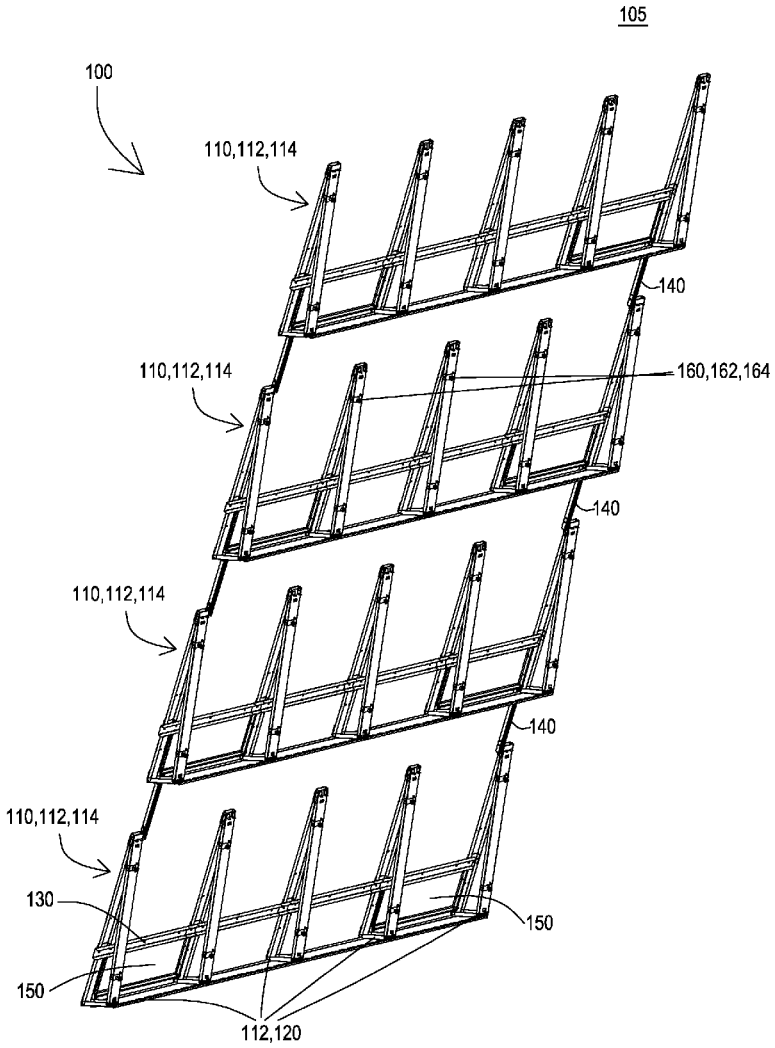
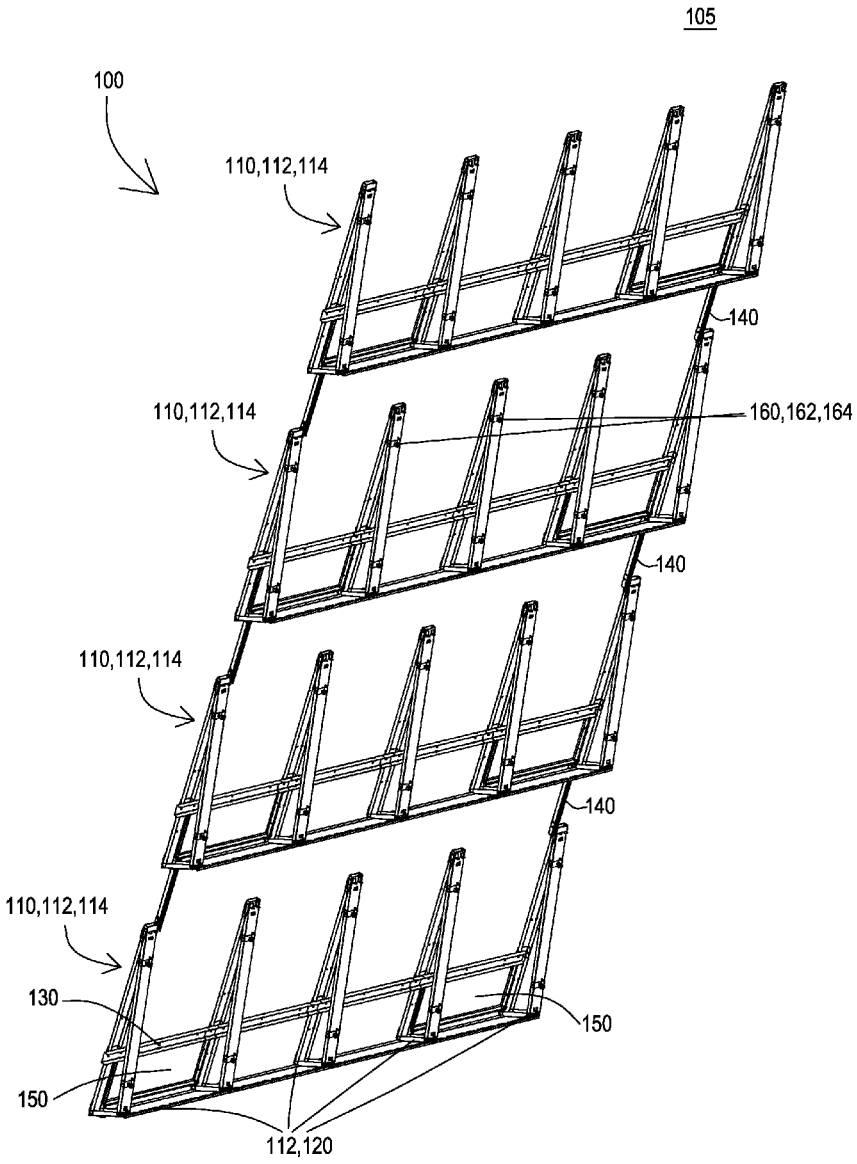
(57) **ABSTRACT**

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.




105
100
110,112,114
140
110,112,114
160,162,164
140
110,112,114
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110,112,114
130
150
150
112,120

FIG. 1

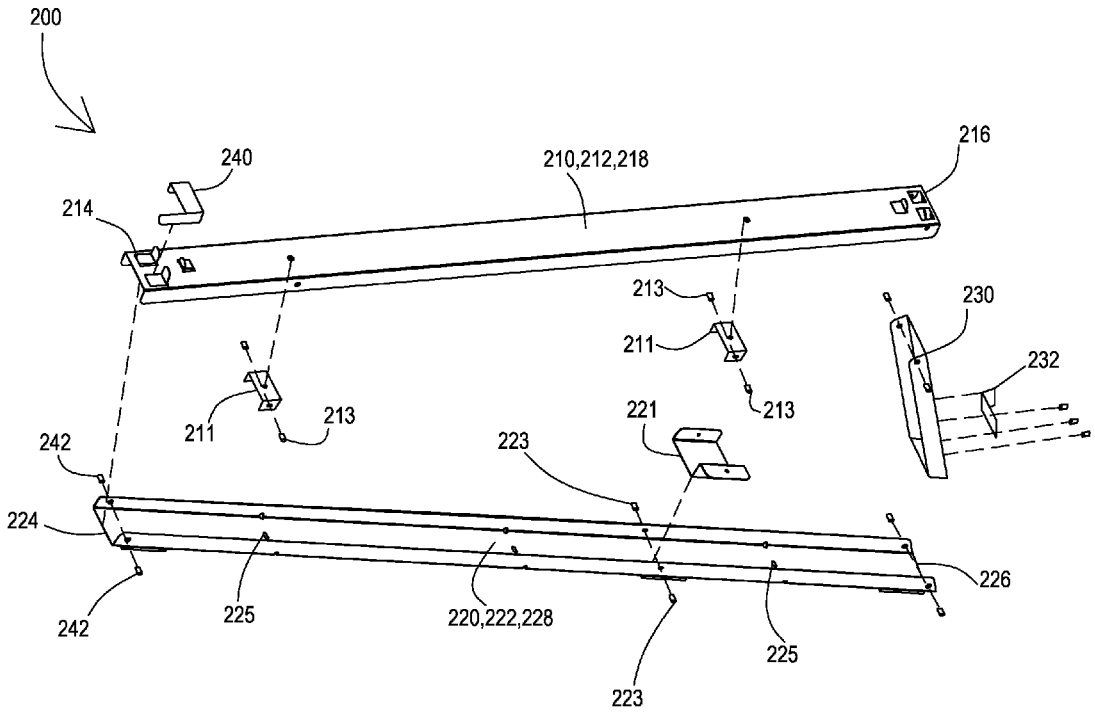
200
240
210,212,218
216
214
213
211
230
232
213
211
213
221
242
223
224
226
242
225
220,222,228
225
223

FIG. 2

ROOF MOUNT BALLAST SOLAR RACKING SYSTEM

[0001] This application claims priority to U.S. Provisional Application 61/436,189 filed on Jan. 25, 2011, the entire disclosure of which is incorporated by reference.

TECHNICAL FIELD & BACKGROUND

[0002] The present invention generally relates to a roof mounted racking system. More specifically, the invention is a roof mount ballast solar racking system.

[0003] 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.

[0004] 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.

[0005] 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.

[0006] 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

[0007] 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:

[0008] FIG. **1** illustrates a top perspective view of a roof mount ballast solar racking system, in accordance with one embodiment of the present invention.

[0009] FIG. **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.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0010] 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 without the specific details. In other instances, well-known features are omitted or simplified in order not to obscure the illustrative embodiments.

[0011] 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 order dependent. In particular, these operations need not be performed in the order of presentation.

[0012] 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" and "including" are synonymous, unless the context dictates otherwise.

[0013] FIG. **1** illustrates a top perspective view of a roof mount ballast solar racking system **100**, in accordance with one embodiment of the present invention.

[0014] 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 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 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 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** 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 made from any other suitable material as well.

[0015] FIG. **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 FIG. **2** is similar to the tri-member assembly **110** illustrated in and described in FIG. **1** and its description.

[0016] 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 (FIG. **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.

[0017] 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.

[0018] 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 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.

[0019] The roof mount ballast solar racking system was developed in order to support 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 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.

[0020] 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.

[0021] 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.

[0022] 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 heavy equipment or hardware as the photovoltaic or solar panels are being installed, which saves time and money on installation expenses.

[0023] 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 preventing rust and corrosion.

[0024] 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 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.

[0025] 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.

[0026] 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.

[0027] 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.

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. 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.

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.

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 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.

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;
- 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 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
- 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.

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 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.

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 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.

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