US 20160134229A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2016/0134229 A1

(43) Pub. Date: May 12, 2016

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(54) **WATER RESISTANT ROOF ASSEMBLY STRUCTURE INTEGRATED WITH SOLAR PANELS**

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(21) Appl. No.: **14/816,552**

(22) Filed: **Aug. 3, 2015**

(30) **Foreign Application Priority Data**

Nov. 11, 2014 (TW) 103139018

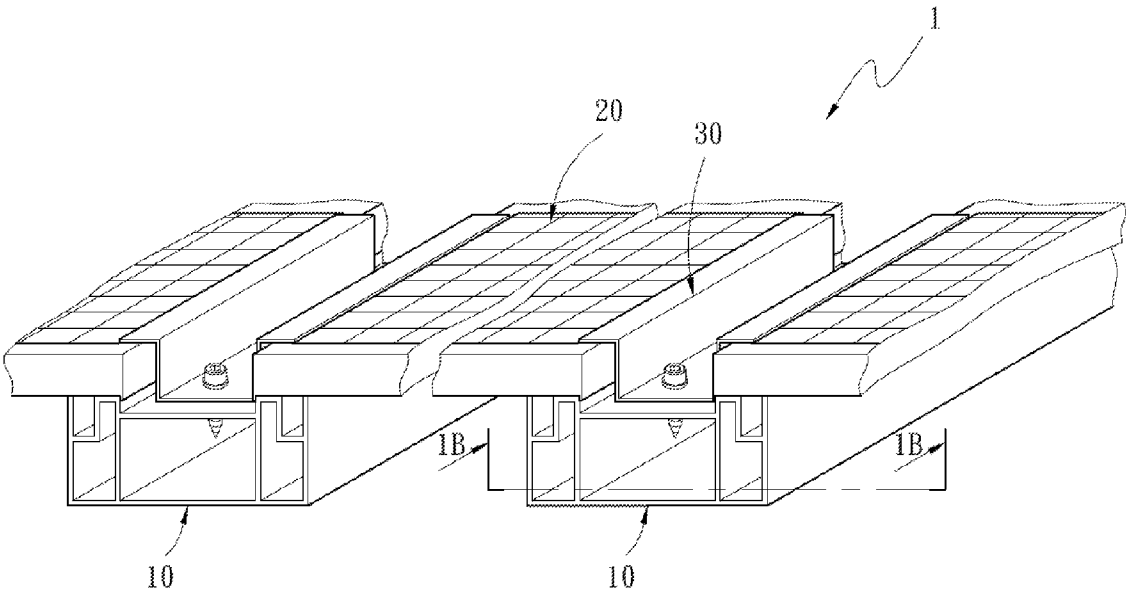
Publication Classification

(51) **Int. Cl.**
H02S 20/23 (2006.01)

(52) **U.S. Cl.**
CPC ***H02S 20/23*** (2014.12)

(57) **ABSTRACT**

A water resistant roof assembly structure integrated with solar panels, for constructing a roof of a building, includes multiple support units arranged at a distance from one another, multiple solar modules disposed across every two adjacent support units, and multiple clamping units. Each support unit includes two carrying sections, a connecting section and two water discharging sections. Each water discharging section includes a valley portion adjacent to the carrying section, and a peak portion away from and having a height as the carrying section. Two sides of each solar module are respectively leaned against the carrying section and the water discharging section of one of the support units. A water discharging channel is formed between the solar module and the water discharging section to limit rainwater to flow towards two sides of the building. Each clamping unit includes a fixing portion, two extension portions and two pressing portions.



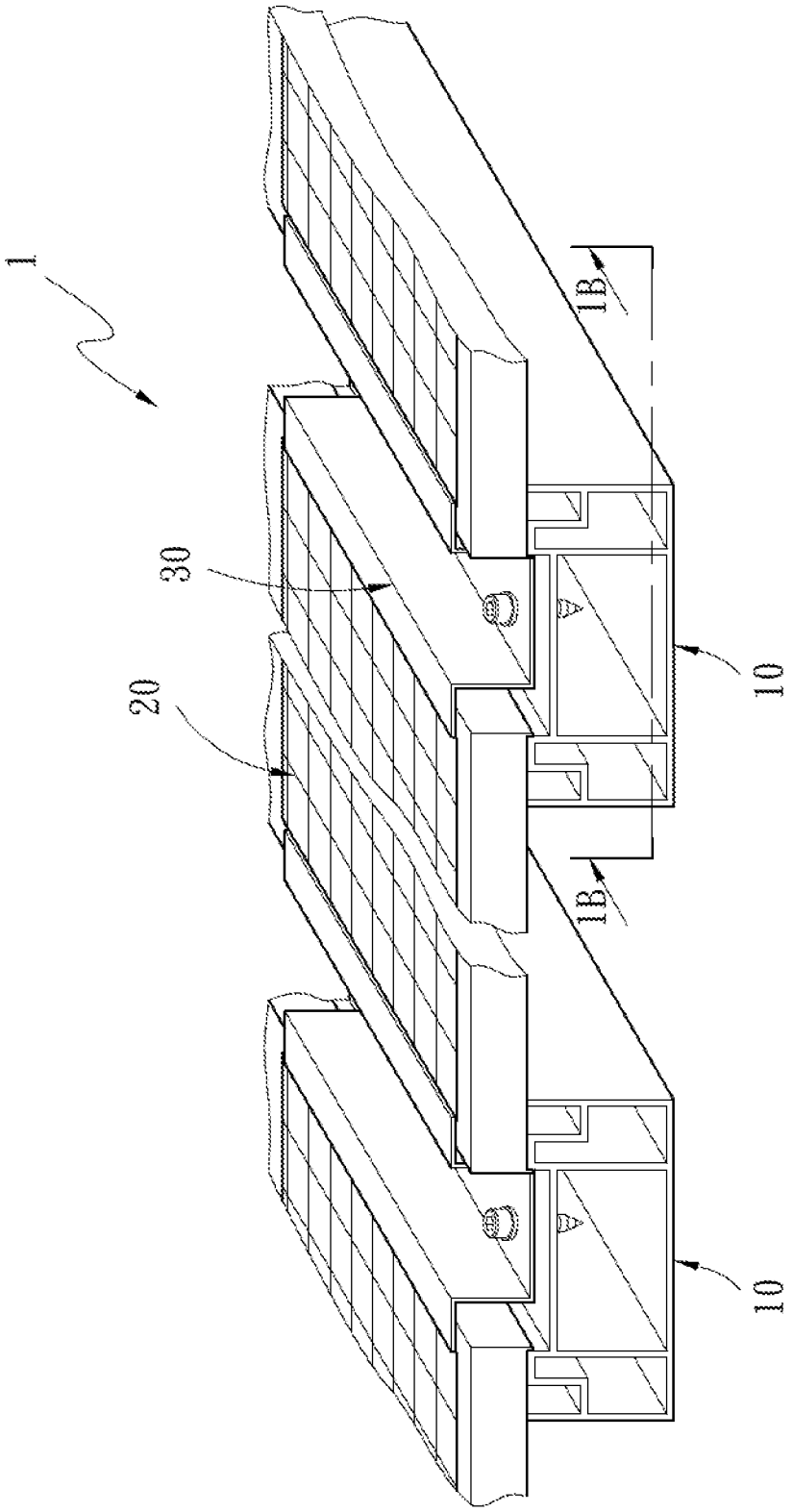


Fig. 1A

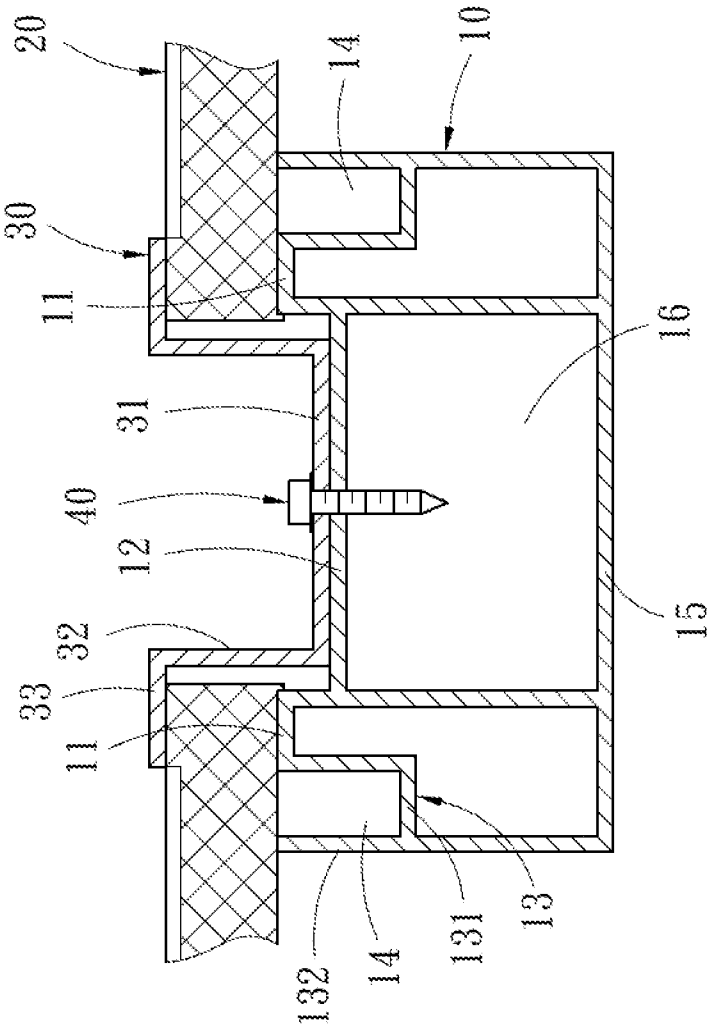


Fig. 1B

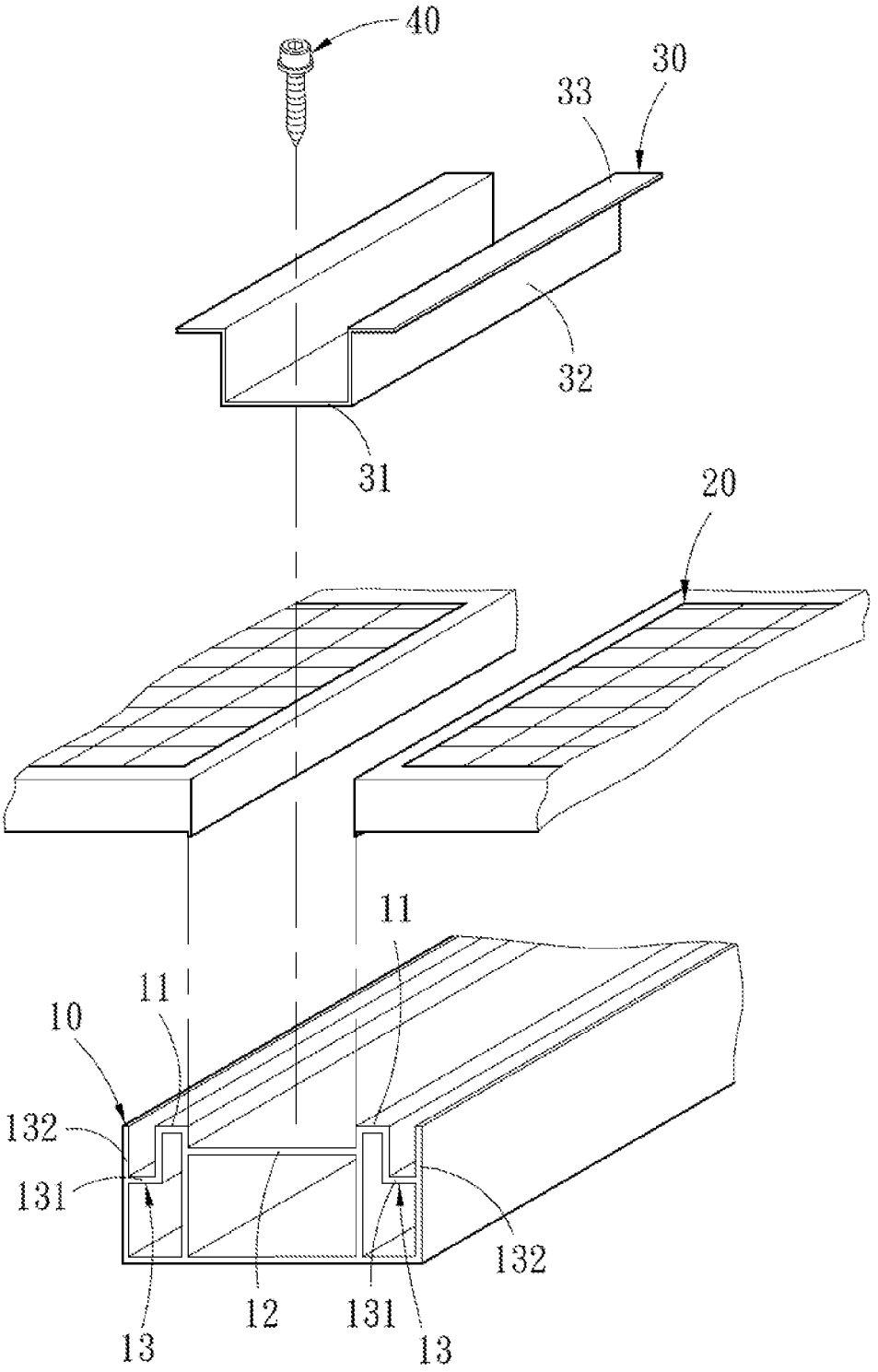


Fig. 2

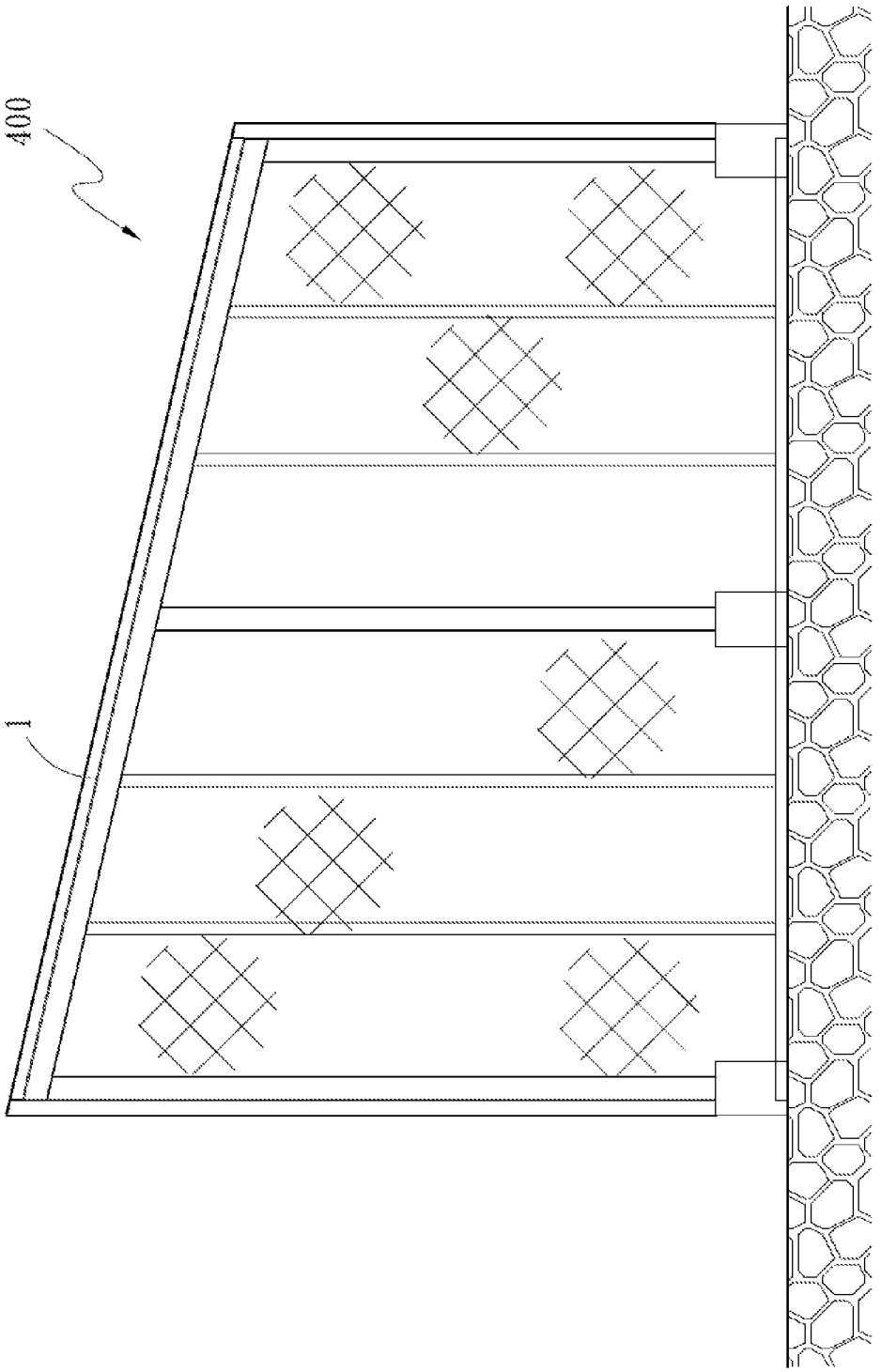


Fig. 3

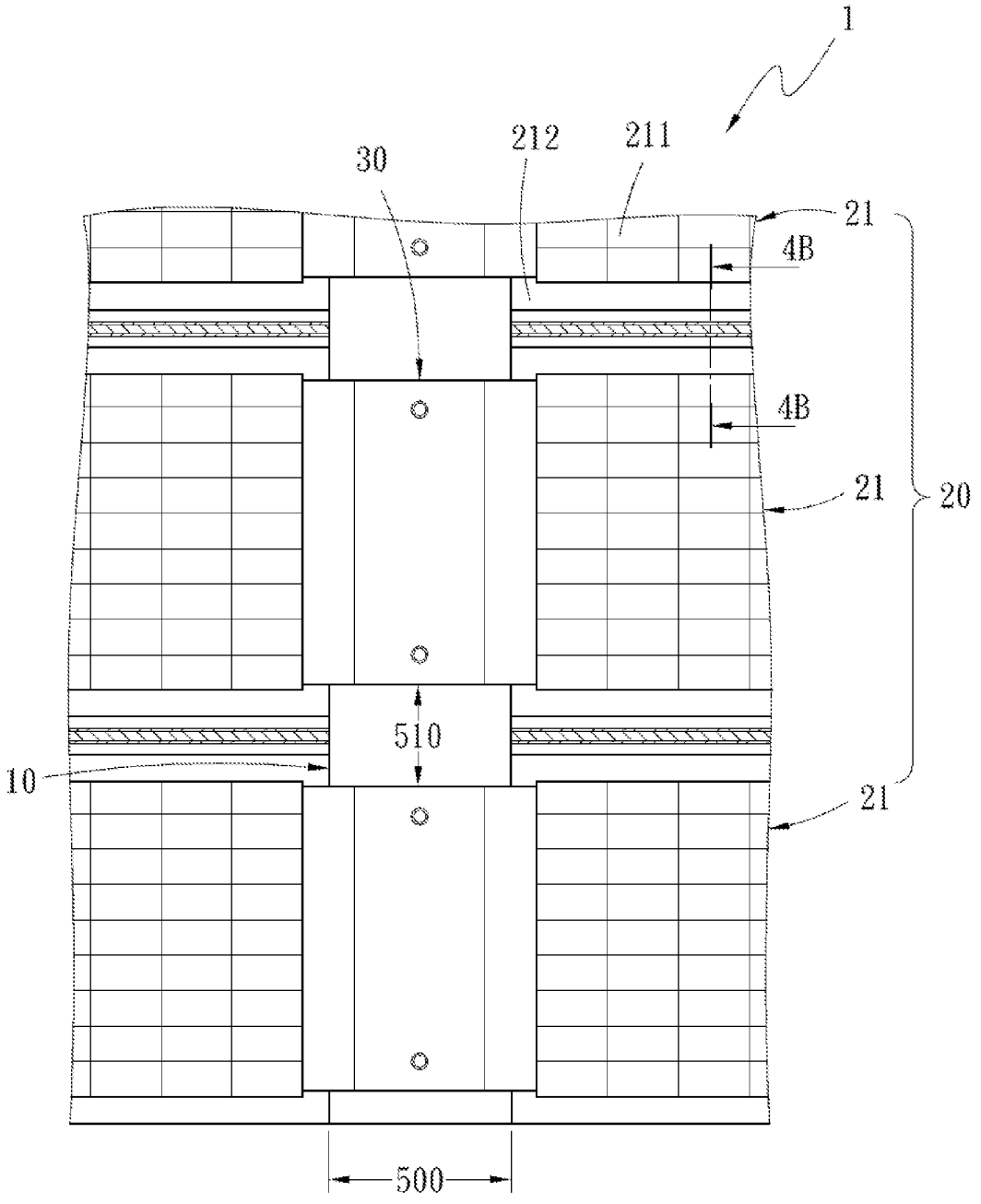


Fig. 4A

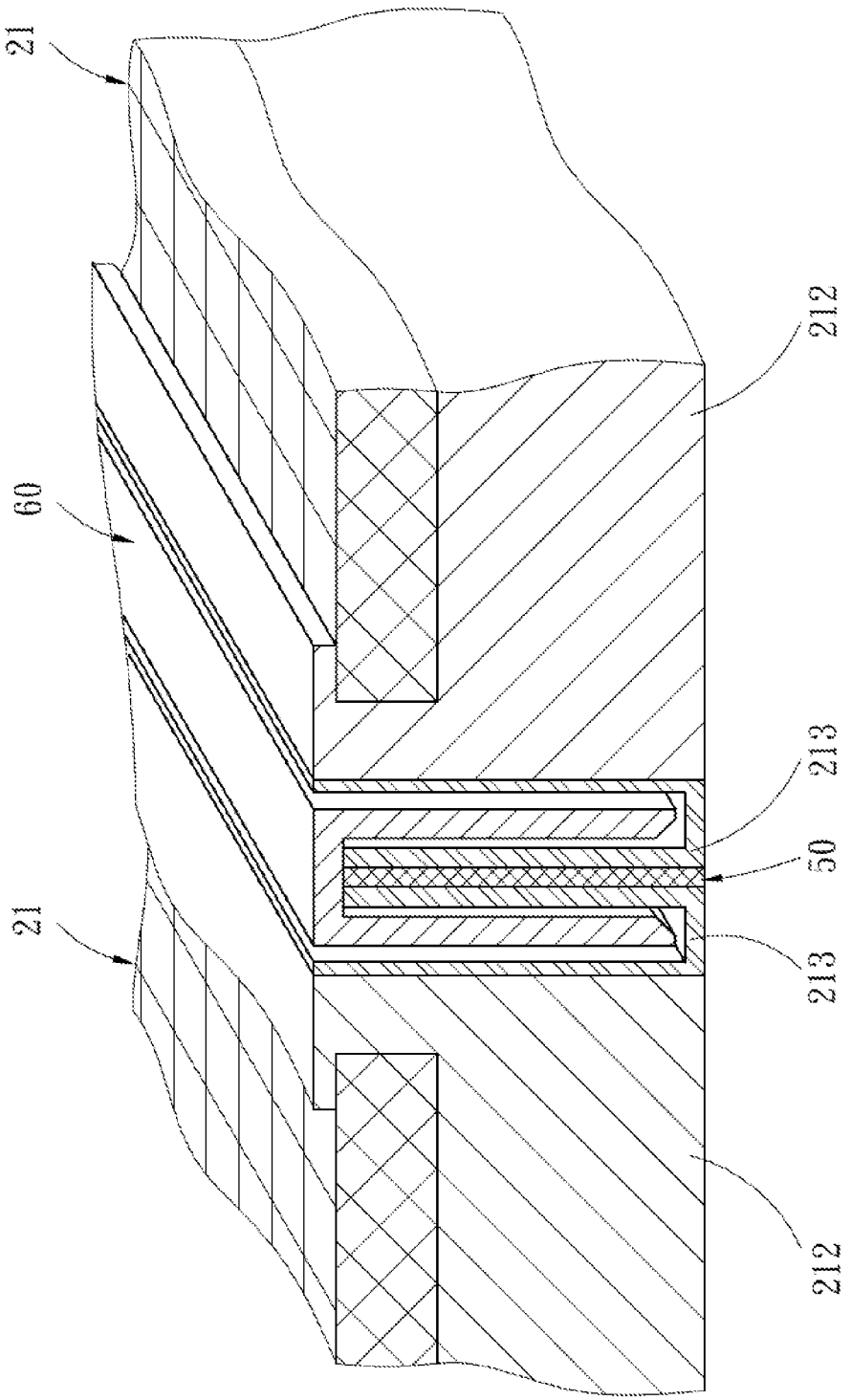


Fig. 4B

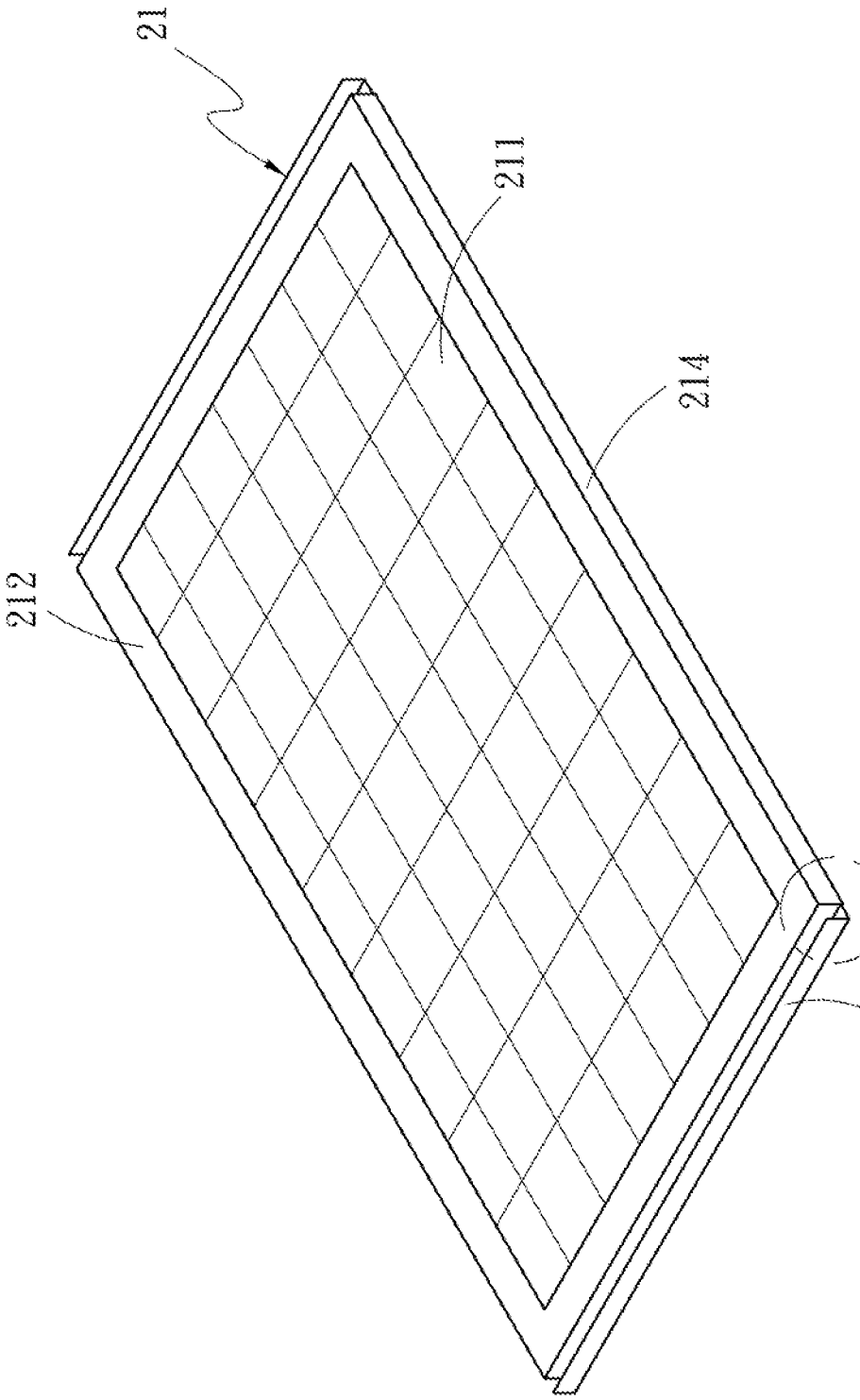


Fig. 5A

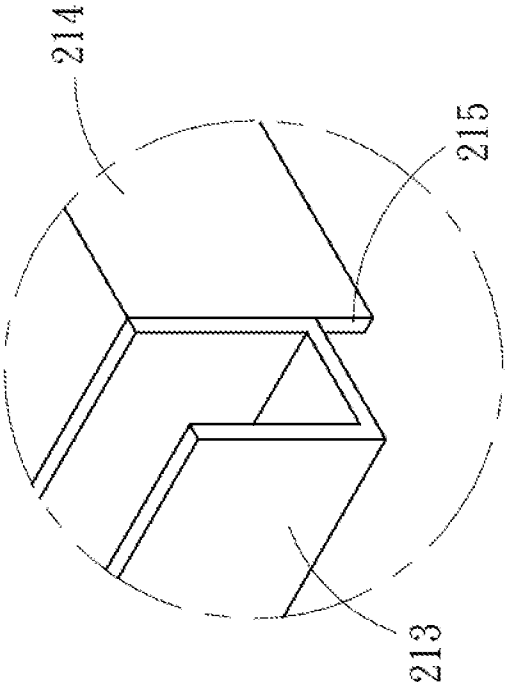


Fig. 5B

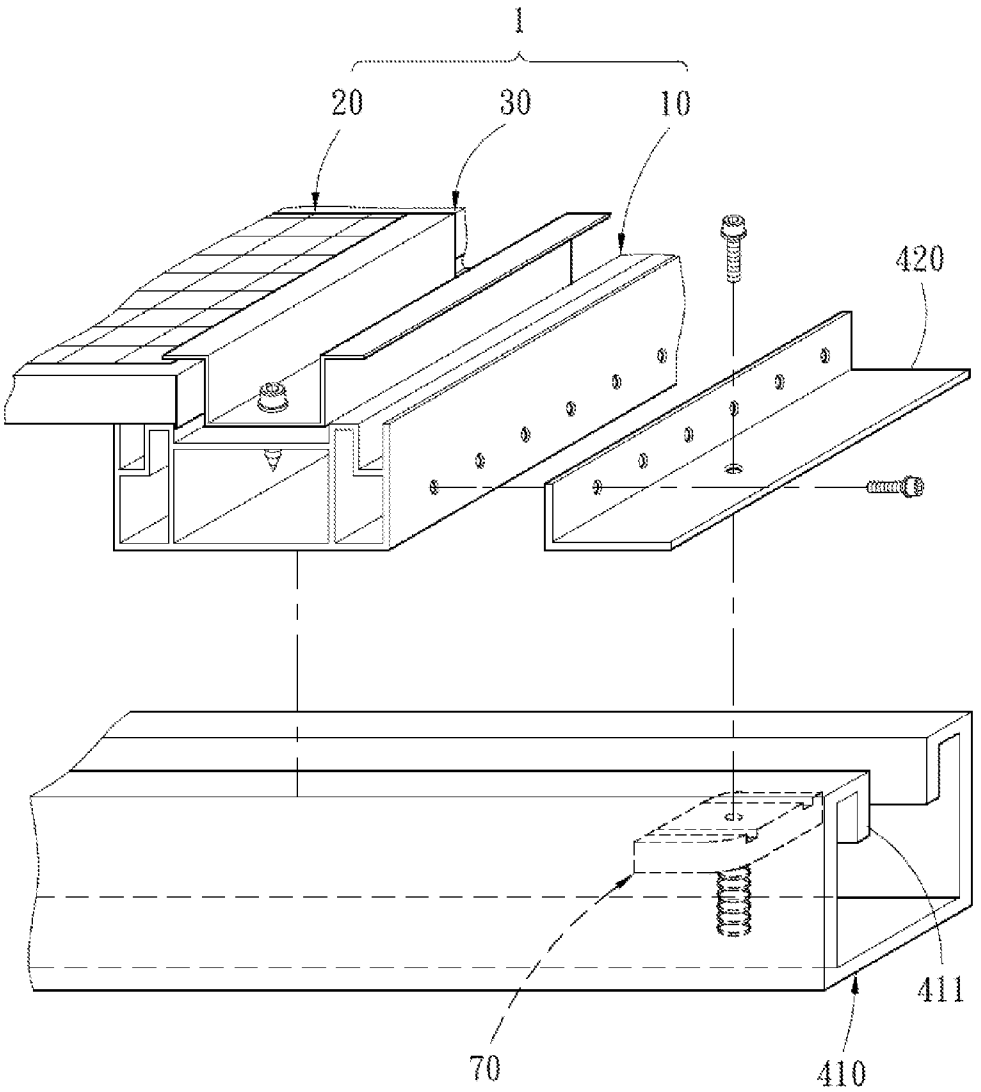


Fig. 6

WATER RESISTANT ROOF ASSEMBLY STRUCTURE INTEGRATED WITH SOLAR PANELS

FIELD OF THE INVENTION

[0001] The present invention relates to a water resistant roof assembly structure integrated with solar panels, and particularly to a water resistant roof assembly structure having functions of both solar power generation and water resistance.

BACKGROUND OF THE INVENTION

[0002] With the gradual rise of international global awareness, in order to reduce environmental pollution caused by thermal power and nuclear power generation, research organizations of different nations have advocated replacing high-pollution energy by renewable energy. Among different types of renewable energy, solar power that features lower production costs and simple application is a focus receiving much attention. In one current common solar power generation method, solar panels are installed at idle areas at a rooftop of a building. Light is converted into electric energy by photoelectric semiconductor, and the electric energy is stored for adequately satisfying general use of common households, thereby achieving the object of energy saving. More specifically, in a conventional method for installing solar panels, a trellis is set up at a rooftop, a lattice is formed at an upper surface of the trellis, and solar panels are mounted into the lattice on the trellis. However, rainwater may seep through gaps between the solar panels and the trellis, and gaps in the trellis may gradually corrodes due to the moisture. As a result, it s necessary that the entire trellis be removed and replaced during maintenance, hence wasting not only time but also building materials.

[0003] Taiwan Patent No. M464492 discloses a water resistant structure for a trellis for solar photoelectric panels. The above disclosure mainly includes a trellis formed by multiple steel frames. A plurality of lattice holes are formed at an upper surface of the trellis, and multiple solar panels may be laid out on the trellis. Further, a water resistant isolation layer is provided below the solar panels. The water resistant isolation layer is formed by a watertight laminate to achieve an effect of preventing rainwater from seeping through.

[0004] In the above prior art, an entire rooftop is covered by the trellis, and a large-area water proof isolation layer is also required. As the water resistant isolation layer is a flat plate, whose flatness may become more difficult to maintain after construction as the area of the water resistant isolation layer gets larger. Further, not only a large-area trellis involves a complicated construction process, but also the trellis after construction is prone to corrosion when exposed in the sun and rain for an extended period of time. With the large planar areas of the trellis and the water proof isolation layer, the level of warping and deformation is hard to predict. Such issues indirectly increase the installation costs of solar panels. If water resistant elements are additionally provided between the solar panels and trellis, extra materials as well as inevitable construction complications are further caused. Thus, the above prior art is a non-ideal solution and needs to be improved.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to solve issues of corrosion due to the lack of water resistance of a conventional metal trellis, and construction complications caused by warping and deformation of a large-area planar workpiece.

[0006] To achieve the above object, the present invention provides a water resistant roof assembly structure integrated with solar panels. The water resistant roof assembly structure is for constructing a roof of a building, and includes a plurality of support units disposed at an upper surface of the building and arranged at a distance from one another, a plurality of solar modules disposed across two adjacent support units, and a plurality of clamping units. Each of the support units includes two carrying sections, a connecting section connected between the two carrying sections and located closer to the building than the two carrying sections, and two water discharging sections each connected to one side of each of the carrying sections away from the connecting section. Each of the water discharging section includes a valley portion connected to the carry section, and a peak potion connected to the valley portion and has a height equal to that of each of the carrying sections. Each of the solar modules has two sides thereof leaned against one of the carrying sections of the two support units, and covers one of the water discharging sections of the two support units to form a water discharging channel for rainwater to flow towards two sides of the building. Each of the clamping units is disposed on one of the support units, and clamps the two solar modules adjacent to two sides of the support unit. Each of the clamping units includes a fixing portion corresponding to the connecting section of the support unit, two extension portions respectively extending from two ends of the fixing portion to upper surfaces of the two solar modules, and two pressing portions respectively extending from the extension portions along the upper surfaces of the two solar panels and pressing against the solar modules.

[0007] Further, each of the solar modules includes a plurality of photovoltaic cells in a cascade arrangement. Each of the photovoltaic cells includes a photoelectric converting unit, and an outer frame disposed around the photoelectric converting unit.

[0008] Further, a protrusion portion is provided at one side of the outer frame near another photovoltaic cell. The water resistant roof assembly structure integrated with solar panels further includes a plurality of insulating bodies each disposed between every two adjacent protrusion portions, and a plurality of connecting members each covering every two adjacent protrusion portions.

[0009] Further, a clamping space is formed between every two solar panels. The clamping units are in a cascade arrangement in the clamping spaces. A clearance space exists between every two adjacent clamping units, and each of the clearance spaces corresponds between every two adjacent photovoltaic cells.

[0010] Further, each of the outer frames includes a side frame plane that faces the clamping unit after the side frame is assembled, and a water blocking section that extends along the side frame plane towards the direction of the building.

[0011] Further, the water resistant roof assembly structure integrated with solar panels further includes a plurality of beam frames mounted between each of the support units and the building. Each of the beam frames includes a guiding track, two positioning members respectively disposed at two ends of the guiding track and capable of appropriately sliding on the guiding track, and two abutting plates respectively connected to the positioning members. Each of the abutting

plates abuts against the two support units at two opposite sides of the water resistant roof assembly structure integrated with solar panels.

[0012] Further, each of the positioning members is a spring channel nut.

[0013] Further, the water resistant roof assembly structure integrated with solar panels further includes a plurality of pressing members. The pressing members penetrate through the connecting sections and the fixing portions to fasten and join the support unit and the clamping unit.

[0014] Further, each of the support units includes a blocking section disposed at one side of the connecting section opposite the clamping unit. A flow guiding channel is formed between the connecting section and the blocking section to guide rainwater to flow towards the two sides of the building.

[0015] Therefore, compared to the prior art, the present invention provides following effects.

[0016] 1. In the present invention, the solar modules are clamped by the support units and the clamping units. Thus, the issue of construction and maintenance complications caused by a trellis made of a large-area steel plate for solar panels of the prior art is solved.

[0017] 2. In the present invention, with the water discharging channels formed by the recessed water discharging sections on the support units, rainwater fallen on the roof can be naturally discharged along the water discharging channels without involving additional water resistant components such as rubber strips and sealing rings. Therefore, the present invention provides a thorough water resistant effect while also featuring the advantage of saving materials and processing steps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. **1**A is a perspective view of an assembly according to a first embodiment of the present invention.

[0019] FIG. **1**B is a section view at a position along **1**B-**1**B of FIG. **1**A.

[0020] FIG. **2** is an exploded perspective view according to the first embodiment of the present invention.

[0021] FIG. **3** is a side view of the present invention combined with a building.

[0022] FIG. **4**A is a planar top view of the present invention from above a building.

[0023] FIG. **4**B is a section view at a position along **4**B-**4**B of FIG. **4**A.

[0024] FIG. **5**A is a perspective view of a photovoltaic cell of the present invention.

[0025] FIG. **5**B is an enlarged partial view of FIG. **5**A.

[0026] FIG. **6** is an exploded perspective view according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] Referring to FIG. **1**A and FIG. **3** showing technical features of the present invention, a water resistant roof assembly structure **1** integrated with solar panels of the present invention is for constructing a roof of a building **400**. For example, the building **400** is a farmhouse, a greenhouse, or a common home. In addition to blocking rainwater from the building **400**, the water resistant roof assembly structure **1** integrated with solar panels simultaneously provides the function of solar power generation. The water resistant roof assembly structure **1** integrated with solar panels of the present invention includes a plurality of support units **10** disposed at an upper surface of the building **400** and arranged at a distant from one another, a plurality of solar modules **20** disposed across every two adjacent support units **10**, and a plurality of clamping units **30**. It should be noted that, the horizontal direction in the drawings of the present invention are aligned with an arrangement direction of the solar modules **20**. In practice, for example but not limited to, the water resistant roof assembly structure **1** integrated with solar panels may be applied for constructing a roof formed by flat planes, inclined planes or irregular planes.

[0028] More specifically, referring to FIG. **1**B and FIG. **2**, each of the support units **10** includes two carrying sections **11**, a connecting section **12** connected between the two carrying sections **11** and located closer to the building **400** than the two carrying sections **11**, and two water discharging sections **13** each connected to one side of each of the carrying sections **11** away from the connecting section **12**. Each of the water discharging section **13** includes a valley portion **131** connected to the carrying section **11**, and a peak portion **132** connected to the valley portion **131** and having a height equal to that of the carrying section **11**. Thus, when it rains, rainwater is allowed to more easily flow into the connecting section **12** and the water discharging sections **13** located at a lower position.

[0029] Each of the solar modules **20** has two sides thereof leaned against onto one of the carrying sections **11** of the two support units **10**, and covers one of the water discharging sections **13** of the two support units **10** to form a water discharging channel **14** for rainwater to flow towards two sides of the building **400**. Thus, when it rains, if rainwater seeps and enters a gap between the solar module **20** and the support unit **10** along an outer edge of the solar module **20**, instead of seeping into the building **400** via the gaps of the roof, the rainwater is guided to the water discharging channel **14** and becomes discharged towards the two sides of the building **400**, thereby providing an ideal water resistant effect.

[0030] Each of the clamping units **30** is disposed on one of the support units **10** and clamps the two solar modules **20** adjacent to two sides of the support unit **10**. Further, each of the clamping units **30** includes a fixing portion **31** corresponding to the connecting section **12** of the support unit **10**, two extension portions **32** respectively extending from two ends of the fixing portion **31** to positions at the upper surfaces of the two solar modules **20**, and two pressing portions **33** respectively extending from the extension portions **32** along the upper surfaces of the two solar modules **20** and pressing against the solar modules **20**. Thus, through the clamping units **30**, the clamping force for clamping the solar modules **20** is further reinforced, so as to achieve the effect of reliably securing the water resistant assembly structure **1** integrated with solar panels of the present invention.

[0031] In one embodiment, the water resistant assembly structure **1** integrated with solar panels of the present invention further includes a plurality of pressing members **40**. The pressing members **40** penetrate through the connecting sections **12** and the fixing portions **31** to fasten and join the support unit **10** and the clamping unit **30**.

[0032] For example, the pressing members **40** may be self-tapping screws. Each of the support units **10** further includes a blocking section **15** disposed at one side of the connecting section **12** opposite the clamping unit **30**. A flow guiding channel **16** is formed between the connecting section **12** and

the blocking section **15** to guide the rainwater seeped via joining gaps of the pressing members **40** and the connecting section **12** to flow towards the two sides of the building **400**, thereby further enhancing the water resistant effect.

[0033] Referring to FIG. **4**A, in one embodiment, each of the solar modules **20** includes a plurality of photovoltaic cells **21** in a cascade arrangement. A clamping space **500** is formed between every two adjacent solar modules **20**, and the clamping units **30** are disposed in a cascade arrangement in the clamping spaces **500**. A clearance space **510** exists between every two adjacent clamping units **30**. Preferably, each clearance space **510** corresponds between every two adjacent photovoltaic cells **21**, so as to guide the rainwater fallen into the joining gap between the two adjacent photovoltaic cells **21** to the connecting section **12** (referring to FIG. **2**), and to allow the rainwater to be discharged from the two sides of the building **400**.

[0034] Referring to FIG. **4**B, FIG. **5**A and FIG. **5**B, each of the photovoltaic cells **21** includes a photoelectric converting unit **211**, and an outer frame **212** disposed around the photoelectric converting unit **211**. A protrusion portion **213** is disposed at one side of the outer frame **212** near another photovoltaic cell **21**. The water resistant roof assembly structure **1** integrated with solar panels further includes a plurality of insulating bodies **50** each disposed between every two adjacent protrusion portions **213**, and a plurality of connecting members **60** each covering every two adjacent protrusion portions **213**. The photoelectric converting unit **211** is formed by assembling multiple photoelectric chips provided with electrodes, and converts received light energy into electric energy. The connecting member **60** is an aluminum extrusion member, and the insulating body **50** is a rubber strip. Rubber paint providing a water resistant function is applied on surfaces of the connecting member **60** and the insulating body **50**, and thus every two adjacent photovoltaic cells **21** may be mutually assembled via each of the connecting members **60** and each of the protrusion portions **213**. Hence, the insulating body **50** is tightly clamped to prevent the two photovoltaic cells **21** from coupling. Further, the gap between every two adjacent photovoltaic cells **21** can be completely sealed to prevent rainwater between the two adjacent photovoltaic cells **21** from seeping into the building **400**.

[0035] Further, considering that rainwater may seep into the building **400** through the joining gaps between the photovoltaic cells **21**, in one embodiment, each of the outer frames **212** includes a side frame plane **214** that faces the clamping unit **30** after the outer frame **212** is assembled, and a water blocking section **215** that extends along the side frame plane **214** towards the direction of the building **400**. The water blocking section **215** extends from the side frame plane **214** towards an interior of the building **400**. Hence, even if rainwater seeps into between the clamping unit **30** and the support unit **10** (referring to FIG. **1**A), the rainwater is still blocked by the water blocking section **215**, flows onto the connecting section **12** and then becomes discharged from the water resistant roof assembly structure **1** integrated with solar panels. That is, rainwater is prevented from seeping into the interior of the building **400** below.

[0036] To allow working staff to easily fine tune the position of the water resistant roof assembly structure **1** integrated with solar panels during a construction process, or to eliminate errors of the components, referring to FIG. **6**, in one embodiment, the water resistant roof assembly structure **1** integrated with solar panels further includes a plurality of beam frames **410** mounted between each of the support units **10** and the building **400**. Each of the beam frames **410** includes a guiding track **411**, two positioning members **70** respectively disposed at two ends of the guiding track **411** and capable of appropriately sliding on the guiding track **411**, and two abutting plates **420** respectively connected to the positioning members **70**. Each of the abutting plates **420** abuts against the two support units **10** at two opposite sides of the water resistant roof assembly structure **1** integrated with solar panels. Each of the positioning members **70** may be a spring channel nut, and is screw fastened onto the beam frame **410** by an element such as a screw, so as to allow the abutting plates **420** to abut against the two outermost support units **10** at the two sides to provide support for preventing the support units **10** from being disengaged. When positions need to be adjusted, only the screw on one of the positioning members **70** needs to be loosened, and the positioning member **70** and the abutting plate **420** are slid to the appropriate positions and then screwed and positioned.

What is claimed is:

1. A water resistant roof assembly structure integrated with solar panels, comprising:

a plurality of support units, disposed at an upper surface of a building and arranged at a distance from one another, each of the support units comprising two carrying sections, a connecting section connected between the two carrying sections and located closer to the building than the two carrying sections, and two water discharging sections each connected to one side of each of the carrying sections away from the connecting section, each of the water discharging sections comprising a valley portion connected to the carrying section, and a peak portion connected to the valley portion and having a height equal to that of the carrying sections;

a plurality of solar modules, disposed across two adjacent support units, each of the solar modules having two sides thereof leaned against onto one of the carrying sections of the two support units, and covering one of the water discharging sections of the two support units to form a water discharging channel for rainwater to flow towards two sides of the building; and

a plurality of clamping units, each of the clamping units disposed on one of the support units and clamping the two solar modules adjacent to two sides of the support unit, each of the clamping units comprising a fixing portion corresponding to the connecting section of the support unit, two extension portions respectively extending from two ends of the fixing portion to positions at upper surfaces of the solar modules, and two pressing portions respectively extending from the extension portions along the upper surfaces of the two solar modules and pressing against the solar modules.

2. The water resistant roof assembly structure integrated with solar panels of claim **1**, wherein each of the solar modules comprises a plurality of photovoltaic cells in a cascade arrangement, and each of the photovoltaic cells comprises a photoelectric converting unit and an outer frame disposed around the photoelectric converting unit.

3. The water resistant roof assembly structure integrated with solar panels of claim **2**, wherein a protrusion portion is disposed at one side of the outer frame near another photovoltaic cell, and the water resistant roof assembly structure further comprises a plurality of insulating bodies each dis-

posed between every two adjacent protrusion portions and a plurality of connecting members each covering every two adjacent protrusion portions.

4. The water resistant roof assembly structure integrated with solar panels of claim **2**, wherein a clamping space is formed between every two adjacent solar modules, the clamping units are disposed in a cascade arrangement in the clamping space, a clearance space exists between every two adjacent clamping units, and each of the clearance spaces corresponds between every two adjacent photovoltaic cells.

5. The water resistant roof assembly structure integrated with solar panels of claim **2**, wherein each of the outer frames comprises a side frame plane that faces the clamping unit after being assembled, and a water blocking section that extends along the side frame plane towards a direction of the building.

6. The water resistant roof assembly structure integrated with solar panels of claim **1**, further comprising:

a plurality of beam frames, disposed between each of the support units and the building, each of the beam frames comprising a guiding track, two positioning members respectively disposed at two ends of the guiding track and capable of appropriate sliding on the guiding track, and two abutting plates respectively connected to the positioning members, each of the abutting plates abutting against two support units at two opposite sides of the water resistant roof assembly structure integrated with solar panels.

7. The water resistant roof assembly structure integrated with solar panels of claim **6**, wherein each of the positioning members is a spring channel nut.

8. The water resistant roof assembly structure integrated with solar panels of claim **1**, further comprising:

a plurality of pressing members, penetrating through the connecting sections and the fixing portions to fasten and join the support unit and the clamping unit.

9. The water resistant roof assembly structure integrated with solar panels of claim **1**, wherein each of the support units comprises a blocking section disposed at one side of the connecting section opposite the clamping unit, and a flow guiding channel is formed between the connecting section and the blocking section to guide rainwater to flow towards the two sides of the building.

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