



ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ

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Наш знак: 30.08.2024

Ваш знак:

Искане за предварително проучване за новост на
изобретение с наименование

**„Мобилна електро-системна буферна електростанция с реверсивни
електрохимични батерии в еднообемни помещения, покрити с наклонени покриви
за фотоволтаични огледални панели с автономни термопомпени системи“**

Патентното ведомство Ви уведомява, че във връзка с Ваше искане № СПИС-976 от
26.08.2024г. е извършено проучване въз основа на:

- ☒ описанието, претенциите
☒ приложените фигури

Класове по МПК: A62C3/16; A62C35/68; A62C37/46; F28F1/18; H01M10/613; H05K7/20;
H02S40/44; H02J3/32; H01L31/042; B60P3/06

Бази-данни: IPAS; Esp@cenet, Internet

При проучването са намерени следните документи, посочени в приложения доклад:

Патентни документи:

WO 2012134400 A1; KR 20210104217 A; ES 2692727A1; CN 106208166 A;

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СТ А Н О В И Щ Е

ОТНОСНО: предварително проучване за новост на
изобретение с наименование

„Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи“

вх. № СпИС-976/26.08.2024 г.

Обектът на проучване е мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи, за който са формулирани дванадесет претенции.

Проучването се отнася до мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи, включваща саморегулиращ се нагревател във всеки кпиматизиращ термопомпен модул, саморегулиращият се нагревател е електрически и е вграден във всеки кпиматизиращ термопомпен модул; като на екваториално наклонените покриви са монтирани фотоволтаични панели, а на полюсно наклонените покриви са монтирани огледални панели; като общ електрически извод от фотоволтаичните панели е свързан, през зареждащ контролер, към електрически вход на програмируем оптимизиращ електропреобразувател, чиито силов електрически извод е свързан към електро захранващи входове на термопомпените модули; първи сигнален вход на програмируемия оптимизиращ електропреобразувател е безжично свързан със сигнален изход от комбиниран датчик за вътрешна и външна температура, втори сигнален вход на програмируемия оптимизиращ електропреобразувател е свързан със сигнален изход от датчик за електрическите параметри на батериите.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи, съгласно претенция 2, характеризираща се с това, че фотоволтаичните панели са еднакви.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи, съгласно претенция 3 характеризираща се с това, че огледалните панели са плоски и еднакви и са произведени от рециклируеми материали.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термопомпени системи, съгласно претенция 4, характеризираща се с това, че в долната част на всички еднообемни помещения е монтирана по една дънна плоча.



Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи съгласно претенция 5 характеризираща се с това, че електропреобразувател включва архивна памет, оперативна памет и е конфигуриран за работа със самообучаващ се изкуствен интелект.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 6, характеризираща се с това, че наклонените покриви под фотоволтаичните панели, и под огледалните панели, са с ъгъл на наклона от 45 ъглови градуса.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 7, характеризираща се с това, че еднакви еднообемни помещения са подредени в една редица, едно до друго с еднакво насочени към екватора взаимно успоредни фотоволтаичните им панели, а непосредствено между тях са разположени еднакви еднообемни помещения с еднакво насочени към полюса взаимно успоредни огледалните им панели.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 8, характеризираща се с това, че еднообемните помещения са подредени в повече от една редица.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенции от 9, характеризираща се с това, че еднообемните помещения са стандартни двадесет футови товарни контейнери.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 10, характеризираща се с това, че еднообемните помещения са стандартни четиридесет футови товарни контейнери.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 11, характеризираща се с това, че в еднообемните помещения към вътрешните им стени, са монтирани хоризонтални стелажи.

Мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, съгласно претенция от 12, характеризираща се с това, че на хоризонтални стелажи са подредени литиево-йонни електро акумулатори.



Задачата на заявеният обект е да се обезпечи мобилната електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, управляване с помощта на самообучаващ се изкуствен интелект, който да обогатява работния си алгоритъм, чрез анализи на натрупвани ретроспективни данни с цел разкриване на циклични модели, от които да прави изводи в реално време, за оптимизация на автоматично управляваната от него буферна електростанция.

При извършеното проучване са намерени документи, които са посочени в приложения доклад, отнасящи се до системи за електроенергията, включващи фотоволтаични панели и множество батерии.

В патентният документ WO 2012134400 A1 публ. на 04.10.2012г. е разкрита мобилна слънчева централа за генериране на електроенергия от фотоволтаични панели поставени върху превозно средство. Слънчевата електроцентрала включва преобразувател на мощност, инвертор, преобразувател на напрежение, батерия, буферна батерия, климатична система и система за диагностика и мониторинг.

В патентен документ KR 20210104217 A публ. на 25.08.2021г. е разкрита система за съхранение на енергията, която повишава ефективността на топлообмена на топлообменник и улеснява поддръжката на климатик. Системата включва най – малко един батериен стелаж с най-малко два батерийни модула, контейнер за поместване на поне една стойка за батерии, климатик и топлообменник.

В патентен документ ES 2692727A1 публ. на 04.12.2018г. е разкрита система със самозахранващ се соларан модул. Системата се състои от система от фотоволтаични панели с контролен модул към две батерии за захранване с електроенергия, система за климатизация, помпа и топлообменник.

В патентен документ CN 106208166 A публ. на 07.12.2016г. е разкрита разпределителна електрическа система включваща множество батерии за съхранение на електроенергия, вътрешна захранваща шина, фотоволтаични панели, инвертор за генериране на енергия, контролер и модул за разпределение на постоянен ток.

Анализът на обекта на проучването и известните решения показва следното:

Новост

В нито един от намерените при проучването документи не е разкрита мобилна електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, които да включват всички технически признаци на обекта на проучването.



Следователно, мобилната електро-системна буферна електростанция с реверсивни електрохимични батерии в еднообемни помещения, покрити с наклонени покриви за фотоволтаични и огледални панели с автономни термopомпени системи, отговаря на изискванията за новост, съгласно чл. 8, ал. 1 от Закона за патентите и регистрацията на полезните модели (ЗПРПМ).

30.08.2024г.

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ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ



ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ

ДОКЛАД ОТ ПРОУЧВАНЕ

ПРОУЧВАНЕ ВХ. № СпИС-976/26.08.2024

I. Уточнен класификационен индекс по МПК

A62C3/16; A62C35/68; A62C37/46; F28F1/18; H01M10/613; H05K7/20; H02S40/44; H02J3/32; H02J3/32; H01L31/042; B60P3/06

II. ОБЛАСТ НА ПРОУЧВАНЕ:

Минимален обхват на проучване

Вид класификация:

МПК

Класификационен индекс:

A62C3/16; A62C35/68; A62C37/46; F28F1/18; H01M10/613; H05K7/20; H02S40/44; H02J3/32; H01L31/042; B60P3/06

Бази данни, в които е извършено проучването

Esp@cenet; IPAS; Internet

III. Релевантни документи

Категория	Цитиране на документите с посочване на релевантните части	Релевантни претенции
A	WO 2012134400 A1 [PIPISTREL D O O; PRISTAVEC JEMEJ; TOMAZIC TINE; BOSKAROL IVO, SI] публ. на 04.10.2012г.	1-12
A	KR 20210104217 A [LG ENERGY SOLUTION LTD, KR] публ. на 25.08.2021г.	1-12
A	ES 2692727A1 [TRIMBOLI LONGUETTO ANTONINO ADRIA IT] публ. на 04.12.2018г.	1-12
A	CN 106208166 A [WUHU GELITE AMPEREX TECH CO LTD] публ. на 07.12.2016г.	1-12

Категория на документа

X – документът е от особено значение; претендираното изобретение няма новост или изобретателска стъпка, когато документът се разглежда самостоятелно

A – документ, отразяващ нивото на техниката, който не е от особено значение

Y – документът е от особено значение; претендираното изобретение няма изобретателска стъпка, когато документът се комбинира с един или повече други документи и тази комбинация е очевидна за специалист в областта

Дата: 30.08.2024

Име: Анастасия Величкова

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US 20240266987A1

(19) **United States**

(12) **Patent Application Publication**
Wentworth et al.

(10) **Pub. No.: US 2024/0266987 A1**

(43) **Pub. Date: Aug. 8, 2024**

(54) **WATERPROOFING MOUNTING SYSTEM
FOR ATTACHING SOLAR MODULES TO A
ROOF**

F24S 25/61 (2006.01)

F24S 25/636 (2006.01)

F24S 25/70 (2006.01)

(71) Applicant: **Wencon Development, Inc., dba
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(US)

(52) **U.S. Cl.**

CPC *H02S 20/23* (2014.12); *F24S 25/33*
(2018.05); *F24S 25/61* (2018.05); *F24S*
25/636 (2018.05); *F24S 25/70* (2018.05);
F24S 2025/6008 (2018.05); *F24S 2025/803*
(2018.05); *F24S 2025/807* (2018.05); *Y02B*
10/10 (2013.01); *Y02B 10/20* (2013.01); *Y02E*
10/47 (2013.01)

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Stuart Wentworth, San Antonio, TX
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(57)

ABSTRACT

A roof mounting system for the attachment of an article to a roof, the system comprising a plurality of PV modules each having at least one corner and a frame member, a flashing member having a top surface; an upstanding sleeve attached to the top surface of the flashing member; an elevated water seal having a borehole formed therethrough, the elevated water seal further comprising at least one screw for providing a waterproof seal between the article and the roof structure; and whereby the plurality of PV modules are interlocked in a way to provide a corner-to-corner coupling arrangement supported above the roof through the frame members of the plurality of PV modules.

(21) Appl. No.: **18/599,799**

(22) Filed: **Mar. 8, 2024**

Publication Classification

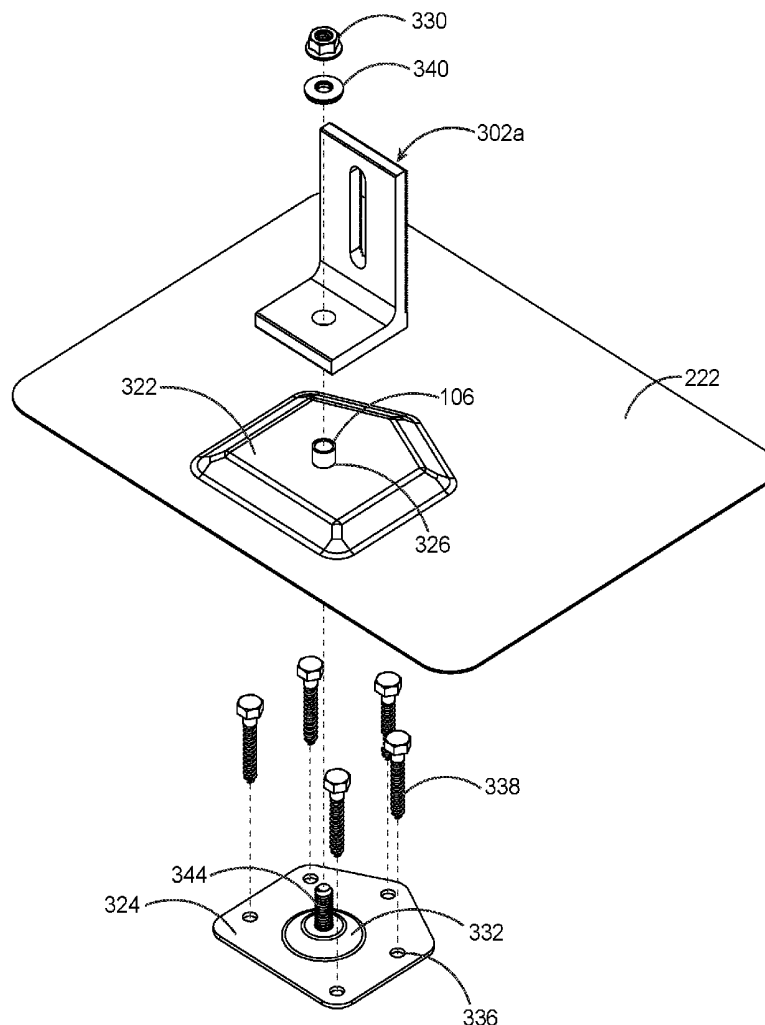
(51) **Int. Cl.**

H02S 20/23 (2006.01)

F24S 25/00 (2006.01)

F24S 25/33 (2006.01)

F24S 25/60 (2006.01)



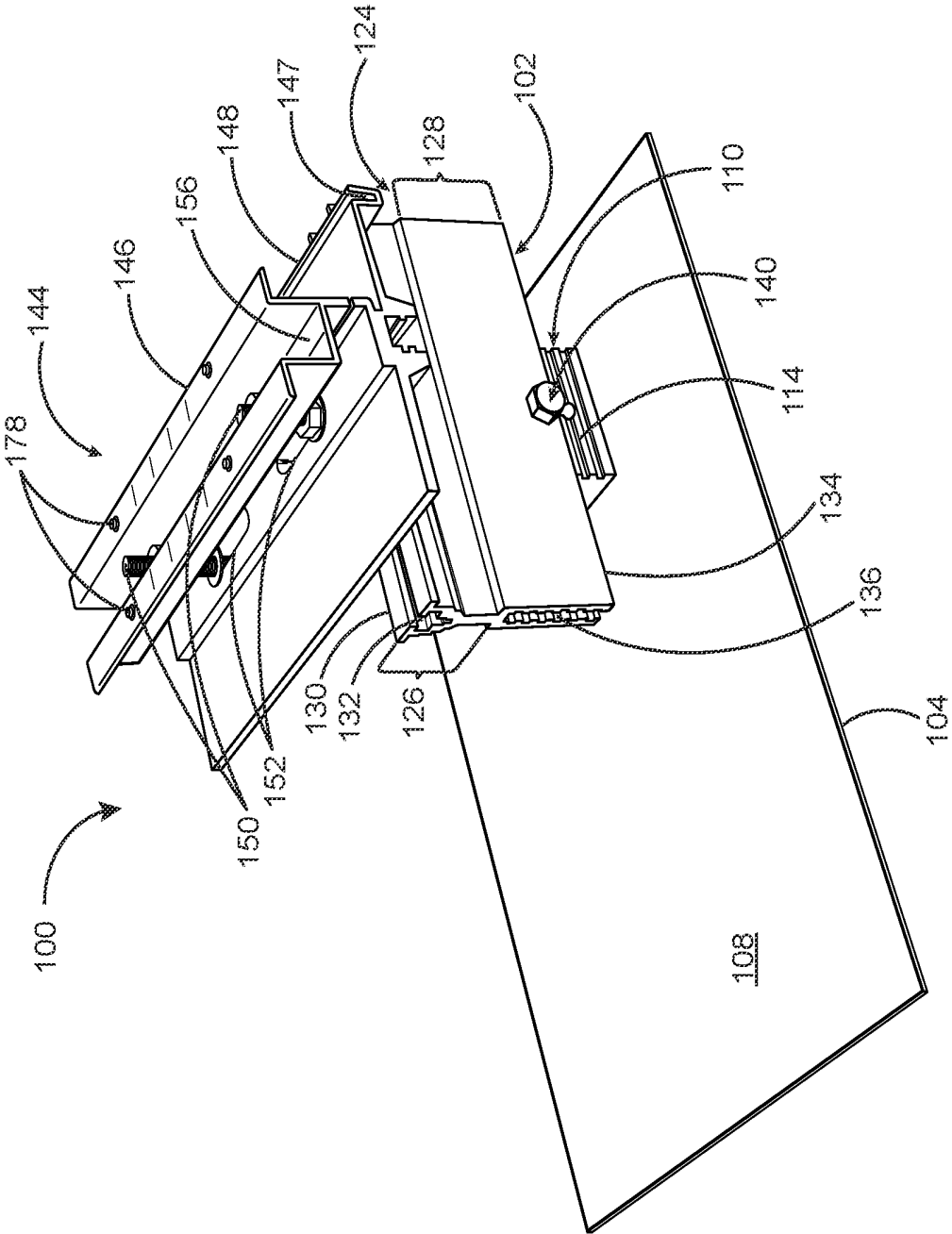


FIG. 1

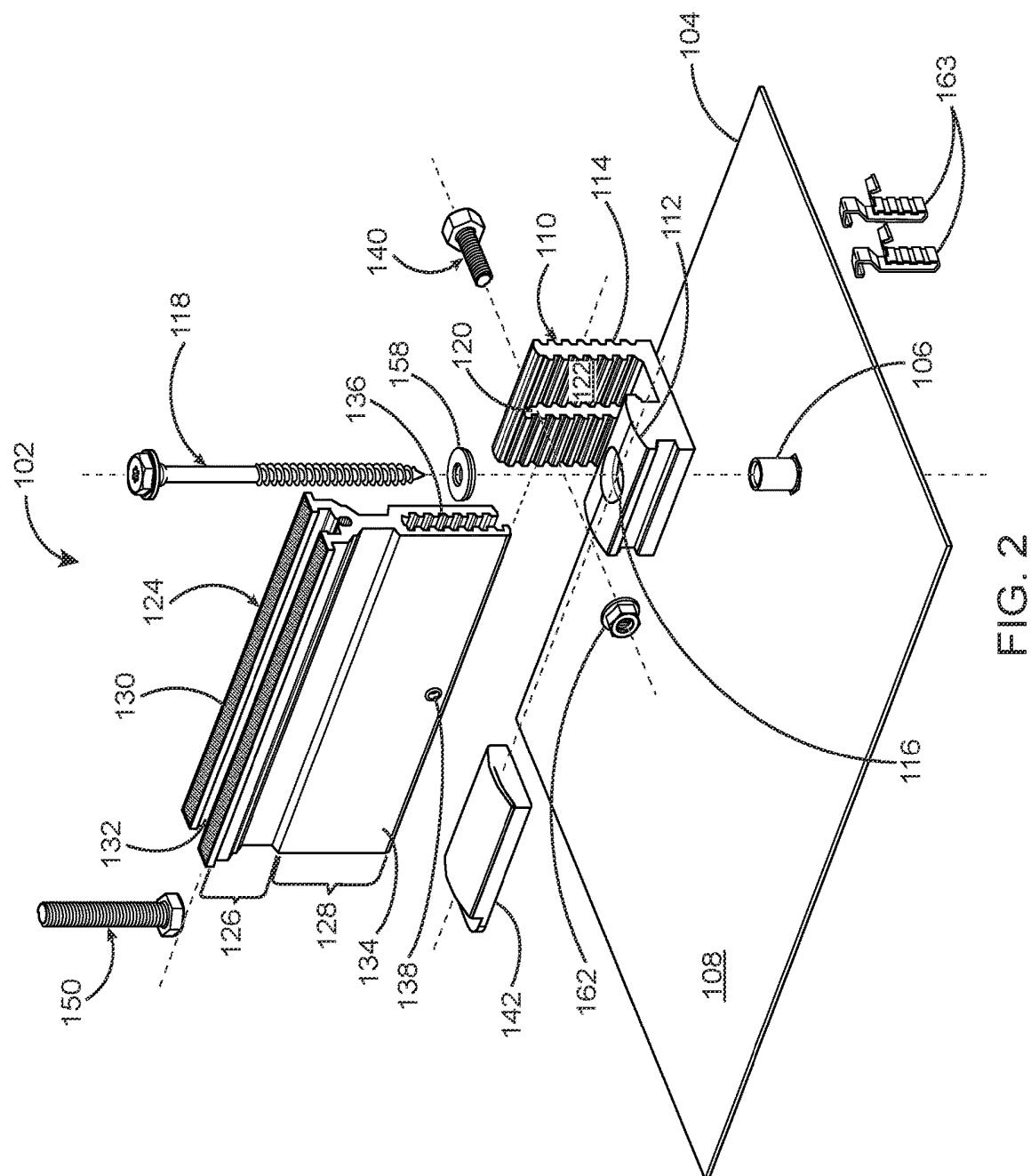


FIG. 2

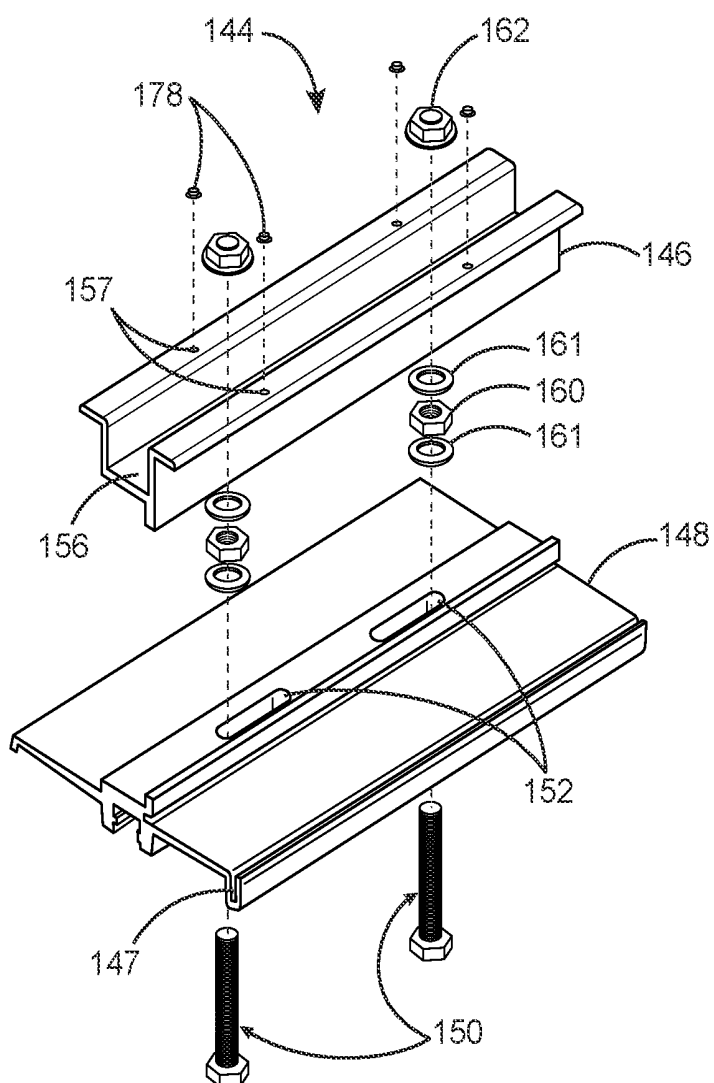
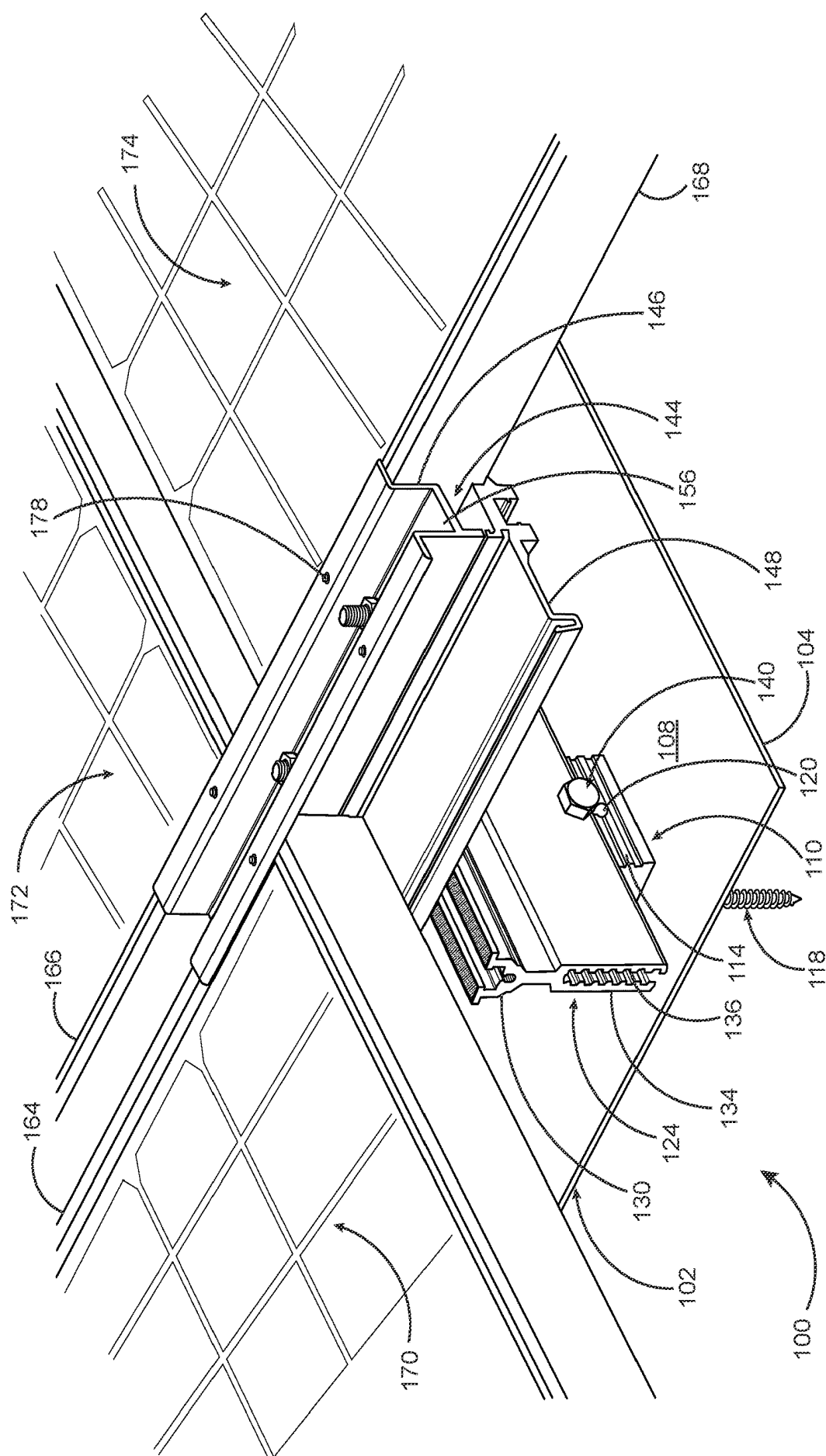


FIG. 3



Q

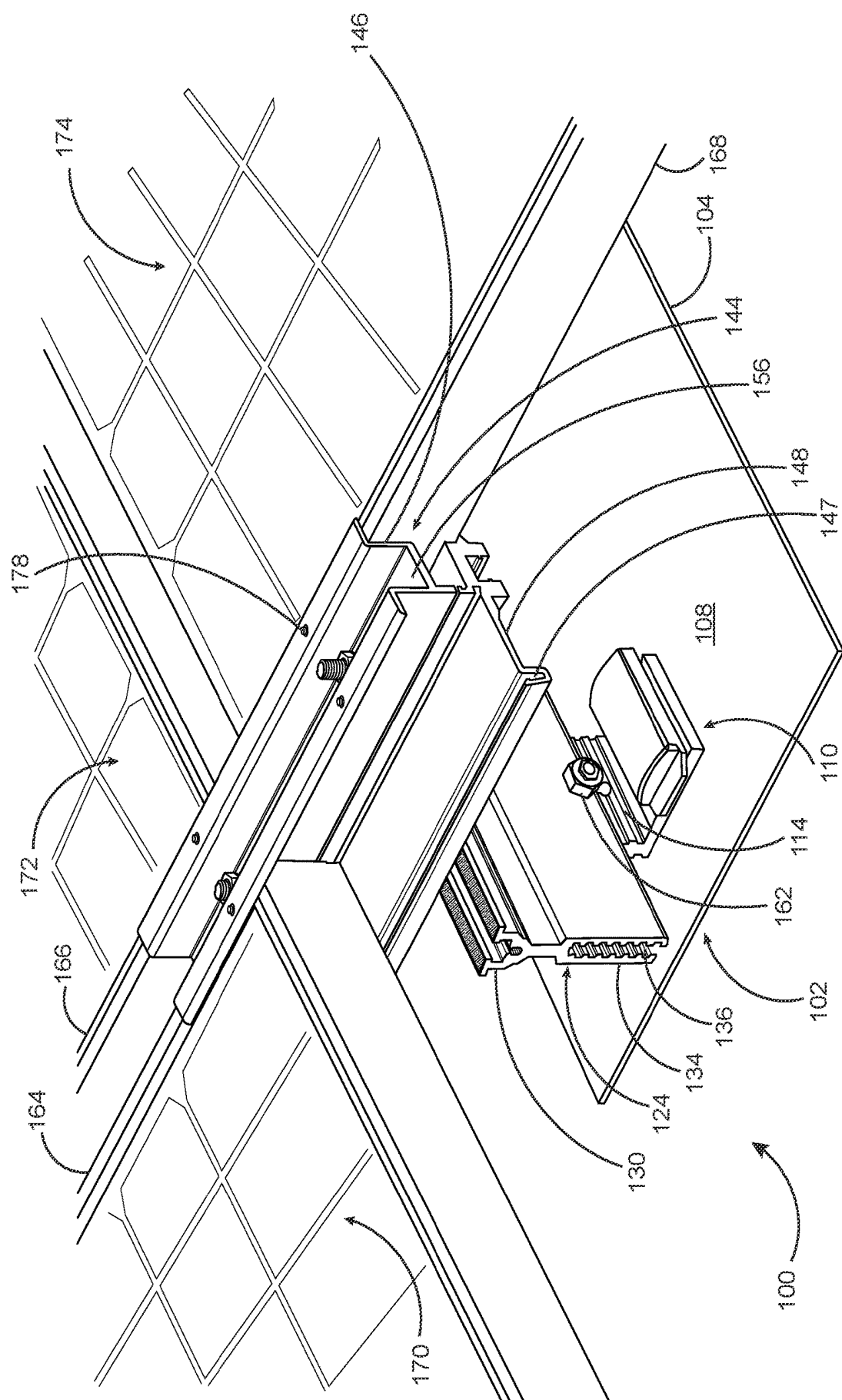


FIG. 5

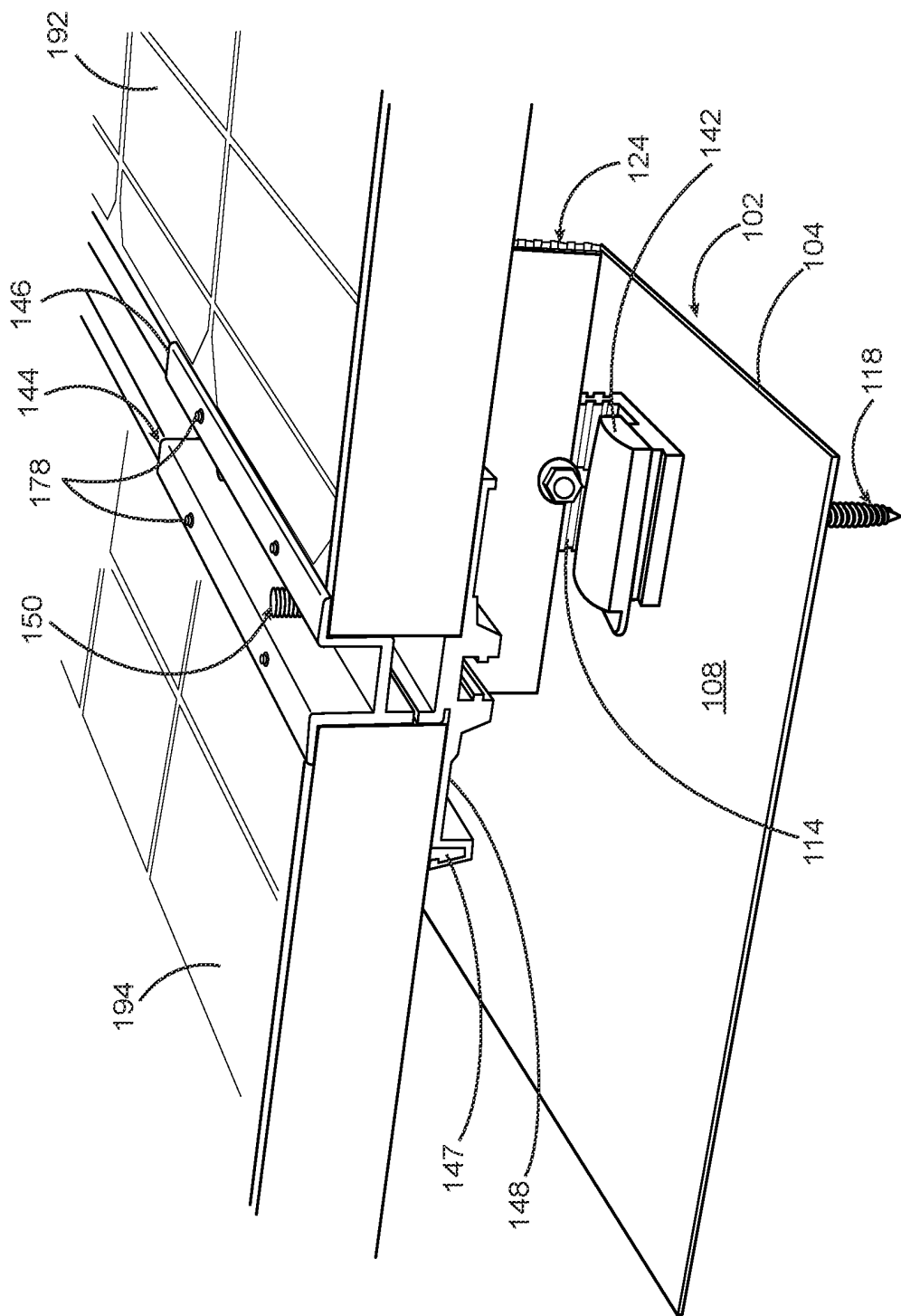
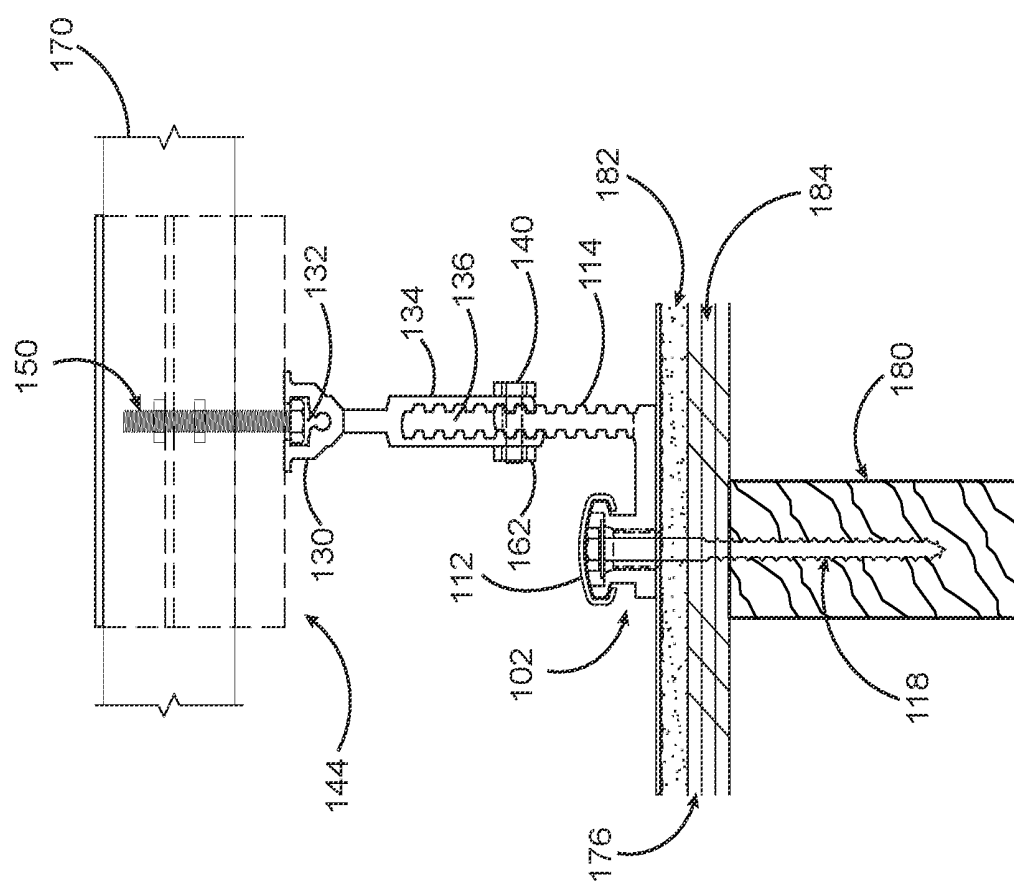


FIG. 6



7
8
9
10
11

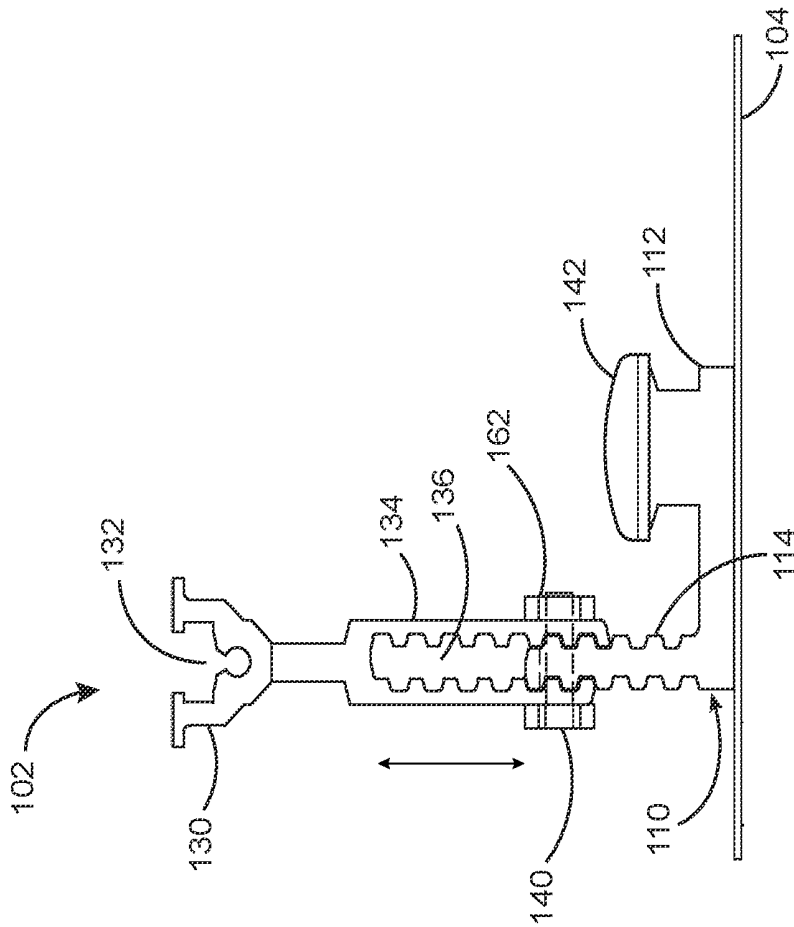


FIG. 8

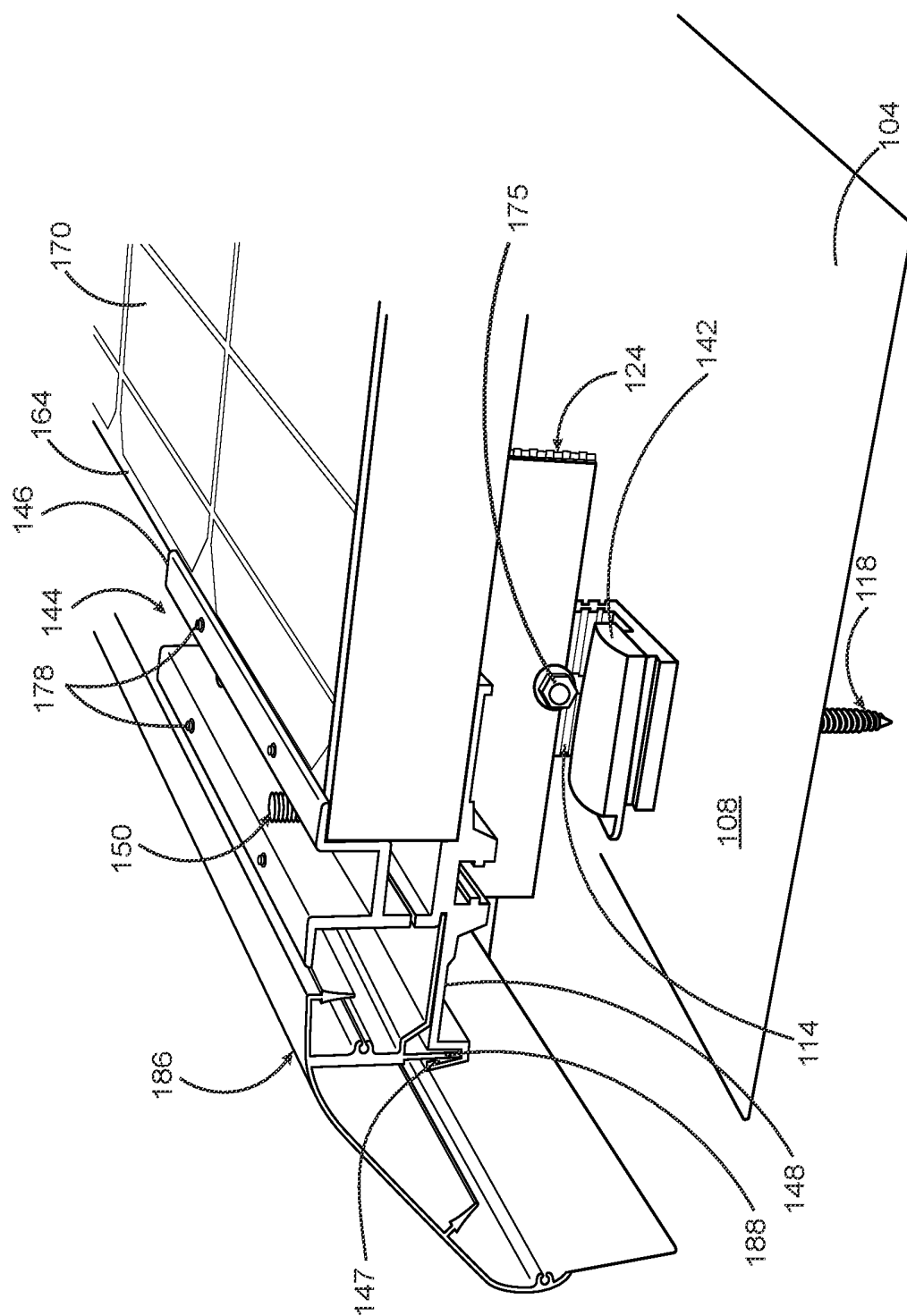


FIG. 9

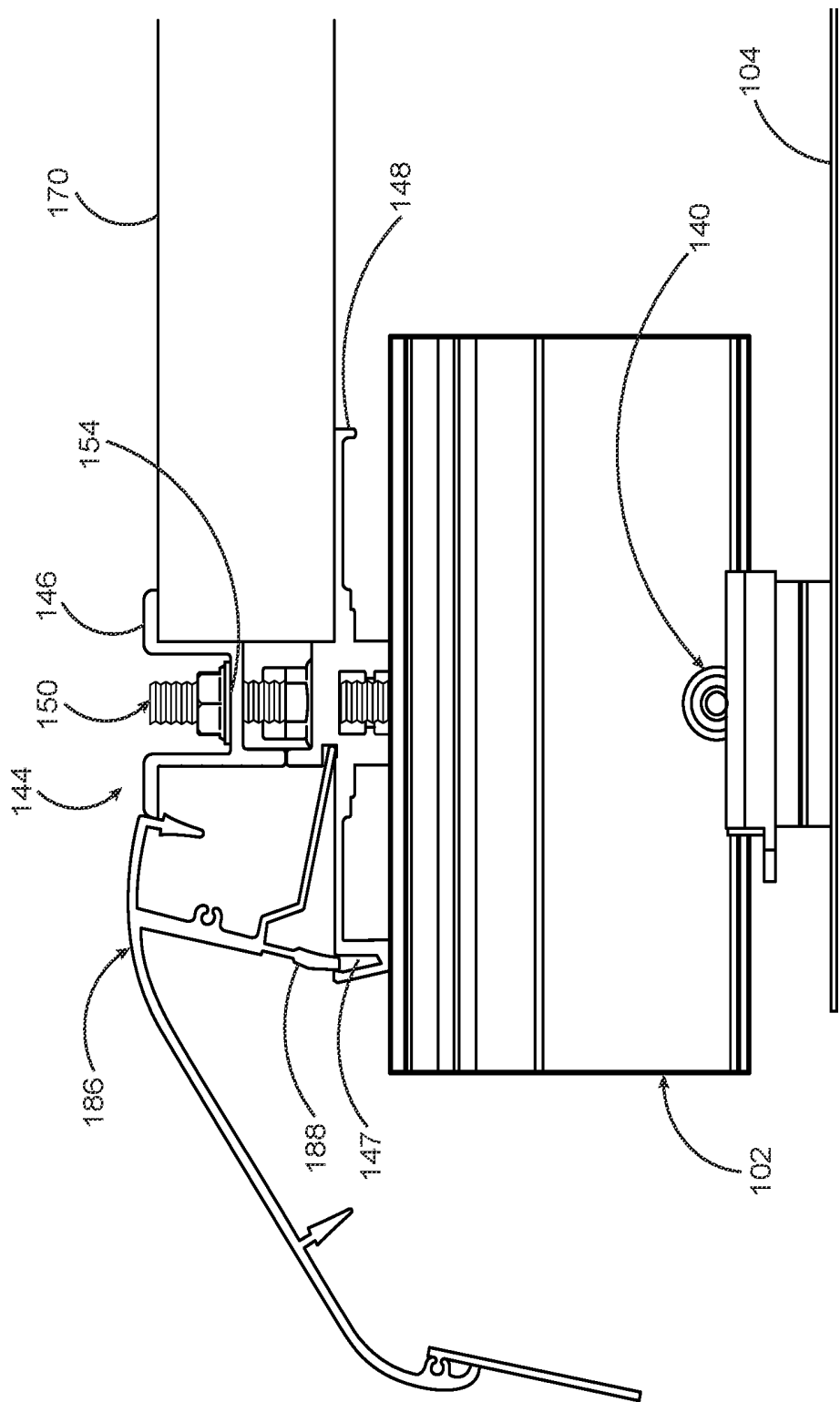


FIG. 10

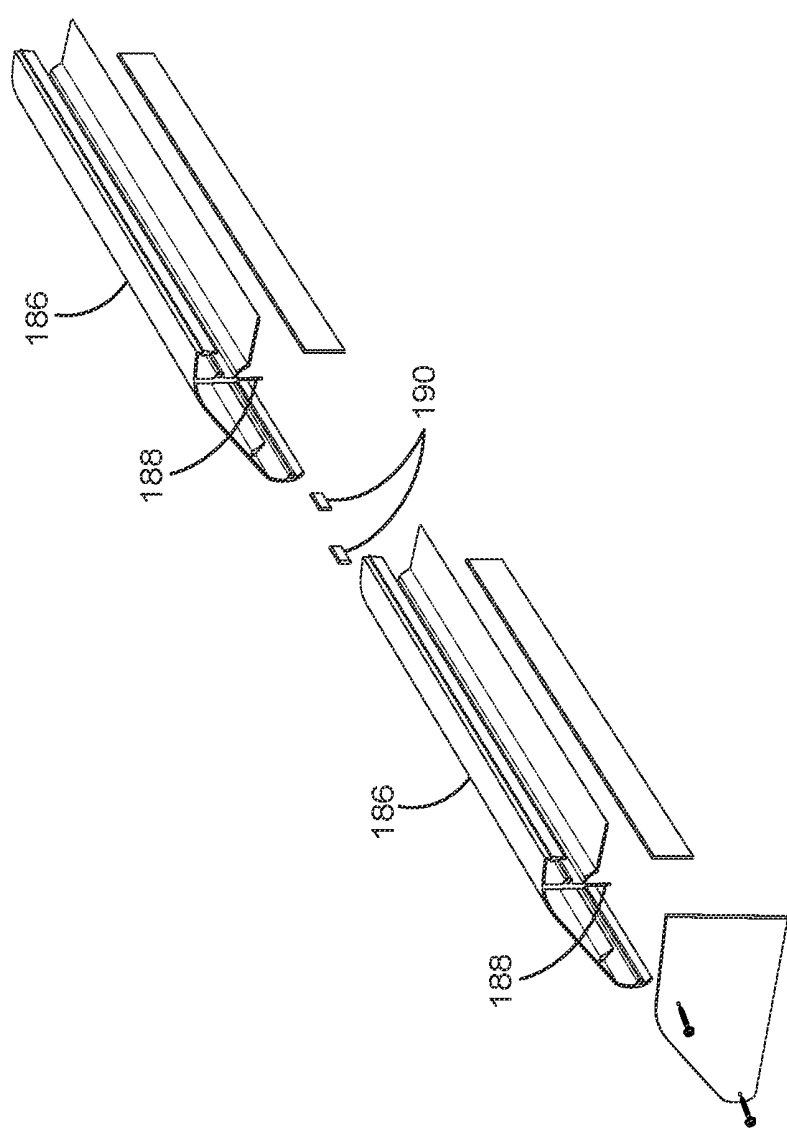


FIG. 11

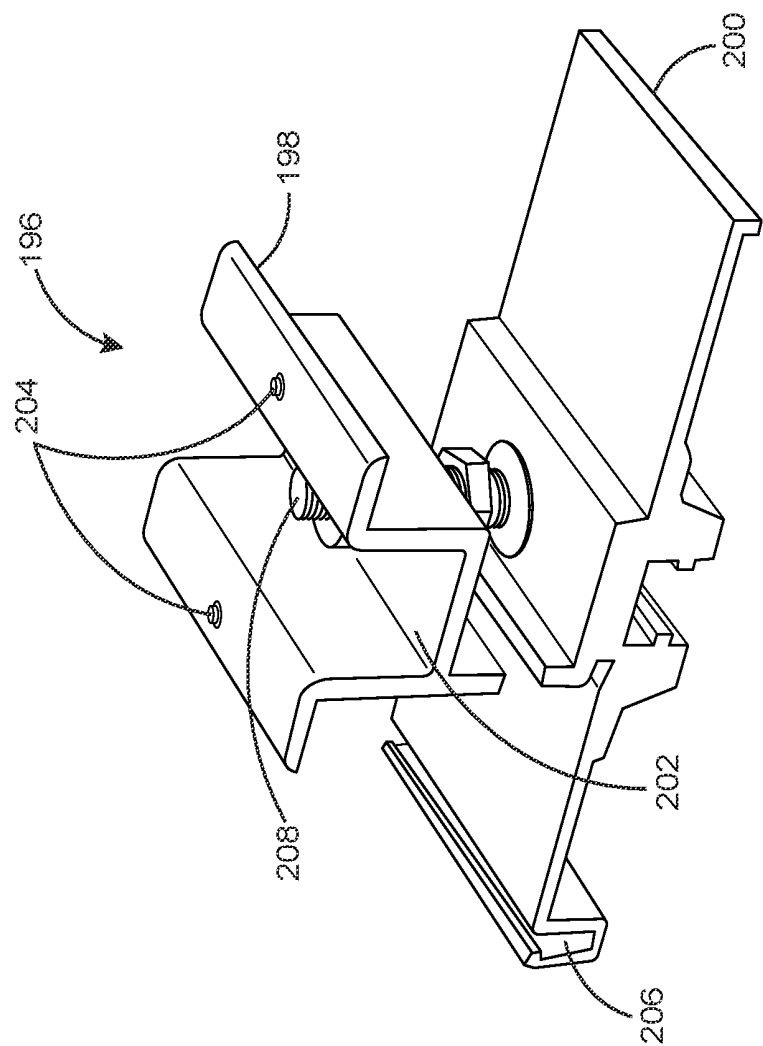


FIG. 12

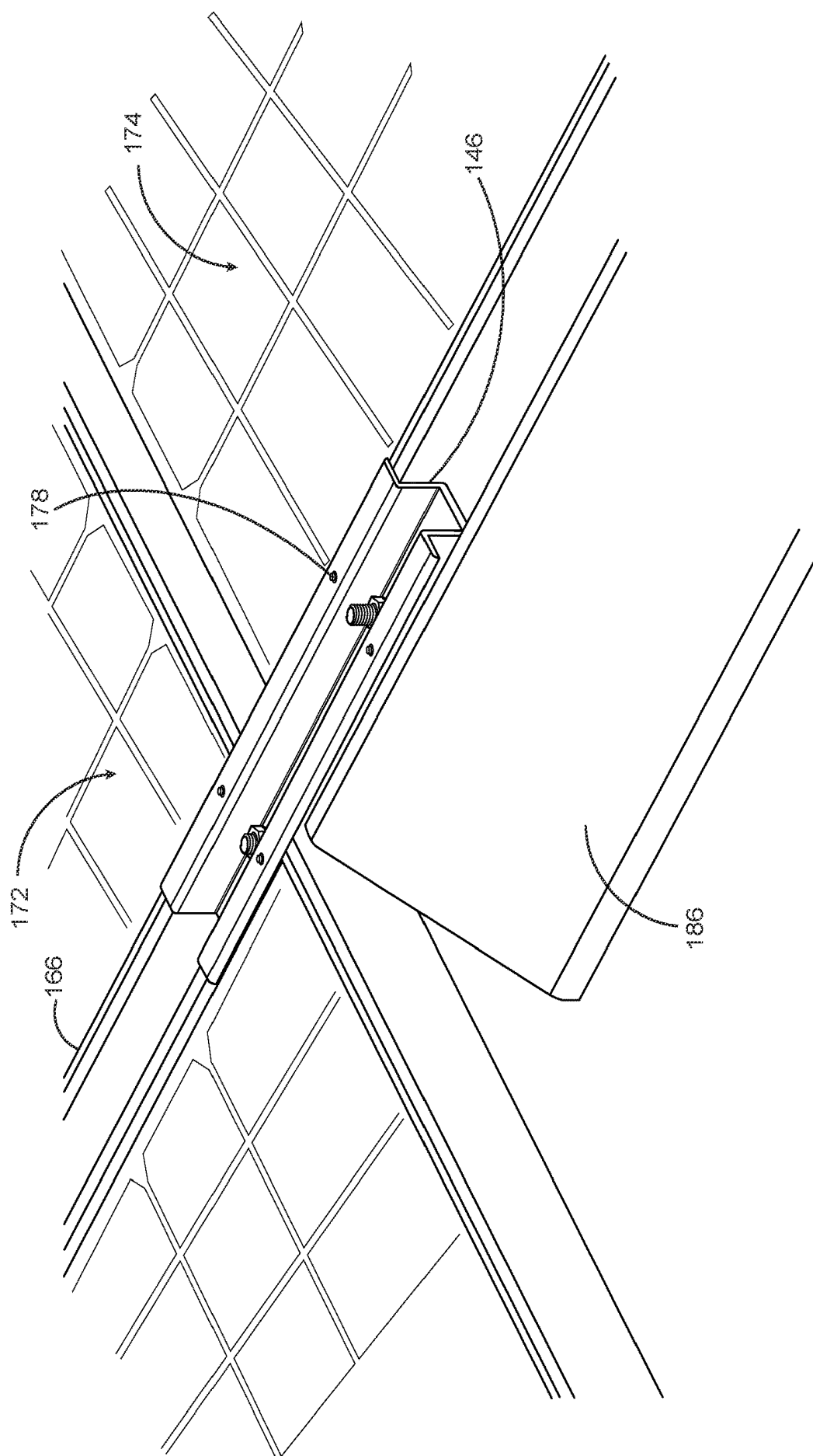


FIG. 13

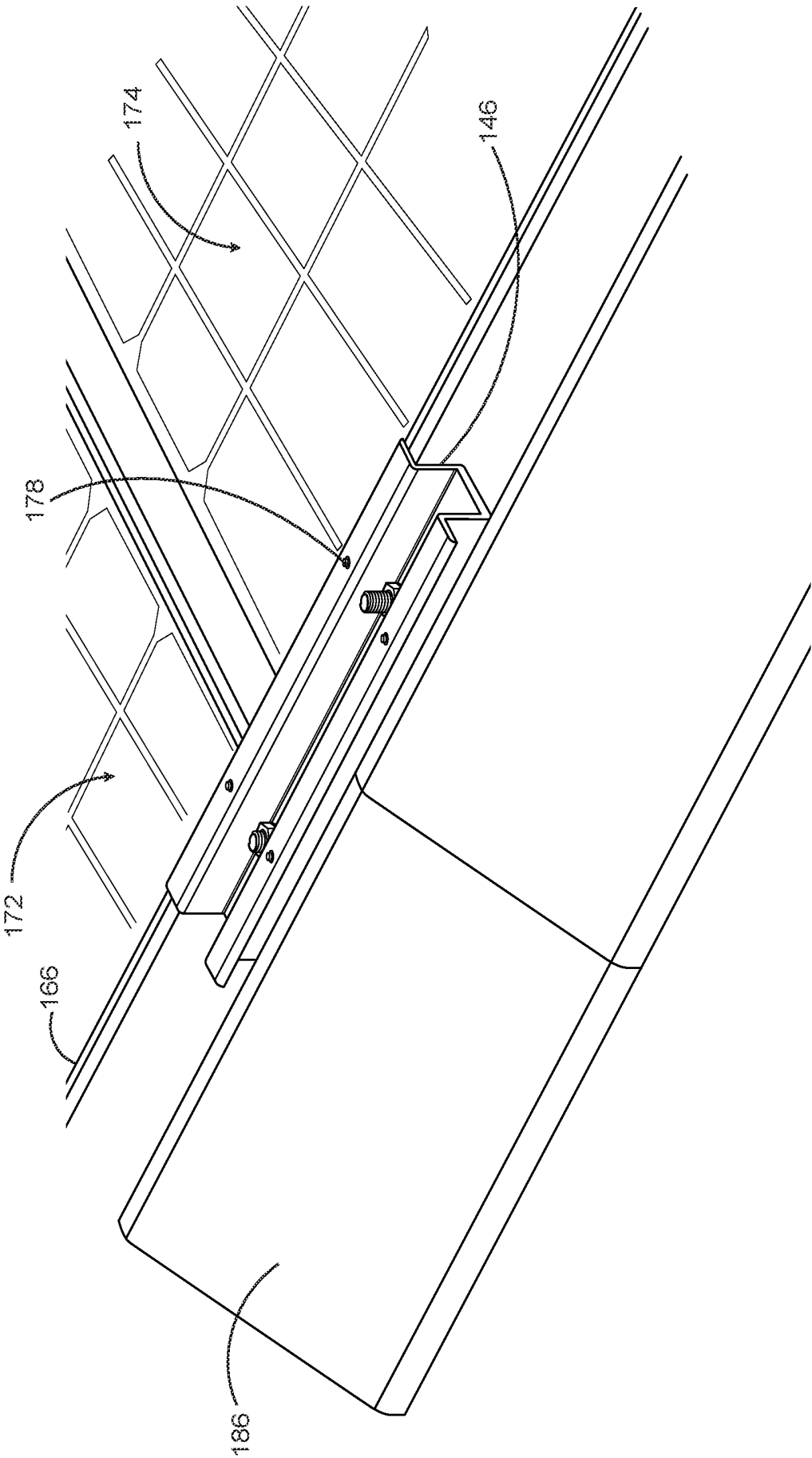


FIG. 14

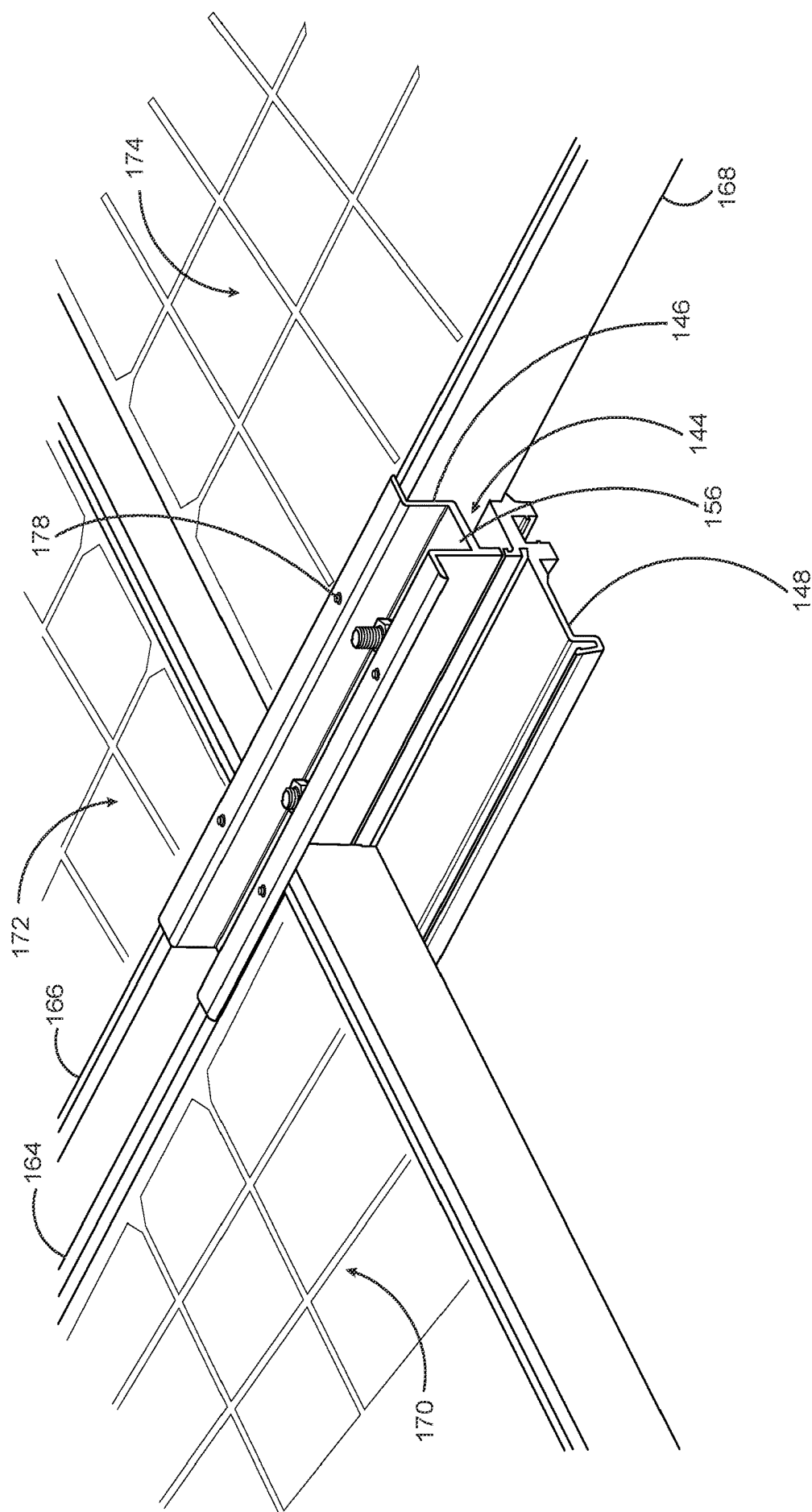


FIG. 15

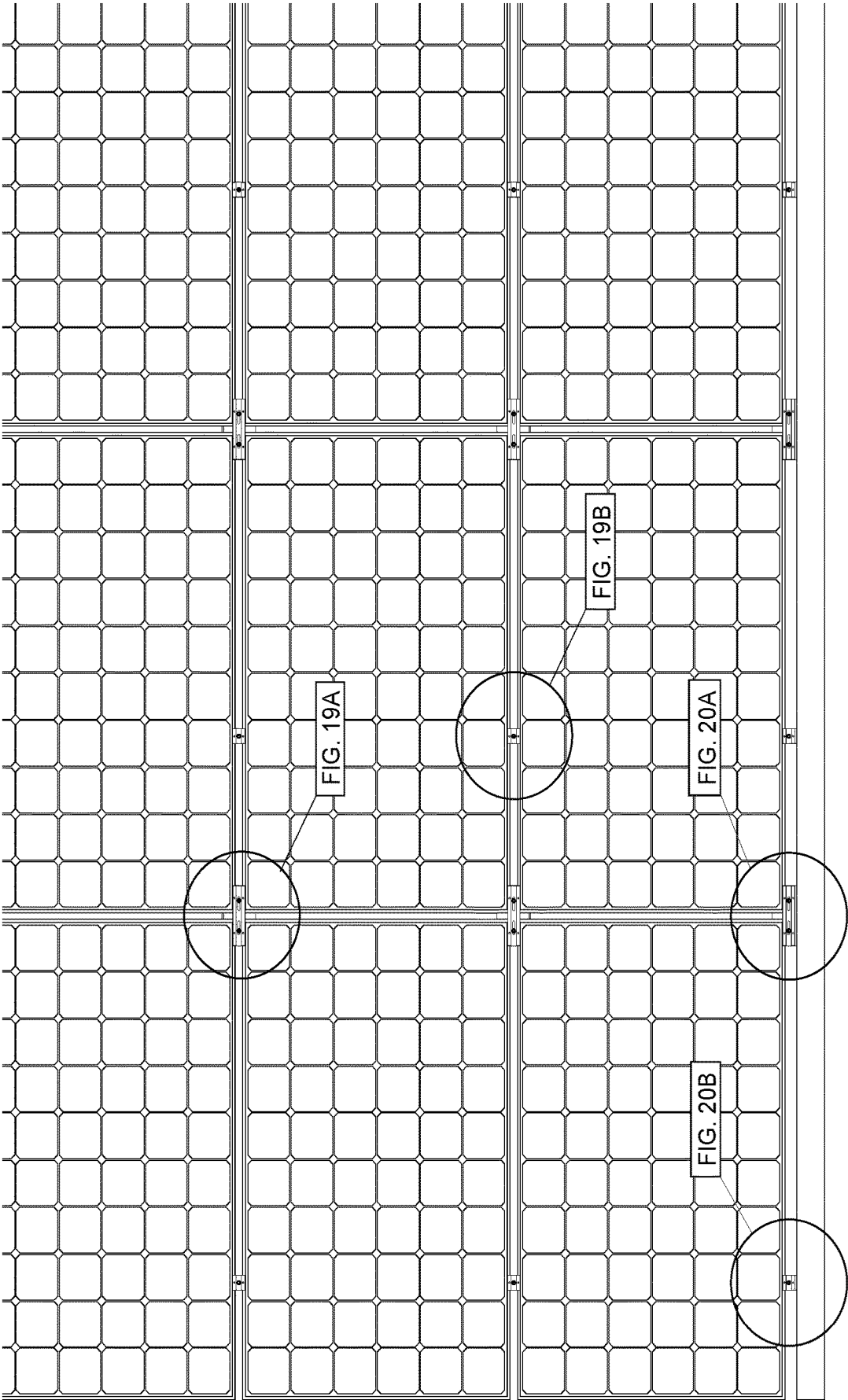


FIG. 16

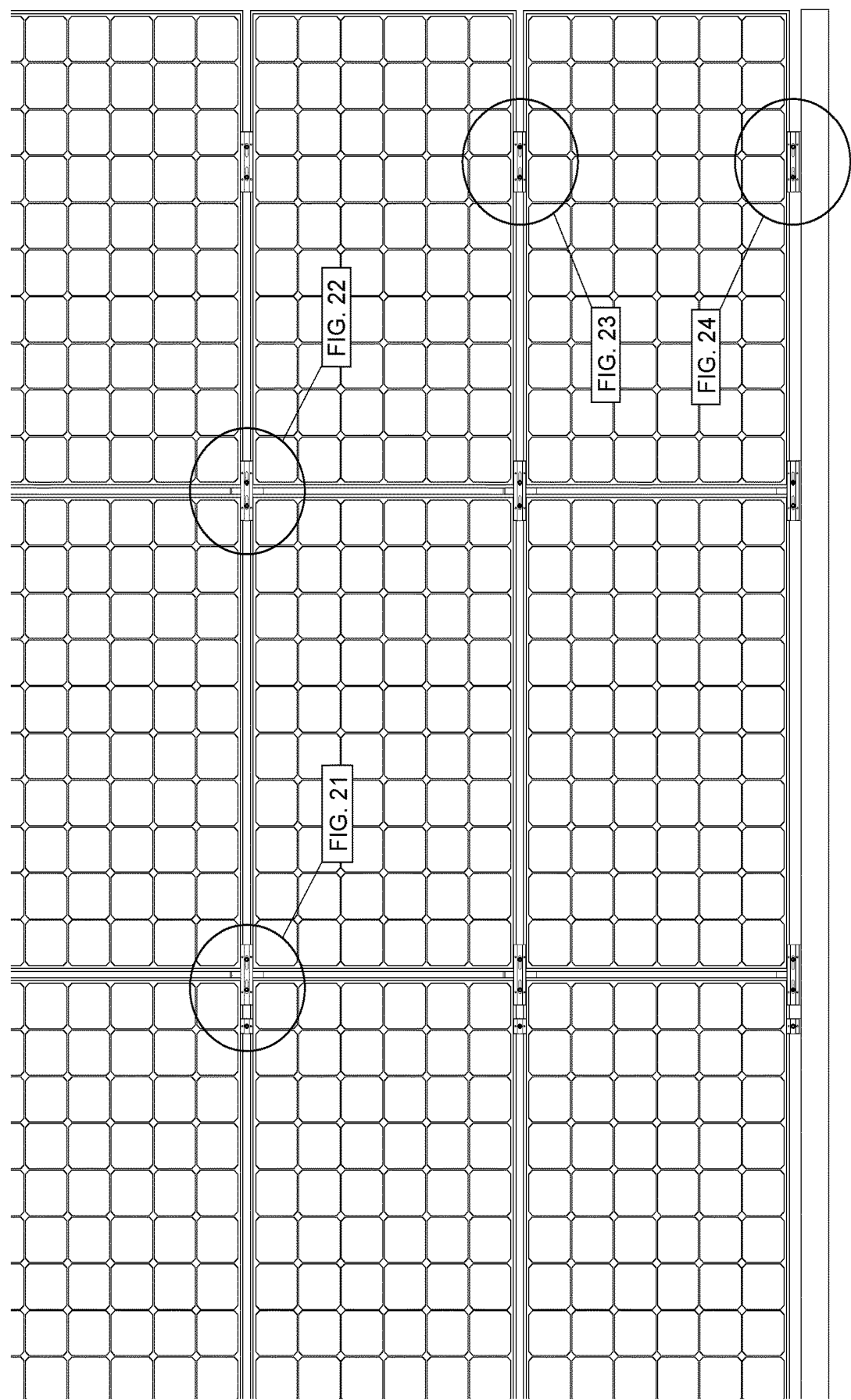


FIG. 17

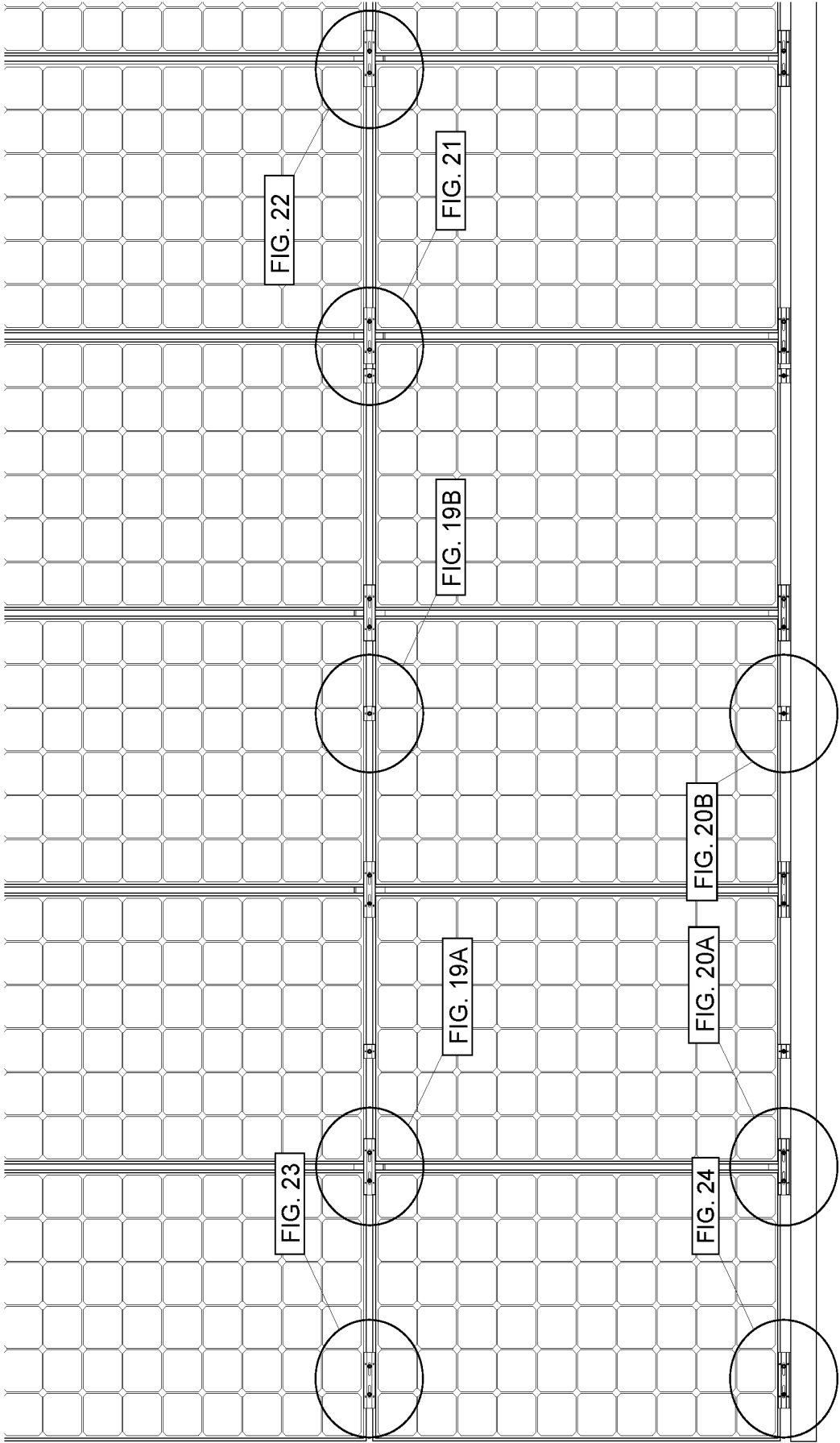


FIG. 18

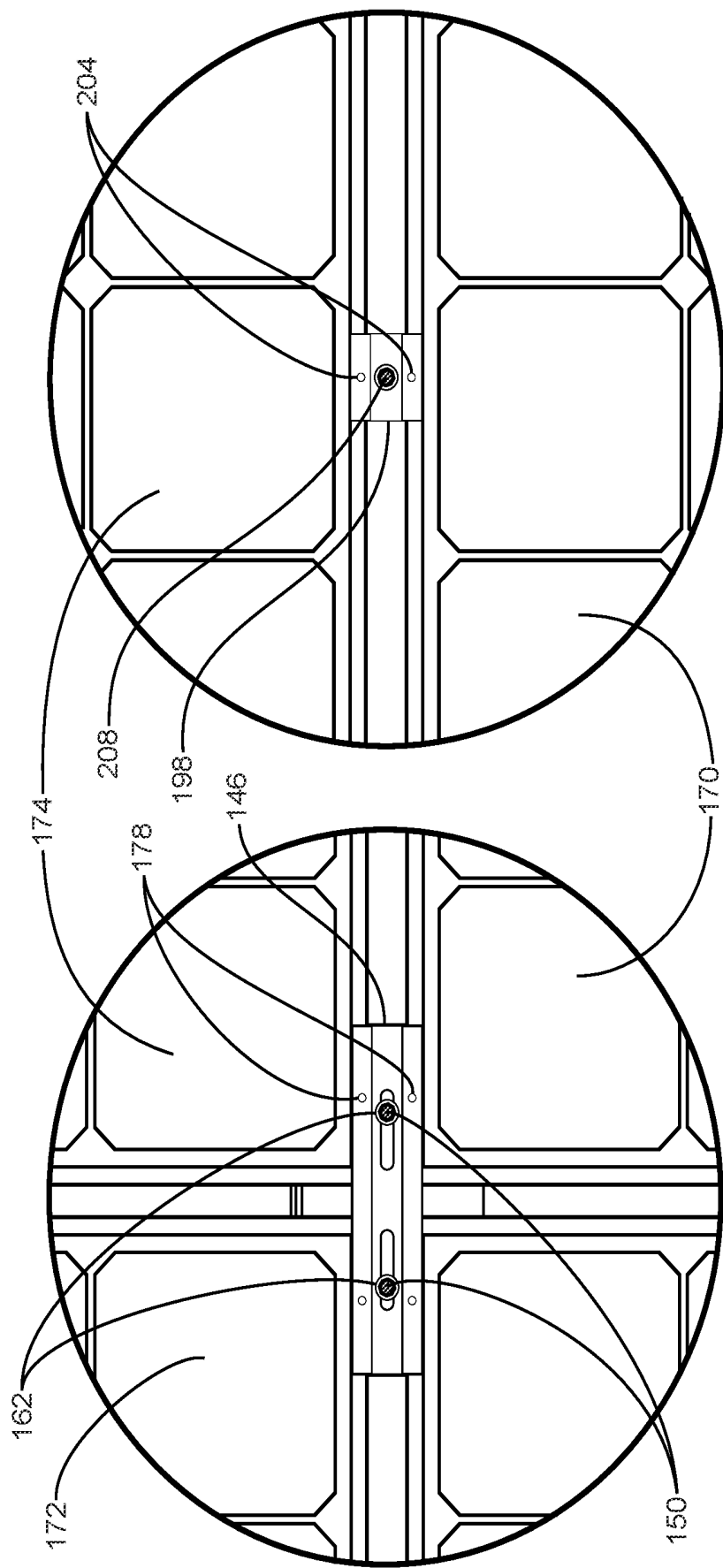


FIG. 19A

FIG. 19B

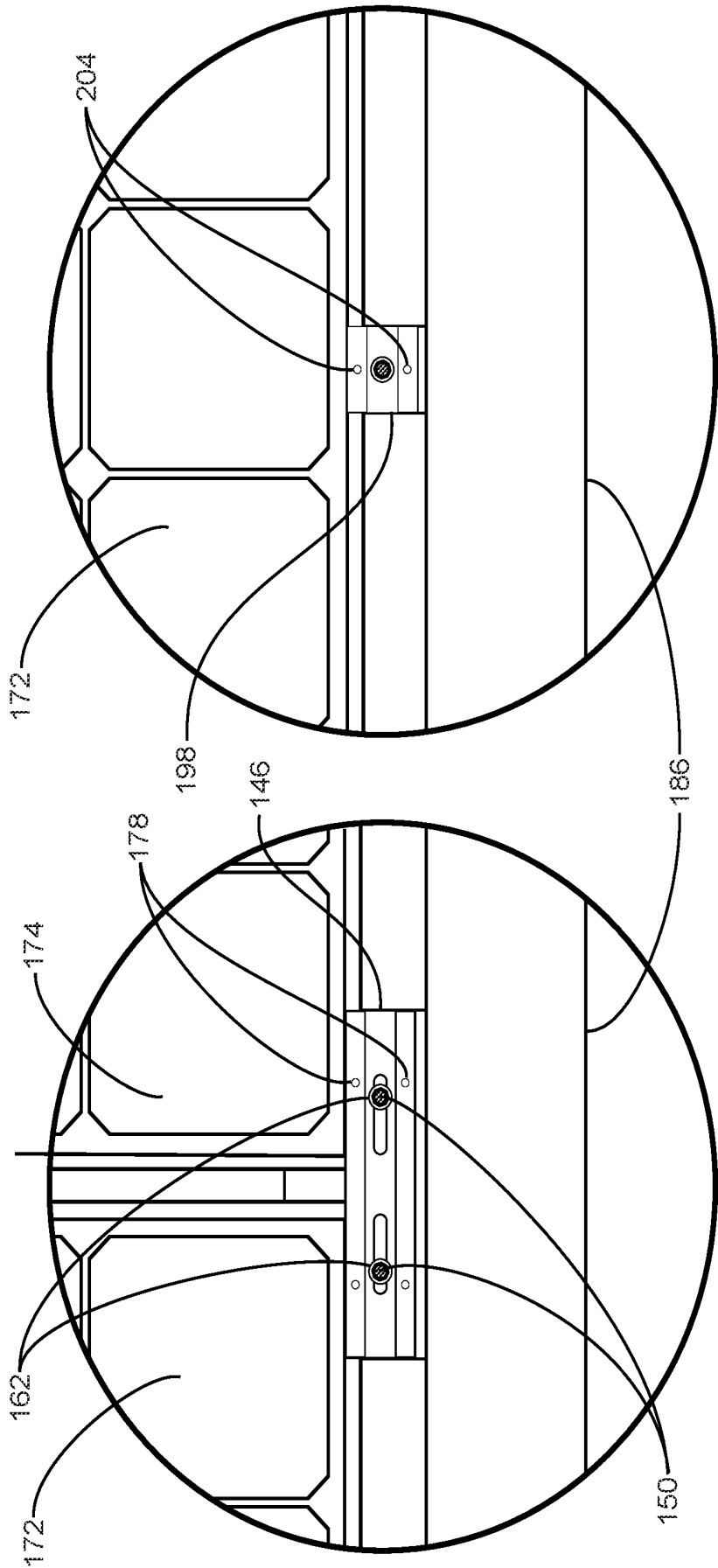


FIG. 20B

FIG. 20A

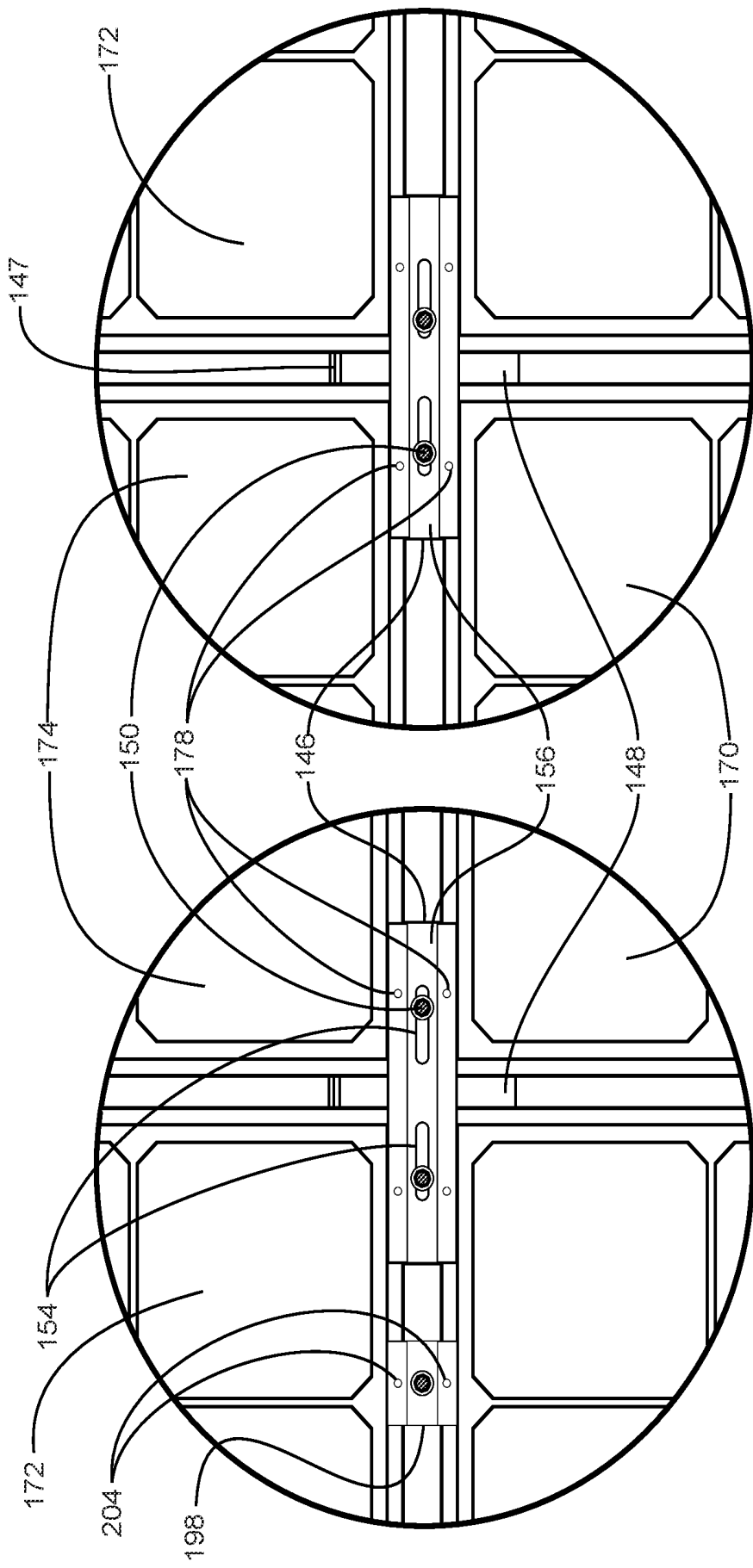


FIG. 22

FIG. 21

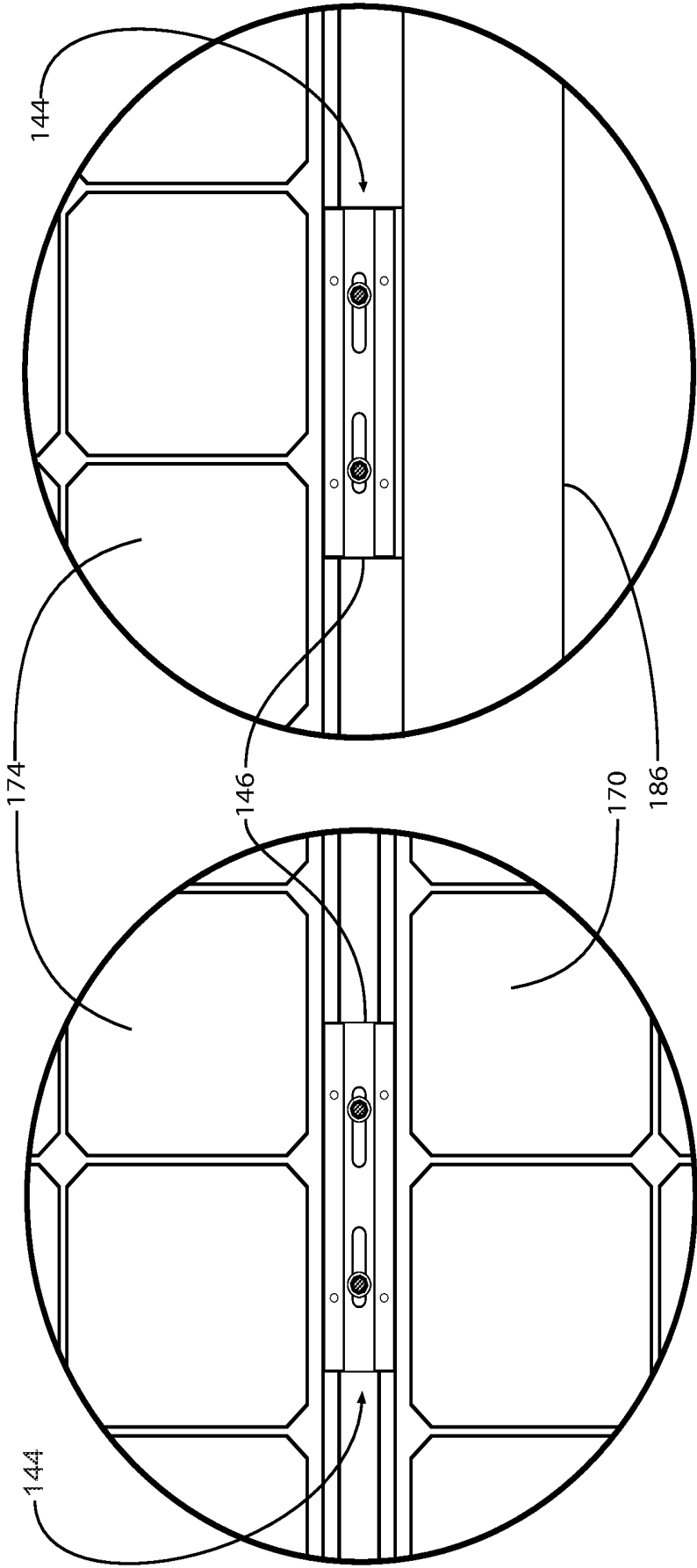


FIG. 24

FIG. 23

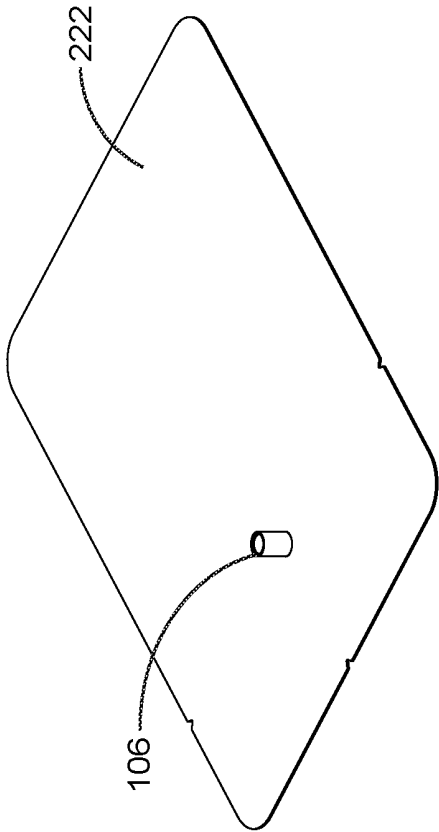


FIG. 25B

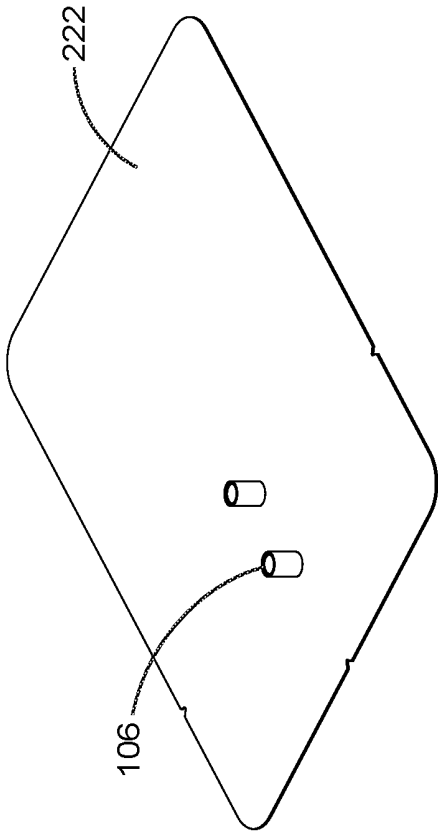


FIG. 25D

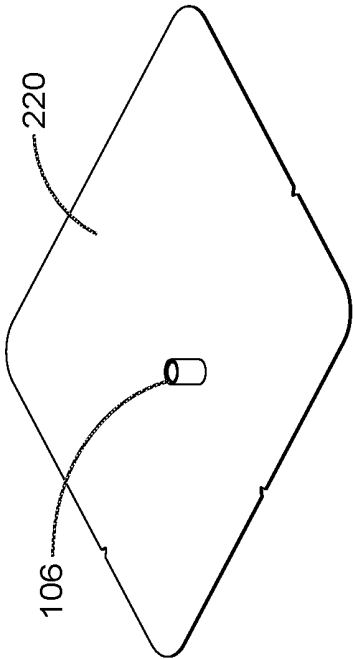


FIG. 25A

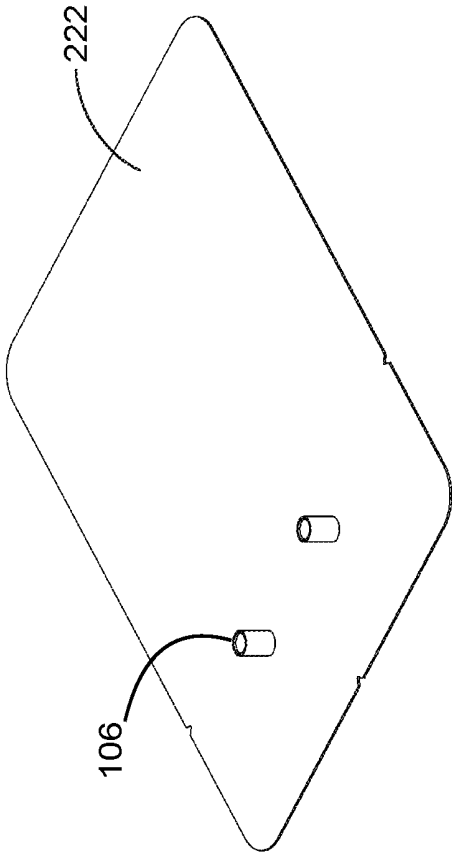
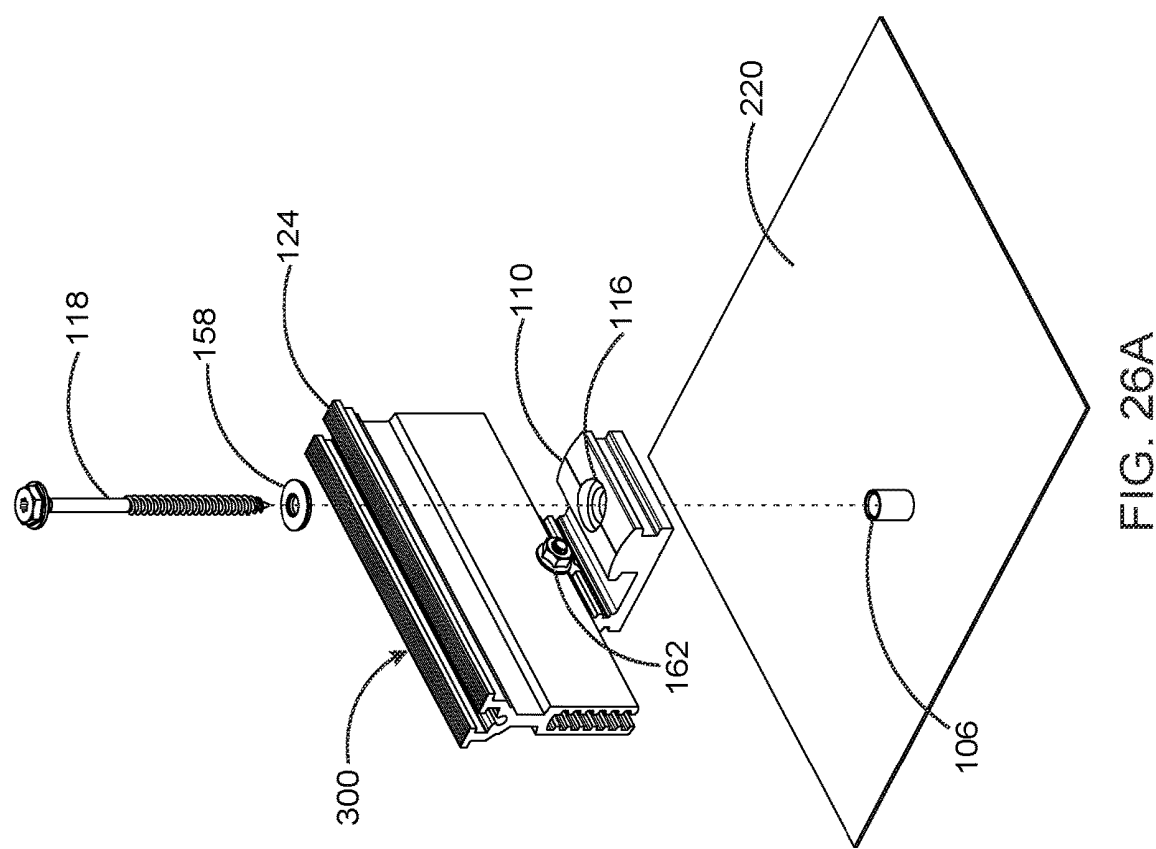


FIG. 25C



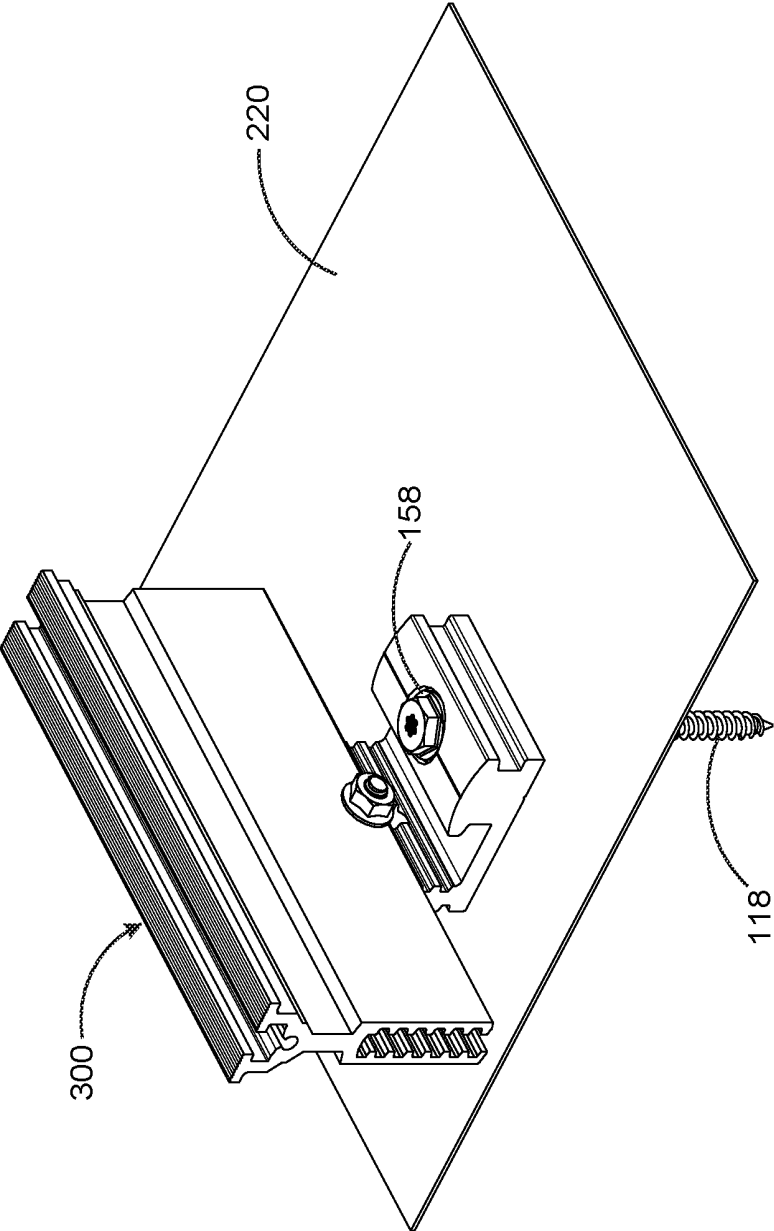


FIG. 26B

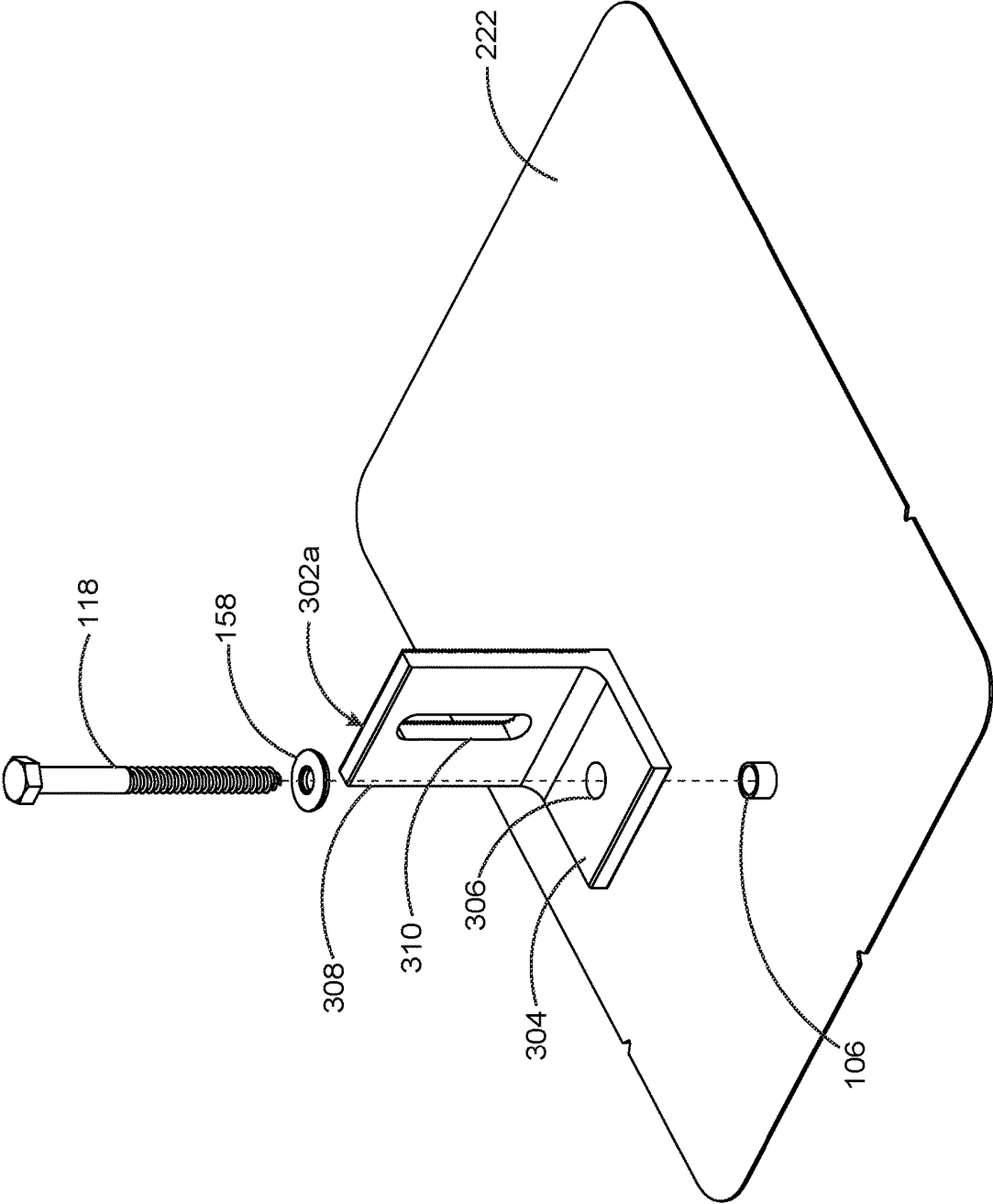


FIG. 27A

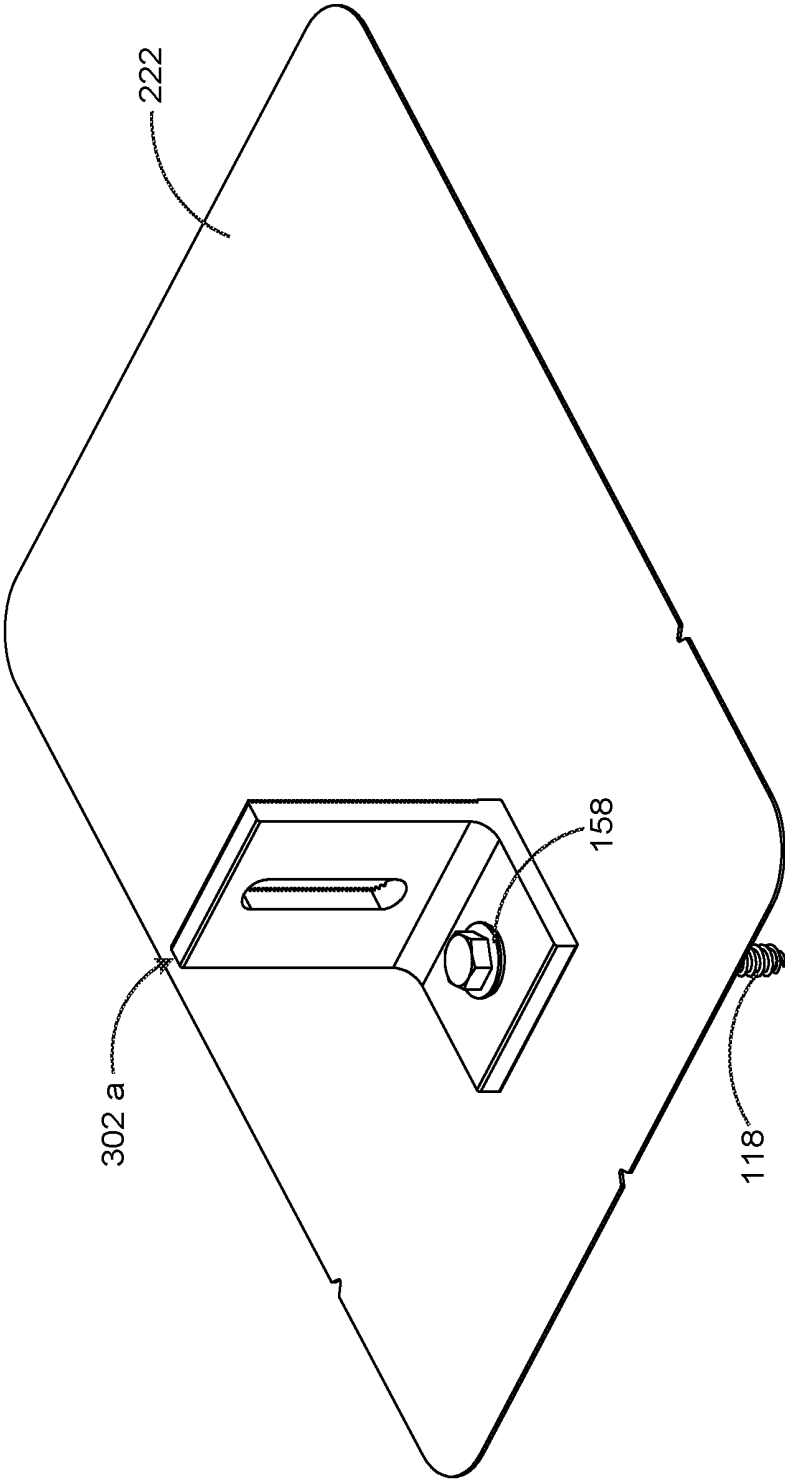


FIG. 27B

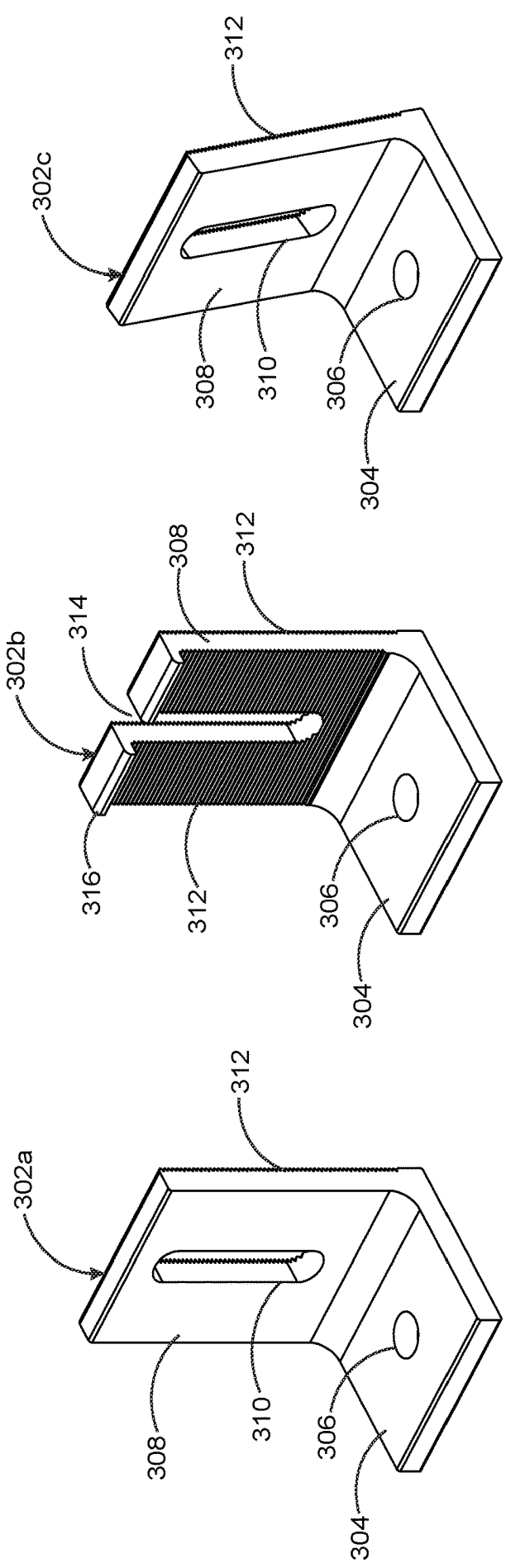


FIG. 28A

FIG. 28B

FIG. 28C

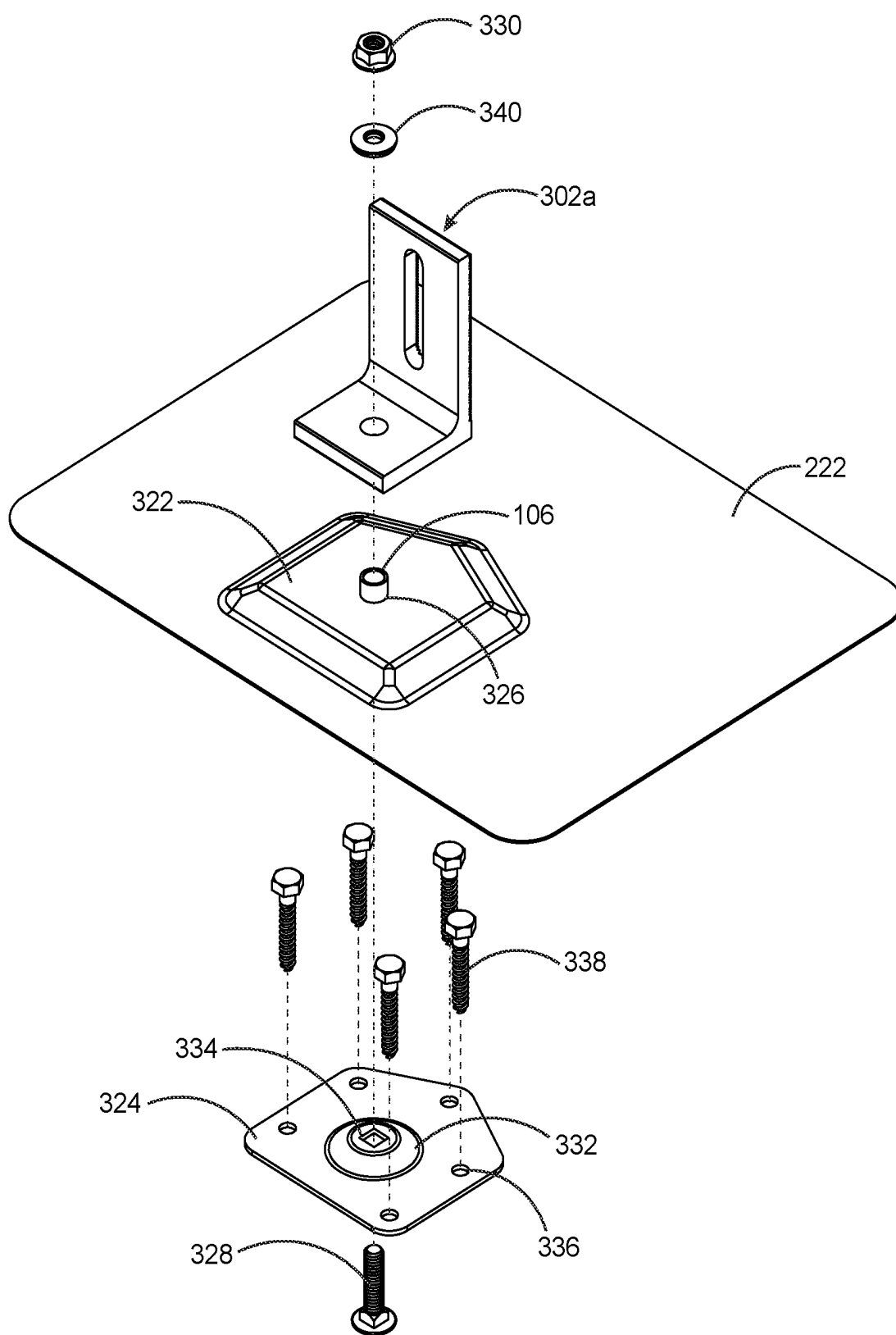


FIG. 29A

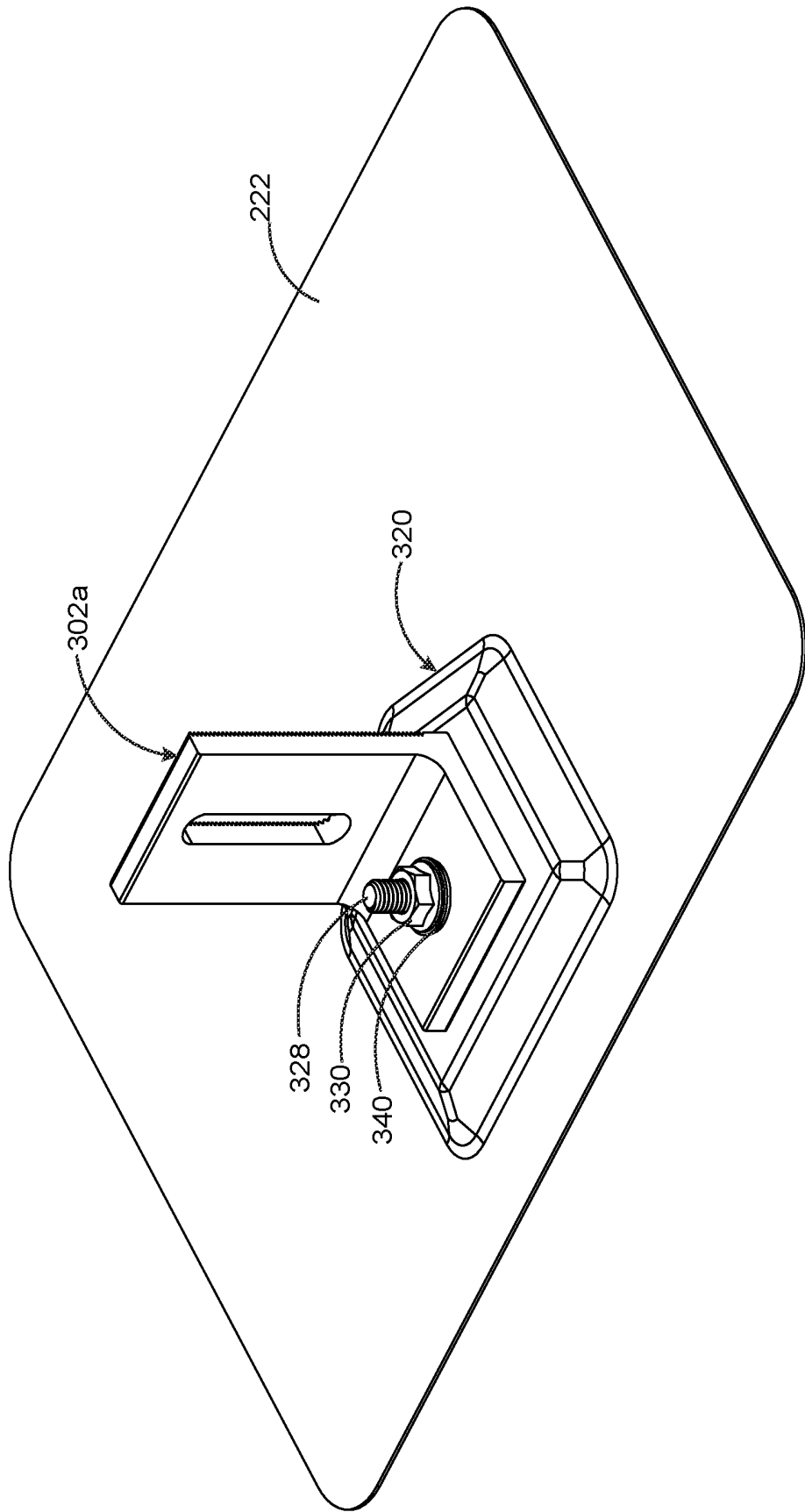


FIG. 29B

FIG. 30A

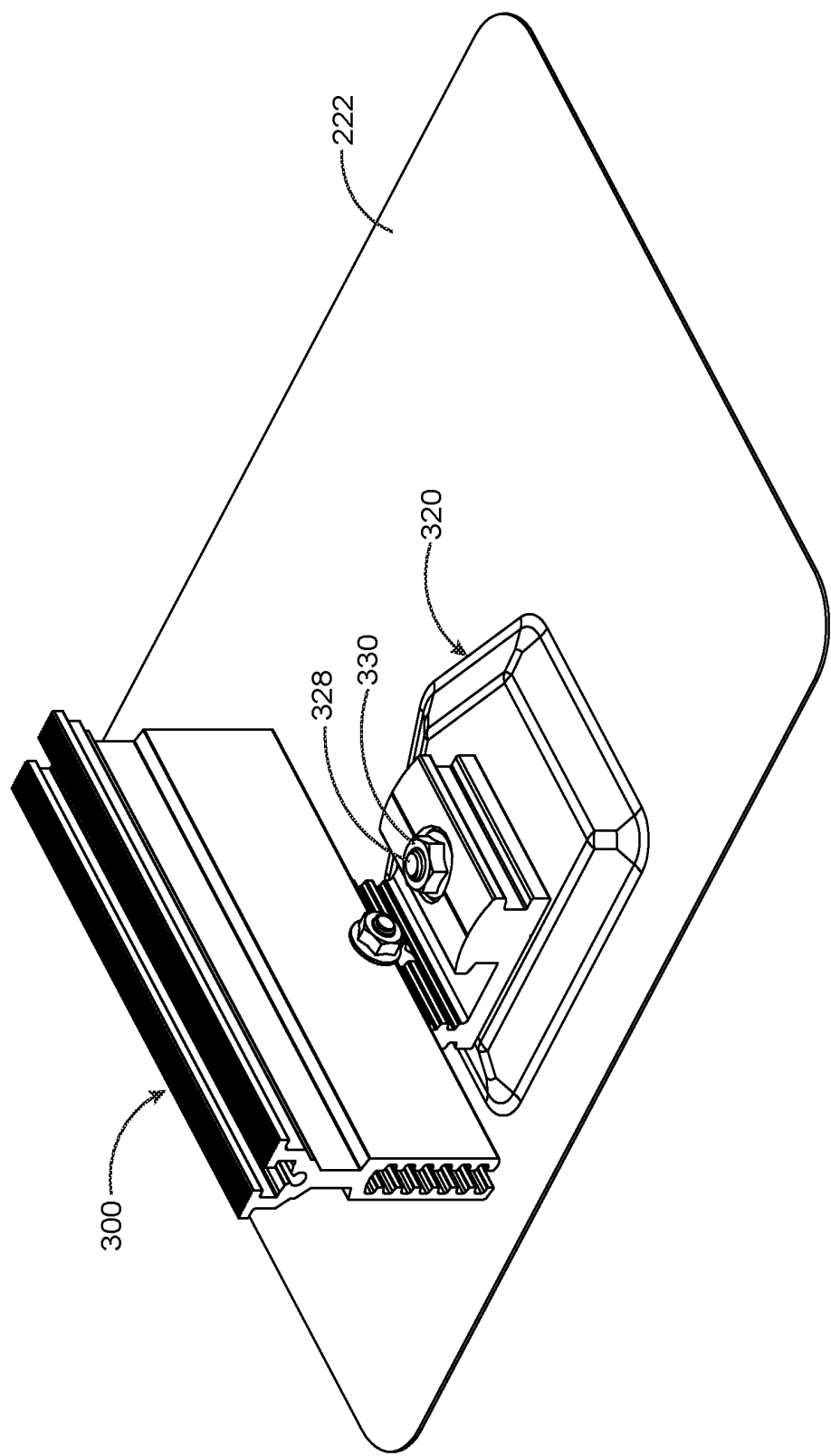


FIG. 30B

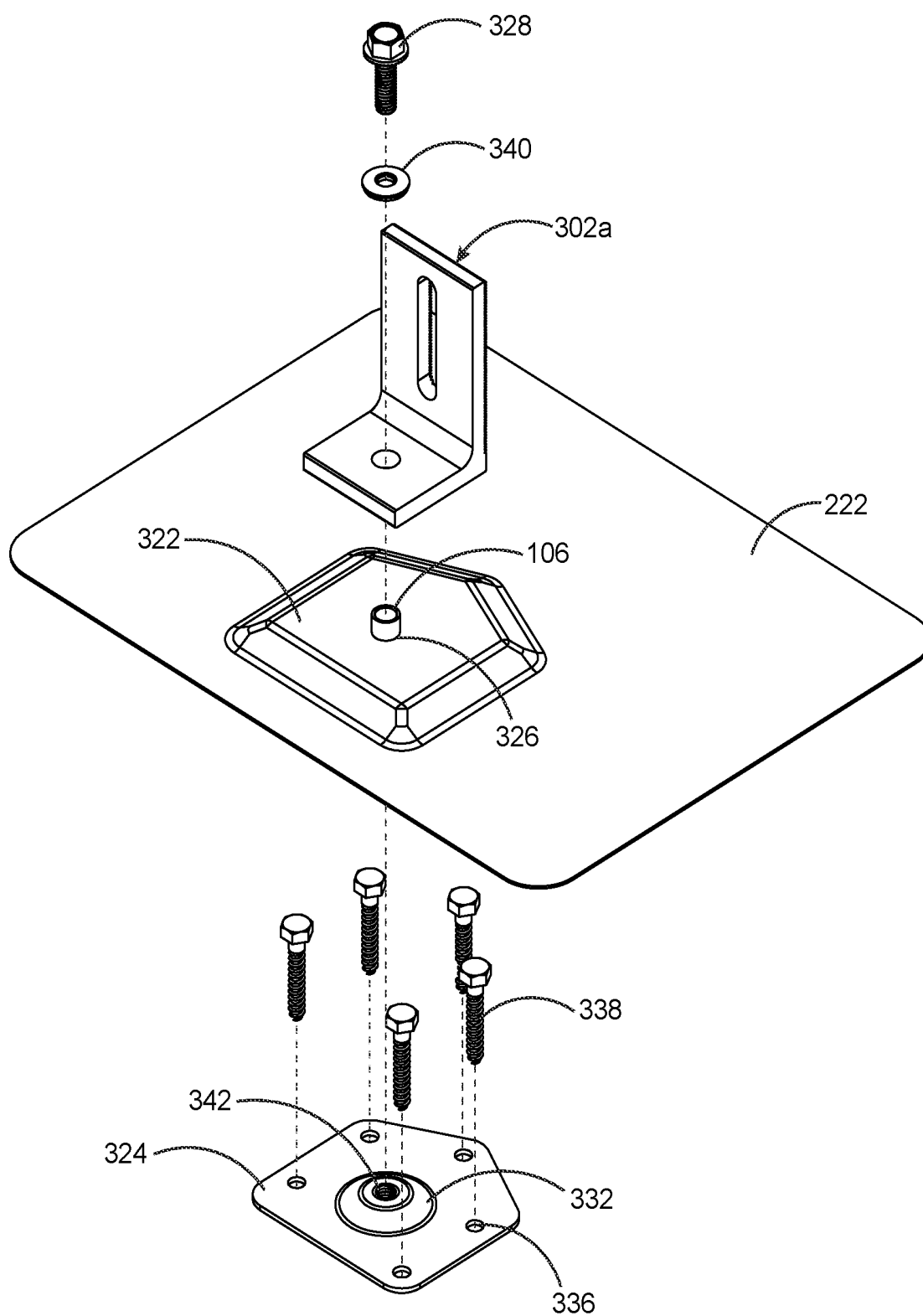


FIG. 31A

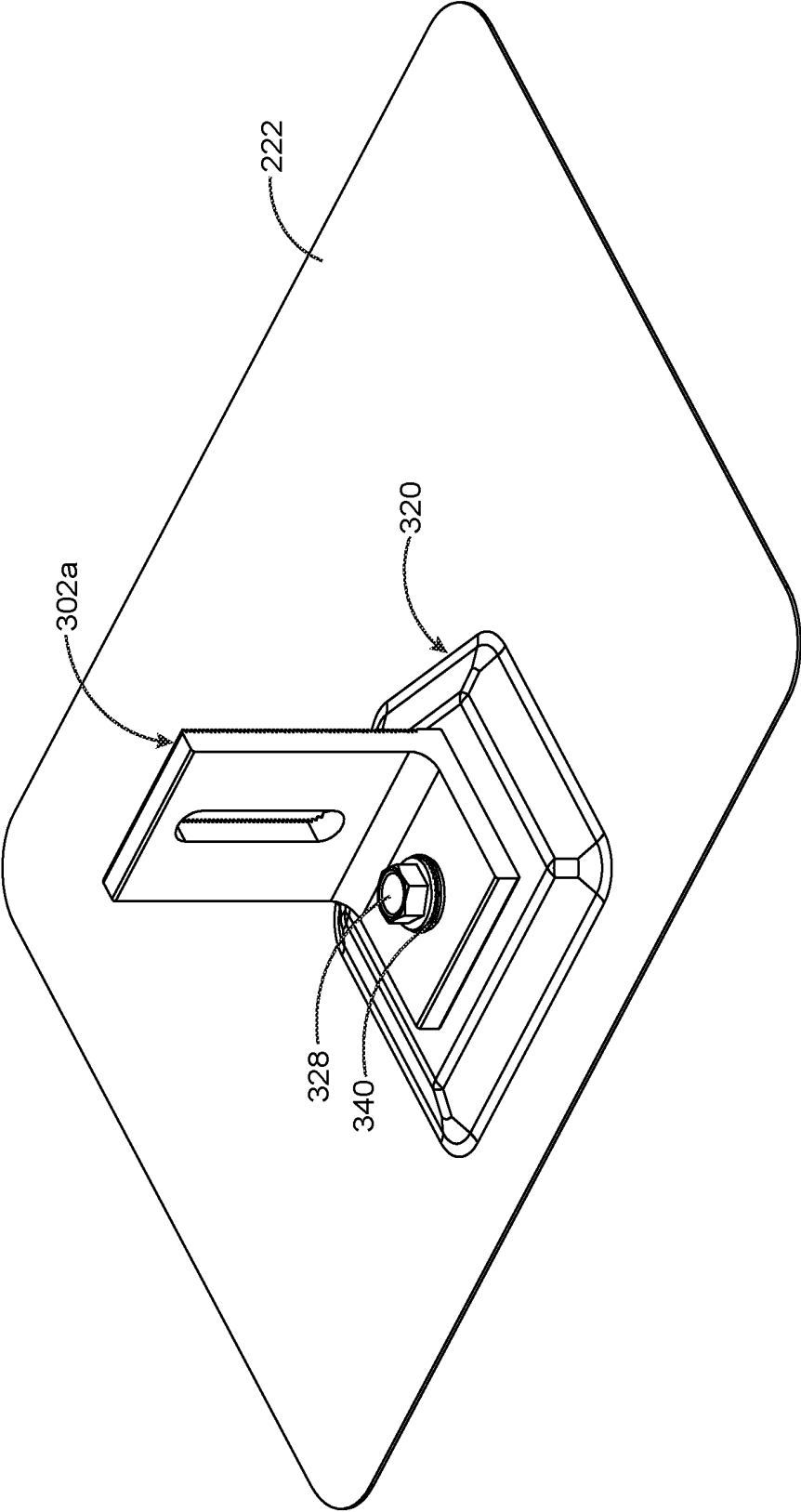


FIG. 31B

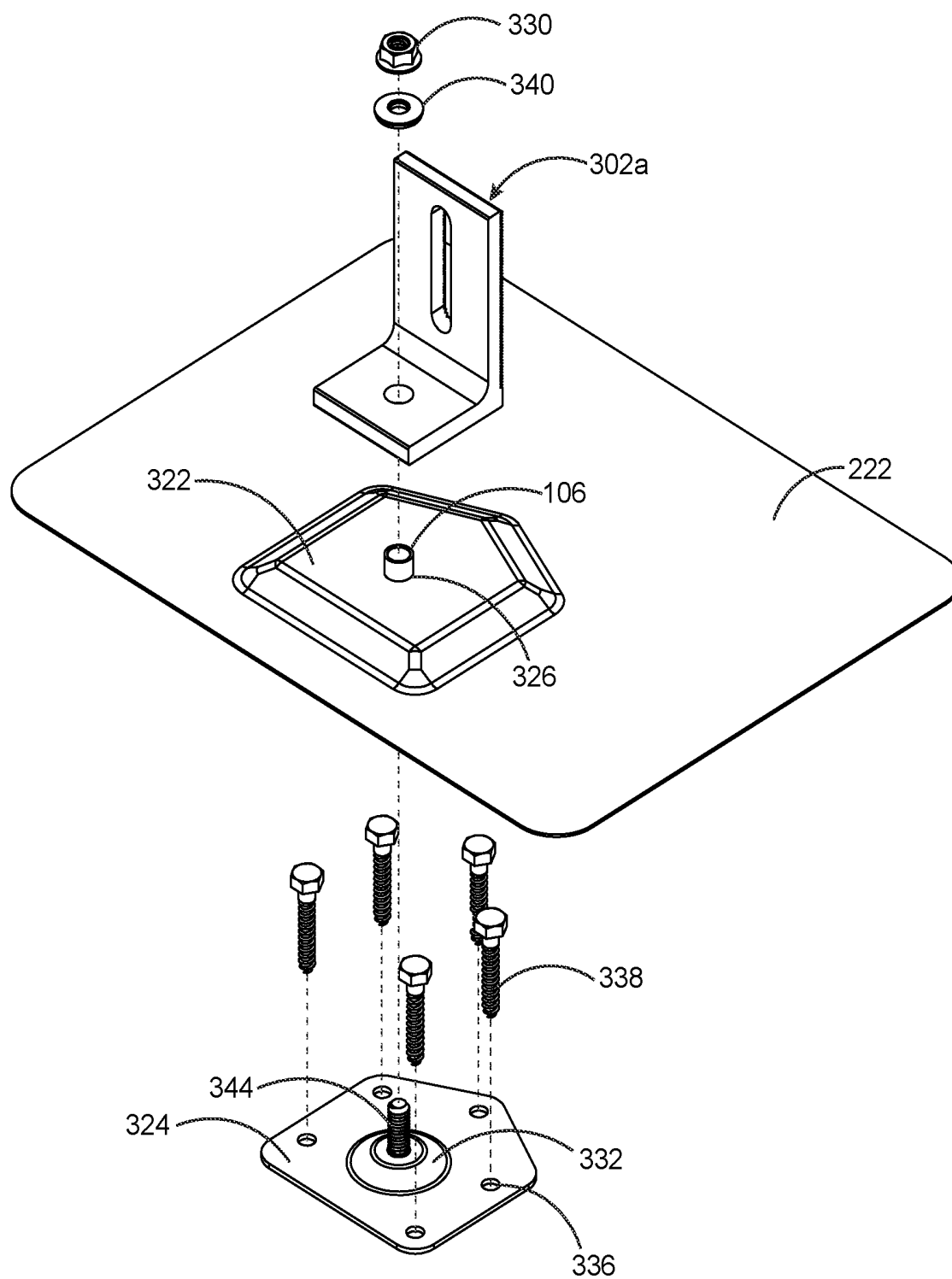


FIG. 32A

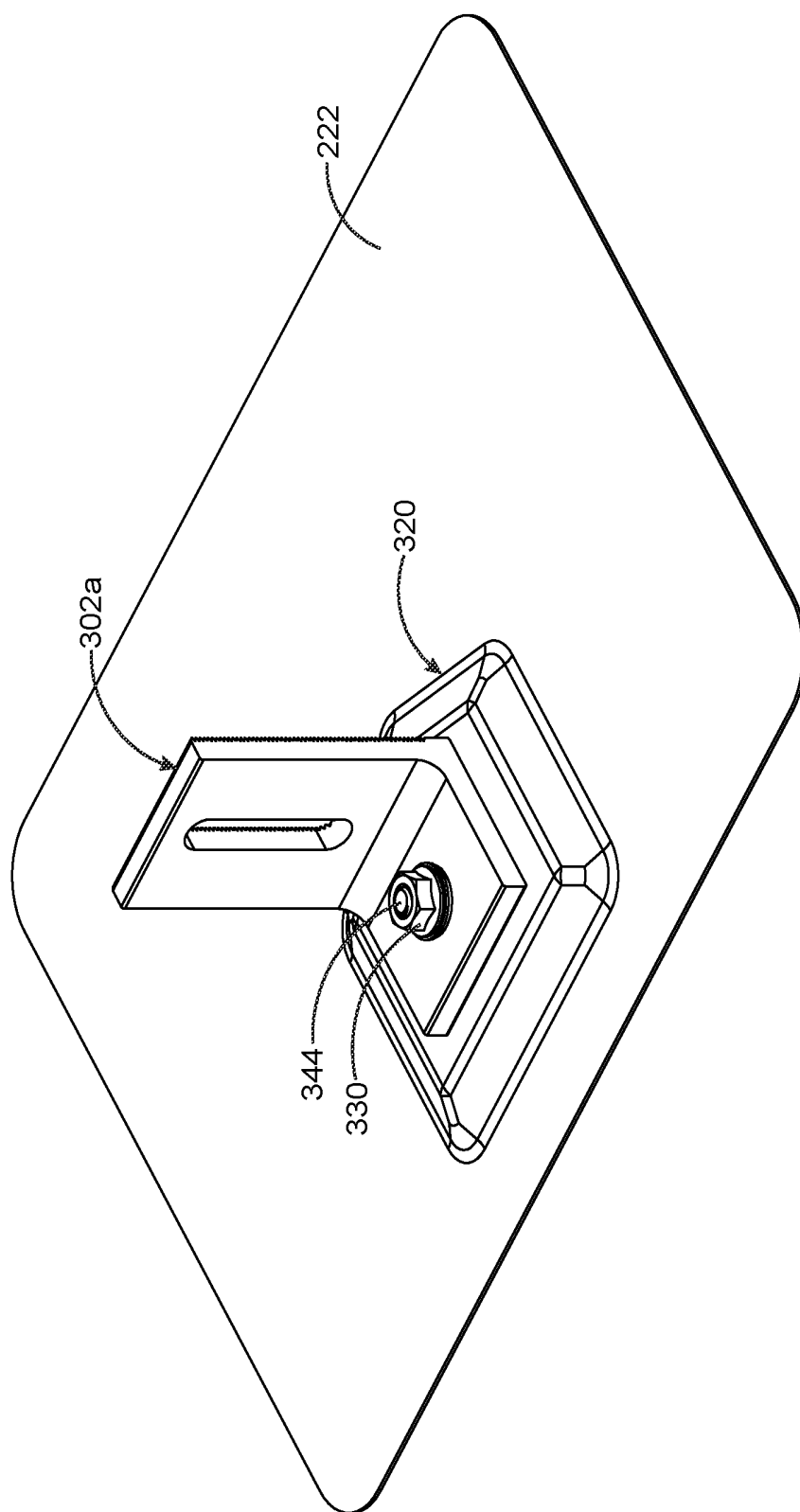


FIG. 32B

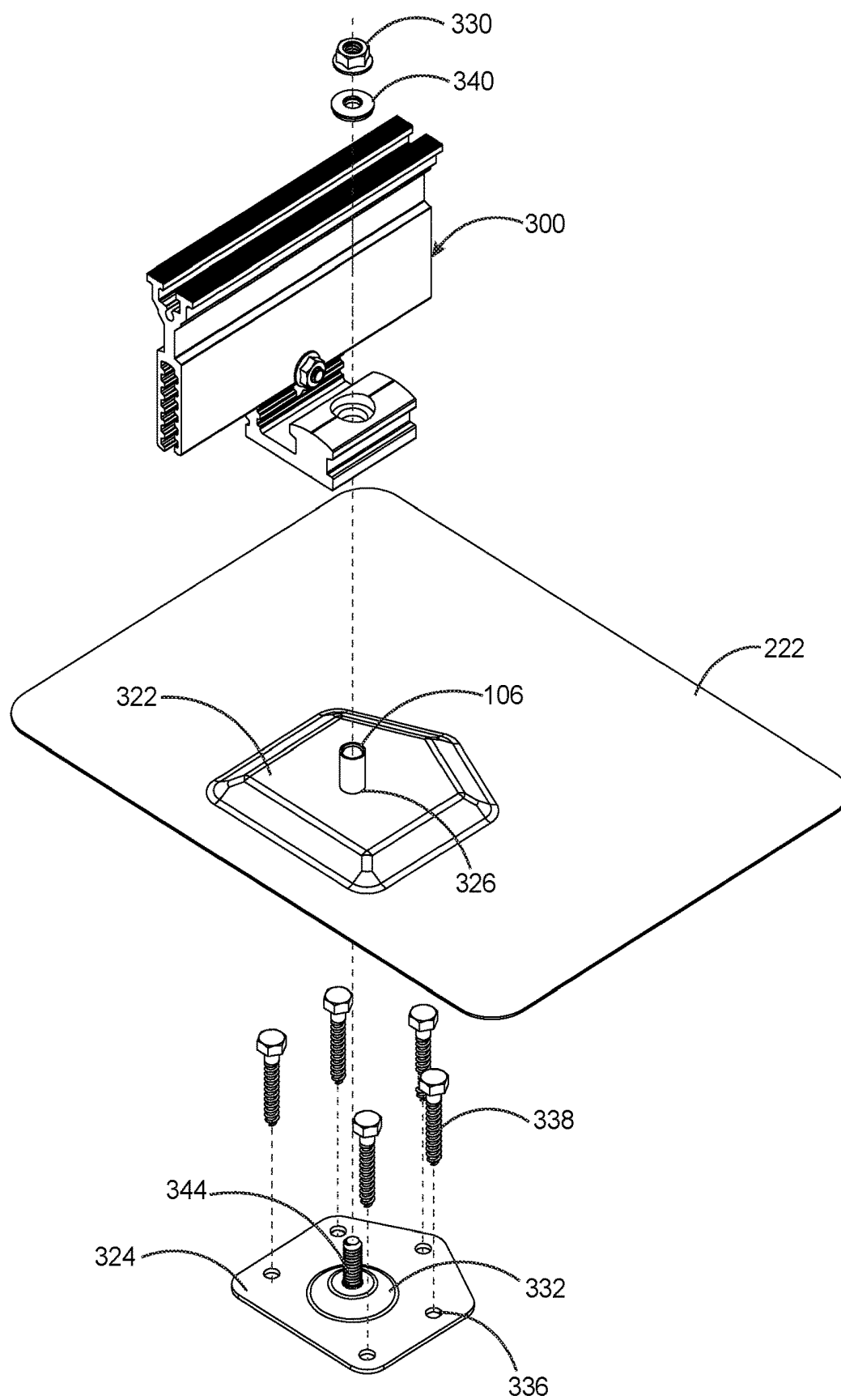


FIG. 33A

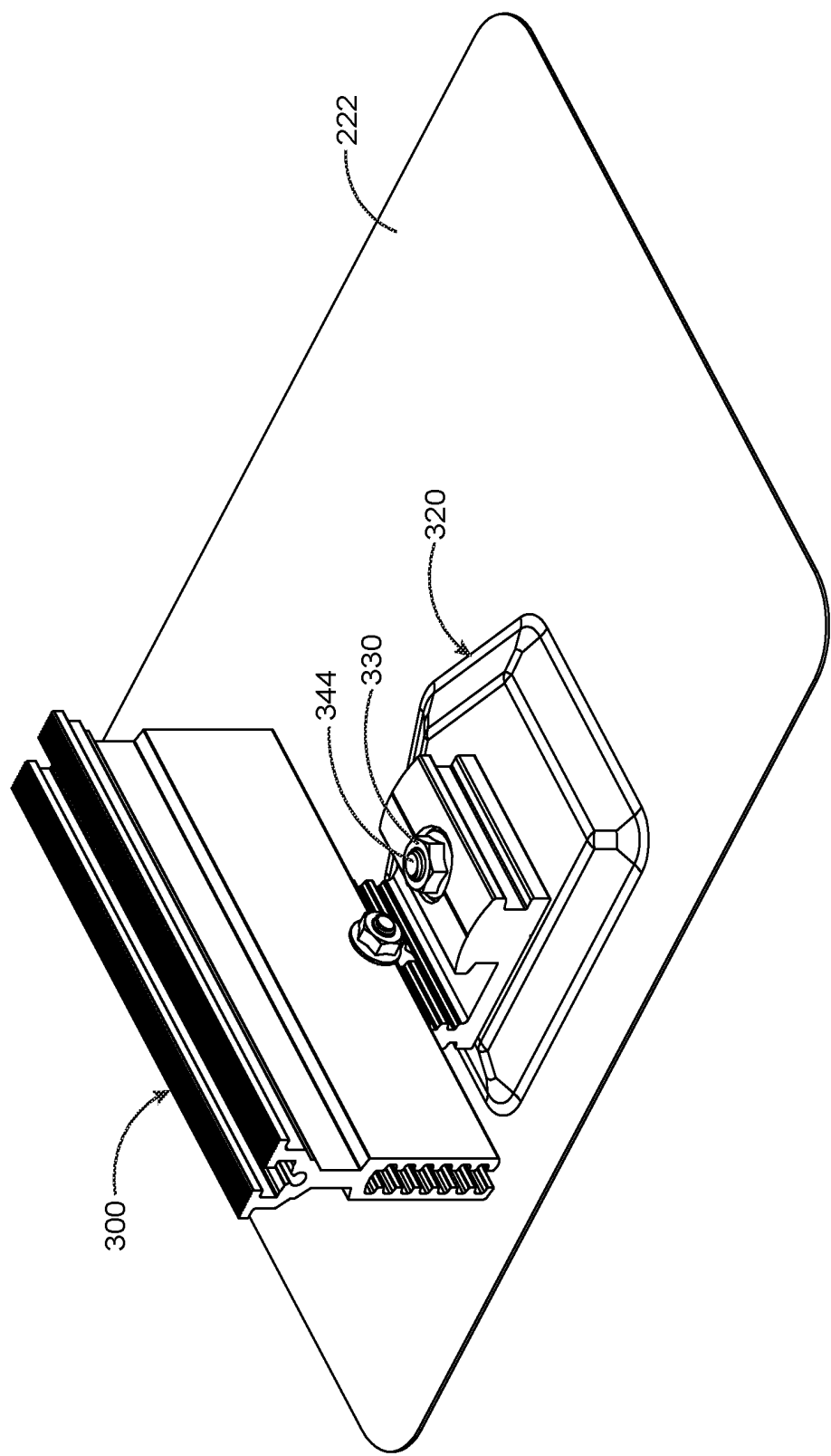


FIG. 33B

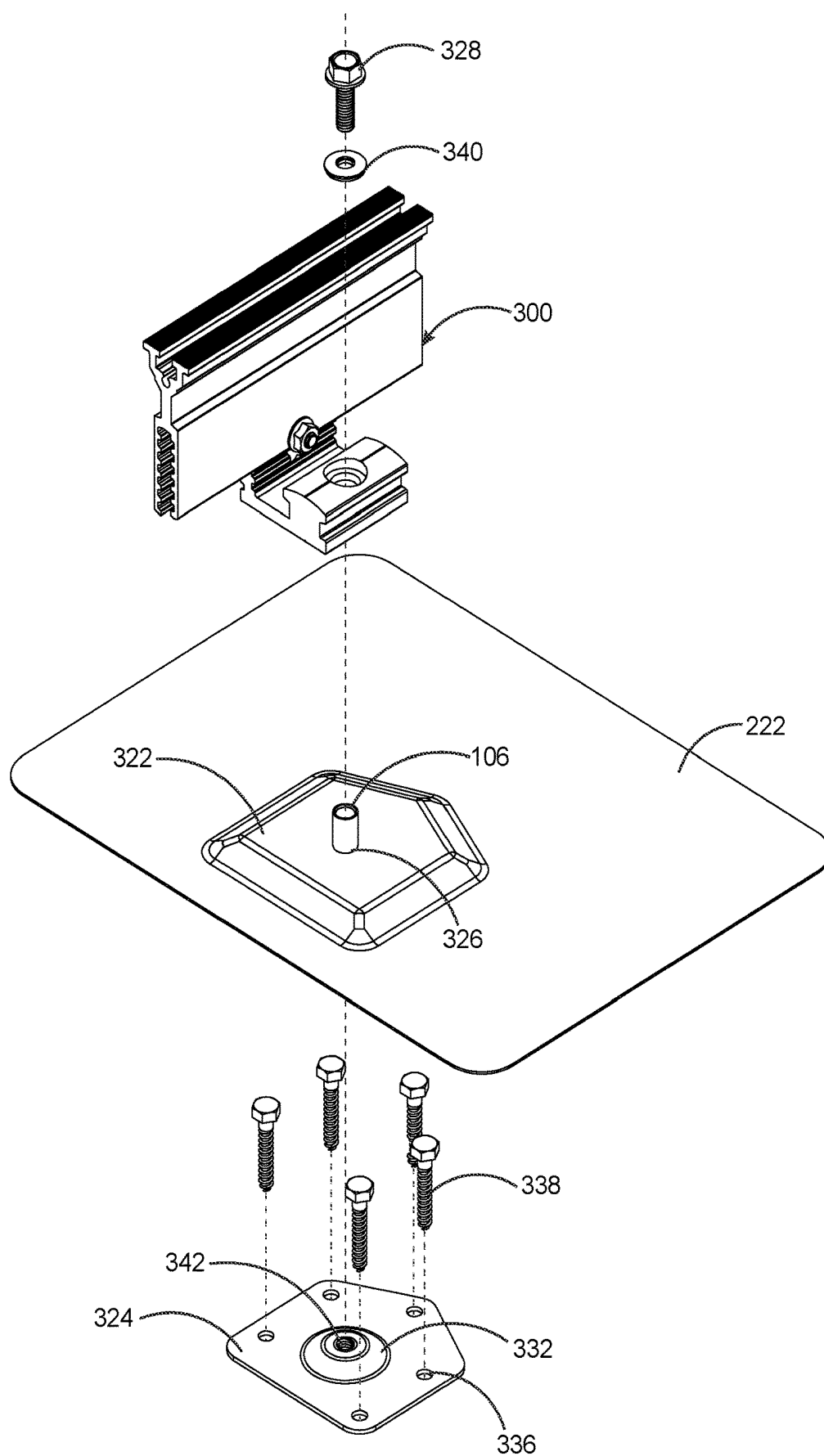


FIG. 34A

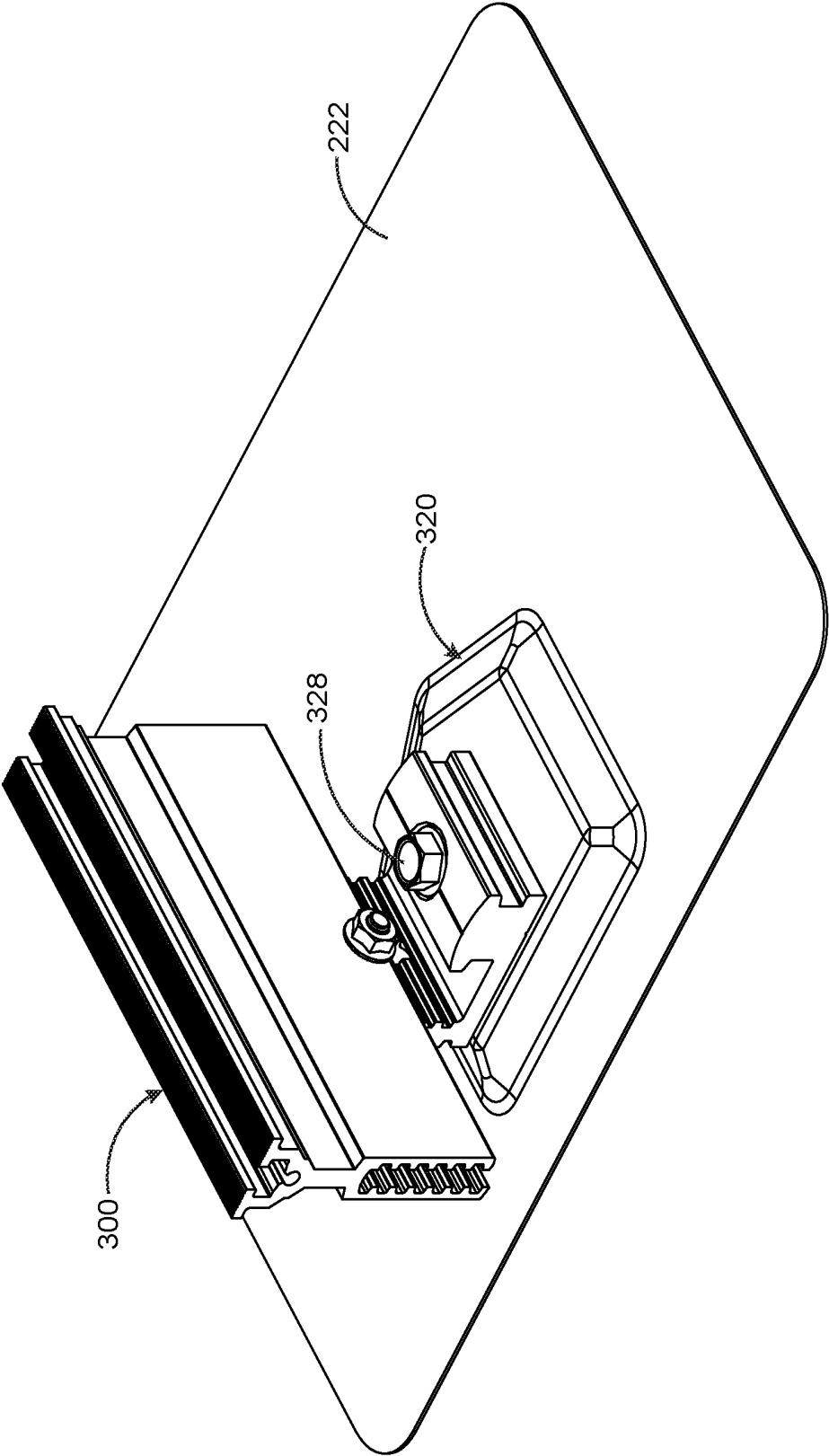


FIG. 34B

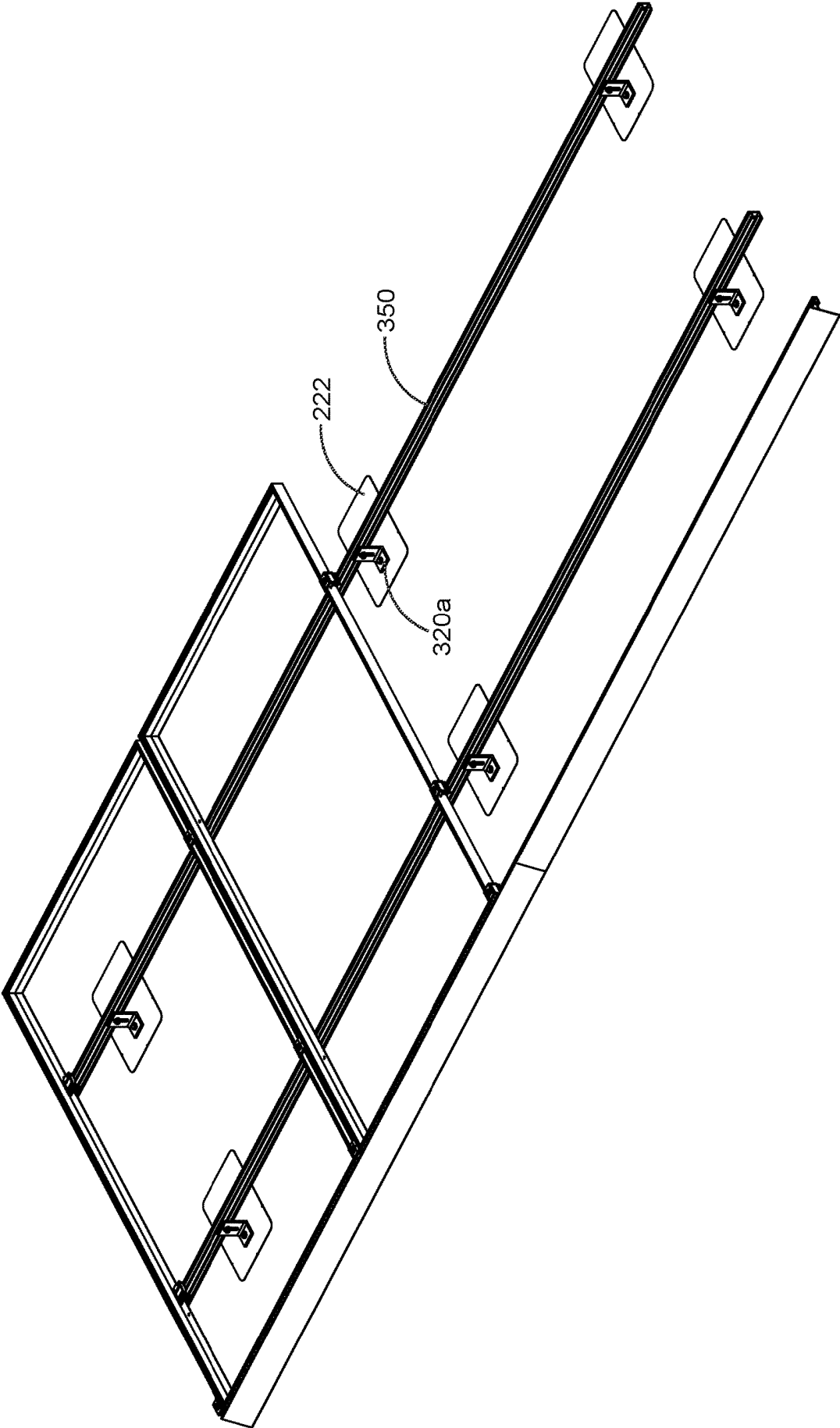


FIG. 35

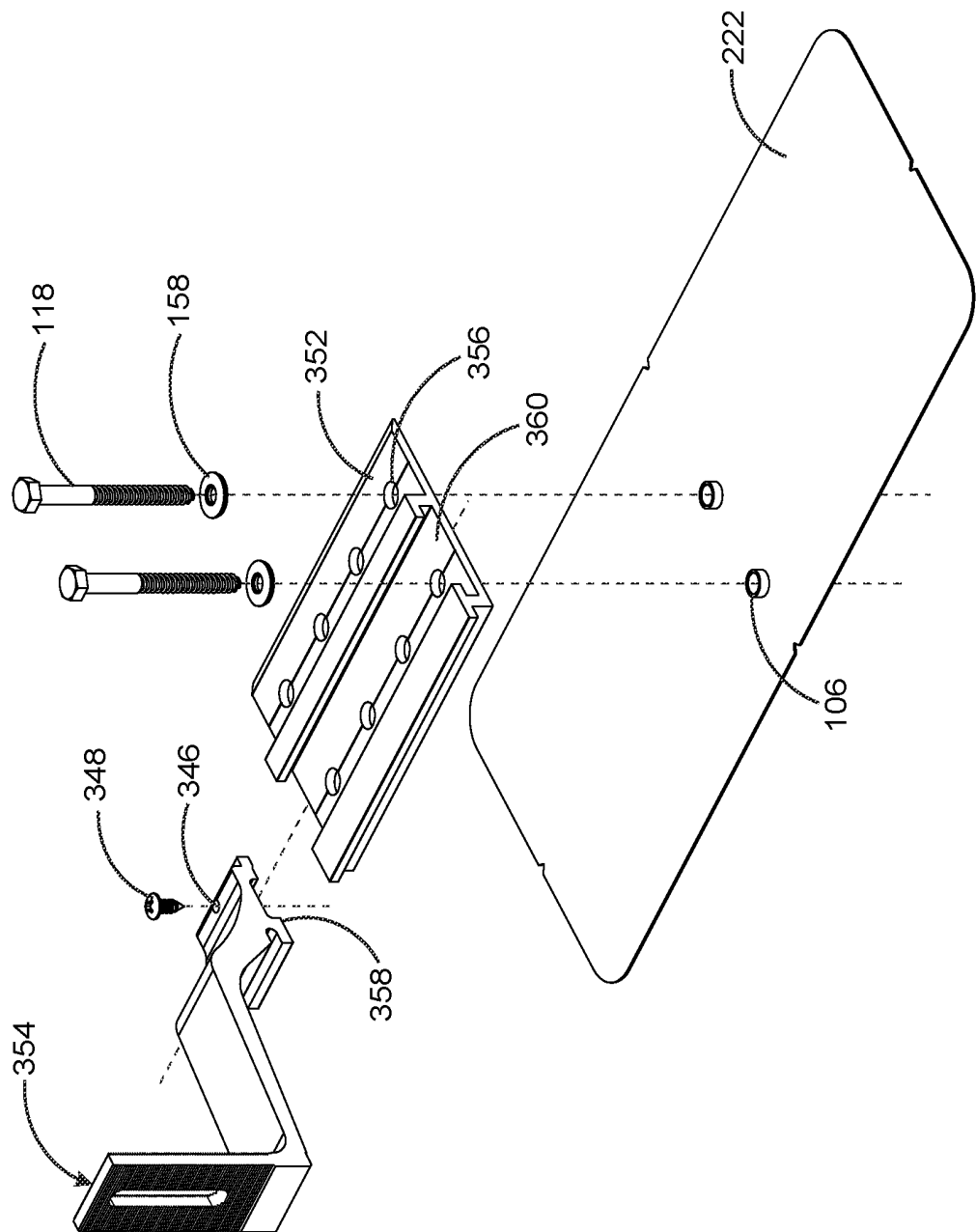


FIG. 36A

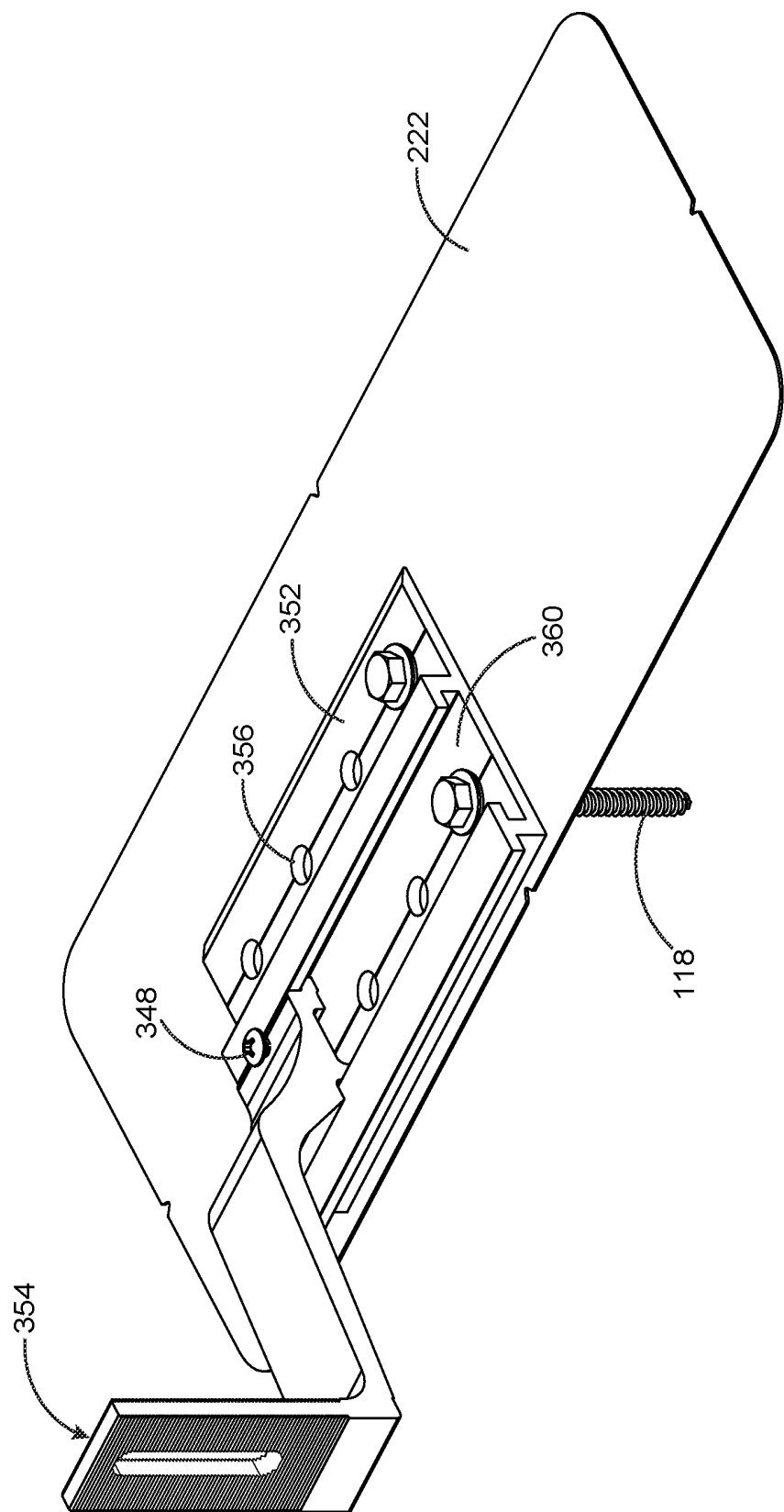
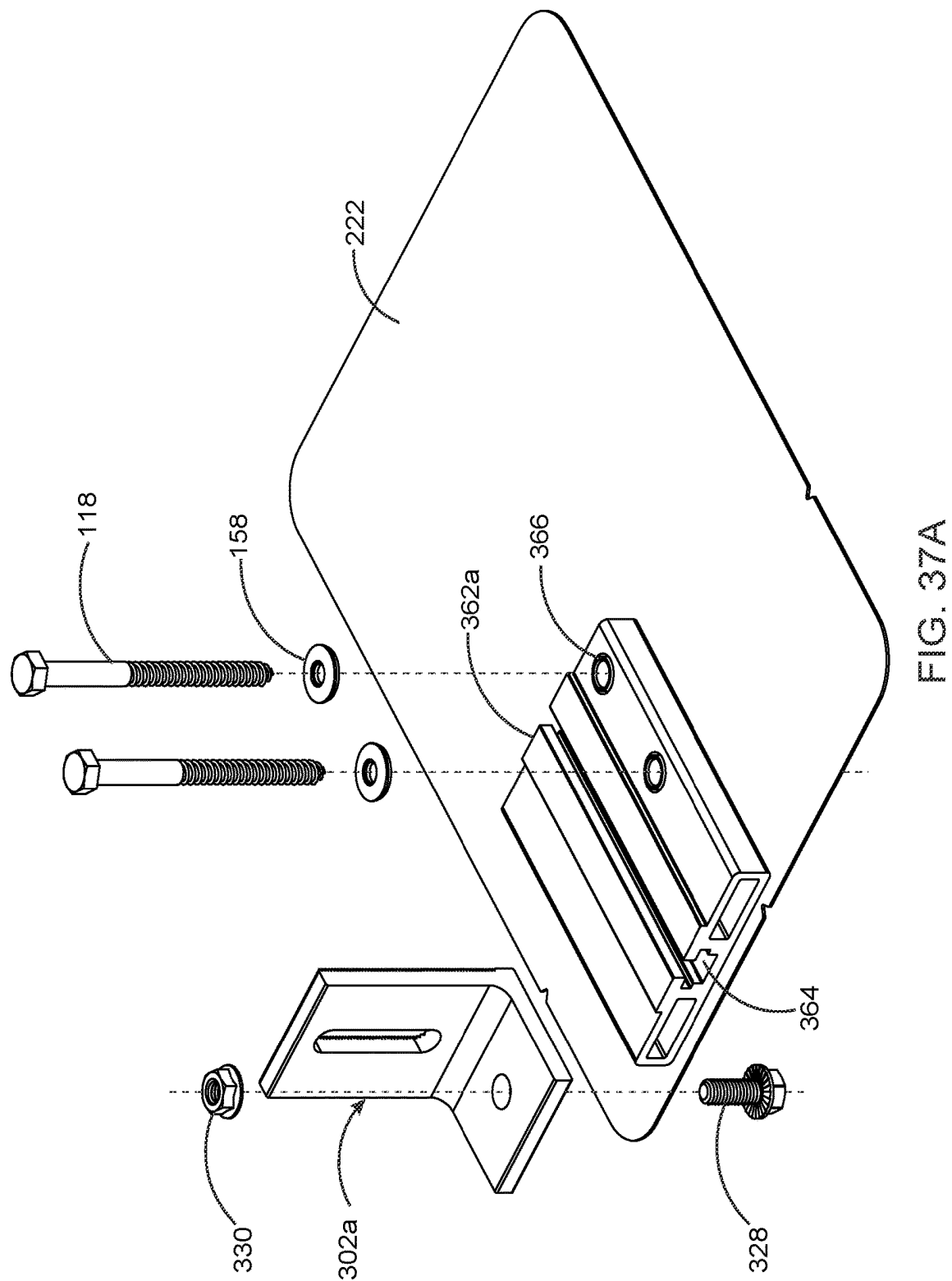


FIG. 36B



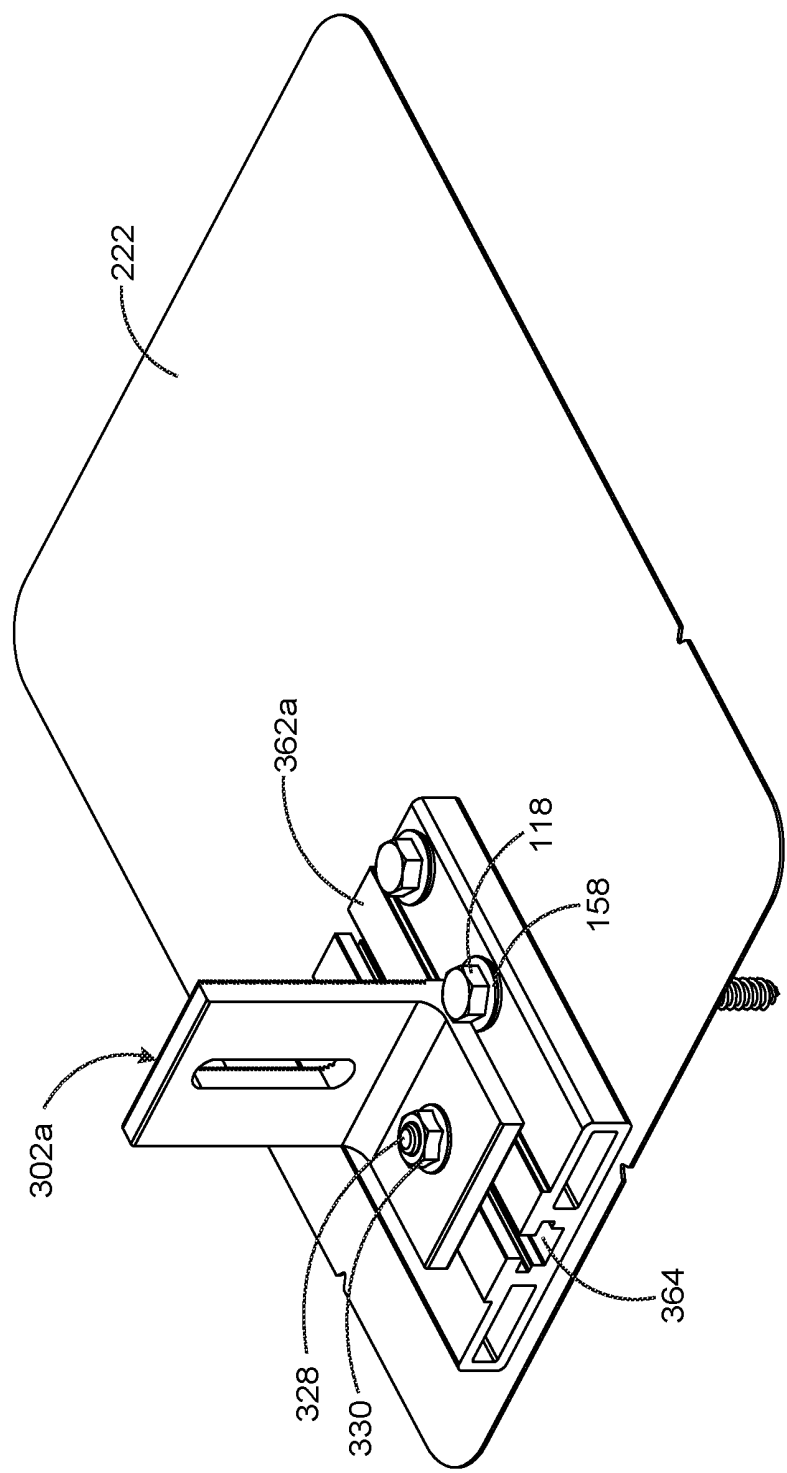


FIG. 37B

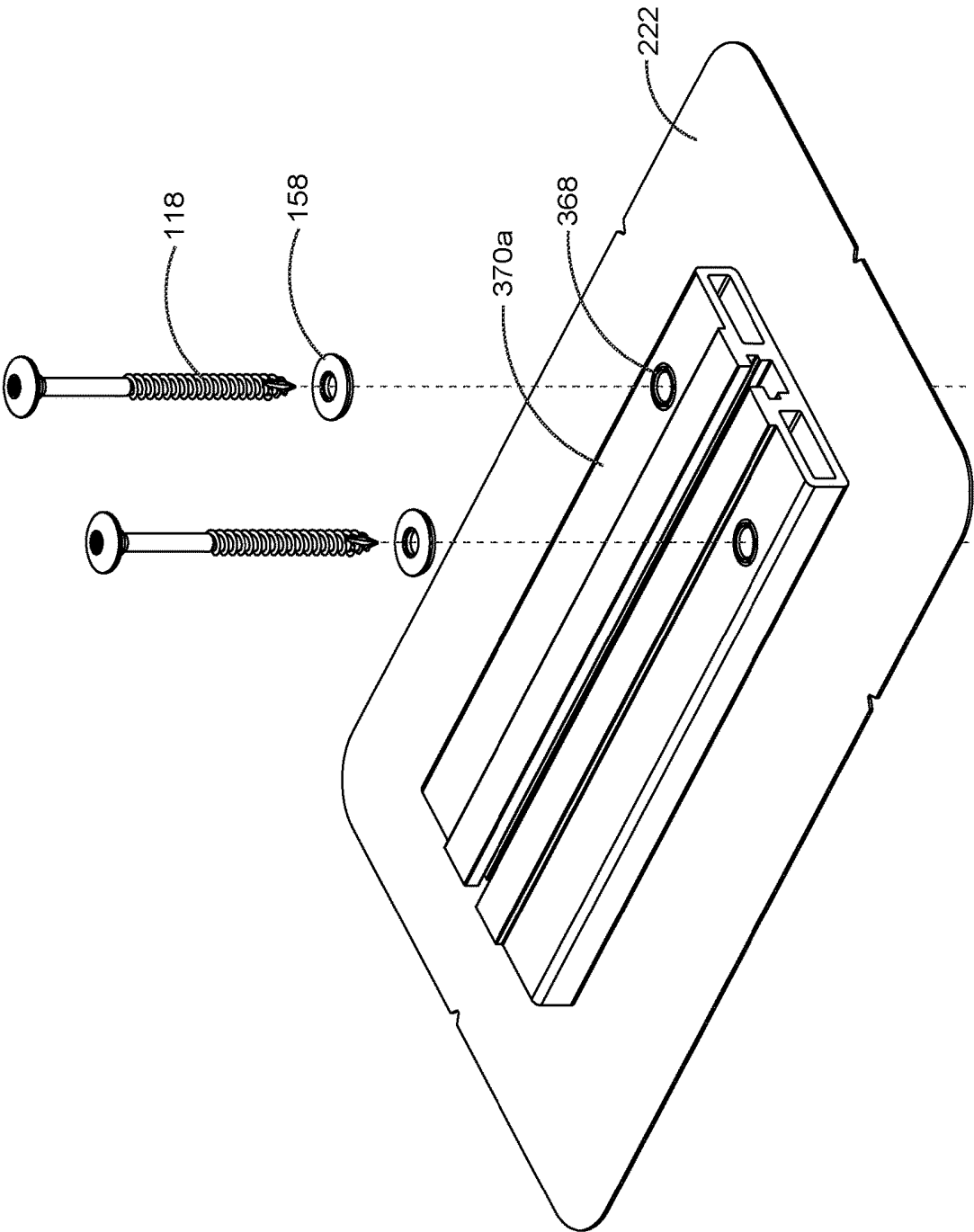


FIG. 38A

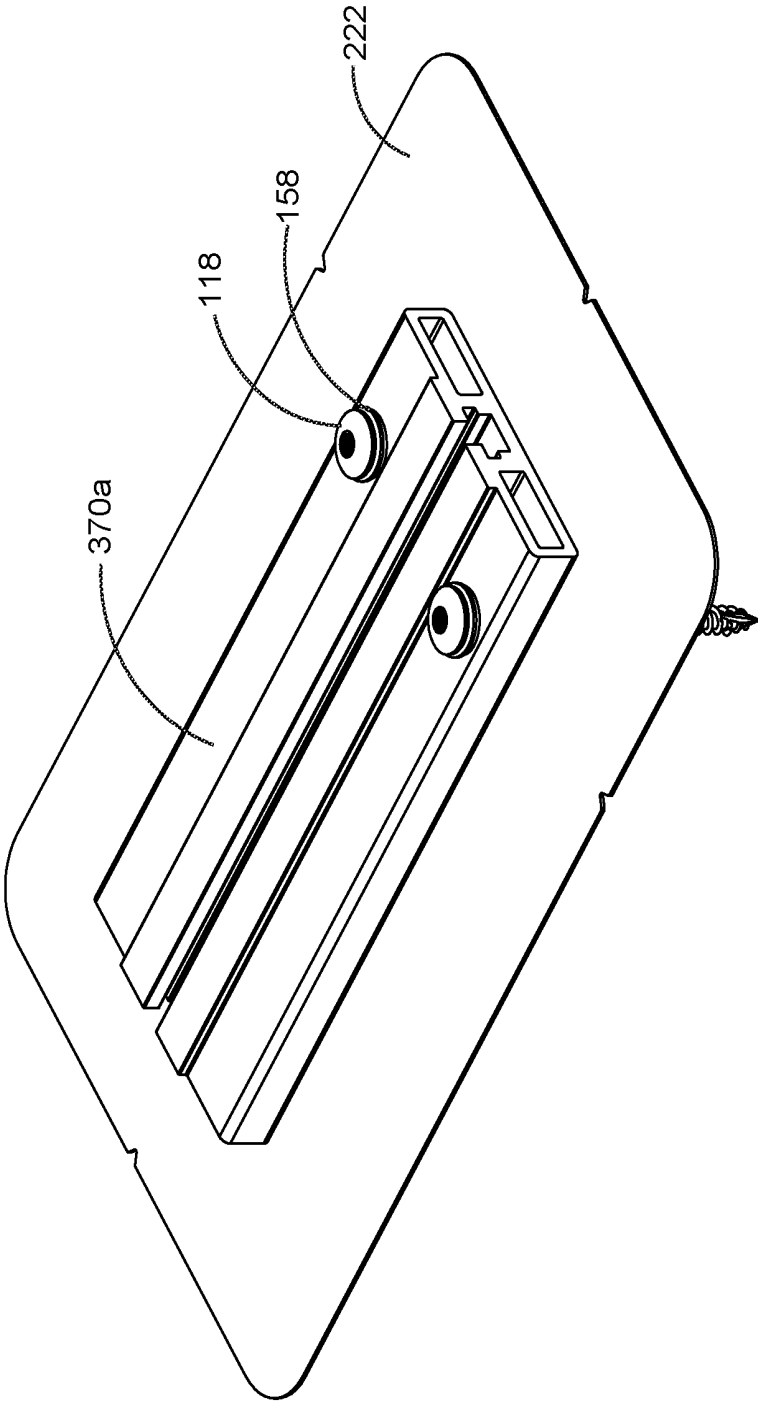


FIG. 38B

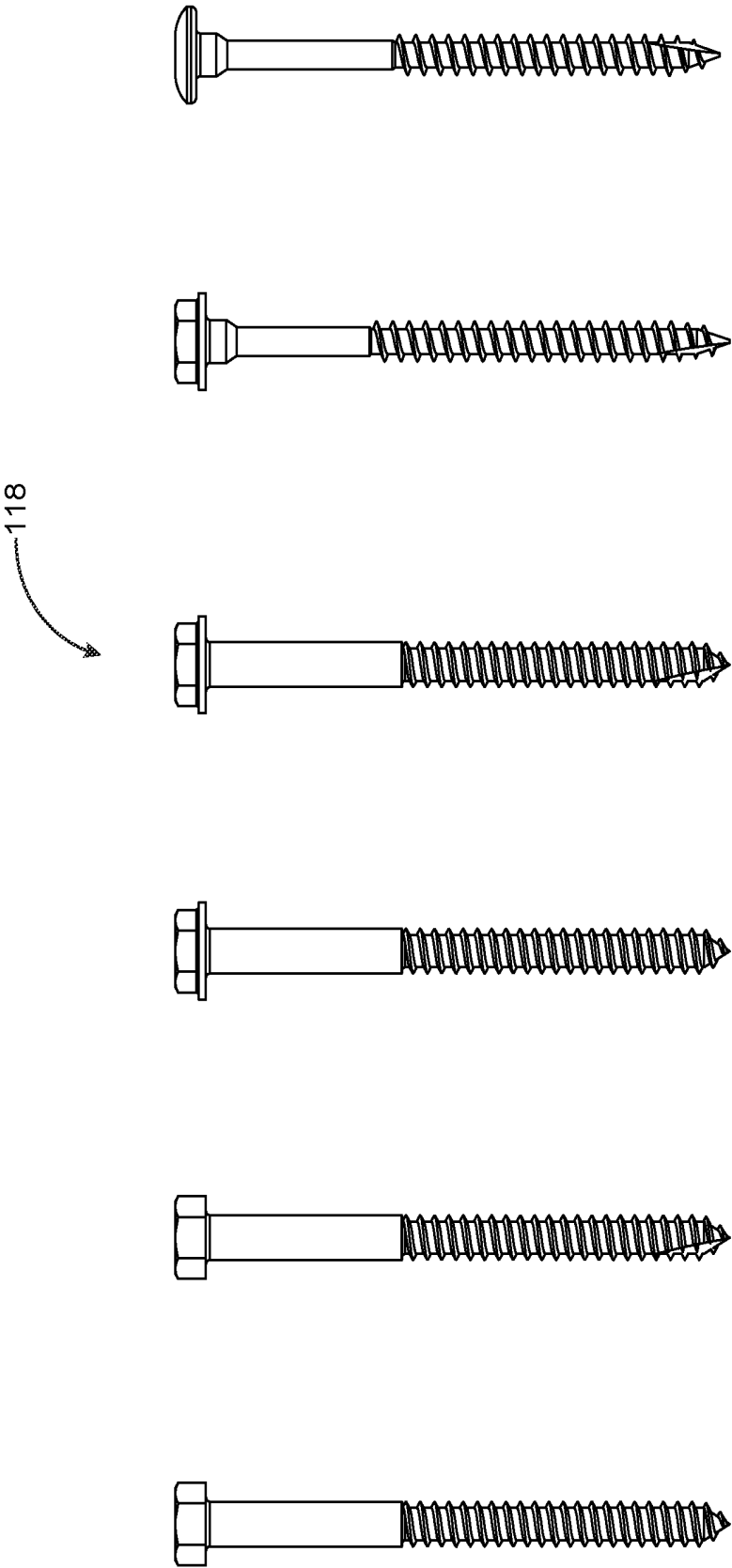


FIG. 39

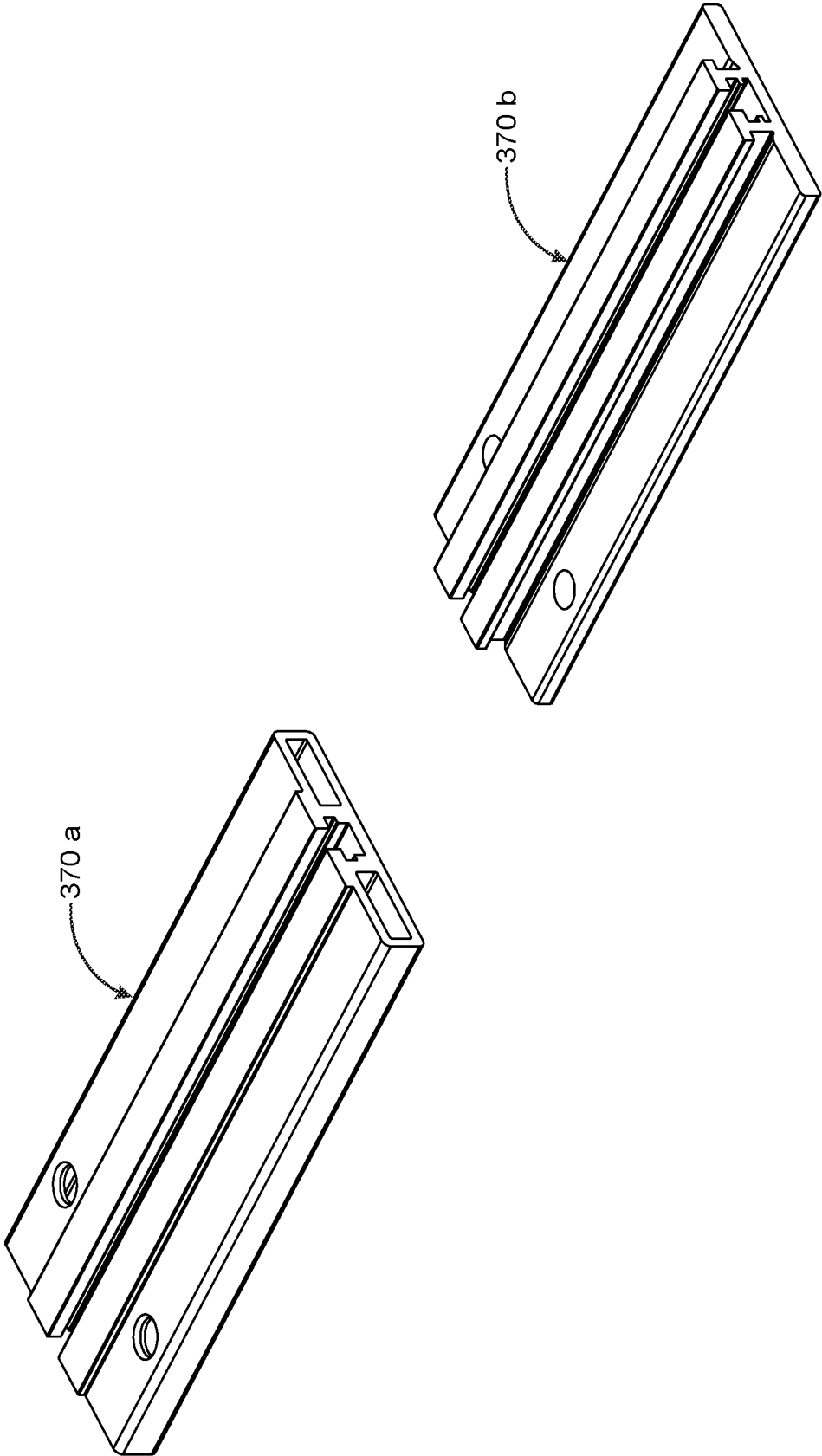


FIG. 40A

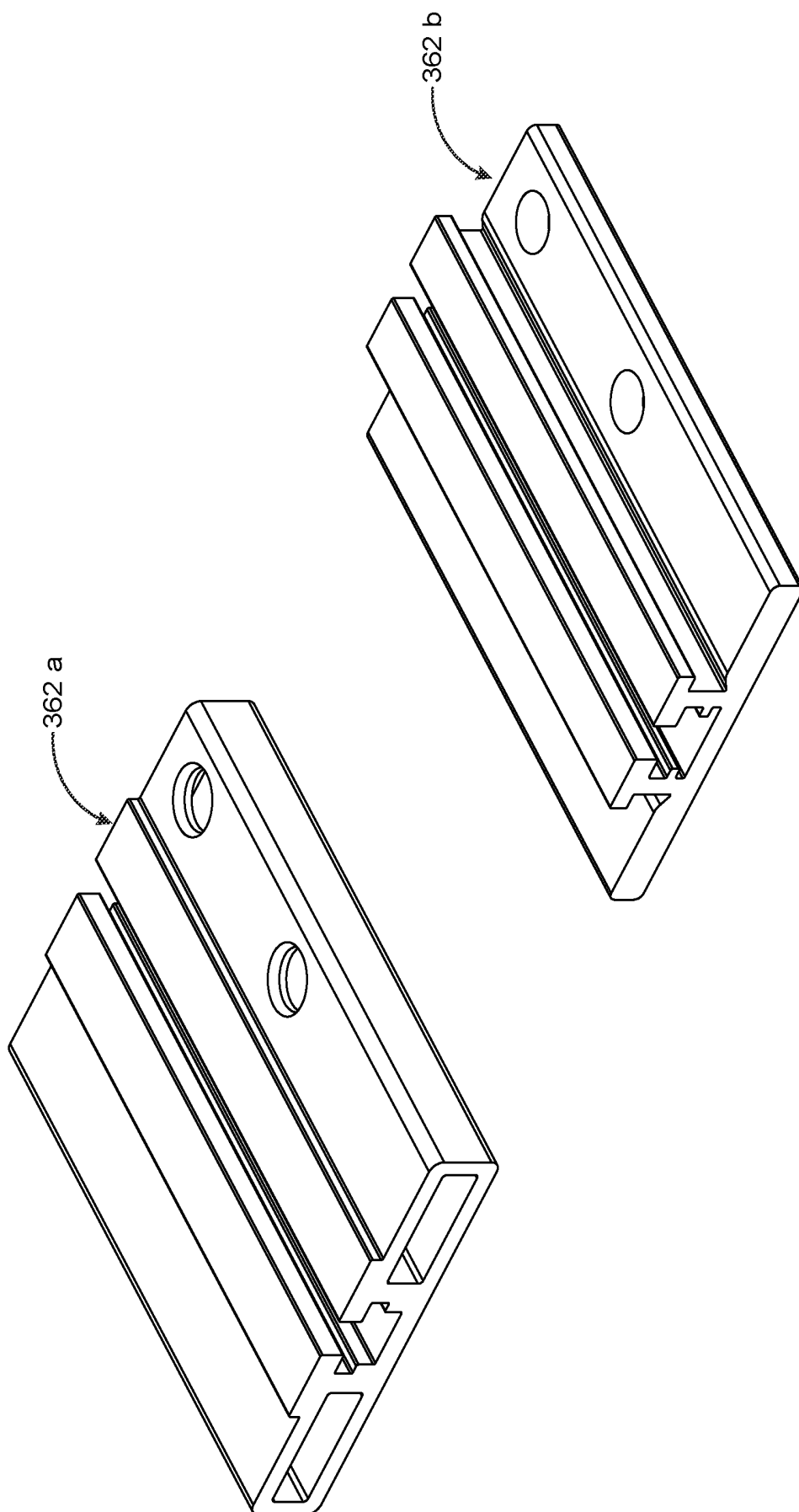


FIG. 40B

WATERPROOFING MOUNTING SYSTEM FOR ATTACHING SOLAR MODULES TO A ROOF

RELATED APPLICATIONS

[0001] This application is a continuation of U.S. nonprovisional application with Ser. No. 18/105,136 filed Feb. 2, 2023 and granted as U.S. Pat. No. 11,936,332 on Mar. 19, 2024, and which is a continuation of U.S. nonprovisional application with Ser. No. 17/364,766 filed Jun. 30, 2021 and granted as U.S. Pat. No. 11,575,343 on Feb. 7, 2023, and which is a Continuation in Part of U.S. nonprovisional application with Ser. No. 17/096,839 filed Nov. 12, 2020, which is a continuation of U.S. nonprovisional application with Ser. No. 16/539,134 filed Aug. 13, 2019, which is a continuation of U.S. nonprovisional application with Ser. No. 16/380,918 filed Apr. 10, 2019, which is a continuation of U.S. nonprovisional patent application Ser. No. 16/160,504 filed Oct. 15, 2018, now patented as U.S. Pat. No. 10,211,775, which is a continuation of U.S. nonprovisional patent application Ser. No. 15/803,656 filed Nov. 3, 2017, now granted as U.S. Pat. No. 10,103,683, which is a continuation of U.S. nonprovisional application with Ser. No. 15/225,704 filed on Aug. 1, 2016 and now granted as U.S. Pat. No. 9,755,572, which is a continuation of U.S. nonprovisional application with Ser. No. 15/045,434 filed on Feb. 17, 2016 and now granted as U.S. Pat. No. 9,712,106, which is a continuation of U.S. nonprovisional application with Ser. No. 14/605,368 filed on Jan. 26, 2015 and now granted as U.S. Pat. No. 9,813,012, which is a continuation of U.S. nonprovisional application with Ser. No. 14/166,633 filed on Jan. 28, 2014, now granted as U.S. Pat. No. 8,938,932 and which claims the benefit of provisional patent application with Ser. No. 61/916,046 filed on Dec. 13, 2013.

BACKGROUND OF THE DISCLOSURE

Technical Field of the Disclosure

[0002] The present embodiment relates in general to mounting systems for photovoltaic (PV) modules on roof structures. More specifically, the present disclosure relates to a rail-less photovoltaic (PV) module mounting system for providing a cost-effective means to install a plurality of photovoltaic (PV) modules on a roof structure.

Description of the Related Art

[0003] With the increased use of photovoltaic (PV) roofing systems for generating electricity, a demand for mounting hardware, which attaches frames for the purpose of installing the PV modules to the roof structure or any other support structure, has been developed. In recent years, various kinds of mounting structures have been used which allow the installation of PV modules to the roof structures. Mounting structures come in a variety of sizes and patterns to meet installation purposes. However, most of the mounting structures require increased labor time and cost for installation of the PV modules on the roof structures.

[0004] Conventional mounting structures for supporting PV modules in frames have considerable drawbacks. For example, many mounting structures utilize rails to mount the PV modules to the roof structure to form a PV array. The use of these rails requires additional materials to support the PV modules. Because of use of the additional material, these

traditional mounting structures can result in excess shipping costs. They can also limit the PV array layout possibilities and dramatically increase the time for designing, engineering and installing the mounting structures. Existing devices are expensive, difficult to use and can require additional manpower to install. For example, a typical 5 kW PV mounting system designed to mount 20 PV panels (15.37% efficient) mounted on a traditional rail mounting system requires approximately 302 parts at a total cost of \$0.69/W retail for the mounting structure only and weighs over 300 Lbs. Typical installation times for a simple 4x5 (4 rows and 5 columns) PV module rail based mounting system are approximately 49 man-hours.

[0005] Traditional rail mounting systems require 5 penetrations per mount, 4 mounts per PV module, additional grounding lugs, and requires specifically engineered PV modules. In addition, existing rail mounting systems may have substandard waterproofing for roof penetrations, along with complex grounding, wire management, and increased labor time on the roof structure due to design flaws. Hard and soft balance of system (BOS) may include bypass diodes, blocking diodes, solar controller, wiring system, battery and/or inverter etc. The hard and soft balance of system (BOS) costs for PV rail mounting system are high due to high material costs as well as long system engineering and installation times. Also, the traditional rail mounting systems require long strings that are difficult to break up, causing difficulty in working around roof obstructions (e.g. vents, skylights).

[0006] One of the existing mounting systems describes an integrated module frame and racking system for a solar panel. The system comprises a plurality of solar modules and a plurality of splices for coupling the plurality of solar modules together. The plurality of splices provide a way to make the connected modules mechanically rigid both during transport to the roof and after mounting for the lifetime of the system; provide wiring connections between modules; provide an electrical grounding path for the modules; provide a way to add modules to the panel; and provide a way to remove or change a defective module. Connector sockets are provided on the sides of the PV modules to simplify the electrical assembly when the PV modules are connected together with splices. However, the frame of the PV module is installed with a groove to attach the mounting bracket and a hole to insert the splice to connect the PV modules, which results in a labor-intensive operation. In addition, it requires one mounting bracket per PV module and multiple holes in the roof structure are required for installation, increasing the risk of leaks.

[0007] Another existing mounting system discloses a photovoltaic (PV) module framing and coupling system which enables the attachment of PV modules to a roof or other mounting surface without requiring the use of separate structural support members. The system provides a parallel coupling for securely interlocking the outside surfaces of parallel frame members together in a side-to-side arrangement to form an array with improved structural load distribution. The coupling member may attach to a slot in the frame at substantially any position along the length of the frame thereby enabling the interconnection of adjacent PV modules along both an x and y-axis. The system may further provide a rotating portion and locking portion for coupling to the frame attachment, mounting brackets for direct connection to a mounting surface, grounding teeth for the

automatic creation of a reliable two axis grounding matrix, and a rapid twist-lock engagement means for reliably interlocking and aligning PV modules in the array. However, this embodiment includes a side-to-side arrangement to form an array and an additional groove/slot is formed on the frame to engage coupling member, which enables the interconnection of frames of adjacent PV modules. In addition, the parallel couplings are extended beyond corner regions of PV modules.

[0008] Various other mounting systems currently available are impossible to retrofit to existing roofs without cutting the shingles. The removal of a single PV panel from the PV array installed using some of these aforementioned mounting structures is difficult and can result in re-work thereby increasing labor and material costs. Some other systems do not allow for the capability to independently remove a single PV panel without deconstructing an entire row of PV panels, which significantly increases maintenance costs.

[0009] Therefore, there is a need for a rail-less roof mounting system that would provide a cost effective and improved means for PV module installations. Such a rail-less roof mounting system would provide an efficient means of installation that does not require any additional material or structure to support the rail-less roof mounting system. Such a rail-less roof mounting system would provide a corner-to-corner coupling arrangement enabling the bridging of a PV module corner directly with adjacent PV module corner. Such a needed device would provide reduced shipping and hardware costs, labor and installation time and cost; reduce the dead load on the roof structure along with design engineering costs; and hard and soft balance of system (BOS) cost. This rail-less roof mounting system would provide a single grounding lug and a single point of penetration with an elevated seal portion for waterproofing the roof structure. Such a rail-less roof mounting system would typically be designed for implementation on composition shingle roofs, tile roofs, metal roofs, low slope roofs, or any roof that would benefit from being waterproof. This mounting system would also provide simple grounding, wire management, and structural quality. This system would be simple, inexpensive, and lightweight. This system would provide an improved engineering design to accommodate high snow and wind loads. Further, this rail-less roof mounting system would allow an installer to easily work around roof obstructions like vents, skylights, and other roof protrusions. This system would also minimize the number of parts and tools needed to assemble and install the PV module. This rail-less roof mounting system would provide the ability to increase vertical leveling adjustability; to independently remove a single PV module without deconstructing an entire row of the PV array; and allow for easy mounting height adjustment after PV modules are installed. Finally, this rail-less roof mounting system would require less manpower to install and rework.

SUMMARY OF THE DISCLOSURE

[0010] 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 rail-less roof mounting system for installing a plurality of photovoltaic (PV) modules on a roof structure. The rail-less roof mounting system comprises a base mount assembly attached to the roof structure. The base mount assembly includes a base member

having a top surface and a bottom surface, a block slider having an elevated seal portion and a vertical engaging portion, and a top slider having a top portion and a bottom portion, and a clamp assembly having a clamp member and a plate member.

[0011] The top surface of the base member is attached with a waterproof means and the bottom surface of the base member is engaged with the roof structure. The elevated seal portion, having a borehole formed therethrough to receive the waterproof means, engages with the base member and the roof structure, utilizing at least one tightening means that is inserted through the borehole. The vertical engaging portion has a vertical groove along a surface thereof. The top slider having a track with a horizontal groove at the top portion and a sliding seal member with a sliding groove and an opening at the bottom portion. The sliding seal member slides over the vertical engaging portion through the sliding groove and secures, utilizing at least one fastening means that inserts through the vertical groove on the vertical engaging portion. The base mount assembly further includes a covering means that is adaptable to securely cover the at least one tightening means on the elevated seal portion for providing waterproof sealing between the base mount assembly and the roof structure.

[0012] The clamp assembly comprises the clamp member that is coupled with the plate member. The clamp member includes a plurality of apertures on an inner surface thereof and a plurality of holes to receive a plurality of screws and the plate member that includes a plurality of slots. The plurality of apertures and the plurality of slots are oriented along a common longitudinal path to receive the at least one securing means. The at least one securing means is slid through the horizontal groove and inserted through the plurality of slots on the plate member and the plurality of apertures on the inner surface of the clamp member. Thus, the clamp member, the plate member and the top slider are secured to each other utilizing the at least one securing means. Thus, the plurality of PV modules are interlocked in a way to provide a corner-to-corner coupling arrangement which enables the connection of PV module corners to adjacent PV module corners by sandwiching above and beneath the frame members of the PV modules.

[0013] A first objective of the present invention is to provide a corner-to-corner coupling arrangement, enabling the bridging of a PV module corner directly with adjacent PV module corner.

[0014] A second objective of the present invention is to provide an efficient means of installation that does not require any additional material or structure to support the rail-less roof mounting system.

[0015] A third objective of the present invention is to provide a cost-effective means for PV modules installation.

[0016] A fourth objective of the present invention is to provide a rail-less roof mounting system that reduces dead load on a roof structure along with design engineering costs and hard and soft balance of system (BOS) costs.

[0017] A fifth objective of the present invention is to provide a rail-less roof mounting system that is lightweight and to provide improved engineering design to accommodate high snow and wind loads.

[0018] A sixth objective of the present invention is to provide a rail-less roof mounting system that allows an installer to easily work around roof obstructions like vents, skylights, and other roof protrusions.

[0019] A seventh objective of the present invention is to provide a rail-less roof mounting system that minimize the number of parts and tools needed to assemble and install the PV module.

[0020] An eighth objective of the present invention is to provide a rail-less roof mounting system that provides the ability to increase vertical leveling adjustability.

[0021] A ninth objective of the present invention is to provide a rail-less roof mounting system that independently removes a single PV module without deconstructing an entire row of the PV array.

[0022] Another objective of the present invention is to provide a rail-less roof mounting system that allows height adjustment of the rail-less roof mounting system after the installation of PV modules.

[0023] Yet another object of the present invention is to provide a rail-less roof mounting system that has a single grounding lug and a single point of penetration with an elevated seal portion for waterproofing the roof structure.

[0024] Still yet another object of the present invention is to provide a rail-less roof mounting system that retrofits into existing roofs without the need to cut shingles.

[0025] Yet still another object of the present invention is to provide a rail-less roof mounting system that eliminates the need to transport to the jobsite, configure and cut long heavy rails for installation purposes.

[0026] Still yet another object of the present invention is to provide a rail-less roof mounting system that can cantilever PV modules in portrait orientation, landscape orientation or a combination of both.

[0027] Yet still another object of the present invention is to provide a rail-less roof mounting system that employs a plurality of wire clips to work in multiple locations to minimize wire management issues.

[0028] 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

[0029] 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 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.

[0030] FIG. 1 illustrates a perspective view of a rail-less roof mounting system for installing a plurality of photovoltaic (PV) modules on a roof structure in accordance with the preferred embodiment of the present invention;

[0031] FIG. 2 illustrates an exploded view of a base mount assembly in accordance with the preferred embodiment of the present invention;

[0032] FIG. 3 illustrates an exploded view of a clamp assembly associated with the base mount assembly in accordance with the preferred embodiment of the present invention;

[0033] FIG. 4 illustrates a first mounting position of the rail-less roof mounting system interlocking the plurality of PV modules to form a corner-to-corner coupling arrangement in accordance with the preferred embodiment of the present invention;

[0034] FIG. 5 illustrates a second mounting position of the rail-less roof mounting system interlocking the plurality of PV modules to form the corner-to-corner coupling arrangement in accordance with the preferred embodiment of the present invention;

[0035] FIG. 6 illustrates the rail-less roof mounting system interlocking two PV modules in an arrangement in accordance with an alternate configuration of the present invention;

[0036] FIG. 7 illustrates installation of the rail-less roof mounting system on the roof structure in accordance with the preferred embodiment of the present invention;

[0037] FIG. 8 illustrates the base mount assembly configured to adjust mounting height of the rail-less roof mounting system in accordance with the preferred embodiment of the present invention;

[0038] FIG. 9 illustrates a perspective view of a PV array skirt providing a snap-fit engagement with the rail-less roof mounting system in accordance with the preferred embodiment of the present invention;

[0039] FIG. 10 illustrates a profile view of the PV array skirt providing the snap-fit engagement with the rail-less roof mounting system shown in FIG. 9;

[0040] FIG. 11 illustrates a perspective view of interlocking of two PV array skirts in accordance with the preferred embodiment of the present invention; and

[0041] FIG. 12 illustrates one embodiment of a clamp assembly in accordance with the present invention and;

[0042] FIG. 13 illustrates an alternative embodiment of a skirt assembly in accordance with the present invention;

[0043] FIG. 14 illustrates an alternative embodiment of a skirt assembly in accordance with the present invention;

[0044] FIG. 15 illustrates an alternative embodiment wherein the corner-to-corner coupling arrangement is supported above the roof by the frame members of the PV modules;

[0045] FIG. 16 illustrates a plan view of multiple PV modules according to an embodiment of the invention, with multiple circles and corresponding figure numbers 19A, 19B, 20A and 20B identified as enlarged views;

[0046] FIG. 17 illustrates a plan view of multiple PV modules according to an embodiment of the invention, with multiple circles and corresponding figure numbers 21, 22, 23 and 24 identified as enlarged views;

[0047] FIG. 18 illustrates a plan view of multiple PV modules according to an embodiment of the invention, with multiple circles and corresponding figure numbers 19A, 19B, 20A, 20B, 21, 22, 23 and 24 identified as enlarged views;

[0048] FIGS. 19A and 19B illustrate the enlarged portion shown in FIGS. 16 and 18;

[0049] FIGS. 20A and 20B illustrate the enlarged portion shown in FIGS. 16 and 18;

[0050] FIG. 21 illustrates the enlarged portion shown in FIG. 17;

[0051] FIG. 22 illustrates the enlarged portion shown in FIG. 17;

[0052] FIG. 23 illustrates the enlarged portion shown in FIGS. 17 and 18;

[0053] FIG. 24 illustrates the enlarged portion shown in FIGS. 17 and 18;

[0054] FIGS. 25A-25D illustrate perspective views of various embodiments of the base member used in accordance with the present invention;

[0055] FIG. 26A illustrates a perspective view of attaching the combination of the block slider and the top slider with the base member in accordance with the preferred embodiment of the present invention;

[0056] FIG. 26B illustrates an assembled perspective view of the block slider and the top slider attached with the base member in accordance with the preferred embodiment of the present invention;

[0057] FIG. 27A illustrates an exploded perspective view of an L-mount clamp with the base member in accordance with one embodiment of the present invention;

[0058] FIG. 27B illustrates an assembled perspective view of the L-mount clamp with the base member in accordance with one embodiment of the present invention;

[0059] FIGS. 28A-28C illustrate perspective views of various embodiments of the L-mount clamp used in accordance with the present invention;

[0060] FIG. 29A illustrates an exploded perspective view of attaching the L-mount clamp utilizing a deck plate assembly with the base member in accordance with one embodiment of the present invention;

[0061] FIG. 29B illustrates an assembled perspective view of the L-mount clamp with the deck plate assembly and the base member in accordance with one embodiment of the present invention;

[0062] FIG. 30A illustrates an exploded perspective view of attaching the combination of the block slider and the top slider with the base member utilizing the deck plate assembly in accordance with one embodiment of the present invention;

[0063] FIG. 30B illustrates an assembled perspective view of the combination of the block slider and the top slider attached with the base member utilizing the deck plate assembly in accordance with one embodiment of the present invention;

[0064] FIG. 31A illustrates an exploded perspective view of attaching the L-mount clamp with the base member utilizing the deck plate assembly having a captive nut in accordance with one embodiment of the present invention;

[0065] FIG. 31B illustrates an assembled perspective view of the L-mount clamp attached with the base member utilizing the deck plate assembly having the captive nut in accordance with one embodiment of the present invention;

[0066] FIG. 32A illustrates an exploded perspective view of attaching the L-mount clamp with the base member utilizing the deck plate assembly having a captive stud in accordance with one embodiment of the present invention;

[0067] FIG. 32B illustrates an assembled perspective view of the L-mount clamp attached with the base member utilizing the deck plate assembly having the captive stud in accordance with one embodiment of the present invention;

[0068] FIG. 33A illustrates an exploded perspective view of attaching the combination of the block slider and the top slider with the base member utilizing the deck plate assembly having the captive stud in accordance with one embodiment of the present invention;

[0069] FIG. 33B illustrates an assembled perspective view of the combination of the block slider and the top slider with the base member utilizing the deck plate assembly having the captive stud in accordance with one embodiment of the present invention;

[0070] FIG. 34A illustrates an exploded perspective view of attaching the combination of block slider and the top slider with the base member utilizing the deck plate assembly

having the captive nut in accordance with one embodiment of the present invention;

[0071] FIG. 34B illustrates an assembled perspective view of the combination of the block slider and the top slider with the base member utilizing the deck plate assembly having the captive nut in accordance with one embodiment of the present invention;

[0072] FIG. 35 illustrates a perspective view of the base member with the L-mount clamp attached to the rails of the PV system in accordance with one embodiment of the present invention;

[0073] FIG. 36A illustrates an exploded perspective view of a tile mount assembly to connect with the base member in accordance with one embodiment of the present invention;

[0074] FIG. 36B illustrates an assembled perspective view of the tile mount assembly with the base member in accordance with one embodiment of the present invention;

[0075] FIG. 37A illustrates an exploded perspective view of a shared rail mount to connect with the base member and the L-mount clamp in accordance with one embodiment of the present invention;

[0076] FIG. 37B illustrates an assembled perspective view of the shared rail mount in accordance with one embodiment of the present invention;

[0077] FIG. 38A illustrates an exploded perspective view of a tile replacement mount to connect with the base member in accordance with one embodiment of the present invention;

[0078] FIG. 38B illustrates an assembled perspective view of the tile replacement mount in accordance with one embodiment of the present invention;

[0079] FIG. 39 illustrates a front view of a plurality of fastening means in accordance with one embodiment of the present invention; and

[0080] FIGS. 40A-40B illustrate a plurality of brackets in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0081] 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.

[0082] 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.

[0083] Turning now to FIG. 1, a perspective view of a rail-less roof mounting system 100 for installing a plurality of photovoltaic (PV) modules 170, 172, 174 (See FIG. 4) on a roof structure 176 (See FIGS. 7, 13, 14 and 15) in accordance with the preferred embodiment of the present invention is illustrated. The rail-less roof mounting system 100 comprises a base mount assembly 102 that is associated with a clamp assembly 144 to bridge the plurality of PV modules 170, 172, 174 and to install the plurality of PV

modules 170, 172, 174 on the roof structure 176. The base mount assembly 102 attached to the roof structure 176 comprises a base member 104 having a top surface 108 and a bottom surface (not shown), a block slider 110 having an elevated seal portion 112 (See FIG. 2) and a vertical engaging portion 114 and a top slider 124 having a top portion 126 and a bottom portion 128.

[0084] The clamp assembly 144 includes a clamp member 146 that is fixed with a plate member 148. The rail-less roof mounting system 100 can be easily disassembled and hence provides a compact means of storage when not in use. The bottom surface (not shown) of the base member 102 is engaged with the roof structure 176. The block slider 110 is connected with the base member 104 and with the bottom portion 128 of the top slider 124. A track 130 having a horizontal groove 132 is included at the top portion 126 of the top slider 124 and a sliding seal member 134 having a sliding groove 136 and an opening 138 are included at the bottom portion 128 of the top slider 124. The sliding seal member 134 is secured to the block slider 110 utilizing at least one fastening means 140. The clamp member 146 and the plate member 148 are attached with the track 130 utilizing at least one securing means 150. The clamp member 146 includes a plurality of apertures 154 (See FIG. 10) on an inner surface 156 thereof and a plurality of holes 157 to receive a plurality of screws 178. The plate member 148 includes a plurality of slots 152 to receive the at least one securing means 150. The clamp member 146 is shown in further detail in FIGS. 19A, 19B, 20A, 20B, 21, 22, 23, and 24 as well as their position within the solar array in FIGS. 16, 17 and 18.

[0085] FIG. 2 illustrates an exploded view of the base mount assembly 102 in accordance with the preferred embodiment of the present invention. A waterproof means 106 is attached on the top surface 108 of the base member 104. In the preferred embodiment, the base member 104 is made from an aluminum flashing. The bottom surface (not shown) of the base member 104 is engaged with the roof structure 176. The elevated seal portion 112, having a borehole 116 formed therethrough to receive the waterproof means 106, engages with the base member 104 and the roof structure 176, utilizing at least one tightening means 118 that is inserted through the borehole 116 and the waterproof means 106. Then, the at least one tightening means 118 comes from the borehole 116 and the waterproof means 106 is drilled into the roof structure 176. The base mount assembly 102 includes a covering means 142 that is adaptable to securely cover the at least one tightening means 118 on the elevated seal portion 112 for providing waterproof sealing between the base mount assembly 102 and the roof structure 176.

[0086] The at least one tightening means 118 is of the type typically known in construction/installation and may comprise a structural screw having a head portion 218. Specifically, the at least one tightening means 118 is a T-30/hex washer head lag screw. A sealing washer 158 is utilized for fitting on the at least one tightening means 118 and adapted to seal the borehole 116 in the elevated seal portion 112, through which the at least one tightening means 118 is fitted, so as to prevent seepage of water. Preferably, the sealing washer 158 is an annular disc, which is deformable to create a tight seal. In one embodiment, the sealing washer 158 comprises a disk 258 of rigid material such as steel, with a section 259 or outer layer of deformable material that may

be selected from a group consisting of: fluorinated silicone, polyurethane and rubber. Additionally, the sealing washer 158, which is most likely to experience wear, is a simple, inexpensive part that can be replaced individually, as needed.

[0087] The vertical engaging portion 114 of the block slider 110 has a vertical groove 120 along the surface 122 thereof. The sliding seal member 134 of the top slider 124 slides over the vertical engaging portion 114 through the sliding groove 136 on the top slider 124 and secures to the block slider 110, utilizing the at least one fastening means 140 that is inserted through the vertical groove 120 on the vertical engaging portion 114 and the opening 138 on the sliding seal member 134. Preferably, the at least one fastening means 140 can be in the form of, for example, a cap screw or similar structures. The at least one fastening means 140 is securely tightened utilizing a lock nut 162. Typically, the lock nut is a serrated flange hex nut. The base mount assembly 102 further includes a plurality of wire clips 163 for holding/retaining one or more wires (not shown) from/for each PV module 170, 172, 174 that is mounted to a building surface by the clamp member 146.

[0088] FIG. 3 illustrates an exploded view of the clamp assembly 144 associated with the base mount assembly 102 in accordance with the preferred embodiment of the present invention. The clamp assembly 144 comprises the clamp member 146 that is coupled with the plate member 148. The clamp member 146 includes a plurality of apertures 154 (See FIG. 10) on an inner surface 156 thereof and a plurality of holes 157 to receive a plurality of screws 178, and the plate member 148 includes a plurality of slots 152. The plurality of apertures 154 and the plurality of slots 152 are oriented along a common longitudinal path to receive the at least one securing means 150.

[0089] The clamp assembly 144 is assembled with the base mount assembly 102 when in use. The at least one securing means 150 is slid through the horizontal groove 132 and inserted through the plurality of slots 152 on the plate member 148 and the plurality of apertures 154 on the inner surface 156 of the clamp member 146. Thus, the clamp member 146, the plate member 148 and the top slider 124 are secured to each other utilizing the at least one securing means 150. The at least one securing means 150 may comprise a cap screw. Preferably, the at least one securing means 150 is a stainless steel $\frac{3}{16}$ "Ø×2" grade 18/8 machine bolt. While securing the clamp assembly 144 with the base mount assembly 102, an engaging nut 160 and a plurality of retainer rings 161 are utilized with the at least one securing means 150 to provide a tight seal. Preferably, the plurality of retainer rings 161 is made of plastic and the engaging nut 160 is a hex nut. It is noted that the engaging nut 160 utilized with the at least one securing means 150 replaces the conventional brake and provides a tight, secure attachment between the clamp assembly 144 and the base mount assembly 102. The least one securing means 150 is securely tightened utilizing the lock nut 162. Specifically, the lock nut 162 is a serrated flange hex nut.

[0090] The clamp member 146 replaces the conventional brake and eliminates edge bridge/mid edge conflict. This clamp assembly 144 works both on top of the base mount assembly 102 as well as independently. Such clamp assembly 144 is adjustable to fit "off-the-shelf" available PV modules. Moreover, the clamp assembly 144 is adjustable to

mount most standard size PV modules. Furthermore, the clamp assembly 144 can fit all types of framed and frameless PV modules.

[0091] FIG. 4 illustrates a first mounting position of the rail-less roof mounting system 100 interlocking the plurality of PV modules 170, 172, 174 to form a corner-to-corner coupling arrangement in accordance with the preferred embodiment of the present invention. The clamp member 146 interconnects the frame member 164 of the PV module 170 to the frame member 166 of the adjacent PV module 172. The clamp member 146 is attached to the frame members 164, 166, 168 of the plurality of PV modules 170, 172, 174 by inserting a plurality of screws 178 into the plurality of holes 157 at a middle of a formed PV array. In the first mounting position, the clamp assembly 144 is coupled with the base mount assembly 102, utilizing one of the securing means 150 that is inserted through one of the apertures 154 in the inner surface 156 of the clamp member 146 and one of the slots 152 on the plate member 148.

[0092] FIG. 5 illustrates a second mounting position of the rail-less roof mounting system 100 interlocking the plurality of PV modules 170, 172, 174 to form the corner-to-corner coupling arrangement in accordance with the preferred embodiment of the present invention. The clamp member 146 interconnects the frame member 164 of the PV module 170 to the frame member 166 of the adjacent PV module 172. In the second mounting position, the clamp assembly 144 is coupled with the base mount assembly 102 utilizing another securing means 150 that is inserted through another aperture 154 in the inner surface 156 of the clamp member 146 and another slot 152 on the plate member 148.

[0093] For instance, the clamp member 146 interlocks corners of the frame members 164, 166, 168 of the plurality of PV modules 170, 172, 174 to form a corner-to-corner coupling arrangement as illustrated in FIGS. 4 and 5. Although the rail-less roof mounting system 100 is shown in FIGS. 4 and 5 holding three PV modules 170, 172, 174, it is noted that the at least one rail-less roof mounting system 100 can bridge four PV modules at the corners in any row and column configuration. Thus, the plurality of PV modules 170, 172, 174 are interlocked in a way to provide the corner-to-corner coupling arrangement which enables the connection of PV module corners to adjacent PV module corners by sandwiching above and beneath the frame members 164, 166, 168 of the plurality of PV modules 170, 172, 174. Moreover, the clamp member 146 interlocks top and bottom surfaces of the frame members 164, 166, 168 of the plurality of PV modules 170, 172, 174 as shown in FIGS. 4 and 5.

[0094] In the preferred embodiment, the plurality of PV modules 170, 172, 174 provided is aluminum framed PV modules. However, while the present invention will be described for use with a framed PV module, the present invention is not so limited. Thus, it is within the scope of the present invention that rigid frameless PV modules, i.e. PV modules utilizing glass modules, may also be utilized to practice the present invention. In one embodiment, the corner-to-corner coupling arrangement provides connection with other mounting and/or racking components and does not provide attachment or connection with any portion of the roof structure 176 such as waterproofing layers, structural rooftop layers or any/all cosmetic layers.

[0095] FIG. 6 illustrates the rail-less roof mounting system 100 interlocking two PV modules 192, 194 in accordance

with an alternate configuration of the present invention. In this configuration, the rail-less roof mounting system 100 interlocks top and bottom surfaces of frame members of two adjacent PV modules 192, 194 at an end of a formed PV array.

[0096] FIG. 7 illustrates installation of the rail-less roof mounting system 100 on the roof structure 176 in accordance with the preferred embodiment of the present invention. The roof structure 176 serves as a mounting surface for the base mount assembly 102. The base member 104 is placed on the roof structure 176 and the at least one tightening means 118 is inserted through the borehole 116, the waterproof means 106 and a roof rafter 180 that is positioned just beneath a roofing material 182 and a roofing sheathing 184. The illustrative installation provides a single point of penetration with the elevated seal portion 112 for providing waterproofing. A minimum embedment depth of 2½ inches is preferred. Typically, the at least one tightening means 118 is a GRK RSS rugged structural screw made of specially hardened steel to provide with high tensile, torque and shear strength. For example, the screw has a ⅜ inch nominal diameter underneath the sealing washer 158, a minimum of torque screw to 13 ft-lb and may be made of hardened steel preferably with an all weather coating such as Climatek™ coating. Furthermore, the roof structure 176 can include pre-stamped and/or pre-drilled pilot holes formed therein through which the at least one tightening means 118 can be inserted. For example, the pilot holes have a diameter of about ⅛ of an inch. More profitably, the rail-less roof mounting system 100 is easily and quickly installed with minimal tools, such as a ½ inch open-end box wrench and a ½ inch socket.

[0097] A method for installing a plurality of photovoltaic (PV) modules 170, 172, 174 on a roof structure 176 includes the following steps. Firstly, a rail-less roof mounting system 100 is provided for mounting the plurality of PV modules 170, 172, 174. The base member 104 is placed on the roof structure 176 and the block slider 110 is positioned above the base member 104 by inserting the waterproof means 106 through the borehole 116 on the elevated seal portion 112. The at least one tightening means 118 is inserted through the borehole 116 and the waterproof means 106 to secure the block slider 110 and the base member 104 with the roof structure 176. The sliding seal member 134 is slid over the vertical engaging portion 114 through the sliding groove 136 on the top slider 124. The at least one fastening means 140 is inserted through the vertical groove 120 on the vertical engaging portion 114 and the opening 138 on the top slider 124 to attach the top slider 124 to the block slider 110. The at least one fastening means 140 is tightened utilizing the lock nut 162. The at least one securing means 150 is slid through the horizontal groove 132 and inserted through the plurality of slots 152 on the plate member 148 and a plurality of apertures 154 on clamp member 146 to attach the clamp member 146 and the plate member 148 with the track 130 of the top slider 124. The at least one securing means 150 is tightened utilizing the lock nut 162.

[0098] Then, the clamp member 146 interconnects the frame member 164 of the PV module 170 to the frame member 166 of the adjacent PV module 172 to provide a corner-to-corner coupling arrangement. Finally, the clamp member 146 is attached with the frame member 164 of the PV module 170 by inserting a plurality of screws 178 into a plurality of holes 157 on the clamp member 146. Thus, the

corner-to-corner coupling arrangement enables the connection of PV module corners to adjacent PV module corners by sandwiching above and beneath the frame members 164, 166, 168 of the plurality of PV modules 170, 172, 174.

[0099] FIG. 8 illustrates the base mount assembly 102 configured to adjust the mounting height of the rail-less roof mounting system 100 in accordance with the preferred embodiment of the present invention. The height of mounting of the rail-less roof mounting system 100 is adjusted by adjusting the position of the top slider 124 along the vertical engaging portion 114 of the block slider 110. The top slider 124 can be moved along the vertical engaging portion 114 and can be secured at desired position or height by tightening the at least one fastening means 140 through the vertical groove 120 on the vertical engaging portion 114 and the opening 138 on the sliding seal member 134.

[0100] FIGS. 9 and 10 illustrate perspective and profile views of a PV array skirt 186 providing a snap-fit engagement with the rail-less roof mounting system 100 in accordance with the preferred embodiment of the present invention. A PV array skirt 186 is installed on an edge of a PV array. The PV array skirt 186 may provide improved aesthetics, safety and structural performance. The PV array skirt 186 may partially or fully obscure air gap and mounting hardware located beneath the PV array. The PV array skirt 186 may allow for the snap-fit engagement of the PV array skirt 186 to the rail-less roof mounting system 100. The rail-less roof mounting system 100 may also allow for the snap-fit engagement with the plurality of PV modules 170, 172, 174. The snap-fit engagement between the PV array skirt 186 and the rail-less roof mounting system 100 is achieved by inserting an extrusion 188 of the PV array skirt 186 along a grooved edge 147 of the plate member 148. Thus, the grooved edge 147 provides a seat for the extrusion 188 of the PV array skirt 186 to provide the snap-fit engagement. The snap-fit engagement provides a longer landing ability to the plate member 148 and an ability to easily clean out debris from under the PV array skirt 186.

[0101] FIG. 11 illustrates a perspective view of interlocking of two PV array skirts 186 in accordance with the preferred embodiment of the present invention. The two PV array skirts 186 are placed end-to-end and ready to be interlocked together with a plurality of skirt clips 190. The plurality of skirt clips 190 is adaptable to prevent the PV array skirt 186 from sagging. The PV array skirt 186 may be manufactured from bent metal and may snap onto the rail-less roof mounting system 100 via the grooved edge 147 of the plate member 148. The rail-less roof mounting system 100 allows for vertical height adjustment therefore allowing for adjustment of height of the PV array skirt 186 above the roof structure 176 thus preventing the debris from entering the underlying air gap. A gap provided between the PV array skirt 186 and the frame member 164 may be sized in order to enable adequate room for installing the plurality of wire clips 163 or any other mounting structures.

[0102] The embodiments discussed above allow for portrait orientation, landscape orientation or a combination of both. In a portrait orientation, the PV array having each of the plurality of PV modules 170, 172, 174 oriented, with the longest axis of the plurality of PV modules 170, 172, 174 extend in a forward-rearward direction, which is typically the south-north direction. The plurality of PV modules 170, 172, 174 have long edges with length running in cross-slope direction. It is noted, however, that the plurality of PV

modules 170, 172, 174 can alternatively be oriented in a landscape orientation, that is, with the longest axis of the plurality of PV modules 170, 172, 174 extending in a lateral or side-to-side direction which is typically the east-west direction. Thus, the above-disclosed rail-less roof mounting system 100 can be used for gable roofs, hip roofs and flat and low slope gable roofs. The plurality of PV modules 170, 172, 174 have short edges with width running in cross-slope direction. Further, the rail-less roof mounting system 100 has the ability to cantilever the plurality of PV modules 170, 172, 174 for both portrait and landscape orientation, for example, 13 inch cantilever portrait and 19 inch cantilever landscape.

[0103] The preferred embodiment reduces the number of parts, the size, and the cost of the parts, resulting in a total part count of approximately 151 (a 50% reduction) and a total mounting system hardware cost of \$0.30/W retail (a 54% reduction). Further, the labor time to install the rail-less roof mounting system 100 is decreased by a minimum of 35%, which results in the reduction of installation times by over 55% as installation efficiencies grow. When the rail-less roof mounting system 100 is installed for bridging the plurality of PV modules 170, 172, 174, it is revealed a decrease of around 47% in non-electrical installation hours. Additional system design and procurement soft-costs are reduced by 67%, when utilizing the system.

[0104] FIG. 12 illustrates one embodiment of a clamp assembly 196 in accordance with the present invention. The clamp assembly 196 is small in size and adaptable to use for end-clamping the plurality of PV modules 170, 172, 174. The clamp assembly 196 includes a clamp member 198 and a plate member 200. The clamp member 198 includes an aperture (not shown) on an inner surface 202 thereof and a pair of holes (not shown) to receive a pair of screws 204 and the plate member 200 includes a slot (not shown). The plate member 200 further includes a grooved edge 206 to accommodate the PV array skirt 186. At least one securing means 208 is inserted through the aperture (not shown) of the clamp member 198 and the slot (not shown) of the plate member 200 to engage the clamp member 198 and the plate member 200. The clamp assembly 196 and related components are shown in further detail in FIGS. 19A, 19B, 20A, 20B, 21, 22, 23, and 24 as well as their position within the solar array in FIGS. 16, 17 and 18.

[0105] FIGS. 25A-25D illustrate perspective views of various alternative embodiments of the base member 104 used in accordance with the present invention. In these figures, the roof slope extends from lower left in the image to top right, which represents the side of the base member closest to the peak of a roof. Said again, the length of the base member is perpendicular with the peak or ridge of the roof, while the width extends left to right in a line parallel with the peak or ridge of the roof and perpendicular to the roof slope. In FIG. 25A, a short base member 220 having a single waterproof means 106, which is centered left to right on the base member, but offset toward the side of the base member that is away from the peak of the roof (that is, on the down slope side) at the top surface 108 as shown. FIG. 25B illustrates a long base member 222 having the waterproof means 106 on the top surface 108. In FIG. 25C, the long base member 222 having a pair of waterproof means 106 on the top surface 108 arranged along the width of the long base member 222 is shown, the waterproof means 106 being offset toward the downslope side away from the peak

of the roof. FIG. 25D illustrates the long base member 222 with the pair of waterproof means 106 arranged along the length of the long base member 222. The short base member 220 and the long base member 222 are substantially flat rectangular metal flashing as previously described.

[0106] FIGS. 26A-26B illustrate an exploded and assembled perspective views of attaching the combination of the block slider 110 and the top slider 124 with the short base member 220 in accordance with the preferred embodiment of the present invention. The block slider 110 and the top slider 124 are connected together by the at least one fastening means securely tightened utilizing a lock nut 162 to form an assembly 300. The borehole 116 on the elevated seal portion 112 of the block slider 110 is positioned over and around so as to engage the waterproof means 106 such that the waterproof means 106 and the borehole 116 align together with the waterproof means 106 inside the borehole 116. In this way the borehole 116 works together and mates with base member 220. The borehole 116 receives the waterproof means 106 and engages with the short base member 220 and the roof structure 176 utilizing the at least one tightening means 118 inserted through the borehole 116 and the waterproof means 106. The at least one tightening means 118 is drilled into the roof structure 176 as previously described. The sealing washer 158 is utilized to fit the at least one tightening means 118 and is adapted to seal the borehole 116 through which the at least one tightening means 118 is fitted, so as to prevent seepage of water. Preferably, the sealing washer 158 is an annular disc, which is deformable to create a tight seal.

[0107] FIGS. 27A-27B illustrate exploded and assembled perspective views of an L-shaped block 302a attached to the long base member 222 in accordance with one embodiment of the present invention. The L-shaped block 302a includes a substantially horizontal portion 304 that functions as an elevated seal portion that is parallel to the roof, and comprises an opening 306 and a vertical engaging portion 308 that is generally perpendicular to the roof, the vertical engaging portion 308 further comprising a long vertical groove 310 and a serrated gripper surface 312 (see FIG. 28A) on the vertical engaging portion 308. Said again, the L-shaped block 302a comprises a first portion parallel to the roof and configured to fit over the base member via a through hole having a consistent diameter, and into which extends the upstanding cylindrical portion, the L-shaped block 302a further comprising a second portion integral to the block, perpendicular to the roof, and comprising an opening. The horizontal portion 304 is substantially perpendicular to and connected to the vertical engaging portion 308 to form the L-shaped block 302a. The L-shaped block 302a is attached to the long base member 222, as illustrated in FIG. 27B, utilizing the at least one tightening means 118 such that the waterproof means on the long base member 222 engages with the opening 306 on the substantially horizontal portion 304.

[0108] FIGS. 28A-28C illustrate perspective views of various embodiments of the L-mount clamps used in accordance with the present invention. In FIG. 28A, the L-shaped block 302a includes a substantially horizontal portion 304 having an opening 306 and a vertical engaging portion 308 having a vertical groove 310 and a serrated gripper surface 312 on the vertical engaging portion 308. The horizontal portion 304 is substantially perpendicular to and connected to the vertical engaging portion 308, and preferably are

integral with one another, that is, formed from a single piece and acting as a unitary component to form the L-shaped block 302a. In FIG. 28B, in the L-mount clamp 302b, the vertical engaging portion 308 has the vertical groove extended to form an extended opening 314 and an extended end 316 on the vertical engaging portion 308. In this embodiment of the L-mount clamp 302b, the serrated gripper surface 312 is provided on either side of the vertical engaging portion 308. FIG. 28C illustrates another embodiment of the L-mount clamp 302c with the substantially horizontal portion 304 having the opening 306 and the vertical engaging portion 308 having the long vertical groove 310 connected in a slanted configuration. The serrated gripper surface 312 is provided on the outer surface of the vertical engaging portion 308. In the L-mount clamp 302c of FIG. 28C, the horizontal portion 304 and the vertical engaging portion 308 are not perpendicular to each other.

[0109] FIGS. 29A-29B illustrates an exploded and assembled perspective views of the L-shaped block 302a attached to the long base member 222 utilizing a deck plate assembly 320 in accordance with one embodiment of the present invention. The deck plate assembly 320 includes a top deck plate 322, a bottom deck plate 324, a plurality of engaging means 338 and an attachment means 328, 330. The top deck plate 322 and the bottom deck plate 324 are substantially pentagonal shaped. The top deck plate 322 is slightly projected outwards and includes a central aperture 326. The bottom deck plate 324 has a plurality of apertures 336 on the outer periphery and a central projected region 332 with a central aperture 334. The plurality of engaging means 338 engages the plurality of apertures 336 on the outer periphery of the bottom plate 324. In this embodiment, the long base member 222 is sandwiched between the top deck plate 322 and the bottom deck plate 324. The top deck plate 322 is positioned over the waterproof means 106 on the long base member 222 such that a portion of the waterproof means 106 is projected above the top deck plate 322. The L-shaped block 302a is positioned on the projected portion of the waterproof means 106. The bottom deck plate 324 is positioned beneath the long base member 222 such that the central aperture 334 on the bottom deck plate 324, the waterproof means 106 and the central aperture 326 on the top deck plate 322 aligns in a straight line. The attachment means 328, 330 engages the bottom deck plate 324, the waterproof means 106, the top deck plate 322 and the L-shaped block 302a to hold the long base member 222, the deck plate assembly 320 and the L-mount clamp together 302a. The attachment means 328, 330 includes a stud 328, a nut 330 and a sealing washer 340. The stud 328 engages through the central aperture 334 on the bottom deck plate 324, the waterproof means 106 on the long base member 222, the central aperture 326 on the top deck plate 322 and the opening 314 on the L-shaped block 302a to hold the long base member 222, the deck plate assembly 320 and the L-shaped block 302a together.

[0110] FIGS. 30A-30B illustrate an exploded and assembled perspective view of the combination of the block slider 110 and the top slider 124 attached to the long base member 222 utilizing the deck plate assembly 320 in accordance with one embodiment of the present invention. In this embodiment, the assembly 300 having the combination of the block slider 110 and the top slider 124 attached to the long base member 222 utilizing the deck plate assembly 320. The long base member 222 is sandwiched between the top

deck plate 322 and the bottom deck plate 324 such that a portion of the waterproof means 106 is projected outwards from the top deck plate 324. The bore hole 116 on the assembly 300 engages with the waterproof means 106 projected above the top deck plate 322. The attachment means 328, 330 of the deck plate assembly 320 including the stud 328, the nut, 330 and the sealing washer 340 holds together the long base member 222, the deck plate assembly 320 and the assembly 300.

[0111] FIGS. 31A-31B illustrate an exploded and assembled perspective view of the L-shaped block 302a attached to the long base member 222 utilizing a deck plate assembly 320 having a captive nut 342 in accordance with one embodiment of the present invention. In this embodiment, the deck plate assembly 320 includes a top deck plate 322, a bottom deck plate 324 with the captive nut 342, a plurality of engaging means 338 and a stud 328 with a sealing washer 340. The top deck plate 322 includes a central aperture 326 and is attached to the top surface 108 of the long base member 222. The waterproof means 106 projects outwards through the central aperture 326 of the top deck plate 322. The bottom deck plate 324 has a plurality of apertures 336 on the outer periphery and a central projected region 332 with the captive nut 342. The plurality of engaging means 338 engages the plurality of apertures 336 on the bottom plate 324. The long base member 222 is sandwiched between the top deck plate 322 and the bottom deck plate 324. The L-shaped block 302a is positioned on the projected portion 332 of the waterproof means 106. The bottom deck plate 324 with the captive nut 342 is positioned beneath the long base member 222. The stud 328 with the sealing washer 340 engages the captive nut 342 on the bottom deck plate 324, thereby holding the deck plate assembly 320, the long base member 222 and the L-shaped block 302a together.

[0112] FIGS. 32A-32B illustrate an exploded and assembled perspective view of attaching the L-shaped block 302a with the long base member 222 utilizing a deck plate assembly 320 having a captive stud 344 in accordance with one embodiment of the present invention. In this embodiment, the deck plate assembly 320 includes a top deck plate 322, a bottom deck plate 324 with a captive stud 344, a plurality of engaging means 338 and a nut 330 with a sealing washer 340. The top deck plate 322 includes a central aperture 326 and is attached to the top surface 108 of the long base member 222 such that the waterproof means 106 projects outwards through the central aperture 326. The bottom deck plate 324 has a plurality of apertures 336 on the outer periphery and a central projected region 332 with the captive stud 344. The plurality of engaging means 338 engages the plurality of apertures 336 on the bottom plate 324. The bottom deck plate 324 with the captive stud 344 is positioned beneath the base member 222 such that the captive stud 344 projects outwards through the waterproof means 106. The L-shaped block 302a is positioned on the base member 222 through the captive stud 344. The nut 330 with the sealing washer 340 engages the captive stud 344 on the bottom deck plate 324, thereby holding the deck plate assembly 320, the base member 222 and the L-shaped block 302a together.

[0113] FIGS. 33A-33B illustrate an exploded and assembled perspective view of attaching the combination of the block slider 110 and the top slider 124 to the long base member 222 utilizing the deck plate assembly 320 having

the captive stud 344 in accordance with one embodiment of the present invention. In this embodiment, the deck plate assembly 320 is similar to that illustrated in FIGS. 32A-32B with the bottom deck plate 324 having the captive stud 344. To attach the assembly 300 with the long base member 222, the bottom deck plate 324 is positioned below the long base member 222 such that the captive stud 344 engages with the waterproof means 106 and projects outwards. The assembly 300 is positioned on the long base member 222 such that the borehole 116 engages with the waterproof means 106. The base member 222 and the assembly 300 is tightened with the sealing washer 340 and the nut 330 with the projected portion 332 of the captive stud 344 on the bottom deck plate 324. Thus, the assembly 300 is attached to the base member 222 utilizing the deck plate assembly 320 having the captive stud 344.

[0114] FIGS. 34A-34B illustrate an exploded and assembled perspective view of attaching the combination of block slider 110 and the top slider 124 to the long base member 222 utilizing the deck plate assembly 320 having the captive nut 342 in accordance with one embodiment of the present invention. This deck plate assembly 320 includes the top deck plate 322, the bottom deck plate 324 with the captive nut 342, the plurality of engaging means 338 and the stud 328 with the sealing washer 340. The top deck plate 322 is attached to the top surface 108 of the base member 222 and the waterproof means 106 projects outwards through the central aperture 326 of the top deck plate 322. The plurality of engaging means 338 engages with the plurality of apertures 336 on the bottom plate 324. The base member 222 is sandwiched between the top deck plate 322 and the bottom deck plate 324. The assembly 300 is positioned on the projected portion of the waterproof means 106. The bottom deck plate 324 with the captive nut 342 is positioned beneath the base member 222. The stud 328 with the sealing washer 340 engages the captive nut 342 on the bottom deck plate 324, thereby holding the deck plate assembly 320, the base member 222 and the assembly 300 together.

[0115] FIG. 35 illustrates a perspective view of multiple base members with the L-shaped block 302a attached to the rails 350 of the PV system in accordance with one embodiment of the present invention. The L-shaped block 302a is attached to the long base member 222 as illustrated in FIGS. 27A and 27B. A plurality of rails 350 for mounting the plurality of photovoltaic modules can be mounted on the L-shaped block 302a. The plurality of rails 350 is connected with the long vertical groove 310 on the vertical engaging portion 308 of the L-shaped block 302a. The L-shaped block 302a is attached to the roof structure and the plurality of rails 350 are connected to the L-shaped block 302a. The vertical engaging portion 308 of the L-shaped block 302a allows the plurality of rails 350 to be held at an elevated position above the roof structure. The photovoltaic modules can then be mounted on the rails 350.

[0116] FIGS. 36A-36B illustrate an exploded and assembled perspective view of a tile mount assembly connected with the long base member 222 accordance with one embodiment of the present invention. In this embodiment, the long base member 222 with a pair of waterproof means 106 is employed as illustrated in FIG. 25C. The tile mount assembly includes a rectangular tile mount 352, an extended L-mount clamp 354 and a pair of tightening means 118 with a pair of washers 158. The rectangular tile mount 352 includes a plurality of tile holes 356 and an extended tile

groove 360 along the length of the rectangular tile mount 352. The plurality of tile holes 356 is distributed on either side along the length of the rectangular tile mount 352. The extended L-mount clamp 354 is similar to the L-shaped block 302a with an extended base portion 358 having a small hole 346 and a small screw 348. The extended base portion 358 is adaptable to slide through the extended tile groove 360 on the rectangular tile mount 352. The rectangular tile mount 352 is positioned on the long base member 222 such that a pair of tile holes 356 coincide with the pair of waterproof means 106 on the long base member 222. The pair of tightening means 118 with the pair of washers 158 is employed to hold the rectangular tile mount 352 with the long base member 222. The extended L-mount clamp 354 is slid through the extended tile groove 360 on the rectangular tile mount 352 and the small screw 348 is tightened with the small hole 346 to fix the extended L-mount clamp 354 in position. This embodiment allows quick fixing of the extended L-mount clamp 354 on the rectangular tile mount 352 and provides an elevated water seal to the roof.

[0117] FIGS. 37A-37B illustrate exploded and assembled perspective views of a shared rail mount 362a connected with the base member 222 and the L-shaped block 302a in accordance with one embodiment of the present invention. This embodiment of the shared rail mount 362a is employed to connect the L-shaped block 302a with the long base member 222. In this embodiment, the long base member 222 of FIG. 25D is employed. The shared rail mount 362a is rectangular in shape and includes a pair of rail mount holes 366 on one side along the length of the shared rail mount 362a and a narrow groove 364 extending along the length of the shared rail mount 362a. The size of the narrow groove 364 is adaptable to accommodate the stud 328 in an inverted position. The shared rail mount 362a is positioned on the long base member 222 such that the pair of waterproof means 106 coincide with the pair of rail mount holes 366. The pair of tightening means 118 with the pair of washers 158 is employed to fix the shared rail mount 362a with the long base member 222. The stud 328 is slid through the narrow groove 364 on the shared rail mount 362a and the L-shaped block 302a is fixed on the shared rail mount 362a by tightening the stud 328 through the opening with the nut 330.

[0118] FIGS. 38A-38B illustrates exploded and assembled perspective views of a tile replacement mount 370a connected with the long base member 222 in accordance with one embodiment of the present invention. The tile replacement mount 370a is rectangular in shape and includes a pair of replacement holes 368 on either side along the length and a narrow groove (not shown). The tile replacement mount 370a is positioned on the long base member 222 such that the pair of waterproof means 106 coincide with the pair of replacement holes 368. In this embodiment, the long base member 222 of FIG. 25C is employed. The pair of tightening means 118 with the pair of washers 158 is employed to fix the tile replacement mount 370a with the long base member 222.

[0119] FIG. 39 illustrates a front view of a plurality of tightening means in accordance with one embodiment of the present invention. The plurality of tightening means along with the washer is used to connect the different types of clamp assemblies with the base member.

[0120] FIGS. 40A-40B illustrate a plurality of brackets in accordance with one embodiment of the present invention.

The tile replacement mount 370a and another embodiment of a tile replacement mount 370b is illustrated in FIG. 40A. FIG. 40B illustrates the shared rail mount 362a and another embodiment of a shared rail mount 362b.

[0121] The presently disclosed system is advantageous because it provides the corner-to-corner coupling arrangement, enabling the bridging of corners of the plurality of PV modules 170, 172, 174. The rail-less roof mounting system 100 provides a single grounding lug for assembling the PV array consisting of 300 PV modules or less. Further, the rail-less roof mounting system 100 includes the plurality of wire clips 163, which are designed to work in multiple locations to minimize wire management issues. The rail-less roof mounting system 100 allows for more customizability in the PV array shape by allowing the installer to easily work around roof obstructions like vents, skylights, and other roof protrusions. This rail-less roof mounting system 100 provides the ability to increase vertical leveling adjustability, for instance, 3 inch to 5 inch. The rail-less roof mounting system 100 has the ability to independently remove a single PV module without deconstructing an entire row of the PV array and allow for easy mounting height adjustment after the plurality of PV modules 170, 172, 174 are installed. The rail-less roof mounting system 100 can be easily assembled and disassembled and the components can be laid flat for easy storage and shipping. Furthermore, the rail-less roof mounting system 100 would require less manpower to install and rework.

[0122] The foregoing description of the preferred embodiment of the present 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 to not be limited by this detailed description, but by the claims and the equivalents to the claims appended hereto.

1. A roof mounting system for attaching at least one PV module to a roof, the system comprising:

- (a.) a roof having a roof surface;
- (b.) a plurality of mounts, each of the plurality of mounts comprising:
 - (i.) a base 222 having a first surface adjacent the roof surface and a second surface opposite the first surface, the second surface comprising a top deck plate 322;
 - (ii.) a bottom deck plate 324 secured to the roof by a plurality of engaging means 338 and through which extends a captive stud 344;
 - (iii.) an upstanding projection connected to and extending away from the base 222, the upstanding projection comprising a distal end having a distal end aperture;
 - (iv.) a block comprising a substantially horizontal portion and a vertical engaging portion, wherein the vertical engaging portion comprises a vertical groove and the substantially horizontal portion has an opening and is configured to fit over the base 222 and upstanding projection;
 - (v.) whereby captive stud 344 extends through said upstanding projection and block and is held in place with a sealing washer, the sealing washer comprising a rigid portion contacting the head portion and a

- deformable part contacting the distal end thereby forming a waterproof seal; and
- (c.) at least one PV module coupled to at least one of said plurality of mounts, the PV module having a mounting height.
2. The roof mounting system of claim 1 wherein the top deck plate 322 and bottom deck plates 324 define five sided polygons.
3. The roof mounting system of claim 1 wherein the bottom deck plate 324 comprises five holes, one for each of said plurality of engaging means 338.
4. The roof mounting system of claim 1 wherein a plurality of structural members are adjustably attached to the block vertical engaging portion and comprise a top portion and a horizontal groove in the top portion extending the length of each structural member.
5. The roof mounting system of claim 4 wherein a plurality of clamp assemblies are connected to the at least one PV module and are configured to connect to the top portion of the structural member via the horizontal groove.
6. The roof mounting system of claim 5 wherein each of the clamp assemblies is configured to sandwich the at least one PV module between a clamp member and a structural member top portion.
7. A roof mounting system for attaching at least one PV module to a roof, the system comprising:
- (a.) a base member having a top surface comprising an upstanding cylindrical portion that extends away from a roof surface, the upstanding cylindrical portion defining a through hole and a distal end aperture, and a bottom surface;
 - (b.) a bottom deck plate 324 secured to the roof by a plurality of engaging means 338 and through which extends a captive stud 344;
 - (c.) a block member comprising:
 - (i.) a first portion parallel to the roof and configured to fit over the base member;
 - (ii.) a through hole into which extends the upstanding cylindrical portion; and
 - (iii.) a second portion integral to the block, perpendicular to the roof, and comprising an opening;
 - (c.) whereby captive stud 344 extends through said upstanding projection and the block and is held place with a sealing washer on the captive stud 344 and which is adapted to seal the base mount assembly to prevent seepage of water, wherein the sealing washer comprises a rigid portion in contact with a nut and a deformable component in contact with:
 - a. the block member first portion;
 - b. the stud 328; and
 - c. the upstanding portion distal end; and
 - (d.) wherein the deformable component is compressed between:
 - a. the nut and the block member first portion; and
 - b. the nut and the upstanding portion distal end; and
 - (f.) at least one PV module.
8. The roof mounting system of claim 7 wherein the bottom deck plate defines a five sided polygon.
9. The roof mounting system of claim 7 wherein the bottom deck plate comprises a plurality of holes, one for each of said plurality of engaging means 338.
10. The roof mounting system of claim 7 wherein a structural member supports the at least one PV module above the roof and comprises a top portion having a track

extending the entire length of the top portion and a bottom portion connecting to the block member second portion.

11. The roof mounting system of claim 10 wherein a clamp assembly connects the at least one PV module to the structural member.

12. The roof mounting system of claim 7 wherein the second portion has an opening has a length that is greater than its width.

13. The roof mounting system of claim 12 wherein the length enables a height adjustable connection between the block member and the structural member.

14. The roof mounting system of claim 7 wherein the block member first portion and the block member second portion extend away from each other at an approximately 90-degree angle.

15. A roof mounting system for installing at least one PV module on a roof surface, the roof mounting system comprising:

- (a.) a base mount assembly attached to a roof surface, the base mount assembly comprising:
 - (i.) a base member having a top surface comprising:
 - (1.) a substantially flat area; and
 - (2.) a rounded upstanding portion extending directly away from the base and having a distal end defining a distal end aperture;
 - (ii.) a block member comprising:
 - (1.) a first portion substantially parallel to the roof surface, configured to fit over the base member upstanding portion, and comprising a through hole configured to surround the upstanding portion; and
 - (2.) a second portion integral to the block and extending away from the roof surface and comprising a vertical groove;
 - (iii.) a bottom deck plate having a captured nut 342;
 - (iv.) a stud 328 extending through said block member first portion, through said distal end aperture and into said bottom deck plate where it is secured by captured nut 342; and
 - (v.) a sealing washer on the stud 328 and adapted to seal the base mount assembly to prevent seepage of water, wherein the sealing washer comprises a rigid portion in contact with a stud head portion and a deformable component in contact with:
 - (1.) the block member first portion;
 - (2.) the stud 328; and
 - (3.) the upstanding portion distal end; and
 - (vi.) wherein the deformable component is compressed between:
 - (1.) the stud head portion and the block member first portion; and
 - (2.) the stud head portion and the upstanding portion distal end;
- (b.) a structural member supporting the at least one PV module above the roof, the structural member having a structural member groove running the entire length of the structural member; and
- (c.) a clamp assembly connecting the at least one PV module to the structural member.

16. The roof mounting system of claim 15 wherein the bottom deck plate defines a five sided polygon.

17. The roof mounting system of claim 15 wherein the bottom deck plate comprises a plurality of holes, one for each of said plurality of engaging means.

18. The roof mounting system of claim **15** wherein the base member is a substantially flat rectangular metal flashing.

19. The roof mounting system of claim **15** wherein the base member is installed in portrait orientation on the roof.

20. The roof mounting system of claim **15** wherein:

(a.) the roof surface has a slope having a high end and a low end;

(b.) the base member has a base member length and a base member width, the base member length having a first end and a second end, and wherein the upstanding portion is located centrally with respect to the base member width and off center and towards the roof surface slope low end with respect to the length of the base member.

21. The roof mounting system of claim **15** wherein the block member first portion and the block member second portion extend away from each other at an approximately 90-degree angle.

22. The roof mounting system of claim **15** wherein the structural member is adjustably connected to the block member second portion via the slotted opening.

23. The adjustable connection of claim **22** wherein the adjustably connected structural member enables a height-variable connection of the at least one PV module to the roof.

24. The roof mounting system of claim **15** wherein the structural member groove is configured to receive a clamp assembly securing means.

25. The roof mounting system of claim **15** wherein the clamp assembly clamps at least one frame member of the at least one PV module between a clamp member and the structural member top portion

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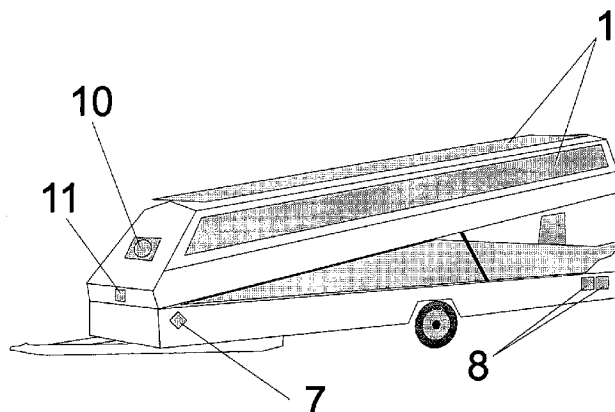
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Fig. 1



(57) Abstract: Mobile solar plant, i.e. an apparatus for generation of electrical energy from photovoltaic cells based on a mobile vehicle, which retains the function of housing another vehicle and can function while driving and when stationary is characterized by that the electrical system consists of photovoltaic cells (1) either mouted directly onto vehicle base structure or in form of panels installed anywhere on the vehicle, DC-DC power converter (2), converting the power generated by the photovoltaic cells to usable, e.g. 12 V or 24 V DC voltage, DC-AC inverter (3), converting the DC voltage to usable AC voltage, e.g. 110 VAC, 240 VAC, etc., a buffer battery (4) of any electrical energy storage principle for temporary electrical energy storage, the bypass switch (5), buffer battery charger (6), electrical inlets (7), electrical outlets (8) and wiring, safety elements (9) and climate control fan/heater assembly (10); optional is a diagnostics/monitoring system (11).



WO 2012/134400 A1

Mobile Solar Powerplant

The present invention is mobile solar plant, i.e. an apparatus for generation of electrical energy from photovoltaic cells based on a mobile vehicle, thus called the Mobile solar powerplant. The Mobile solar powerplant consists of the electrical system installed on the mobile vehicle base, which can be any road-worthy vehicle that can be towed by another vehicle or move independently, either powerless or with independent means of locomotion. While methods for mobile power generation based on the photovoltaic principle exist, UN 7795837 (B1), US 2010212659 (A1), US 6380481 (B1) US 5969501 (A) they all focus on a device used for production of electrical energy, which is installed on a moving towable vehicle. The present invention however represents an upgrade of an existing towable vehicle in such manner, that the existing vehicle retains the capability of housing another vehicle, i.e. aircraft, land-based or maritime vehicle, which can receive charge from the electrical system of the present invention. The present invention removes the necessity of one vehicle towing the trailer, which houses the aircraft, land-based or maritime vehicle to be charged, and another vehicle which would have the role of providing electrical energy via the photovoltaic principle and combines these functions in one vehicle. Furthermore, besides providing charging energy to the aircraft, land-based or maritime vehicle, which is being housed inside the vehicle base, the present invention can provide power to other electrical appliances via standardised electrical outlets. Also, as a contrast to above mentioned recognised inventions, the Mobile Solar Plant can function both during driving and when stationary and is not subject to use only when stationary and arranged for operation. All elements of the electrical system of the Mobile Solar Plant are fixed and do not need to be repositioned for their function. The components are small and lightweight, in contrast to UN 7795837 (B1), US 2010212659 (A1), US 6380481 (B1) US 5969501 (A), and can be installed anywhere on the vehicle using standardised brackets and fastening elements.

Primarily, the Mobile solar powerplant is designed to transport and provide means of mobile standalone charging to an electric-powered aeroplane, but its scope also stretches to use with land-based, maritime or other vehicles and also in vehicle-free operation as a stand alone mobile powerplant, providing power to electrical appliances of DC and AC kind. The Mobile Solar Powerplant's electrical system comprises small and lightweight elements, which permit for an installation of the system to an existing, non-dedicated towable vehicle. Because of this the capacity of housing of another vehicle on-board the towable vehicle is retained. The Mobile solar powerplant can operate either stationary or while moving. The electrical system provides for conversion of solar energy derived via photovoltaic cells into useful DC and AC circuits for connection of any electrical

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appliance, functioning together with the base vehicle or as an independent solar powerplant with energy storage.

The invention will be described by the figures showing:

Figure 1 – Mobile solar powerplant representation,

Figure 2 – electrical system schematic.

Any mobile vehicle can be used as a base to the electrical system. The electrical system consists of photovoltaic cells 1 either mounted directly onto vehicle base structure or in the form of panels installed anywhere on the vehicle, DC-DC power converter 2 converting the power generated by the photovoltaic cells to usable, e.g. 12 V or 24 V DC voltage, DC-AC inverter 3 converting the DC voltage to usable AC voltage, e.g. 110 VAC, 240 VAC, etc., a buffer battery 4 of any electrical energy storage principle for temporary electrical energy storage, the bypass switch 5, buffer battery charger 6, electrical inlets 7, electrical outlets 8 and wiring 9, safety elements 10 and climate control fan/heater assembly 11. Optional is a diagnostics/monitoring system 11. The schematic of the electrical system of Mobile solar powerplant is shown in Figure 2. The components are small and lightweight, in contrast to UN 7795837 (B1), US 2010212659 (A1), US 6380481 (B1) US 5969501 (A)

The photovoltaic cells 1 gather the energy from solar radiation and power the DC-DC power converter 2. The number of photovoltaic cells is arbitrary and depends on the desired power capability of the system. Connections of the photovoltaic cells 1 to the DC-DC power converter 2 depend on its characteristics, however in principle both serial and parallel as well as hybrid wiring configurations are covered.

The DC-DC power converter 2 receives power from the photovoltaic cells 1 and converts it to usable DC voltage, while providing for protection properties to the photovoltaic cells 1. Use of multiple DC-DC converters in serial, parallel or hybrid configurations is covered by wording »DC-DC power converter«. The DC-DC power converter 2 can take advantage of all electronic, electromechanic, electromagnetic or other principles to achieve its function. Output of the DC-DC power converter 2 is a stabilised DC voltage, which can be utilised by widespread appliances requiring DC voltage i.e. 12V, 24V or other for its function.

The DC-AC inverter 3 converts the DC voltage to AC of desired voltage and frequency. Use of multiple DC-AC inverters in serial, parallel or hybrid configurations is covered by wording »DC-AC inverter«. The DC-AC inverter 3 can take advantage of all electronic, electromechanic, electromagnetic or other

principles to achieve its function. Output of the DC-AC inverter 3 is stabilised AC electrical power, which can be utilised by widespread appliances requiring AC voltage i.e. 110 VAC 60 Hz, 240 VAC 50 Hz or other for its function.

The buffer battery 4 is charged by the buffer battery charger 6. The buffer battery 4 can use any principle of storing electrical energy for shorter or longer periods of time. The properties of the battery follow desired power and storage characteristics of the system. The battery charger provides means of delivering electrical power to the buffer battery 4 in order to achieve long-term or electrical energy storage.

Bypass switch 5 provides the capability of connecting the Mobile solar powerplant to an electrical network in case its function of delivering power from photovoltaic cells is not desired or otherwise hindered. When the Mobile solar powerplant is connected to the electrical network, the capability of charging the buffer battery 4 is retained, as is the ability of the Mobile solar powerplant electrical outlets 8 to provide useful DC and AC electrical power. When activated, the bypass switch 5 disconnects photovoltaic cells 1 and DC-DC power controller 2 from the system.

There can be one or more electrical inlets 7 installed anywhere on the Mobile solar powerplant. The electrical inlets 7 are used to connect the Mobile solar powerplant to the electrical network when its function of delivering power from photovoltaic cells is not desired or otherwise hindered. The inlets can be of various shape, style and form, but can accept regular established electrical network/cable elements.

There can be one or more electrical outlets 8 on/inside the Mobile solar powerplant, delivering useful DC and AC power to be used for powering electrical appliances, including chargers of electrical vehicles being housed in the Mobile solar powerplant. The inlets can be of various shape, style and form, but can accept regular established electrical network/cable elements.

The wiring and safety elements 9 connect all components electrically. The safety elements 9 include but are not limited to circuit breakers, fuses, power relay, signal checks, diagnostics systems and other support elements.

The climate control fan/heater assembly 10 regulates the temperature inside the Mobile solar powerplant, should this be important for the vehicle stored inside the Mobile solar powerplant. The fan/heater assembly 10 uses electrical energy to heat and/or cool the interior of the Mobile solar powerplant by inducing thermal emissions and providing for a steady flow of air through the Mobile solar powerplant. Its mounting location can be anywhere on the Mobile solar powerplant.

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The diagnostics/monitoring system 11 is the apparatus that gathers information from individual system components and displays it to the user. It can consist of a screen, diagnostics connector or other means, including wireless signal connections, of delivering information about the system to the user. Its mounting location can be anywhere on the Mobile solar powerplant.

PATENT CLAIM

1. Mobile solar plant, i.e. an apparatus for generation of electrical energy from photovoltaic cells based on a mobile vehicle, characterized by that the electrical system consists of photovoltaic cells (1) either mounted directly onto vehicle base structure or in form of panels installed anywhere on the vehicle, DC-DC power converter (2), converting the power generated by the photovoltaic cells to usable, e.g. 12 V or 24 V DC voltage, DC-AC inverter (3), converting the DC voltage to usable AC voltage, e.g. 110 VAC, 240 VAC, etc., a buffer battery (4) of any electrical energy storage principle for temporary electrical energy storage, the bypass switch (5), buffer battery charger (6), electrical inlets (7), electrical outlets (8) and wiring, safety elements (9) and climate control fan/heater assembly (10), optional is a diagnostics/monitoring system (11); and by the option of housing/transporting/charging other aerial, ground or maritime vehicles or other devices and providing means of electrical energy from photovoltaic source or battery storage while driving or when stationary.

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

EPO-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 982 971 A (MARIN RANDY L [US]) 8 January 1991 (1991-01-08) the whole document -----	1
X	US 7 795 837 B1 (HAUN DARRELL N [US] ET AL) 14 September 2010 (2010-09-14) the whole document -----	1
A	US 2010/111660 A1 (MATHEWS KEVIN MICHAEL [NZ]) 6 May 2010 (2010-05-06) paragraph [0034]; figure 9 -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4982971	A	08-01-1991	NONE
US 7795837	B1	14-09-2010	NONE
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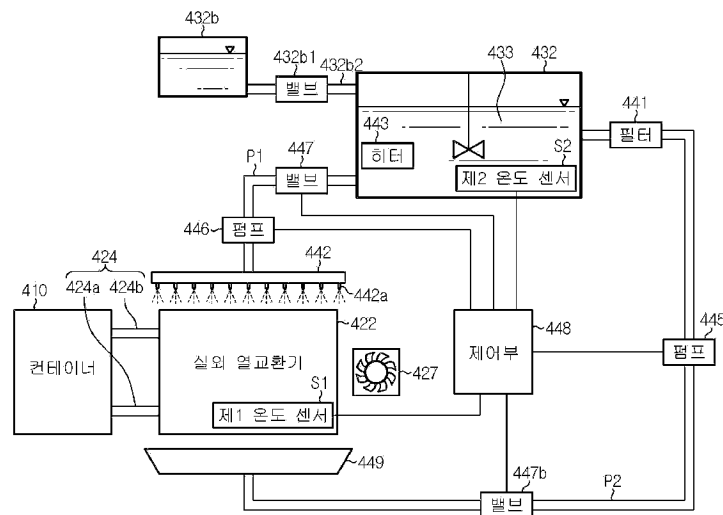
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(54) 발명의 명칭 전력 저장 시스템

(57) 요약

본 발명은 실외 열교환기의 열교환 효율을 높이고 공조기의 유지 관리가 손쉬운 전력 저장 시스템을 개시한다. 상기와 같은 목적을 달성하기 위한 본 발명에 따른 전력 저장 시스템은, 적어도 둘 이상의 배터리 모듈을 구비하는 적어도 하나 이상의 배터리 랙; 상기 적어도 하나 이상의 배터리 랙을 수용하는 컨테이너; 상기 컨테이너 내부의 승온된 열교환 매체를 냉각시키도록 구성된 실외 열교환기, 및 상기 열교환 매체가 상기 컨테이너와 상기 실외 열교환기 사이를 순환하도록 구성된 순환 유로를 구비한 공조기; 내부에 소화액을 내장한 소화 탱크를 구비하고, 상기 적어도 하나 이상의 배터리 모듈의 온도가 소정 온도 이상이 되거나 또는 상기 적어도 하나 이상의 배터리 모듈에서 연기가 발생될 때 이를 감지하여 소화액을 상기 배터리 모듈에 공급하도록 구성된 소화 유닛; 및 상기 소화 탱크의 소화액을 상기 실외 열교환기의 외면에 살포하도록 구성된 공조기 관리 유닛을 포함한다.

배관도



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명세서

청구범위

청구항 1

적어도 둘 이상의 배터리 모듈을 구비하는 적어도 하나 이상의 배터리 랙;

상기 적어도 하나 이상의 배터리 랙을 수용하는 컨테이너;

상기 컨테이너 내부의 승온된 열교환 매체를 냉각시키도록 구성된 실외 열교환기, 및 상기 열교환 매체가 상기 컨테이너와 상기 실외 열교환기 사이를 순환하도록 구성된 순환 유로를 구비한 공조기;

내부에 소화액을 내장한 소화 탱크를 구비하고, 상기 적어도 하나 이상의 배터리 모듈의 온도가 소정 온도 이상이 되거나 또는 상기 적어도 하나 이상의 배터리 모듈에서 연기가 발생될 때 이를 감지하여 소화액을 상기 배터리 모듈에 공급하도록 구성된 소화 유닛; 및

상기 소화 탱크의 소화액을 상기 실외 열교환기의 외면에 살포하도록 구성된 공조기 관리 유닛

을 포함하는 것을 특징으로 하는 전력 저장 시스템.

청구항 2

제1항에 있어서,

상기 공조기 관리 유닛은,

상기 소화액이 상기 실외 열교환기의 외면에 고르게 살포되도록 소정 간격으로 이격된 다수의 노즐을 가진 공급 헤더를 구비하고,

상기 실외 열교환기는 내부 공간을 따라 상기 열교환 매체가 이동되도록 구성되고 외면에서 외측 방향으로 돌출되고 관을 따라 선형으로 연장된 리브가 구비된 나선형 관, 또는 다수의 핀이 형성된 튜브를 구비한 것을 특징으로 하는 전력 저장 시스템.

청구항 3

제2항에 있어서,

상기 공조기 관리 유닛은,

상기 소화 탱크의 출구와 상기 공급 헤더의 입구를 연결하도록 구성된 공급관;

상기 소화액을 상기 공급관을 통해 상기 공급 헤더로 공급하도록 공급 펌프;

상기 공급관의 개폐 조절이 가능한 능동형 밸브; 및

상기 능동형 밸브와 상기 공급 펌프의 작동을 제어하도록 구성된 제어부

를 더 구비하는 것을 특징으로 하는 전력 저장 시스템.

청구항 4

제2항에 있어서,

상기 공조기 관리 유닛은,

상기 실외 열교환기에 살포된 소화액을 집수하도록 구성된 집수관;

상기 집수관의 출구와 상기 소화 탱크의 입구 사이를 연결하도록 구성된 회수관; 및

상기 집수관에 집수된 소화액을 상기 회수관을 통해 상기 소화 탱크로 이송하도록 구성된 회수 펌프

를 더 구비하는 것을 특징으로 하는 전력 저장 시스템.

청구항 5

제3항에 있어서,

상기 공조기 관리 유닛은,

상기 실외 열교환기의 온도를 측정하도록 구성된 제1 온도 센서;

상기 소화 탱크의 소화액의 온도를 측정하도록 구성된 제2 온도 센서; 및

상기 소화 탱크의 내장된 소화액을 가열하도록 구성된 히터를 더 구비한 것을 특징으로 하는 전력 저장 시스템.

청구항 6

제5항에 있어서,

상기 제어부는,

상기 실외 열교환기의 온도가 소정 온도 이상이거나, 또는 소정 온도 이하일 경우, 상기 능동형 밸브를 개방하고 공급 펌프를 구동 시키도록 구성된 것을 특징으로 하는 전력 저장 시스템.

청구항 7

제6항에 있어서,

상기 제어부는,

상기 소화 탱크의 내장된 소화액의 온도가 소정 온도 이하일 경우, 상기 히터를 작동시켜 상기 소화 탱크 내부의 소화액의 온도를 높이도록 구성된 것을 특징으로 하는 전력 저장 시스템.

청구항 8

제1항에 있어서,

상기 소화 탱크에는 상기 소화액과 섞여 있는 부동액을 더 구비하는 것을 특징으로 하는 전력 저장 시스템.

청구항 9

제4항에 있어서,

상기 공조기 관리 유닛은,

상기 회수관에 위치하고 상기 집수된 소화액의 오염 물질을 제거하도록 구성된 여과 필터가 더 구비된 것을 특징으로 하는 전력 저장 시스템.

청구항 10

제1항에 있어서,

상기 공조기 관리 유닛은,

소화액이 내장되고 상기 소화 탱크의 소화액의 양이 소정 이하가 될 경우, 소화액을 보충하도록 구성된 보조 탱크를 더 구비하는 것을 특징으로 하는 전력 저장 시스템.

발명의 설명

기술 분야

본 발명은 전력 저장 시스템에 관한 것으로서, 보다 상세하게는 실외 열교환기의 열교환 효율을 높이고 공조기의 유지 관리가 손쉬운 전력 저장 시스템에 관한 것이다.

배경 기술

[0001]

- [0002] 현재 상용화된 이차전지로는 니켈 카드뮴 전지, 니켈 수소 전지, 니켈 아연 전지, 리튬 이차전지 등이 있는데, 이 중에서 리튬 이차전지는 니켈 계열의 이차전지에 비해 메모리 효과가 거의 일어나지 않아 충방전이 자유롭고, 자가 방전율이 매우 낮으며 에너지 밀도가 높은 장점으로 각광을 받고 있다.
- [0003] 이러한 리튬 이차전지는 주로 리튬계 산화물과 탄소재를 각각 양극 활물질과 음극 활물질로 사용한다. 리튬 이차전지는, 이러한 양극 활물질과 음극 활물질이 각각 도포된 양극판과 음극판이 세퍼레이터를 사이에 두고 배치된 전극 조립체와, 전극 조립체를 전해액과 함께 밀봉 수납하는 외장재, 즉 전지 파우치 외장재를 구비한다.
- [0004] 최근에는 휴대형 전자기기와 같은 소형 장치뿐만 아니라, 자동차나 전력저장장치와 같은 중대형 장치에도 이차전지가 널리 이용되고 있다. 이러한 중대형 장치에 이용되는 경우, 용량 및 출력을 높이기 위해 많은 수의 이차전지가 전기적으로 연결된다. 특히, 이러한 중대형 장치에는 적층이 용이하다는 장점으로 인해 파우치형 이차전지가 많이 이용된다.
- [0005] 한편, 근래 에너지 저장원으로서의 활용을 비롯하여 대용량 구조에 대한 필요성이 높아지면서 다수의 이차전지를 내부에 수용한 다수의 배터리 팩을 구비한 다수의 배터리 랙, 이러한 다수의 배터리 랙을 내부에 보관하도록 구성된 컨테이너, 및 다수의 배터리 랙을 냉각하기 위한 공조기를 포함한 전력 저장 장치에 대한 수요가 증가하고 있다.
- [0006] 또한, 이러한 전력 저장 장치의 종래의 일반적인 공조기의 경우, 여름철에는 실외 공기 온도가 급상승하여, 실외에 구비된 공조기의 열교환기(응축기)를 효과적으로 냉각 시킬 수 없어, 공조기가 고장 나거나, 셧다운 되는 등의 문제가 발생되었다.
- [0007] 더욱이, 열대 지방이나, 사막 지역의 경우, 실외 공기의 온도가 섭씨 40도 이상으로 유지되고, 이로 인해, 소형의 실외 열교환기(응축기)를 효과적으로 냉각 시킬 수 없어, 대형의 실외 열교환기로 대체해야 하는 문제가 있다.
- [0008] 그리고, 겨울철에는, 배터리 팩이 냉각되지 않도록, 배터리 랙이 수용되는 컨테이너 내부를 난방 시킬 필요가 있었다. 그러나, 겨울철에는 실외기에 장착된 열교환기에 착상이 생겨, 컨테이너의 내부의 난방을 잠시 중단하고, 공조기의 냉동 사이클을 반대로 돌려서 제상을 해줘야 하는 문제가 있다. 이로 인해, 컨테이너 난방이 잠시 중단되어, 내부의 다수의 배터리 팩이 과냉각될 수 있는 위험성이 있었다.

발명의 내용

해결하려는 과제

- [0009] 따라서, 본 발명은 상기와 같은 문제점을 해결하기 위해 창안된 것으로서, 실외 열교환기의 열교환 효율을 높이고 공조기의 유지 관리가 손쉬운 전력 저장 시스템을 제공하는 것을 목적으로 한다.
- [0010] 본 발명의 다른 목적 및 장점들은 하기의 설명에 의해서 이해될 수 있으며, 본 발명의 실시예에 의해 보다 분명하게 알게 될 것이다. 또한, 본 발명의 목적 및 장점들은 특허 청구 범위에 나타낸 수단 및 그 조합에 의해 실현될 수 있음을 쉽게 알 수 있을 것이다.

과제의 해결 수단

- [0011] 상기와 같은 목적을 달성하기 위한 본 발명에 따른 전력 저장 시스템은,
- [0012] 적어도 둘 이상의 배터리 모듈을 구비하는 적어도 하나 이상의 배터리 랙;
- [0013] 상기 적어도 하나 이상의 배터리 랙을 수용하는 컨테이너;
- [0014] 상기 컨테이너 내부의 승온된 열교환 매체를 냉각시키도록 구성된 실외 열교환기, 및 상기 열교환 매체가 상기 컨테이너와 상기 실외 열교환기 사이를 순환하도록 구성된 순환 유로를 구비한 공조기;
- [0015] 내부에 소화액을 내장한 소화 탱크를 구비하고, 상기 적어도 하나 이상의 배터리 모듈의 온도가 소정 온도 이상이 되거나 또는 상기 적어도 하나 이상의 배터리 모듈에서 연기가 발생될 때 이를 감지하여 소화액을 상기 배터리 모듈에 공급하도록 구성된 소화 유닛; 및
- [0016] 상기 소화 탱크의 소화액을 상기 실외 열교환기의 외면에 살포하도록 구성된 공조기 관리 유닛을 포함한다.
- [0017] 또한, 상기 공조기 관리 유닛은,

- [0018] 상기 소화액이 상기 실외 열교환기의 외면에 고르게 살포되도록 소정 간격으로 이격된 다수의 노즐을 가진 공급 헤더를 구비하고,
- [0019] 상기 실외 열교환기는 내부 공간을 따라 상기 열교환 매체가 이동되도록 구성되고 외면에서 외측 방향으로 돌출되고 관을 따라 선형으로 연장된 리브가 구비된 나선형 관, 또는 다수의 핀이 형성된 튜브를 구비할 수 있다.
- [0020] 더욱이, 상기 공조기 관리 유닛은,
- [0021] 상기 소화 탱크의 출구와 상기 공급 헤더의 입구를 연결하도록 구성된 공급관;
- [0022] 상기 소화액을 상기 공급관을 통해 상기 공급 헤더로 공급하도록 공급 펌프;
- [0023] 상기 공급관의 개폐 조절이 가능한 능동형 밸브; 및
- [0024] 상기 능동형 밸브와 상기 공급 펌프의 작동을 제어하도록 구성된 제어부를 더 구비할 수 있다.
- [0025] 그리고, 상기 공조기 관리 유닛은,
- [0026] 상기 실외 열교환기에 살포된 소화액을 집수하도록 구성된 집수관;
- [0027] 상기 집수관의 출구와 상기 소화 탱크의 입구 사이를 연결하도록 구성된 회수관; 및
- [0028] 상기 집수관에 집수된 소화액을 상기 회수관을 통해 상기 소화 탱크로 이송하도록 구성된 회수 펌프를 더 구비할 수 있다.
- [0029] 나아가, 상기 공조기 관리 유닛은,
- [0030] 상기 실외 열교환기의 온도를 측정하도록 구성된 제1 온도 센서;
- [0031] 상기 소화 탱크의 소화액의 온도를 측정하도록 구성된 제2 온도 센서; 및
- [0032] 상기 소화 탱크의 내장된 소화액을 가열하도록 구성된 히터를 더 구비할 수 있다.
- [0033] 또한, 상기 제어부는,
- [0034] 상기 실외 열교환기의 온도가 소정 온도 이상이거나, 또는 소정 온도 이하일 경우, 상기 능동형 밸브를 개방하고 공급 펌프를 구동 시키도록 구성될 수 있다.
- [0035] 그리고, 상기 제어부는,
- [0036] 상기 소화 탱크의 내장된 소화액의 온도가 소정 온도 이하일 경우, 상기 히터를 작동시켜 상기 소화 탱크 내부의 소화액의 온도를 높이도록 구성될 수 있다.
- [0037] 나아가, 상기 소화 탱크에는 상기 소화액과 섞여 있는 부동액을 더 구비할 수 있다.
- [0038] 또한, 상기 공조기 관리 유닛은,
- [0039] 상기 회수관에 위치하고 상기 집수된 소화액의 오염 물질을 제거하도록 구성된 여과 필터가 더 구비할 수 있다.
- [0040] 더욱이, 상기 공조기 관리 유닛은,
- [0041] 소화액이 내장되고 상기 소화 탱크의 소화액의 양이 소정 이하가 될 경우, 소화액을 보충하도록 구성된 보조 탱크를 더 구비할 수 있다.

발명의 효과

- [0042] 본 발명의 일 측면에 의하면, 본 발명의 전력 저장 장치는, 소화 탱크의 소화액을 실외 열교환기의 외면에 살포하도록 구성된 공조기 관리 유닛을 포함함으로써, 실외 열교환기에 살포된 소화액의 기화열 또는 열교환을 이용해, 실외 열교환기의 열교환 효율을 높일 수 있다. 이에 따라, 작은 규모의 실외 열교환기의 적용이 가능하여, 전력 저장 시스템의 가격 경쟁력을 높일 수 있다.
- [0043] 또한, 본 발명의 일 측면에 의하면, 공조기 관리 유닛은, 소화액이 실외 열교환기의 외면에 고르게 살포되도록 소정 간격으로 이격된 다수의 노즐을 가진 공급 헤더를 구비하고, 실외 열교환기는 내부 공간을 따라 열교환 매체가 이동되도록 구성되고 외면에 관을 따라 선형으로 연장된 리브가 구비된 나선형 관을 구비함으로써, 공급 헤더로부터 실외 열교환기로 공급된 소화액이 중력에 의해 곤장 유실되지 않고 나선형 관을 따라 상부에서 하부

로 이동될 수 있어, 소화액과 나선형 관 간의 열교환율을 효과적으로 높일 수 있다. 이에 따라, 공조기 관리 유닛에 의한 실외 열교환기의 열교환(냉각) 효율을 극대화할 수 있다. 더욱이, 겨울철에는 실외 열교환기에 형성된 서리를 효과적으로 녹여 제거할 수 있다.

도면의 간단한 설명

[0044] 본 명세서에 첨부되는 다음의 도면들은 본 발명의 바람직한 실시예를 예시하는 것이며, 후술하는 발명의 상세한 설명과 함께 본 발명의 기술사상을 더욱 이해시키는 역할을 하는 것이므로, 본 발명은 그러한 도면에 기재된 사항에만 한정되어 해석되어서는 안 된다.

도 1은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 구성들을 개략적으로 나타내는 개념도이다.

도 2는, 본 발명의 일 실시예에 따른 배터리 랙과 컨테이너를 개략적으로 나타내는 사시도이다.

도 3은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 일부 구성들을 개략적으로 나타내는 개념도이다.

도 4는, 본 발명의 일 실시예에 따른 전력 저장 시스템의 셀 어셈블리를 개략적으로 나타내는 사시도이다.

도 5는, 본 발명의 일 실시예에 따른 전력 저장 시스템의 공급 헤더, 실외 열교환기, 및 집수관을 개략적으로 나타내는 모식도이다.

도 6은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 공급 헤더를 개략적으로 나타내는 일측면도이다.

도 7은, 도 6의 실외 열교환기의 나선형 관을 절단한 단면 모습을 개략적으로 나타내는 단면도이다.

도 8은, 본 발명의 다른 일 실시예에 따른 전력 저장 시스템의 실외 열교환기를 개략적으로 나타내는 모식도이다.

발명을 실시하기 위한 구체적인 내용

[0045] 이하, 첨부된 도면을 참조하여 본 발명의 바람직한 실시예를 상세히 설명하기로 한다. 이에 앞서, 본 명세서 및 청구범위에 사용된 용어나 단어는 통상적이거나 사전적인 의미로 한정해서 해석되어서는 안 되며, 발명자는 그 자신의 발명을 가장 최선의 방법으로 설명하기 위해 용어의 개념을 적절하게 정의할 수 있다는 원칙에 입각하여 본 발명의 기술적 사상에 부합하는 의미와 개념으로 해석되어야만 한다.

[0046] 따라서, 본 명세서에 기재된 실시예와 도면에 도시된 구성은 본 발명의 가장 바람직한 일 실시예에 불과할 뿐이고 본 발명의 기술적 사상에 모두 대변하는 것은 아니므로, 본 출원시점에 있어서 이들을 대체할 수 있는 다양한 균등물과 변형예들이 있을 수 있음을 이해하여야 한다.

[0048] 도 1은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 구성들을 개략적으로 나타내는 개념도이다. 도 2는, 본 발명의 일 실시예에 따른 배터리 랙과 컨테이너를 개략적으로 나타내는 사시도이다. 그리고, 도 3은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 일부 구성들을 개략적으로 나타내는 개념도이다.

[0049] 도 1 내지 도 3을 참조하면, 본 발명의 전력 저장 시스템(400)은, 적어도 하나 이상의 배터리 랙(300), 컨테이너(410), 공조기(420), 소화 유닛(430), 및 공조기 관리 유닛(440)을 포함할 수 있다.

[0050] 여기서, 배터리 랙(300)은, 적어도 둘 이상의 배터리 모듈(200)을 구비할 수 있다. 상기 배터리 모듈(200)은, 복수개가 구비될 경우, 일방향으로 배열될 수 있다. 이때, 상기 배터리 모듈(200)은 적어도 하나 이상의 셀 어셈블리(도 4의 100)를 구비할 수 있다. 상기 셀 어셈블리(100)는 일방향으로 배열된 복수의 이차전지(110)를 가질 수 있다.

[0051] 또한, 상기 이차전지(110)는 파우치형 이차전지(110)일 수 있다. 예를 들어, 도 4에 도시된 바와 같이, 셀 어셈블리(100)는 복수개의 파우치형 이차전지(110)가 전후 방향으로 나란하게 상호 적층된 형태로 구성될 수 있다. 예를 들면, 도 4에 도시된 바와 같이, 하나의 셀 어셈블리(100)는 21개의 파우치형 이차전지(110)가 구비될 수 있다.

[0052] 특히, 이러한 파우치형 이차전지(110)는, 전극 조립체(도시하지 않음), 전해액(도시하지 않음) 및 파우치(116)를 구비할 수 있다.

[0053] 더욱이, 상기 양극 리드(111)와 상기 음극 리드(112)는, 상기 이차전지(110)의 중심을 기준으로 서로 반대 방향

의 좌우 방향의 단부에 형성될 수 있다. 즉, 상기 양극 리드(111)는 상기 이차전지(110)의 중심을 기준으로 일 단부(우단부)에 구비될 수 있다. 또한, 상기 음극 리드(112)는 이차전지(110)의 중심을 기준으로 타단부(좌단부)에 구비될 수 있다.

[0054] 그러나, 본 발명에 따른 배터리 모듈(200)에는, 앞서 설명한 좌우치형 이차전지(110)로만 한정되는 것은 아니고 본원발명의 출원 시점에 공지된 다양한 이차전지(110)가 채용될 수 있다.

[0055] 한편, 상기 컨테이너(410)는, 상기 적어도 하나 이상의 배터리 팩(300)을 수용하도록 내부 공간을 가질 수 있다. 상기 컨테이너(410)는, 상기 전력 저장 시스템(400)의 외관을 형성하도록 외벽이 구비될 수 있다. 예를 들면, 상기 컨테이너(410)는 일반적 내부에 물건을 보관할 수 있는 일반적인 유형의 컨테이너(410)일 수 있다. 이에, 여기서는 컨테이너(410)의 구체적인 구성들의 설명은 생략하기로 한다.

[0056] 예를 들면, 도 2에 도시된 바와 같이, 상기 컨테이너(410)는 내부가 비어 있는 사각 박스 형태를 가질 수 있다. 상기 컨테이너(410)의 전방벽 및 후방벽 각각의 상단에 열교환 매체를 공급하는 공급구(K3)를 형성시켰다. 또한, 승온된 열교환 매체를 흡입하여 외부로 배출될 수 있도록 컨테이너(410)의 전방벽 및 후방벽 각각에 흡입구(K2)를 형성시켰다.

[0057] 더욱이, 상기 공조기(420)는, 상기 컨테이너(410) 내부의 승온된 열교환 매체를 냉각시키도록 구성된 실외 열교환기(422)를 구비할 수 있다. 그러나, 반드시 냉각 기능 외에, 상기 실외 열교환기(422)는 열교환 매체의 온도를 높이는 기능을 수행할 수 있다. 예를 들면, 상기 실외 열교환기(422)는 열전도성이 높은 금속을 구비할 수 있다. 여기서, 상기 열교환 매체는 예를 들면, 산업용 냉매 물질 또는 공기일 수 있다.

[0058] 그리고, 상기 공조기(420)는 상기 열교환 매체가 상기 컨테이너(410)와 상기 실외 열교환기(422) 사이를 순환하도록 구성된 순환 유로(424)를 구비할 수 있다. 즉, 상기 순환 유로(424)는 송풍기(427)에 의해 상기 실외 열교환기(422)에서 냉각된 열교환 매체를 상기 컨테이너(410)로 공급하도록 구성된 송출관(424b)과, 상기 컨테이너(410)에 승온된 열교환 매체를 상기 실외 열교환기(422)로 이송하는 흡입관(424a)을 구비할 수 있다.

[0059] 나아가, 상기 공조기(420)는 열교환 매체를 이송 시키도록 구성된 송풍기(427)를 구비할 수 있다. 상기 송풍기(427)는, 상기 컨테이너(410) 내부의 승온된 열교환 매체를 흡입하여 실외 열교환기(422)로 이송하거나, 또는 상기 실외 열교환기(422)에서 열교환된 열교환 매체를 상기 컨테이너(410) 내부로 공급하도록 구성될 수 있다.

[0060] 한편, 상기 소화 유닛(430)은, 상기 적어도 하나 이상의 배터리 모듈(200)의 온도가 소정 온도 이상이 되거나, 또는 상기 적어도 하나 이상의 배터리 모듈(200)에서 연기가 발생될 때 이를 감지하여 소화액(433)을 상기 배터리 모듈(200)에 공급하도록 구성될 수 있다. 예를 들면, 상기 소정 온도는 섭씨 200도 이상일 수 있다.

[0061] 또한, 상기 소화 유닛(430)은 내부에 소화액(433)을 내장한 소화 탱크(432)를 구비할 수 있다. 상기 소화 탱크(432)는 내부에 소화액(433)이 수용될 수 있다. 예를 들면, 상기 소화액(433)은, 탄산칼륨과 같은 무기염의 농후(濃厚)용액, 화합포, 공기포, 이산화탄소, 또는 물일 수 있다. 또한, 상기 소화 탱크(432)는 소화액(433)을 적절한 압력으로 분사 내지 배관을 따라 이동시키기 위해 압축 가스를 내부에 구비할 수 있다.

[0062] 더욱이, 상기 소화 탱크(432)는, 내부에 소화액(433)이 수용될 수 있다. 예를 들면, 상기 소화액(433)은, 물일 수 있다. 또한, 상기 소화 탱크(432)는 소화액(433)을 적절한 압력으로 분사 내지 배관을 따라 이동시키기 위해 압축 가스를 내부에 구비할 수 있다.

[0063] 한편, 상기 공조기 관리 유닛(440)은, 상기 소화 탱크(432)의 소화액(433)을 상기 실외 열교환기(422)의 외면에 살포하도록 구성될 수 있다. 상기 공조기 관리 유닛(440)은, 상기 실외 열교환기(422)의 열교환 매체의 열교환이 이루어지는 냉각부에 상기 소화 탱크(432)의 소화액(433)을 고르게 분사 시킬 수 있다.

[0064] 따라서, 본 발명의 이러한 구성에 의하면, 본 발명은, 상기 소화 탱크(432)의 소화액(433)을 상기 실외 열교환기(422)의 외면에 살포하도록 구성된 공조기 관리 유닛(440)을 포함함으로써, 상기 실외 열교환기(422)에 살포된 소화액(433)의 기화열을 이용해, 실외 열교환기(422)의 열교환 효율을 높일 수 있다. 이에 따라, 작은 규모의 실외 열교환기(422)의 적용이 가능하여, 전력 저장 시스템의 가격 경쟁력을 높일 수 있다.

[0065] 더욱이, 겨울철, 실외 열교환기(422)에 착상(서리)이 발생될 경우, 소화액(433)을 살포하여 이를 제거할 수 있다. 즉, 종래기술에서는 실외 열교환기(422)에 착상이 발생할 경우, 실외 열교환기(422)의 냉동 사이클을 역으로 돌려서 제상을 실시하였는 바, 이를 위해 컨테이너(410)의 난방을 중단시키는 것이 불가피하였다. 반면에, 본 발명은, 겨울철 컨테이너(410)의 난방을 중단시키지 않아도 냉각 유닛의 소화액(433)을 이용해 실외 열교환

기(422)에 형성된 서리를 제거할 수 있어, 배터리 랙(300)이 과냉각 되는 위험을 피할 수 있다.

[0066] 도 5는, 본 발명의 일 실시예에 따른 전력 저장 시스템의 공급 헤더, 실외 열교환기, 및 집수관을 개략적으로 나타내는 모식도이다. 도 6은, 본 발명의 일 실시예에 따른 전력 저장 시스템의 공급 헤더를 개략적으로 나타내는 일측면도이다. 그리고, 도 7은, 도 6의 실외 열교환기의 나선형 관을 절단한 단면 모습을 개략적으로 나타내는 단면도이다.

[0067] 다시 도 3과 도 5 내지 도 7를 참조하면, 상기 공조기 관리 유닛(440)은 공급 헤더(442)를 구비할 수 있다. 상기 공급 헤더(442)는 상기 소화액(433)이 상기 실외 열교환기(422)의 외면에 고르게 살포되도록 소정 간격으로 이격된 다수의 노즐(442a)을 가질 수 있다. 예를 들면, 도 6에 도시된 바와 같이, 상기 공급 헤더(442)의 하부에는 한 쌍의 노즐(442a)이 소정 간격으로 상기 공급 헤더(442)의 길이 방향을 따라 배열될 수 있다.

[0068] 또한, 상기 실외 열교환기(422)는 상하 방향으로 연장된 나선형의 관(444)을 구비할 수 있다. 상기 나선형 관(422a)은 내부 공간을 따라 상기 열교환 매체가 이동되도록 구성될 수 있다. 예를 들면, 도 7에 도시된 바와 같이, 상기 나선형 관(422a)의 외면에는 관을 따라 선형으로 연장된 리브(R1)가 형성될 수 있다. 상기 리브(R1)는 외측 방향으로 돌출된 형태를 가질 수 있다. 상기 나선형 관(422a)은 상기 공급 헤더(442)에서 공급된 소화액(433)이 상기 리브(R1) 사이의 공간을 따라 하부 방향으로 이동하도록 구성될 수 있다.

[0069] 따라서, 본 발명의 이러한 구성에 의하면, 상기 공조기 관리 유닛(440)은, 상기 소화액(433)이 상기 실외 열교환기(422)의 외면에 고르게 살포되도록 소정 간격으로 이격된 다수의 노즐(442a)을 가진 공급 헤더(442)를 구비하고, 상기 실외 열교환기(422)는 내부 공간을 따라 상기 열교환 매체가 이동되도록 구성되고 외면에 관을 따라 선형으로 연장된 리브(R1)가 구비된 나선형 관(422a)을 구비함으로써, 상기 공급 헤더(442)로부터 상기 실외 열교환기(422)로 공급된 소화액(433)이 중력에 의해 곧장 유실되지 않고 상기 나선형 관(422a)을 따라 상부에서 하부로 이동될 수 있어, 상기 소화액(433)과 상기 나선형 관(422a) 간의 열교환율을 효과적으로 높일 수 있다. 이에 따라, 상기 공조기 관리 유닛(440)에 의한 상기 실외 열교환기(422)의 열교환(냉각) 효율을 극대화할 수 있다. 더욱이, 겨울철에는 상기 실외 열교환기(422)에 형성된 서리를 효과적으로 녹여 제거할 수 있다.

[0070] 도 8은, 본 발명의 다른 일 실시예에 따른 전력 저장 시스템의 실외 열교환기를 개략적으로 나타내는 모식도이다.

[0071] 도 8을 참조하면, 본 발명의 다른 일 실시예에 따른 전력 저장 시스템의 실외 열교환기(422A)는, 도 5의 실외 열교환기(422)와 비교할 경우, 나선형 관 대신에 다수의 핀(422b1)이 형성된 튜브(422b)를 구비할 수 있다.

[0072] 구체적으로, 상기 튜브(422b)는 일단이 냉각된 열교환 매체를 상기 컨테이너(410)로 공급하도록 구성된 송출관(424b)과 연결되고, 타단이 상기 컨테이너(410)에 승온된 열교환 매체를 상기 실외 열교환기(422A)로 이송하는 흡입관(424a)과 연결될 수 있다.

[0073] 따라서, 본 발명의 이러한 구성에 의하면, 본 발명은, 공급 헤더(442)의 노즐(442a)로부터 소화액이 상기 실외 열교환기(422A)의 다수의 핀(422b1)과 튜브(442b)에 살포됨으로써, 소화액과 열교환 매체 간의 열교환이 이루어져, 열교환기의 냉각 효율을 극대화시킬 수 있다.

[0074] 다시 도 3을 참조하면, 상기 공조기 관리 유닛(440)은, 공급관(P1), 공급 펌프(446), 능동형 밸브(447), 및 제어부(448)를 더 구비할 수 있다. 상기 공급관(P1)은 상기 소화 탱크(432)의 출구와 상기 공급 헤더(442)의 입구를 연결하도록 구성될 수 있다. 상기 공급 펌프(446)는 상기 소화액(433)을 상기 공급관(P1)을 통해 상기 공급 헤더(442)로 공급하도록 압력을 발생시킬 수 있다. 상기 능동형 밸브(447)는 상기 제어부(448)의 신호에 따라 상기 공급관(P1)의 개폐 조절이 가능하도록 구성될 수 있다. 상기 제어부(448)는 상기 능동형 밸브(447)와 상기 공급 펌프(446)의 작동을 제어하도록 구성될 수 있다. 상기 능동형 밸브(447)는, 예를 들면, 제어 밸브, 전동 밸브, 솔레노이드 밸브, 또는 공압 밸브 등일 수 있다.

[0075] 또한, 상기 공조기 관리 유닛(440)은, 집수관(449), 회수관(P2), 회수 밸브(447b), 및 회수 펌프(445)를 더 구비할 수 있다. 상기 집수관(449)은 상기 실외 열교환기(422)에 살포된 소화액(433)을 집수하도록 구성될 수 있다. 상기 집수관(449)은 상기 실외 열교환기(422)의 하부를 커버할 수 있는 크기의 볼(bowl) 형태를 가질 수 있다.

[0076] 더욱이, 상기 회수관(P2)은 상기 집수관(449)의 출구와 상기 소화 탱크(432)의 입구 사이를 연결하도록 구성된 관일 수 있다. 상기 회수관(P2)은 상기 집수관(449)에 집수된 소화액(433)이 상기 소화 탱크(432)까지 이동할 수 있는 이동 통로를 제공할 수 있다. 상기 회수 밸브(447b)는 상기 제어부(448)에 의해 상기 회수관(P2)이 개

방되거나 폐쇄되도록 제어될 수 있다. 상기 회수 펌프(445)는 상기 집수관(449)에 집수된 소화액(433)을 상기 회수관(P2)을 통해 상기 소화 탱크(432)로 이송하도록 상기 회수관(P2)에 압력을 발생시킬 수 있다.

[0077] 그리고, 상기 공조기 관리 유닛(440)은, 제1 온도 센서(S1), 제2 온도 센서(S2), 및 히터(443)를 더 구비할 수 있다. 구체적으로, 상기 제1 온도 센서(S1)는 상기 실외 열교환기(422)의 온도를 측정하도록 구성될 수 있다. 상기 제1 온도 센서(S1)는 신호 케이블을 이용해 측정된 온도 정보를 상기 제어부(448)로 송신할 수 있도록 구성될 수 있다. 상기 제2 온도 센서(S2)는 상기 소화 탱크(432)의 소화액(433)의 온도를 측정하도록 구성될 수 있다.

[0078] 나아가, 상기 제2 온도 센서(S2)는 신호 케이블을 이용해 측정된 온도 정보를 상기 제어부(448)로 송신할 수 있도록 구성될 수 있다. 상기 히터(443)는 상기 소화 탱크(432)의 내장된 소화액(433)을 가열하도록 구성될 수 있다. 상기 히터(443)는 상기 제어부(448)의 신호에 따라 온/오프 작동될 수 있다.

[0079] 따라서, 본 발명의 이러한 구성에 의하면, 본 발명은, 제1 온도 센서(S1), 제2 온도 센서(S2), 및 상기 소화 탱크(432)의 내장된 소화액(433)을 가열하도록 구성된 히터(443)를 더 구비함으로써, 겨울철, 실외 열교환기(422)에 서리가 형성될 경우, 상기 히터(443)에 의해 가열된 소화액(433)을 상기 실외 열교환기(422)에 살포할 수 있다. 이에 따라, 상기 실외 열교환기(422)의 착상을 빠르게 제거할 수 있는 이점이 있다.

[0080] 한편, 상기 제어부(448)는, 상기 실외 열교환기(422)의 온도가 소정 온도 이상일 경우, 상기 능동형 밸브(447)를 개방하고 공급 펌프(446)를 구동 시키도록 구성될 수 있다. 즉, 여름철, 상기 실외 열교환기(422)의 냉각 능력 이상의 냉각 효율이 필요해질 경우, 상기 제어부(448)는 상기 제1 온도 센서(S1)로부터 상기 실외 열교환기(422)의 온도가 소정 온도(섭씨 40도) 이상이 될 경우, 상기 능동형 밸브(447)를 개방 시키고 상기 공급 펌프(446)를 구동 시켜 상기 소화 탱크(432)의 소화액(433)을 상기 공급 헤더(442)로 공급시킬 수 있다.

[0081] 반대로, 상기 제어부(448)는 상기 실외 열교환기(422)의 온도가 소정 온도(섭씨 영하 10도) 이하일 경우, 상기 능동형 밸브(447)를 개방 시키고 상기 공급 펌프(446)를 구동시켜 상기 소화 탱크(432)의 소화액(433)을 상기 공급 헤더(442)로 공급시킬 수 있다. 이때, 소화액(433)은 히터(443)에 의해 대략 섭씨 50도 이상까지 승온될 수 있다.

[0082] 그리고, 상기 제어부(448)는, 상기 소화 탱크(432)의 내장된 소화액(433)의 온도가 소정 온도 이하일 경우, 히터(443)를 작동시켜 상기 소화 탱크(432) 내부의 소화액(433)의 온도를 높이도록 구성될 수 있다. 즉, 겨울철이나, 냉대 기후 지역에 상기 전력 저장 시스템이 설치될 경우, 상기 제어부(448)는 상기 제2 온도 센서(S2)로부터 수신된 상기 소화 탱크(432)의 소화액(433)의 온도가 소정 온도(예: 섭씨 0도) 이하일 경우, 상기 히터(443)를 작동시켜 상기 소화 탱크(432) 내부의 소화액(433)의 온도를 높일 수 있다.

[0083] 따라서, 본 발명의 이러한 구성에 의하면, 본 발명은, 제어부(448)가 상기 소화 탱크(432)의 내장된 소화액(433)의 온도가 소정 온도 이하일 경우, 상기 히터(443)를 작동시켜 상기 소화 탱크(432) 내부의 소화액(433)의 온도를 높이도록 구성됨으로써, 겨울철 실외 열교환기(422)의 착상을 효과적으로 제거할 수 있다. 더욱이, 상기 소화 탱크(432) 내부의 소화액(433)이 얼지 않도록 유지시킬 수 있어, 화재 발생시 소화액(433) 공급이 되지 않는 문제를 해결할 수 있다.

[0084] 더욱이, 상기 소화 탱크(432)에는 상기 소화액(433)과 섞여 있는 부동액(보이지 않음)을 더 구비할 수 있다. 상기 부동액은 상기 소화액(433)이 기온이 낮을 때 얼지 않고 액체 상태를 유지하도록 구성될 수 있다. 예를 들면, 상기 부동액은 에틸렌글리콜, 또는 프로필렌글리콜을 구비할 수 있다.

[0085] 그리고, 상기 공조기 관리 유닛(440)은, 상기 회수관(P2)에 위치한 여과 필터(441)를 구비할 수 있다. 상기 여과 필터(441)는 상기 회수관(P2)에 연결될 수 있다. 상기 여과 필터(441)는 상기 집수된 소화액(433)의 오염 물질을 제거하도록 구성될 수 있다. 상기 여과 필터(441)는 10 μ m 이상 크기의 오염물질을 제거하도록 구성될 수 있다. 상기 여과 필터(441)는 상기 회수관(P2)을 통과하는 소화액(433)의 오염 물질을 여과하도록 구성될 수 있다.

[0086] 따라서, 본 발명의 이러한 구성에 의하면, 상기 공조기 관리 유닛(440)은, 상기 회수관(P2)에 위치하고 상기 집수된 소화액(433)의 오염 물질을 제거하도록 구성된 여과 필터(441)가 더 구비됨으로써, 상기 소화액(433)이 상기 실외 열교환기(422)에 살포되는 과정에서 유입된 오염 물질을 제거함으로써, 오염 물질에 의해 상기 회수관(P2) 또는 상기 공급관(P1)이 폐색되는 것을 방지할 수 있다. 이에 따라, 전력 저장 시스템(400)의 내구성을 효과적으로 높일 수 있다.

- [0087] 또한, 다시 도 3을 참조하면, 상기 공조기 관리 유닛(440)은, 보조 탱크(432b)를 더 구비할 수 있다. 상기 보조 탱크(432b)는 여분의 소화액(433)이 내장될 수 있다. 상기 보조 탱크(432b)는 상기 소화 탱크(432)의 내장된 소화액(433)의 양이 소정 이하가 될 경우, 소화액(433)을 보충하도록 구성될 수 있다.
- [0088] 더욱이, 상기 소화 탱크(432)에는 소화액(433)의 수위를 측정하는 측정 센서(도시하지 않음)가 구비될 수 있다. 상기 제어부(448)는 상기 측정 센서를 통해 상기 소화 탱크(432)의 소화액(433)의 수위 정보를 수신할 수 있다. 상기 제어부(448)는 상기 소화 탱크(432)의 소화액(433)의 수위가 소정 이하가 될 경우, 상기 보조 탱크(432b)로부터 상기 소화 탱크(432)로 여분의 소화액(433)을 공급하도록 보조 밸브(432b1)를 개방시킬 수 있다. 상기 보조 탱크(432b)와 상기 소화 탱크(432)는 보조 배관(432b2)으로 연결될 수 있다. 상기 보조 배관(432b2)은 상기 보조 탱크(432b)의 여분의 소화액(433)을 상기 소화 탱크(432)로 이송할 수 있도록 구성될 수 있다.
- [0089] 한편, 다시 도 2를 참조하면, 상기 배터리 랙(300)은, 랙 케이스(310)의 내부 또는 외부에 배터리 관리 장치(Battery Management System; BMS) 등 다른 구성요소를 더 포함할 수 있다.
- [0090] 상기 랙 케이스(310)는 또한, 상기 복수의 배터리 모듈(200)을 상하 방향으로 적층된 형태로 수용하도록 구성될 수 있다. 상기 랙 케이스(310) 내부에서는 배터리 모듈(200)의 하부면이 수평면에 평행한 형태로 탑재될 수 있다.
- [0091] 여기서 수평 방향이란, 상기 배터리 모듈(200)을 지면에 놓았을 때 지면에 평행한 방향을 의미한다고 할 수 있으며, 상하 방향에 수직하는 평면상의 적어도 한 방향이 라고도 할 수 있다.
- [0092] 더욱이, 상기 랙 케이스(310)는 적어도 일측이 개방 가능한 형태로 구성되어, 개방된 측면을 통해 배터리 모듈(200)이 내부 공간으로 인입될 수 있다. 다만, 상기 랙 케이스(310)는, 이러한 개방된 측면이 폐쇄 가능하도록 구성될 수도 있다.
- [0093] 한편, 다시 본 발명의 일 실시예에 따른 전력 저장 시스템(400)은 상기 배터리 랙(300)을 적어도 둘 이상 포함할 수 있다. 상기 둘 이상의 배터리 랙(300)은 일방향으로 배열되도록 배치될 수 있다. 예를 들면, 도 2에 도시된 바와 같이, 상기 전력 저장 시스템(400)은 3개의 배터리 랙(300)이 일방향으로 배열되도록 구성될 수 있다. 또한, 상기 전력 저장 시스템(400)은 3개의 배터리 랙(300)의 충방전을 제어할 수 있는 별도의 중앙 제어부(도시하지 않음)를 구비할 수 있다.
- [0095] 한편, 본 명세서에서는 상, 하, 좌, 우, 전, 후와 같은 방향을 나타내는 용어가 사용되었으나, 이러한 용어들은 설명의 편의를 위한 것일 뿐, 대상이 되는 사물의 위치나 관측자의 위치 등에 따라 달라질 수 있음은 본 발명의 당업자에게 자명하다.
- [0096] 이상과 같이, 본 발명은 비록 한정된 실시예와 도면에 의해 설명되었으나, 본 발명은 이것에 의해 한정되지 않으며 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자에 의해 본 발명의 기술사상과 아래에 기재될 특허 청구범위의 균등범위 내에서 다양한 수정 및 변형이 가능함은 물론이다.

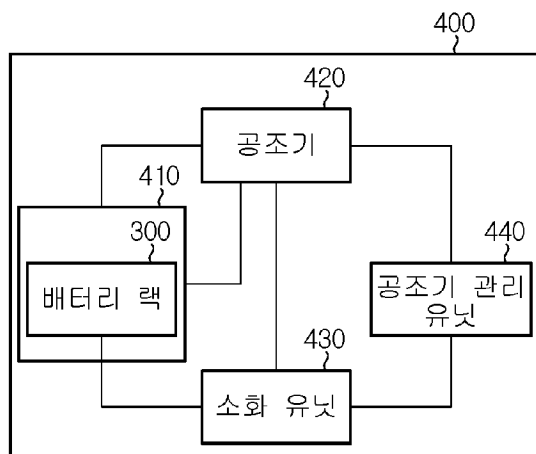
부호의 설명

- [0097] 400: 전력 저장 장치
410: 컨테이너
420: 공조기 422: 실외 열교환기
424: 순환 유로
430: 소화 유닛 432: 소화 탱크
433: 소화액
440: 공조기 관리 유닛 442: 공급 헤더
442a: 노즐 422a, 422b: 나선형 관, 튜브
R1: 리브 P1: 공급관
446: 공급 펌프 447: 능동형 밸브

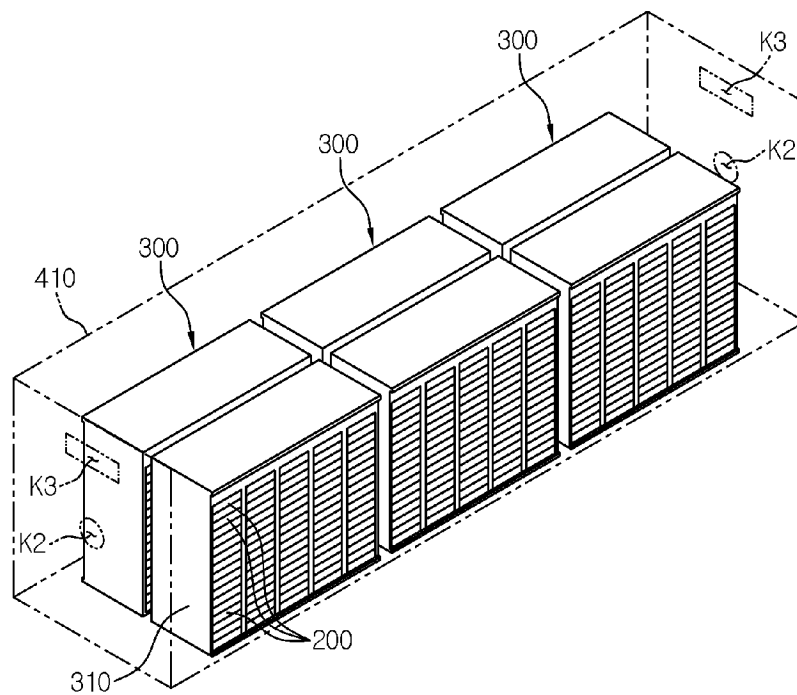
448: 제어부 449: 집수관
P2: 회수관 445: 회수 펌프
S1, S2: 제1 온도 센서, 제2 온도 센서
443: 히터 441: 여과 필터
432b: 보조 탱크
300: 배터리 랙 310: 랙 케이스
200: 배터리 모듈 100: 셀 어셈블리
110: 이차전지

도면

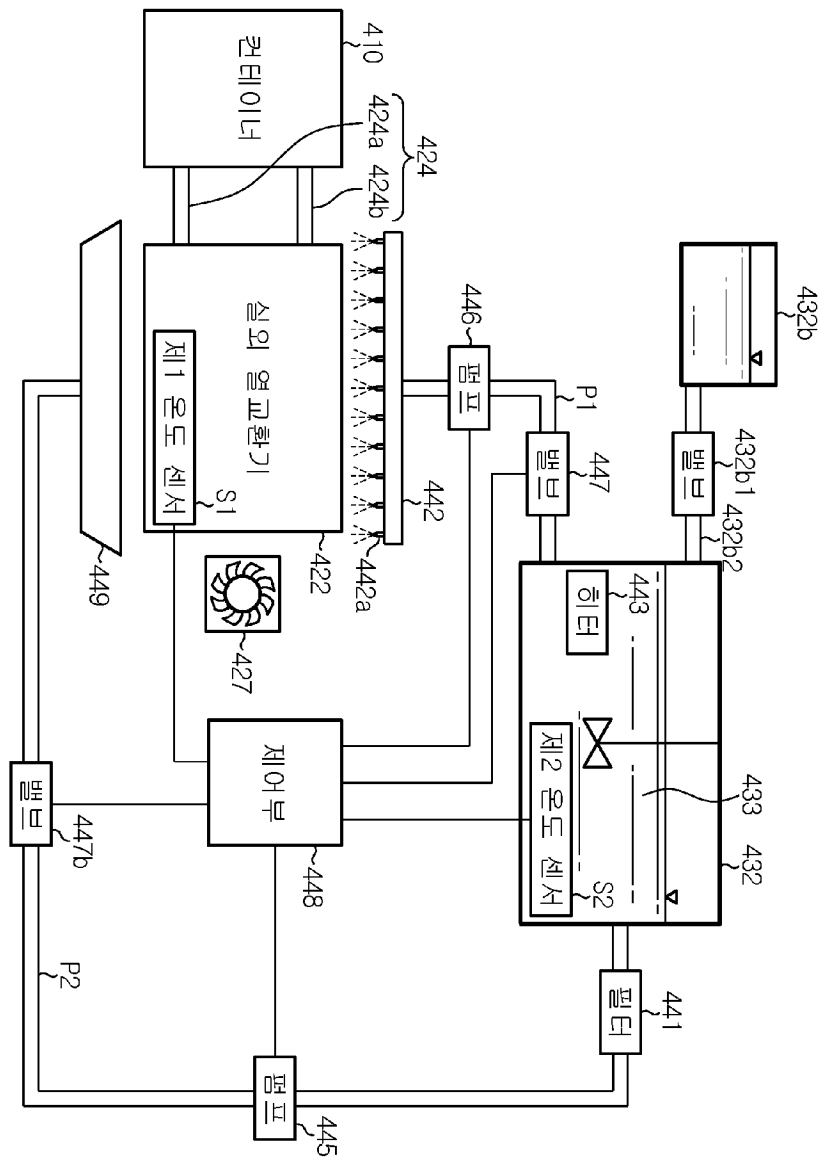
도면1



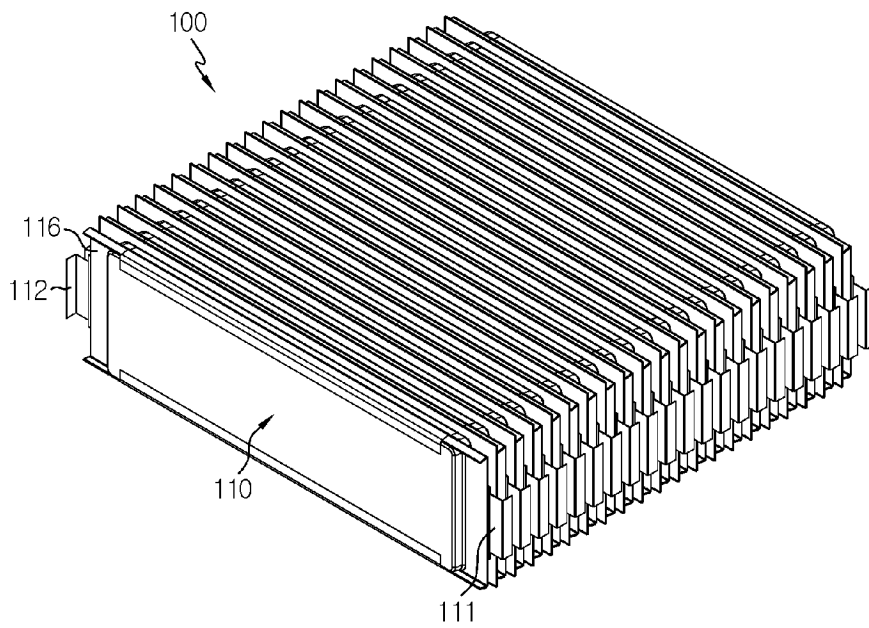
도면2



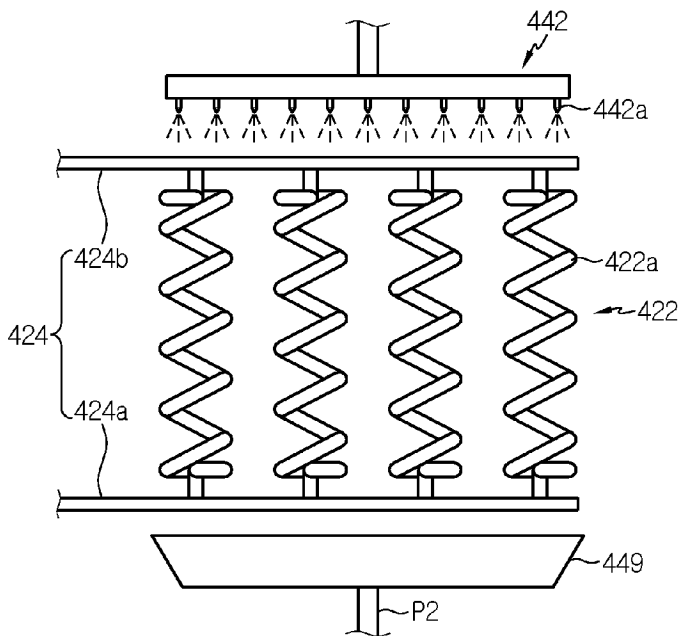
도면 3



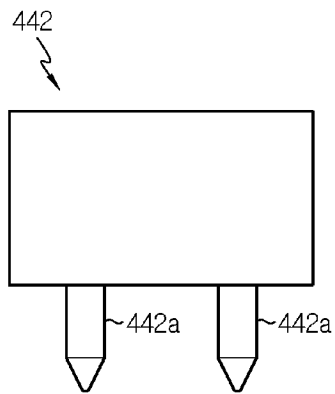
도면4



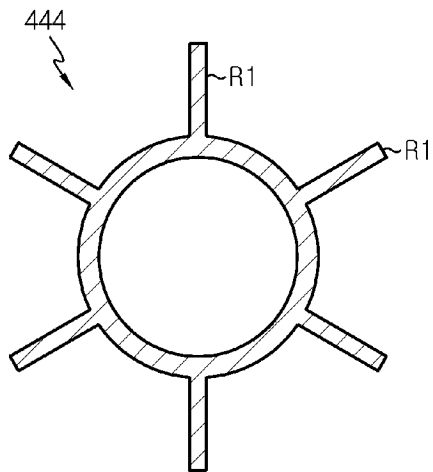
도면5



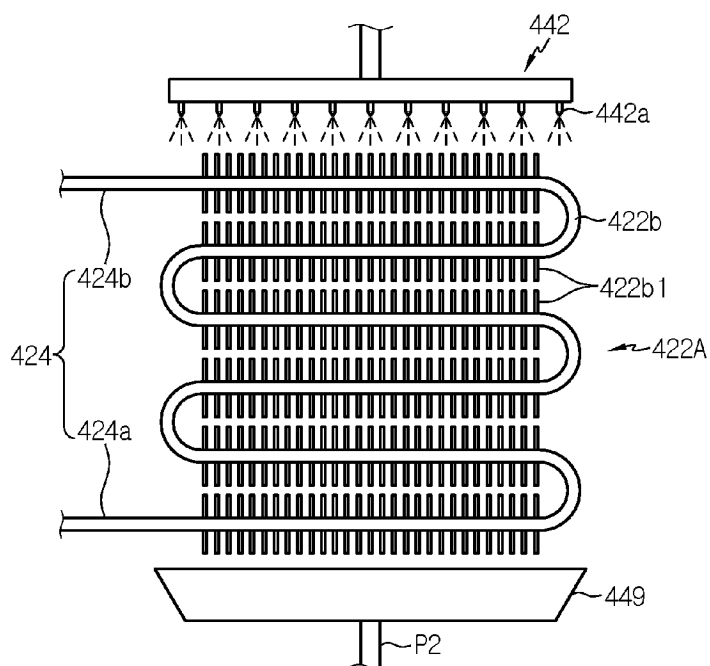
도면6



도면7



도면8



12

DEMANDE DE BREVET D'INVENTION

A1

22 Date de dépôt : 28.02.07.

30 Priorité :

43 Date de mise à la disposition du public de la
demande : 29.08.08 Bulletin 08/35.

56 Liste des documents cités dans le rapport de
recherche préliminaire : *Se reporter à la fin du
présent fascicule*

60 Références à d'autres documents nationaux
apparentés :

71 Demandeur(s) : JULIEN LACAZE Société anonyme —
FR.

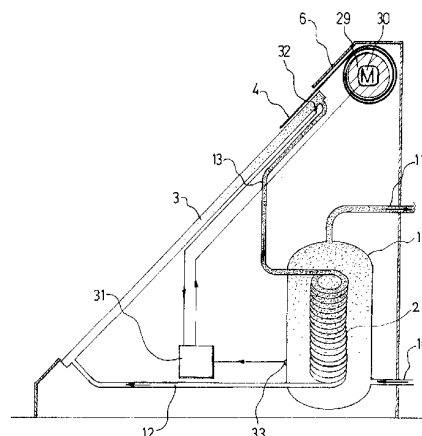
72 Inventeur(s) : LACAZE BENOIT.

73 Titulaire(s) :

74 Mandataire(s) : BARRE LAFORGUE ET ASSOCIES.

54 DISPOSITIF DE CHAUFFAGE DE FLUIDE(S) PAR ENERGIE SOLAIRE THERMIQUE.

57 L'invention concerne un dispositif de chauffage d'un
fluide par énergie solaire comprenant un pan (3) solaire
thermique adapté pour chauffer un fluide par absorption du
rayonnement solaire, une conduite (12) d'amenée audit pan
(3) solaire, de fluide à chauffer, une conduite (13) de prélè-
vement de fluide chauffé par ledit pan (3) solaire, caracté-
risé en ce qu'il comprend un pare-soleil (4) mobile de
régulation de la température du fluide adapté pour être pla-
cé dans une position déployée, dans laquelle il recouvre
une partie dudit pan (3) solaire de manière à limiter la calé-
faction du fluide par ledit pan (3) solaire.



DISPOSITIF DE CHAUFFAGE DE FLUIDE(S) PAR ÉNERGIE SOLAIRE THERMIQUE

5 La présente invention concerne un dispositif de chauffage de fluide(s) –notamment d’eau– par énergie solaire thermique.

Le chauffage d’eau par rayonnement solaire est connu et utilisé pour la production d’eau chaude sanitaire ou d’eau distillée, le chauffage des piscines et des habitations, ainsi que le séchage de céréales.

10 L’énergie solaire présente un certain nombre d’avantages parmi lesquels l’économie, l’abondance du rayonnement solaire et le caractère écologique de cette forme d’énergie. Parmi les différents moyens d’utiliser l’énergie solaire, l’énergie solaire thermique permet de récupérer la chaleur du rayonnement solaire au sein d’un fluide caloporteur, gazeux ou liquide, pour
15 chauffer directement ce fluide, dit fluide primaire, ou indirectement un autre fluide, dit fluide secondaire, par des échanges thermiques entre le fluide primaire et le fluide secondaire.

Les dispositifs connus de chauffage direct d’un fluide par énergie solaire thermique comprennent en général :

- 20 - un pan solaire thermique comprenant au moins un panneau solaire thermique comprenant au moins un capteur solaire thermique, ledit pan solaire thermique étant adapté pour chauffer par absorption du rayonnement solaire, un fluide circulant dans ce capteur solaire thermique,
- au moins une conduite d’amenée, audit pan solaire,
25 de fluide à chauffer,
- au moins une conduite de distribution de fluide chauffé par ledit pan solaire thermique.

Un tel dispositif peut, par exemple, chauffer un fluide directement utilisé dans une installation, par exemple de l’eau courante, de l’eau
30 d’une installation de chauffage central, de l’eau d’une piscine, etc. Dans ces cas,

le fluide chauffé par le dispositif de chauffage direct est de l'eau stockée dans un ballon, un réservoir, une piscine, etc. Dans le cas de la piscine, l'eau est prélevée de la piscine, par exemple par l'intermédiaire d'une pompe ; amenée au pan solaire thermique par une conduite d'amenée ; chauffée par le pan solaire thermique ; et reversée à la piscine par une conduite de distribution.

Un tel dispositif de chauffage direct d'un fluide peut, en variante, être intégré dans un dispositif de chauffage indirect d'un fluide, dit fluide secondaire, distinct du fluide caloporteur, dit fluide primaire, chauffé directement par le dispositif de chauffage direct. Le dispositif de chauffage direct de fluide primaire forme alors un circuit primaire thermique adapté pour chauffer un fluide caloporteur primaire destiné à permettre, par l'intermédiaire d'un échangeur thermique, des échanges thermiques entre ce fluide caloporteur primaire chauffé et le fluide secondaire à chauffer. Tel est par exemple le cas lorsque le fluide secondaire est de l'eau courante ou de l'eau d'une installation de chauffage central pour lesquelles il est préférable d'éviter une circulation de l'eau dans des circuits multiples, pour des raisons d'hygiène et/ou de fiabilité de fonctionnement.

Les dispositifs connus de chauffage indirect de fluide par énergie solaire thermique comprennent en général :

- un réservoir de stockage et de chauffage de fluide, dit fluide secondaire,
- au moins une conduite, dite conduite d'entrée, agencée entre une source de fluide secondaire et le réservoir de manière à permettre l'alimentation de ce réservoir en fluide secondaire à chauffer,
- au moins une conduite, dite conduite de sortie, reliée audit réservoir de manière à permettre un prélèvement de fluide secondaire chauffé à partir de ce réservoir,
- un dispositif de chauffage direct d'un fluide caloporteur, dit fluide primaire, relié audit réservoir de façon à assurer des échanges thermiques entre le fluide caloporteur primaire chauffé et le fluide secondaire du réservoir.

Les capteurs solaires thermiques formant les panneaux solaires sont idéalement agencés sur le toit d'un bâtiment tel qu'une maison d'habitation, orientés vers le sud et inclinés de manière à recevoir le rayonnement le plus intense possible, l'inclinaison dépendant de la latitude de l'habitation. Ces

5 capteurs solaires thermiques sont adaptés pour capter l'énergie solaire et réchauffer le fluide caloporteur jusqu'à des températures pouvant aller de 30°C à 100°C selon le type de capteur utilisé.

Un inconvénient récurrent qui frappe les dispositifs de chauffage de fluide(s) par énergie solaire thermique concerne la surchauffe du

10 fluide caloporteur primaire et du fluide secondaire pendant les périodes d'ensoleillement intense.

Pour pallier cet inconvénient, certains dispositifs connus prévoient l'intégration d'un mitigeur thermostatique qui permet de limiter la température du fluide délivré à un dispositif d'utilisation de ce fluide chauffé, tel

15 qu'une douche, un lavabo, un réseau de chauffage, etc. Dans le cas d'une installation de chauffage d'eau sanitaire, un mitigeur thermostatique assure un mélange entre une eau froide prélevée du réseau d'eau et une eau chaude chauffée par les panneaux solaires. La température de l'eau mitigée est contrôlée par un élément thermostatique et comparée à une température de consigne

20 prédéterminée. Si l'eau mélangée n'est pas conforme à la valeur de consigne, un thermostat déplace un piston qui régule les prélèvements d'eau chaude et d'eau froide jusqu'à ce que la température de l'eau soit conforme à la consigne. Cette solution présente un bilan énergétique très défavorable étant donné qu'elle procède à un refroidissement d'une eau chaude préalablement chauffée par le

25 dispositif de chauffage d'eau par énergie solaire.

D'autres dispositifs connus prévoient, éventuellement en combinaison du mitigeur thermostatique, une vidange automatique du fluide des panneaux solaires dès que le fluide caloporteur primaire et/ou secondaire a atteint une valeur de consigne en température prédéterminée.

30 Cette solution, bien qu'elle permette de limiter la surchauffe en période d'ensoleillement intense, présente en réalité des

inconvenients relatifs à l'intégrité des panneaux solaires.

En particulier, les capteurs solaires sont souvent constitués de tubes en verres, notamment de tubes en verre à double enveloppe sous vide, à l'intérieur desquels circule un fluide caloporteur. Ces capteurs tubulaires tels que
5 décrits par exemple dans FR-2 429 979, FR-2 319 859 ou US-4 120 285 permettent de créer un effet de serre. Une fois vidangés du fluide caloporteur, ces tubes en verre, toujours exposés au soleil, peuvent atteindre des températures très élevées, de l'ordre de 250°C. Or, le fluide caloporteur ne circulant plus dans les capteurs tubulaires, ces derniers ne peuvent plus décharger la chaleur accumulée
10 vers le fluide caloporteur. Dès lors, il existe un risque important de rupture de tels capteurs. Les niveaux de pression et de température rencontrés sont tels qu'en cas de mauvaise utilisation de l'installation, notamment à la mise en service ou à l'arrêt de la circulation du fluide caloporteur, des chocs thermiques peuvent se produire, susceptibles d'entraîner la rupture des capteurs.

15 Aucune solution satisfaisante n'a jusqu'à ce jour été apportée à ce problème crucial, qui limite depuis plus de 30 ans le développement des capteurs solaires thermiques connus.

L'invention vise à pallier ces inconvenients et à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique qui préserve
20 l'intégrité des capteurs solaires thermiques, y compris en période d'ensoleillement intense.

L'invention vise également à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique qui préserve l'intégrité des capteurs solaires, quels que soient les capteurs solaires thermiques utilisés.

25 L'invention vise également à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique qui contribue à augmenter la durée de vie des capteurs solaires thermiques.

L'invention vise également à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique dont le fonctionnement et la
30 régulation puissent être automatisés.

L'invention vise également à proposer un dispositif de

chauffage de fluide(s) par énergie solaire thermique qui présente un bilan énergétique favorable.

L'invention vise également à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique qui puisse réguler la température du fluide chauffé délivré à un dispositif alimenté par ce fluide chauffé, sans mitigeur thermostatique.

L'invention vise également à proposer un dispositif de chauffage de fluide(s) par énergie solaire thermique qui puisse être manutentionné.

L'invention vise également à proposer un dispositif compact de chauffage de fluide(s).

Pour ce faire, l'invention concerne un dispositif de chauffage de fluide(s) par énergie solaire thermique comprenant :

- un pan solaire thermique comprenant au moins un panneau solaire thermique comprenant au moins un capteur solaire thermique, ledit pan solaire thermique étant adapté pour chauffer un fluide, dit fluide primaire, par absorption du rayonnement solaire,
 - au moins une conduite d'amenée, audit pan solaire, de fluide primaire à chauffer,
 - au moins une conduite de prélèvement de fluide primaire chauffé par ledit pan solaire thermique,
- caractérisé en ce qu'il comprend un pare-soleil mobile de régulation de la température dudit fluide primaire, ledit pare-soleil mobile étant adapté pour pouvoir être placé dans au moins une position, dite position déployée, dans laquelle il recouvre au moins une partie, dite partie masquée, dudit pan solaire thermique de manière à empêcher une exposition directe au soleil de cette partie masquée, limitant ainsi la caléfaction du fluide primaire par ledit pan solaire.

Un tel dispositif de chauffage de fluide(s) selon l'invention est désigné dans la suite du texte par « dispositif de chauffage direct d'un fluide ».

Avantageusement, un dispositif selon l'invention comprend en outre :

- au moins un réservoir de stockage et de chauffage d'un fluide, dit fluide secondaire, distinct dudit fluide primaire,
- 5 - au moins une conduite, dite conduite d'entrée, agencée entre une source de fluide secondaire à chauffer et ledit réservoir de fluide secondaire de manière à permettre l'alimentation de ce réservoir en fluide secondaire,
- au moins une conduite, dite conduite de sortie,
- 10 reliée audit réservoir de fluide secondaire de manière à permettre un prélèvement de fluide secondaire chauffé à partir de ce réservoir,
- un échangeur thermique agencé dans le réservoir de stockage de fluide secondaire et relié auxdites conduites d'amenée et de prélèvement de fluide primaire de manière à pouvoir assurer des échanges
- 15 thermiques entre ledit fluide primaire et ledit fluide secondaire.

Un tel dispositif de chauffage de fluide(s) selon l'invention est désigné dans la suite du texte par « dispositif de chauffage indirect d'un fluide ». L'expression « un dispositif de chauffage selon l'invention » fait référence aussi bien à un dispositif de chauffage direct d'un fluide primaire selon

20 l'invention et à un dispositif de chauffage indirect d'un fluide secondaire selon l'invention, sauf stipulation contraire explicite.

Un dispositif de chauffage de fluide(s) par énergie solaire selon l'invention comprend un pare-soleil de régulation de la température du fluide primaire circulant dans le pan solaire thermique. Selon l'invention, le pare-

25 soleil de régulation de la température du fluide primaire est adapté pour être placé dans au moins une position déployée dans laquelle il entrave au moins en partie le cheminement des rayons solaires vers le pan solaire. Cette partie entravée est dite partie masquée du pan solaire.

Un « pare-soleil » désigne dans tout le texte, un dispositif

30 adapté pour empêcher la propagation des rayons solaires au-delà de ce dispositif, un dispositif qui permet la création de zones d'ombres au-delà de ce dispositif, et

un dispositif qui réduit l'insolation au-delà de ce dispositif. Un pare-soleil peut présenter diverses formes et structures. Il peut s'agir d'un écran opaque, d'un ensemble de lames montées sur un bâti, d'un rideau, etc.

Avantageusement et selon l'invention, le pare-soleil de
5 régulation de la température du fluide primaire est adapté pour pouvoir être placé dans au moins une deuxième position, dite position rétractée, dans laquelle il autorise une exposition directe au soleil d'au moins une partie dudit pan solaire de surface plus grande que la surface de ladite partie masquée.

Selon l'invention, lorsque le pare-soleil est dans la position
10 rétractée, la surface du pan solaire directement exposée au soleil est plus grande que la surface du pan solaire directement exposée au soleil lorsque le pare-soleil est dans la position déployée.

Dès lors, à rayonnement solaire constant, un déplacement
du pare-soleil d'une position déployée vers une position rétractée conduit à une
15 augmentation de la température du fluide primaire, alors qu'un déplacement du pare-soleil d'une position rétractée vers une position déployée conduit à une diminution de la température du fluide primaire.

Dans le cas d'un dispositif de chauffage indirect d'un fluide
secondaire, les déplacements du pare-soleil permettent également de réguler la
20 température du fluide secondaire étant donné que ce dernier est en échange thermique avec le fluide primaire qui circule dans le pan solaire thermique.

Avantageusement et selon l'invention, le pare-soleil mobile
de régulation est adapté pour pouvoir être placé :

- dans une position, dite position totalement
25 rétractée, dans laquelle il autorise une exposition directe au soleil de la totalité dudit pan solaire thermique,

- dans une position, dite position totalement
déployée, dans laquelle il recouvre l'intégralité dudit pan solaire thermique,
empêchant ainsi la caléfaction du fluide primaire.

30 Selon l'invention, dans la position totalement rétractée, le pare-soleil est sans effet sur la caléfaction du fluide primaire par les rayons

solaires ; le pan solaire peut recevoir la totalité du rayonnement solaire disponible et assurer ainsi un réchauffement optimal du fluide.

Dans le cas d'un dispositif de chauffage indirect de fluide secondaire, dans la position totalement rétractée du pare-soleil, le fluide primaire
5 peut assurer, par l'intermédiaire de l'échangeur thermique, des échanges thermiques avec le fluide secondaire qui conduisent à un réchauffement optimal de ce dernier.

Dans une position déployée du pare-soleil, seule une partie de la surface du pan solaire est directement exposée au soleil, ce qui limite le
10 réchauffement du fluide caloporteur primaire; le réchauffement du fluide secondaire du réservoir de stockage par le fluide primaire est donc également limité. A rayonnement solaire constant, la température du fluide secondaire, chauffé par un dispositif de chauffage direct selon l'invention, est directement proportionnelle à la surface du pan solaire directement exposée au soleil.
15 Autrement dit, la température du fluide secondaire chauffé par un dispositif selon l'invention est régulée par la position du pare-soleil par rapport au pan solaire.

Un pare-soleil selon l'invention permet, outre une régulation de la température du fluide secondaire et/ou primaire chauffé par un dispositif de chauffage selon l'invention, de préserver l'intégrité des capteurs
20 solaires pendant les périodes d'ensoleillement intense au cours desquelles un dispositif selon l'invention peut être inactivé. En particulier, si le fluide secondaire a atteint une valeur de consigne prédéterminée, un pare-soleil selon l'invention peut recouvrir intégralement le pan solaire et empêcher ainsi un réchauffement excessif des capteurs, ce qui évite les survenues de chocs
25 thermiques, et de surcroît des casses de capteurs.

Cette solution permet de résoudre les problèmes de casse des capteurs solaires thermiques, sans solution depuis plus de 30 ans.

De plus, un pare-soleil selon l'invention peut, si nécessaire, être placé en position totalement déployée au cours de chutes de grêle, de neige,
30 de pluie, pour protéger les capteurs solaires thermiques qu'il recouvre.

Avantageusement, un dispositif selon l'invention

comprend un châssis autoporteur portant le pan solaire thermique et le pare-soleil mobile de régulation.

Selon l'invention, le pare-soleil de régulation peut être déplacé entre la position rétractée et une ou plusieurs positions déployées. De préférence, le pare-soleil peut occuper une infinité continue de positions déployées entre la position totalement rétractée dans laquelle il n'entrave pas le cheminement du rayonnement solaire jusqu'au pan solaire, et la position totalement déployée, dans laquelle il recouvre totalement le pan solaire de sorte qu'aucun rayon solaire ne peut atteindre le pan solaire.

Avantageusement, un dispositif selon l'invention comprend des moyens de guidage du pare-soleil d'au moins une position rétractée à au moins une position déployée et vice-versa.

Les déplacements du pare-soleil de régulation de la position rétractée à une position déployée et vice versa, ou d'une position déployée à une autre position déployée, peuvent être le résultat d'actions manuelles exercées par un opérateur humain sur le pare-soleil de régulation ou être tributaires de l'actionnement de moyens motorisés.

Ces déplacements, manuels ou motorisés, peuvent être commandés par un automate de commande adapté pour déterminer la surface du pan solaire à exposer directement au soleil pour maintenir la température du fluide secondaire et/ou primaire à une valeur prédéterminée, compte tenu, par exemple de l'ensoleillement ambiant, de la quantité de fluide secondaire ou primaire requise, de la force du vent, de la période de la journée, etc.

De préférence, dans le cas où les déplacements du pare-soleil sont motorisés, l'automate de commande pilote les moyens motorisés de telle sorte que la régulation de la température de fluide secondaire et/ou primaire soit entièrement automatique.

Avantageusement et selon l'invention, un dispositif de chauffage de fluide(s) par énergie solaire thermique comprend :

- un moteur électrique commandé adapté pour assurer un déplacement du pare-soleil de la position rétractée à au moins une

position déployée et vice-versa,

- un automate de commande adapté pour commander la mise en route du moteur électrique en fonction de la température du fluide à la sortie du pan solaire thermique.

5 Selon une variante de l'invention, et dans le cas d'un dispositif de chauffage indirect d'un fluide secondaire, l'automate de commande est adapté pour commander la mise en route du moteur électrique en fonction de la température du fluide primaire dans l'échangeur thermique, à l'entrée du pan solaire thermique, ou de la température du fluide secondaire dans le réservoir de
10 stockage de fluide secondaire.

 L'automate de commande peut être relié à un ou plusieurs capteurs, chaque capteur étant adapté pour fournir à l'automate des mesures représentatives de l'état du dispositif de chauffage et/ou des conditions environnementales. Il peut s'agir par exemple de capteurs de températures du
15 fluide secondaire dans le réservoir de stockage, de capteurs de température du fluide primaire, de capteurs de température de l'air ambiant, de capteurs de luminosité, de capteurs de position du pare-soleil, de capteurs anémométriques, de capteurs de niveaux de fluide secondaire dans le réservoir de stockage, de capteurs hygrométriques, de capteurs barométriques, etc.

20 L'automate peut également comprendre des unités de calcul et de traitement pour déterminer, en fonction des mesures fournies par les capteurs, la position requise du pare-soleil de régulation.

 Un pare-soleil d'un dispositif selon l'invention recouvre, dans une position déployée, au moins une partie du pan solaire. Un pare-soleil
25 présente donc dans cette position, une face en regard du pan solaire et une face exposée aux rayonnements du soleil dont le pare-soleil entrave le cheminement.

 Avantageusement et selon l'invention, le pare-soleil comprend sur une face, dite face d'exposition, recevant le rayonnement solaire une fois en position déployée, au moins une cellule photovoltaïque reliée à une
30 batterie d'accumulation d'énergie électrique de manière que ledit pare-soleil puisse générer de l'énergie électrique lorsqu'il est en position déployée.

Un dispositif de chauffage selon cette variante de l'invention est particulièrement performant car, outre la régulation de la température du fluide obtenue par déplacement d'un pare-soleil mobile, il permet de transformer l'énergie solaire en une autre forme d'énergie, y compris lorsque
5 le pan solaire est partiellement ou totalement recouvert par le pare-soleil.

Dès lors, pendant les périodes d'ensoleillement intense, lorsque le fluide secondaire et/ou primaire a atteint une température de consigne, le pare-soleil est déplacé de la position rétractée dans laquelle il se trouvait vers une position déployée –notamment vers la position totalement déployée–. Le
10 pare-soleil, équipé d'au moins un capteur photovoltaïque peut, dans cette position, produire de l'énergie électrique et transmettre cette dernière à une batterie d'accumulateurs.

L'énergie électrique stockée par la batterie peut être utilisée, par exemple pour assurer le déplacement du pare-soleil des positions
15 rétractées aux positions déployées et vice-versa, rendant ainsi le dispositif énergétiquement totalement autonome. L'énergie électrique peut également être utilisée pour alimenter tous types de dispositifs nécessitant une alimentation électrique.

Selon une variante de l'invention, le pare-soleil est adapté
20 pour pouvoir être, en position rétractée, placé de telle sorte que ladite face d'exposition du pare-soleil puisse recevoir le rayonnement solaire, de manière à ce que ledit pan solaire puisse produire de l'énergie électrique dans cette position rétractée.

Ainsi, selon cette variante, le pare-soleil peut être, dans une
25 position rétractée –notamment dans une position totalement rétractée–, exposé au soleil, de manière à ce que les cellules photovoltaïques produisent constamment de l'énergie électrique, quelle que soit la position du pare-soleil, rétractée ou déployée.

Pour ce faire, le pan solaire et le pare-soleil peuvent être
30 plans et être agencés parallèlement l'un à côté de l'autre en position rétractée, de telle sorte que le pan solaire et le pare-soleil puissent être totalement insolés.

Pour atteindre une position déployée, le pare-soleil est déplacé au-dessus du pan solaire de manière à recouvrir au moins une partie du pan solaire thermique. Selon ce mode de réalisation, le pare-soleil reçoit la même quantité de rayonnement quelle que soit sa position, rétractée ou déployée.

5 Selon un autre mode de réalisation de cette variante, le pare-soleil peut être, en position rétractée, agencée à l'horizontale, en arrière du pan solaire thermique, la face d'exposition face au ciel. Le maintien à l'horizontale du pare-soleil peut, par exemple, être réalisé par des rails horizontaux s'étendant horizontalement à l'arrière du pan solaire thermique et
10 adaptés pour porter le pare-soleil. En combinaison, un dispositif selon l'invention peut comprendre des rails verticaux agencés à l'arrière du pan solaire thermique et adaptés pour maintenir le pare-soleil, en position rétractée, verticalement à l'arrière du pare-soleil. Ainsi, le pare-soleil peut présenter au moins deux positions totalement rétractées, l'une horizontale à l'arrière du pan solaire, dans
15 laquelle il peut produire de l'énergie électrique, et l'autre verticale à l'arrière du pan solaire, dans laquelle la face d'exposition ne reçoit pas ou peu de rayonnement solaire. Selon cette variante, le pare-soleil peut être positionné à la verticale à l'arrière du pan solaire thermique lorsque la vitesse et/ou la direction du vent atteint (atteignent) une vitesse et/ou une direction prédéterminée(s), pour
20 laquelle (lesquelles) la position horizontale offre une prise au vent trop importante. Selon cette variante, le dispositif de chauffage peut également comprendre un système d'aiguillage permettant d'aiguiller le pare-soleil en position rétractée horizontale ou verticale sur commande de l'automate de commande, en fonction par exemple de la vitesse et/ou de la direction du vent.

25 Avantageusement et selon l'invention, le pare-soleil comprend une pluralité de cellules photovoltaïques agencées sur la face d'exposition du pare-soleil, formant ainsi un pan solaire photovoltaïque.

 Les cellules photovoltaïques d'un pan solaire photovoltaïque d'un dispositif selon l'invention produisent un courant continu,
30 permettant d'alimenter des appareils électriques à courant continu.

 Avantageusement, un dispositif de chauffage selon

l'invention comprend en outre un onduleur adapté pour convertir un courant continu généré par ledit pan solaire photovoltaïque en un courant alternatif pouvant être transmis à un réseau électrique alternatif.

En effet, la plupart des appareils électriques de grande consommation sont destinés à être alimentés par un courant alternatif. Dès lors, un tel onduleur, adapté pour transformer un courant continu en un courant alternatif, permet d'utiliser le courant produit par le pan solaire photovoltaïque pour alimenter de tels appareils à courant alternatif et/ou de réinjecter l'électricité produite par ce pan photovoltaïque sur un réseau électrique public.

Un pare-soleil selon l'invention peut présenter diverses formes et structures. Sa forme et sa structure déterminent sa position rétractée et ses positions déployées.

Avantageusement, dans une variante conforme à l'invention, le pare-soleil est formé d'un rideau souple adapté pour pouvoir être enroulé sur lui-même de manière à être logé, en position rétractée, dans un compartiment de stockage, et à être déroulé le long et au-dessus du pan solaire thermique en position déployée.

Dans le cas où le dispositif de chauffage comprend un châssis autoporteur portant le pan solaire thermique, le compartiment de stockage est de préférence fixé sur ce châssis autoporteur, le long d'un de ces bords périphériques.

Cette variante de l'invention présente plusieurs avantages. En particulier, le compartiment de stockage permet de protéger le rideau lorsque celui-ci n'est pas utilisé, par exemple, la nuit, lors de précipitations, au cours de chutes de neige, de grêle, etc. Le rideau enroulé permet également de limiter les impacts sur l'esthétique du lieu d'implantation du dispositif de chauffage. Son rangement est compact. De plus, l'enroulement et le déroulement automatiques d'un rideau par un moteur électrique sont des opérations courantes, particulièrement simples et économiques à mettre en œuvre. Dès lors, les déplacements d'un rideau de la position rétractée vers une ou plusieurs positions déployées, et vice-versa par enroulement et déroulement du rideau, peuvent être

réalisés aisément, par des moyens connus, et sans montage compliqué.

Un dispositif de chauffage selon l'invention peut présenter diverses formes et structures.

Selon l'invention, un dispositif de chauffage comprend un
5 châssis autoporteur portant le pan solaire thermique. Le châssis étant autoporteur, il peut être agencé selon les besoins, sur le toit d'une habitation, dans un jardin, sur une terrasse, etc.

Avantageusement et selon l'invention, le pan solaire thermique est monté incliné sur ledit châssis autoporteur en faisant un angle avec
10 la verticale compris entre 30 et 60 degrés, notamment 45 degrés.

Selon cette variante avantageuse de l'invention, le pan solaire thermique porté incliné par le châssis autoporteur forme un plan incliné par rapport à la verticale. De préférence, le compartiment de stockage du rideau formant le pare-soleil de régulation est fixé sur le châssis autoporteur au
15 voisinage de la partie haute de ce plan incliné. Dès lors, le déroulement du rideau d'une position rétractée vers une position déployée est facilité par la gravitation.

De plus, de telles inclinaisons permettent d'optimiser la quantité de rayonnement solaire reçue par le pan solaire.

Le châssis d'un dispositif selon l'invention étant
20 autoporteur, il peut recevoir tous types de panneaux solaires. Un panneau solaire selon l'invention peut comprendre tous types de capteurs solaires thermiques.

Avantageusement et selon l'invention, chaque panneau solaire thermique du pan solaire thermique comprend des capteurs solaires choisis parmi les capteurs plans vitrés, les capteurs plans sans vitrage, les
25 capteurs à plaque perforée sans vitrage, les capteurs tubulaires sous vide, les capteurs à concentrateurs paraboliques et les capteurs à réflecteurs cylindro-paraboliques.

Avantageusement, un dispositif selon l'invention comprend un carter rigide porté par le châssis autoporteur de sorte qu'un tel dispositif de
30 chauffage puisse être manutentionné d'un seul tenant.

En outre, un carter rigide protège les éléments –conduites

d'amenée et de prélèvement de fluide primaire, réservoir de stockage de fluide secondaire, automate de commande, etc.– agencés à l'intérieur de ce carter rigide, contre les intempéries.

L'invention concerne en outre un dispositif de chauffage de fluide(s) par énergie solaire thermique –notamment un dispositif de chauffage direct d'un fluide et un dispositif de chauffage indirect d'un fluide par énergie solaire thermique– caractérisés en combinaison par tout ou partie des caractéristiques mentionnées ci-dessus ou ci-après.

D'autres caractéristiques, buts et avantages de l'invention apparaîtront à la lecture de la description suivante qui présente à titre d'exemple non limitatif un mode de réalisation de l'invention, en référence aux dessins annexés ; sur ces dessins :

- la figure 1 est une vue schématique d'un dispositif de chauffage indirect d'eau par énergie solaire thermique selon l'invention,

- la figure 2 est une vue schématique en perspective d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de l'invention dont un pare-soleil de régulation selon un mode de réalisation de l'invention est en position totalement rétractée dans un compartiment de stockage,

- la figure 3 est une vue schématique en perspective d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de l'invention dont un pare-soleil de régulation selon un mode de réalisation de l'invention est dans une position déployée sur le pan solaire thermique, intermédiaire entre la position totalement rétractée et la position totalement déployée,

- la figure 4 est une vue schématique en perspective d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de l'invention dont un pare-soleil de régulation selon un mode de régulation de l'invention est en position totalement déployée sur le pan solaire thermique,

- la figure 5 est une vue schématique en coupe d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de

l'invention dont un pare-soleil de régulation selon un autre mode de réalisation est en position totalement rétractée,

- la figure 6 est une vue schématique en coupe d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de
5 l'invention dont un pare-soleil de régulation selon un autre mode de réalisation est dans une position déployée, intermédiaire entre la position totalement rétractée et la position totalement déployée,

- la figure 7 est une vue schématique en coupe d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de
10 l'invention dont un pare-soleil de régulation selon un autre mode de réalisation est en position totalement rétractée,

- la figure 8 est une vue schématique en coupe d'un dispositif de chauffage d'eau par énergie solaire selon un mode de réalisation de l'invention dont un pare-soleil selon un autre mode de réalisation est dans une
15 position totalement déployée,

- la figure 9 est une vue schématique en coupe du dispositif de chauffage de la figure 8 dont le pare-soleil est en position totalement rétractée à l'arrière du pan solaire sur des rails horizontaux.

Un dispositif de chauffage indirect d'eau par énergie
20 solaire thermique selon l'invention comprend, tel que représenté sur la figure 1, un réservoir 1 de stockage et de chauffage d'eau ; une conduite, dite conduite 10 d'entrée, agencée entre une source d'eau à chauffer et le réservoir 1 de stockage de manière à permettre l'alimentation de ce réservoir 1 en eau à chauffer ; et une conduite, dite conduite 11 de sortie, reliée au réservoir 1 de stockage d'eau et
25 présentant une extrémité adaptée pour être reliée à au moins un dispositif requérant une alimentation en eau chauffée.

Le réservoir 1 de stockage et de chauffage d'eau peut être aussi bien une citerne, un ballon, une cuve, un silo, et de manière générale tout récipient adapté pour contenir de l'eau. Ce réservoir peut également être
30 composé de plusieurs ballons, citernes, cuves, silos, etc.

La présente description fait référence à un dispositif de

chauffage d'eau, mais rien n'empêche d'utiliser un dispositif de chauffage selon l'invention pour chauffer tout autre type de fluide, par exemple, un fluide caloporteur destiné à alimenter un dispositif de chauffage central d'une habitation.

5 Un dispositif de chauffage indirect d'eau selon le mode de réalisation des figures comprend également un échangeur 2 thermique agencé dans le réservoir 1 et adapté pour assurer des échanges thermiques entre un fluide caloporteur primaire directement chauffé par énergie solaire thermique et l'eau du réservoir 1 de stockage d'eau. Tous types d'échangeurs thermiques connus
10 adaptés pour assurer des échanges thermiques entre un fluide caloporteur primaire et l'eau du réservoir 1 de stockage peuvent être utilisés dans un dispositif de chauffage selon ce mode de réalisation de l'invention. Par exemple, il peut s'agir d'un échangeur thermique à serpentins, d'un échangeur à plaques, etc.

15 Un dispositif selon l'invention comprend également un ensemble de panneaux solaires thermiques, dit pan 3 solaire thermique, relié à l'échangeur 2 thermique par une conduite 12 d'amenée de fluide caloporteur primaire à chauffer par ce pan 3 solaire thermique, et par une conduite 13 de distribution de fluide caloporteur primaire chauffé par ce pan 3 solaire thermique.
20 Le pan 3 solaire thermique est adapté pour chauffer le fluide caloporteur primaire par une absorption du rayonnement solaire en chaleur.

 Le pan 3 solaire thermique, l'échangeur 2 thermique et les conduites 12 d'amenée et 13 de distribution forment un circuit fluidique, dit circuit primaire. Selon l'invention, le fluide caloporteur primaire du circuit
25 primaire peut être un fluide liquide ou un fluide gazeux. Selon un mode de réalisation de l'invention, le fluide primaire est une solution aqueuse comprenant un composé d'eau et d'antigel, tel que le méthanol ou l'éthylène glycol. Rien n'empêche d'utiliser néanmoins d'autres types de fluides caloporteurs.

 Un circuit primaire selon l'invention peut également
30 comprendre de manière connue une pompe adaptée pour pomper le fluide caloporteur primaire et le faire circuler dans le circuit primaire.

Un pan 3 solaire selon l'invention peut présenter diverses formes et structures. Un pan 3 solaire est composé d'une pluralité de capteurs solaires thermiques. Ces capteurs peuvent être de tous types. Il peut s'agir, par exemple, de capteurs vitrés, de capteurs sous vide, de capteurs à concentrateurs paraboliques, etc.

Selon le mode de réalisation des figures, le dispositif de chauffage d'eau par énergie solaire comprend un châssis 5 autoporteur portant le pan 3 solaire thermique. Ce châssis 5 peut être réalisé par assemblage d'un ensemble de poutres (longerons, nervures, traverses, montants, etc.), poutrelles, raidisseurs, arceaux, cadres, lisses, plaques, etc. Le châssis 5 autoporteur d'un dispositif de chauffage d'eau selon l'invention peut être installé dans un jardin, sur une terrasse, sur un toit d'une habitation, notamment sur un toit plat, etc.

Selon le mode de réalisation des figures, un dispositif de chauffage d'eau par énergie solaire comprend un carter rigide porté par le châssis autoporteur de telle sorte que le dispositif de chauffage peut être manutentionné d'un seul tenant. Ce dispositif à carter rigide comprend un châssis 5 autoporteur à section droite transversale sensiblement triangulaire. Ainsi, selon ce mode de réalisation, le châssis 5 comprend une face 16 inclinée adaptée pour recevoir le pan 3 solaire, un socle 17 destiné à être mis en contact avec le sol du lieu d'implantation du dispositif de chauffage et une face 18 arrière. La face 16 inclinée, le socle 17 et la face 18 arrière définissent une enceinte à l'intérieur de laquelle sont logés, le réservoir 1 de stockage d'eau, la conduite 12 d'amenée du fluide caloporteur primaire, la conduite 13 de délivrance du fluide caloporteur primaire, la conduite 10 d'entrée d'eau, la conduite 11 de sortie d'eau, etc.

Selon le mode de réalisation des figures, les conduites 10 d'entrée d'eau et 11 de sortie d'eau comprennent à une de leur extrémité agencée à l'extérieur de l'enceinte définie par les faces du châssis 5, des connecteurs adaptés pour recevoir d'autres conduites. Ces connecteurs facilitent l'installation d'un dispositif de chauffage selon l'invention. En particulier, il suffit de relier l'arrivée d'eau froide, du bâtiment où le dispositif est installé, au connecteur de la conduite 10 d'entrée, et la sortie d'eau chaude au connecteur de la conduite 11 de

sortie, pour que le dispositif de chauffage d'eau selon l'invention soit opérationnel.

Un dispositif de chauffage est en général agencé de telle manière que le pan 3 solaire soit face au Sud. Dès lors, selon le mode de
5 réalisation des figures, la face 18 arrière du châssis 5 est orientée face au Nord.

Selon l'invention, un dispositif de chauffage d'eau par énergie solaire comprend également un pare-soleil 4 mobile de régulation de la température du fluide caloporteur primaire du circuit primaire.

Le pare-soleil 4 mobile est adapté pour pouvoir être
10 déplacé d'au moins une position, dite position déployée, dans laquelle il recouvre au moins une partie, dite partie masquée, du pan 3 solaire thermique de manière à empêcher une exposition directe au soleil de cette partie du pan 3 solaire, limitant ainsi la caléfaction du fluide caloporteur primaire par le pan 3 solaire, vers une position, dite position rétractée, dans laquelle il autorise une exposition directe au
15 soleil d'une partie du pan 3 solaire thermique dont la surface est plus grande que la surface de la partie masquée.

Selon un mode de réalisation avantageux, le pare-soleil 4 est adapté pour pouvoir être déplacé entre une position, dite position totalement rétractée, dans laquelle il autorise une exposition directe au soleil de la totalité
20 dudit pan solaire thermique et une position, dite position totalement déployée, dans laquelle il recouvre l'intégralité dudit pan solaire thermique, empêchant ainsi la caléfaction du fluide caloporteur primaire.

Le pan 3 solaire thermique, les conduites 12 d'amenée du fluide primaire et 13 de prélèvement de fluide primaire, et le pare-soleil 4 de
25 régulation forment un dispositif de chauffage direct d'un fluide selon l'invention.

Avantageusement, ce dispositif de chauffage direct d'un fluide selon l'invention est intégré dans un dispositif de chauffage indirect d'eau, par exemple d'eau sanitaire, selon l'invention.

Dès lors, l'ensemble des variantes décrites relatives au pan
30 3 solaire thermique, au pare-soleil 4 de régulation, et aux conduites d'amenée et de prélèvement de fluide, d'un dispositif de chauffage indirect d'eau selon

l'invention, s'appliquent également à un dispositif de chauffage direct d'un fluide selon l'invention.

Rien n'empêche néanmoins qu'un dispositif de chauffage direct d'un fluide selon l'invention soit utilisé indépendamment d'un dispositif de chauffage indirect d'eau selon l'invention, c'est-à-dire sans réservoir de stockage d'eau, sans conduite d'entrée et de sortie d'eau, et sans échangeur thermique. Par exemple, un dispositif de chauffage direct d'un fluide selon l'invention peut être utilisé pour chauffer une eau de piscine. Dès lors, l'eau de la piscine fait office de fluide caloporteur, la conduite d'amenée est agencée entre la piscine et le pan solaire thermique, et la conduite de prélèvement est agencée entre le pan solaire thermique et la piscine. Le pan solaire thermique est de préférence monté sur un châssis autoporteur portant également un pare-soleil selon un mode de réalisation de l'invention.

Selon l'invention, un pare-soleil 4 peut être réalisé par divers moyens. Selon un mode de réalisation, un pare-soleil est constitué d'un ensemble de lames opaques, en bois, en plastique, en verre, etc., montées sur le châssis d'un dispositif de chauffage et adaptées pour pouvoir être déplacées, dans une position déployée au-dessus du pan 3 solaire pour créer des zones d'ombres sur le pan 3 solaire et réduire ainsi l'insolation des capteurs solaires du pan 3 solaire.

Selon un autre mode de réalisation, le pare-soleil 4 est un panneau rigide opaque à la lumière qui peut être déplacé pour recouvrir le pan 3 solaire en position déployée. Une grande variété de matériaux peut être utilisée pour fabriquer un tel pare-soleil. Ces matériaux sont bien connus de l'homme du métier. Par exemple, il peut s'agir de tissus, de matériaux polymériques, de bois, de verres, etc.

Selon un mode de réalisation particulièrement avantageux, et tel que représenté sur les figures 2, 3, 4, et 7, le pare-soleil 4 est formé d'un rideau souple adapté pour être enroulé sur lui-même de manière à pouvoir être logé, en position rétractée, dans un compartiment 6 de stockage et être déroulé le long du pan 3 solaire thermique en position déployée.

L'enroulement et le déroulement du rideau sur le pan 3 solaire thermique peuvent être guidés par des moyens de guidage. Ces moyens de guidage peuvent être de tous types connus.

Par exemple et tel que représenté sur les figures, le châssis 5 comprend des glissières 22 latérales ménagées de part et d'autre du pan 3 solaire thermique. Ces glissières 22 permettent de guider le déploiement du rideau sur le pan 3 solaire thermique.

De préférence, ce compartiment 6 de stockage est porté par le châssis 5 autoporteur.

Selon un mode de réalisation de l'invention tel que représenté schématiquement sur la figure 1, le compartiment 6 de stockage s'étend selon une direction, dite direction longitudinale, parallèle à un bord du pan 3 solaire. Le compartiment 6 de stockage comprend un arbre 29 logé à l'intérieur du compartiment 6 de stockage qui s'étend le long de la direction longitudinale. Cet arbre 29 est porté par deux paliers et est adapté pour être entraîné en rotation par un moteur 30 électrique. L'accouplement entre le moteur 30 électrique et l'arbre 29 peut se faire par tous les moyens connus, par exemple par un système d'engrenages débrayables. Le rideau souple est fixé par une de ses extrémités à l'arbre 29 du compartiment 6 de stockage de telle sorte que la mise en rotation de l'arbre 29 par le moteur 30 électrique procure un enroulement ou un déroulement du rideau autour de l'arbre 29, selon le sens de rotation de l'arbre.

Selon un mode de réalisation avantageux de l'invention, le rideau présente, une fois totalement déployé, une forme et des dimensions sensiblement égales à la forme et aux dimensions du pan 3 solaire, de manière à pouvoir entièrement recouvrir ce dernier.

Selon un autre mode de réalisation, et tel que représenté sur la figure 5, le pare-soleil 4 est formé d'un rideau souple adapté pour être logé, en position rétractée, le long de la face 18 arrière du châssis 5.

Le déplacement du rideau de la position rétractée à une position déployée consiste à amener le rideau de l'arrière du châssis vers la face

inclinée. Ce déplacement peut être facilité par l'aménagement de rouleaux 20 entre la face 18 arrière et la face 16 inclinée sur lesquels le rideau peut rouler.

Selon un mode de réalisation particulièrement avantageux de l'invention, le dispositif de chauffage est muni d'un moteur 30 électrique
5 commandé adapté pour assurer un déplacement du pare-soleil de la position rétractée à au moins une position déployée et vice-versa et d'un automate 31 de commande adapté pour commander la mise en route du moteur 30 électrique en fonction, notamment, de la température de l'eau dans ledit réservoir 1 de stockage.

10 L'automate 31 de commande peut être relié à un ou plusieurs capteurs 32, 33, chaque capteur 32, 33 étant adapté pour fournir à l'automate 31 des mesures représentatives de l'état du dispositif de chauffage et/ou des conditions environnementales. Il peut s'agir par exemple de capteurs 33 de température de l'eau dans le réservoir 1 de stockage, de capteurs 32 de
15 température du fluide caloporteur du circuit primaire, de capteurs de température de l'air ambiant, de capteurs de luminosité, de capteurs de position du pare-soleil, de capteurs anémométriques, de capteurs de niveaux d'eau dans le réservoir de stockage, de capteurs hygrométriques, de capteurs barométriques, etc.

L'automate 31 de commande comprend également de
20 manière connue des unités de calculs et de traitements adaptées pour déterminer la commande moteur nécessaire en fonction des paramètres relevés par les différents capteurs 32, 33.

Selon un mode de réalisation particulièrement avantageux de l'invention, et tel que représenté sur les figures, le pare-soleil 4 comprend sur
25 une face, dite face 8 d'exposition, recevant le rayonnement solaire une fois en position déployée, au moins une cellule 23, 24 photovoltaïque –notamment une pluralité de cellules 23, 24 photovoltaïques formant un pan solaire photovoltaïque– reliée à une batterie d'accumulation d'énergie électrique de manière que le pare-soleil 4 puisse générer de l'énergie électrique lorsqu'il est en
30 position déployée.

Dans le cas où le pare-soleil est un rideau adapté pour être

enroulé et déroulé pour passer de la position rétractée à une position déployée, tel que représenté sur les figures 2, 3 et 4, un pare-soleil équipé de cellules 23 photovoltaïques peut par exemple être réalisé par un rideau flexcell® commercialisé par la société suisse VHF-Technologies SA. Un tel rideau a un
5 poids extrêmement léger, de l'ordre de 4 kg/m², le rendant parfaitement adapté au recouvrement, en position déployée, d'un pan solaire thermique. De plus, ses cellules 23 photovoltaïques sont très résistantes, notamment plus résistantes que les cellules photovoltaïques en silicium cristallin constituées de couches de verres. Un tel rideau pare-soleil peut également être constitué par un rouleau
10 d'étanchéité synthétique Evalon®-Solar commercialisé par la société allemande Alwitra.

Selon un autre mode de réalisation, tel que représenté sur la figure 6, le rideau est une toile synthétique sur laquelle ont été régulièrement installées des cellules 24 photovoltaïques rigides, par exemple des plaques de
15 cellules en silicium cristallin constituées de couches de verres. Selon ce mode de réalisation, le rideau est logé, en position rétractée, le long de la face 18 arrière du châssis 5. Le passage du rideau de la position rétractée à une position déployée, notamment à la position totalement déployée, est facilité par un rouleau 28 à méplats adaptés pour porter chaque plaque de cellule 24
20 photovoltaïque de l'arrière du châssis 5 vers le pan 3 solaire.

Un pare-soleil équipé de cellules photovoltaïques, souples ou rigides, réparties continûment ou non sur le pare-soleil et ménagées sur la face 8 d'exposition du pare-soleil, peut produire, lorsqu'il est en position déployée, de l'énergie électrique et transmettre cette dernière à une batterie d'accumulateurs,
25 non représentée sur les figures, pour la recharge de cette dernière.

Tous types de batteries peuvent être utilisés et sont bien connus de l'homme du métier.

Cette énergie électrique accumulée dans une batterie peut être utilisée, par exemple, pour assurer le déplacement du pare-soleil de la
30 position rétractée à une position déployée et vice-versa, rendant ainsi le dispositif énergétiquement totalement autonome. Rien n'empêche d'utiliser cette énergie

électrique accumulée pour alimenter d'autres dispositifs électriques.

Selon un mode de réalisation avantageux non représenté sur les figures, un dispositif selon l'invention comprend un onduleur adapté pour transformer un courant continu en un courant alternatif de manière à pouvoir
5 réinjecter l'électricité produite par un pan photovoltaïque selon l'invention sur un réseau électrique public ou pour alimenter des dispositifs électriques fonctionnant sur courant alternatif.

Le déplacement du pare-soleil de la position rétractée à une position déployée, d'une position déployée à une autre position déployée, et
10 d'une position déployée à la position rétractée, est avantageusement commandé par un automate. Cet automate permet de réguler la température du fluide caloporteur du circuit primaire en adaptant la surface du pan solaire thermique exposée au soleil aux besoins en eau chaude. Cet automate peut être un automate programmable. De manière connue, il peut comprendre des moyens logiciels
15 pour déterminer, en fonction d'algorithmes prédéterminés et d'un certains nombres de paramètres, la position requise du pare-soleil. Ces paramètres peuvent être la température de l'eau dans le réservoir de stockage, la température du fluide caloporteur, la température extérieure, la vitesse du vent extérieur (un vent trop fort pouvant nécessiter le déplacement du pare-soleil de régulation en
20 position rétractée), une estimation des besoins en eau chaude pour les prochaines heures, etc.

Selon une variante avantageuse de l'invention, un dispositif de chauffage comprend un pare-soleil équipé de capteurs photovoltaïques, adapté pour être insolé, y compris lorsqu'il est en position rétractée.

25 Pour ce faire, selon un mode de réalisation, le dispositif présente un pan solaire plan et un pare-soleil plan équipé de capteurs photovoltaïques, agencés parallèlement l'un à côté de l'autre en position rétractée, de telle sorte que le pan solaire et le pare-soleil puissent être totalement insolés. Selon ce mode de réalisation, le pare-soleil est adapté pour produire de
30 l'énergie électrique quelle que soit sa position, rétractée ou déployée.

Selon un autre mode de réalisation de cette variante, tel que

représenté sur les figures 8 et 9, le pare-soleil peut être, en position rétractée, agencée à l'horizontale, en arrière du pan solaire thermique, la face d'exposition face au ciel. Le maintien à l'horizontale du pare-soleil peut, par exemple, être réalisé par des rails 41 horizontaux s'étendant horizontalement à l'arrière du pan

5 3 solaire thermique et adaptés pour porter le pare-soleil. Un tel agencement permet une production d'énergie électrique quelle que soit la position du pare-soleil. Selon ce mode de réalisation, le déplacement du pare-soleil d'une position déployée vers une position rétractée horizontale, peut être obtenu par un mécanisme articulé, du type mécanisme de porte sectionnelle, adapté pour

10 déplacé le pare-soleil d'une position déployée dans laquelle il recouvre une partie du pan solaire thermique vers une position rétractée horizontale. Ce mécanisme peut être entraîné, de manière connue, par un moteur électrique. Ce mécanisme peut comprendre, par exemple, tel que représenté sur les figures 8 et 9, des rails 43 inclinés s'étendant latéralement de chaque côté du pan 3 solaire thermique et

15 adaptés pour guider le pare-soleil en position déployée, et des rails 41 horizontaux soutenus par des poteaux 42. Selon d'autres modes de réalisation, ces rails 41 peuvent présenter un angle non nul avec l'horizontal de manière à permettre une meilleure exposition au soleil du pare-soleil lorsque celui-ci est en position rétractée, sur ces rails 41.

20 En combinaison de ce mode de réalisation, et tel que représenté sur les figures 8 et 9, le dispositif peut comprendre des rails 40 verticaux ménagés à l'arrière du pan 3 solaire thermique, adaptés pour recevoir le pare-soleil. Un tel dispositif comprend ainsi deux positions totalement rétractées, l'une horizontale correspondant au placement du pare-soleil sur les rails 41

25 horizontaux et une autre verticale correspondant au placement du pare-soleil sur les rails 40 verticaux. Selon ce mode de réalisation, le mécanisme articulé peut comprendre un système 44 d'aiguillage adapté pour aiguiller le pare-soleil en position rétractée horizontale sur les rails 41 horizontaux ou en position rétractée verticale sur les rails 40 verticaux. Ce système 44 d'aiguillage est

30 avantageusement piloté par l'automate de commande. Le maintien du pare-soleil sur les rails peut être réalisé par différents moyens, par exemple par

l'intermédiaire de roulettes emprisonnées dans les rails et adaptées pour assurer le déplacement du pare-soleil le long des rails. Ce mode de réalisation peut faire l'objet de nombreuses variantes.

Le déplacement du pare-soleil d'une position déployée sur les rails 43 inclinés à une position rétractée sur les rails 41 horizontaux ou sur les rails 40 verticaux peut également, par exemple, être assuré par un mécanisme à crémaillère, à courroie, à vis sans fin, etc.

Un dispositif de chauffage d'eau par énergie solaire selon l'invention est particulièrement adapté au chauffage d'eau sanitaire destinée à un usage collectif ou industriel. Un dispositif de chauffage selon l'invention peut présenter un pan solaire de toutes dimensions. Par exemple, un pan solaire selon l'invention peut présenter une surface de 25m², ce qui permet de chauffer de l'ordre de 1300 litres d'eau par jour, et de générer 2,5 kWh lorsque le pare-soleil est en position totalement déployée. Un dispositif de chauffage d'eau selon l'invention étant de préférence monobloc autoporteur, il est particulièrement aisé d'associer plusieurs dispositifs les uns aux autres pour permettre le chauffage d'une plus grande quantité d'eau.

Un dispositif de chauffage direct d'un fluide primaire selon l'invention et un dispositif de chauffage indirect d'un fluide secondaire— notamment d'eau— selon l'invention munis d'un pare-soleil de régulation de la température du fluide secondaire et/ou primaire permettent de pallier les inconvénients des dispositifs de l'art antérieur en permettant notamment de protéger les panneaux solaires thermiques pendant les périodes d'ensoleillement intense au cours desquelles le fluide peut rapidement atteindre une température de consigne et les capteurs peuvent rapidement être en surchauffe. Cela permet d'augmenter la durée de vie des panneaux solaires thermiques en éliminant les risques de chocs thermiques. De plus, un pare-soleil selon l'invention peut être équipé de cellules photovoltaïques de telle sorte que le dispositif de chauffage d'eau peut se transformer, lorsque l'eau est suffisamment chaude, en dispositif de production d'énergie électrique.

REVENDICATIONS

1/- Dispositif de chauffage de fluide(s) par énergie solaire thermique comprenant :

- un pan (3) solaire thermique comprenant au moins
- 5 un panneau solaire thermique comprenant au moins un capteur solaire thermique, ledit pan (3) solaire thermique étant adapté pour chauffer un fluide, dit fluide primaire, par absorption du rayonnement solaire,
- au moins une conduite (12) d'amenée, audit pan (3) solaire, de fluide primaire à chauffer,
- 10 - au moins une conduite (13) de prélèvement de fluide primaire chauffé par ledit pan (3) solaire thermique, caractérisé en ce qu'il comprend un pare-soleil (4) mobile de régulation de la température dudit fluide primaire, ledit pare-soleil (4) mobile étant adapté pour pouvoir être placé dans au moins une position, dite position déployée, dans
- 15 laquelle il recouvre au moins une partie, dite partie masquée, dudit pan (3) solaire thermique de manière à empêcher une exposition directe au soleil de cette partie masquée, limitant ainsi la caléfaction du fluide primaire par ledit pan (3) solaire.

2/- Dispositif selon la revendication 1, caractérisé en ce que ledit pare-soleil de régulation de la température dudit fluide primaire est

20 adapté pour pouvoir être placé dans une position, dite position rétractée, dans laquelle il autorise une exposition directe au soleil d'au moins une partie dudit pan solaire de surface plus grande que la surface de ladite partie masquée.

3/- Dispositif selon la revendication 2, caractérisé en ce qu'il comprend des moyens de guidage du pare-soleil d'au moins une position

25 rétractée à au moins une position déployée et vice-versa.

4/- Dispositif selon l'une des revendications 1 à 3, caractérisé en ce que ledit pare-soleil de régulation est adapté pour pouvoir être placé :

- dans une position, dite position totalement
- 30 rétractée, dans laquelle il autorise une exposition directe au soleil de la totalité dudit pan solaire thermique,

- dans une position, dite position totalement déployée, dans laquelle il recouvre l'intégralité dudit pan solaire thermique, empêchant ainsi la caléfaction du fluide.

5 5/- Dispositif selon la revendication 4, caractérisé en ce qu'il comprend :

- un moteur électrique commandé adapté pour assurer des déplacements du pare-soleil (4) entre ladite position totalement rétractée et ladite position totalement déployée et vice-versa,

10 - un automate de commande adapté pour commander la mise en route du moteur électrique en fonction de la température dudit fluide primaire.

6/- Dispositif selon l'une des revendications 1 à 5, caractérisé en ce que ledit pare-soleil (4) comprend sur une face, dite face (8) d'exposition, recevant le rayonnement solaire une fois en position déployée, au
15 moins une cellule (22 ; 23) photovoltaïque reliée à une batterie d'accumulation d'énergie électrique de manière que ledit pare-soleil (4) puisse générer de l'énergie électrique lorsqu'il est en position déployée.

7/- Dispositif selon la revendication 6, caractérisé en ce que ledit pare-soleil (4) comprend une pluralité de cellules (22 ; 23)
20 photovoltaïques agencées sur ladite face (8) d'exposition dudit pare-soleil (4), formant un pan solaire photovoltaïque escamotable.

8/- Dispositif selon la revendication 7, caractérisé en ce qu'il comprend un onduleur adapté pour convertir un courant continu généré par ledit pan solaire photovoltaïque en un courant alternatif pouvant être transmis à
25 un réseau électrique alternatif.

9/- Dispositif selon la revendication 2, caractérisé en ce que ledit pare-soleil (4) est formé d'un rideau souple adapté pour pouvoir être enroulé sur lui-même de manière à être logé, en position rétractée, dans un compartiment (6) de stockage, et à être déroulé le long et au-dessus du pan (3)
30 solaire thermique en position déployée.

10/- Dispositif selon l'une des revendications 1 à 9,

caractérisé en ce que chaque panneau solaire thermique dudit pan (3) solaire thermique comprend des capteurs solaires choisis parmi les capteurs plans vitrés, les capteurs plans sans vitrage, les capteurs à plaque perforée sans vitrage, les capteurs tubulaires sous vide, les capteurs à concentrateurs paraboliques et les
5 capteurs à réflecteurs cylindro-paraboliques.

11/- Dispositif selon l'une des revendications 1 à 10, caractérisé en ce qu'il comprend un châssis (5) autoporteur portant ledit pan (3) solaire thermique et ledit pare-soleil (4) mobile de régulation.

12/- Dispositif selon l'une des revendications 1 à 11,
10 caractérisé en ce que ledit pan (3) solaire thermique est monté incliné sur ledit châssis (5) autoporteur en faisant un angle avec la verticale compris entre 30 et 60 degrés.

13/- Dispositif selon les revendications 2 et 7 prises ensemble, caractérisé en ce que ledit pan solaire photovoltaïque escamotable
15 formant ledit pare-soleil est adapté pour pouvoir être, en position rétractée, placé de telle sorte que ladite face d'exposition du pare-soleil puisse recevoir le rayonnement solaire, de manière à ce que ledit pan solaire puisse produire de l'énergie électrique, quelle que soit la position du pare-soleil.

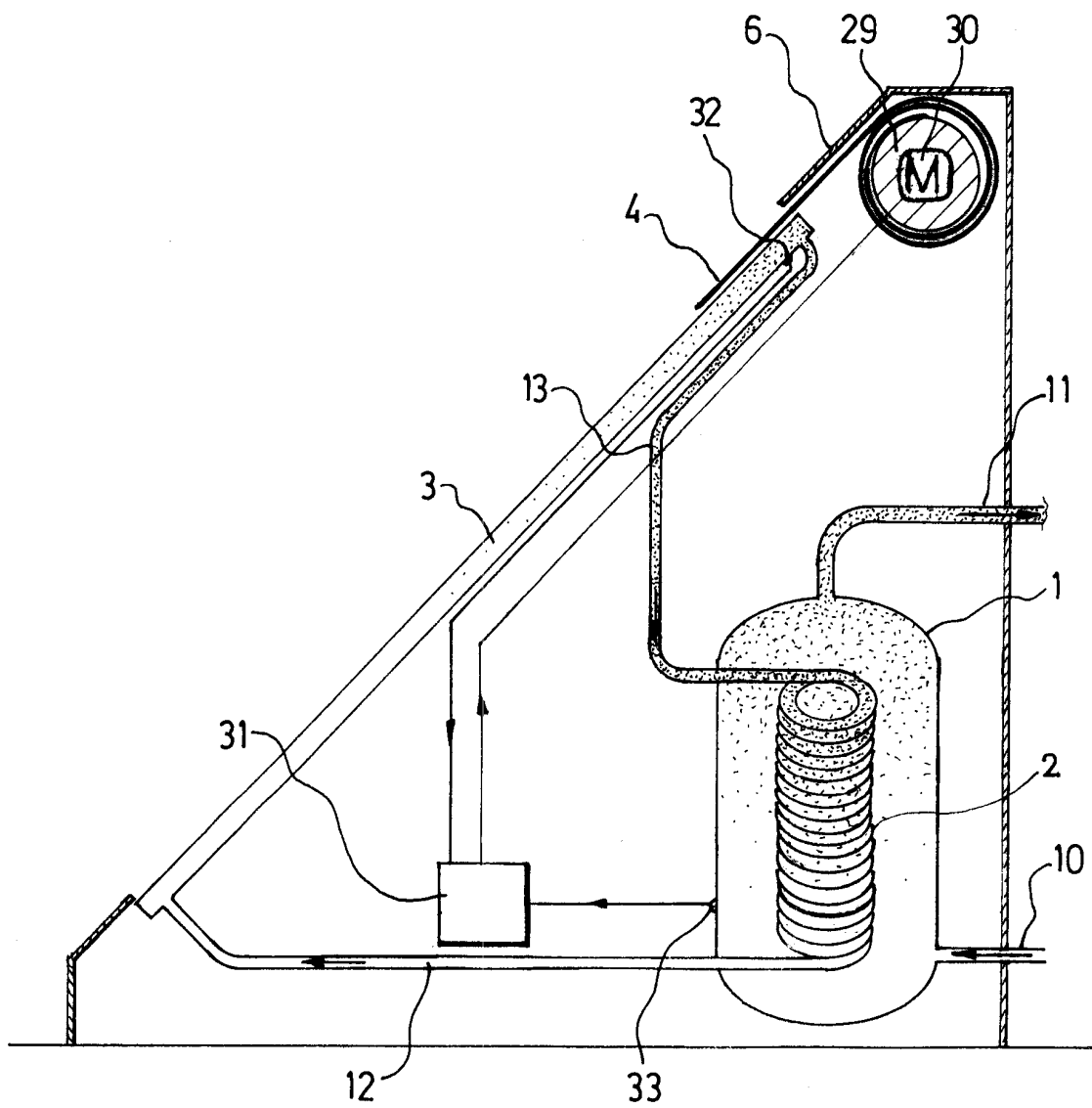
14/- Dispositif selon l'une des revendications 1 à 13,
20 caractérisé en ce qu'il comprend en outre :

- un réservoir (1) de stockage et de chauffage d'un fluide, dit fluide secondaire, distinct dudit fluide primaire,
- au moins une conduite, dite conduite (10) d'entrée, agencée entre une source de fluide secondaire à chauffer et ledit réservoir (1) de
25 fluide secondaire de manière à permettre l'alimentation de ce réservoir (1) en fluide secondaire à chauffer,
- au moins une conduite, dite conduite (11) de sortie, reliée audit réservoir (1) de fluide secondaire de manière à permettre un prélèvement de fluide secondaire chauffée à partir de ce réservoir (1),
30
- un échangeur thermique agencé dans ledit réservoir (1) de stockage et relié auxdites conduites (12) d'amenée et (13) de prélèvement

de fluide primaire, de manière à pouvoir assurer des échanges thermiques entre ledit fluide primaire et ledit fluide secondaire.

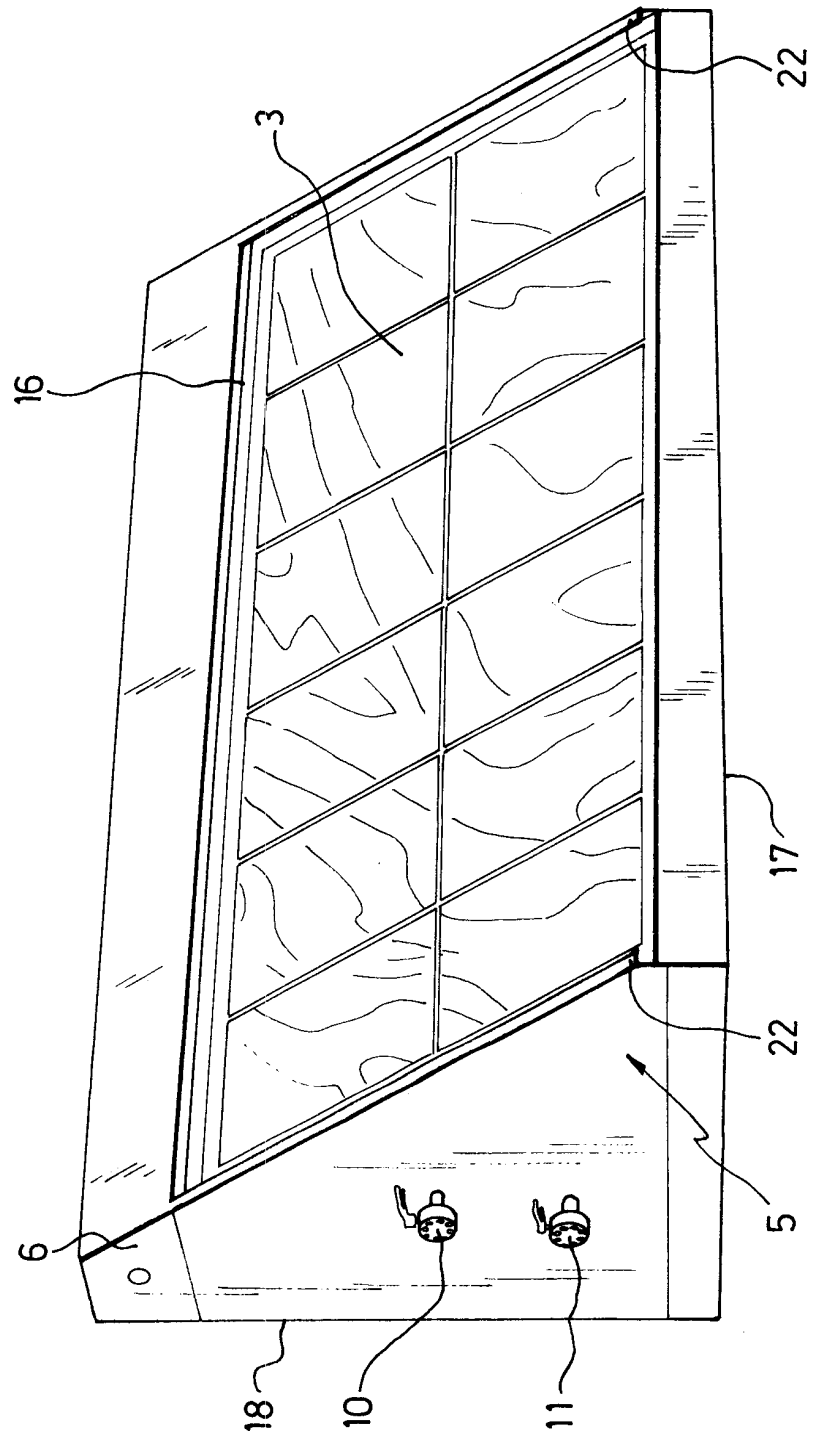
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Fig 1



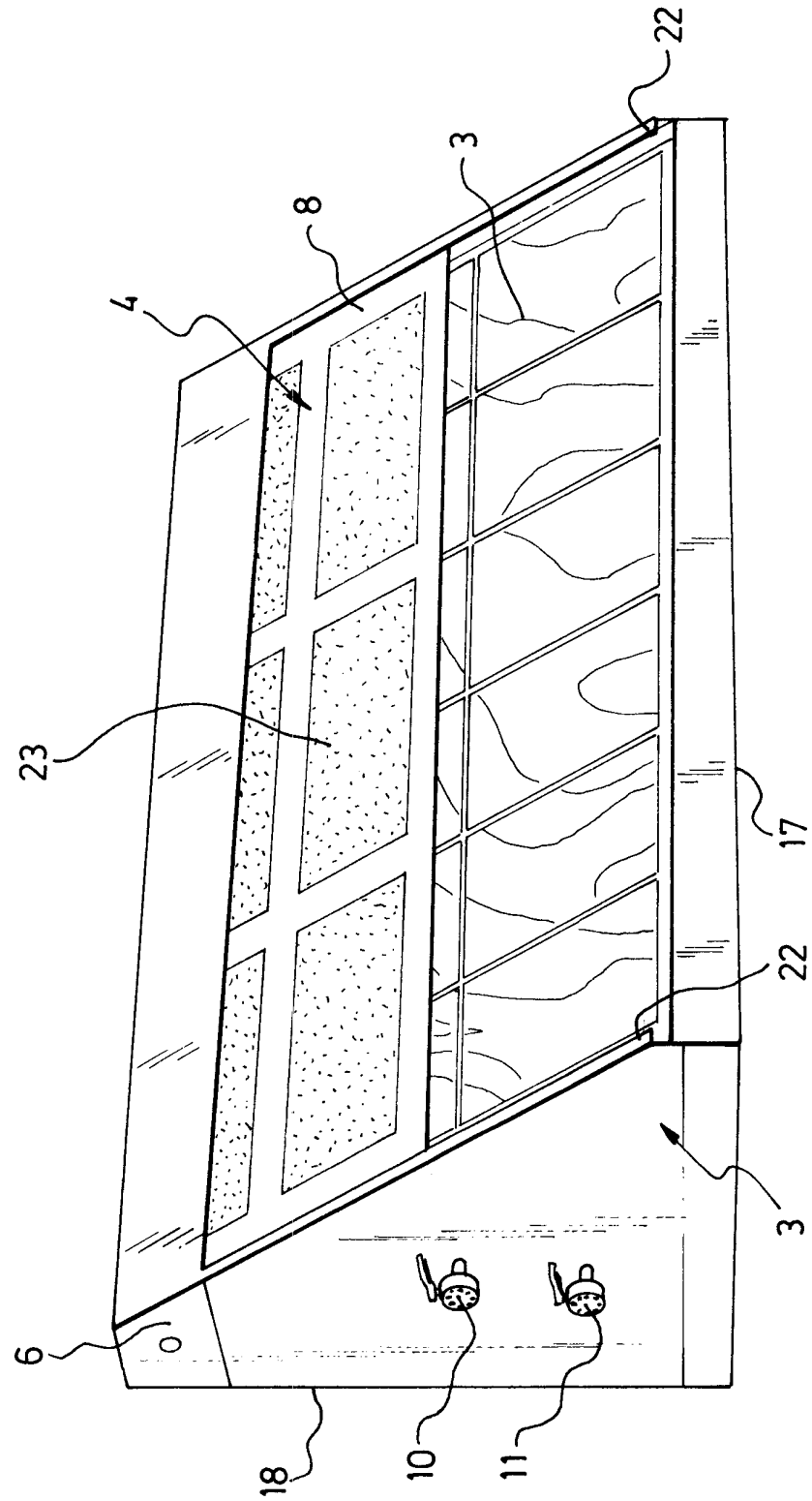
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Fig 2



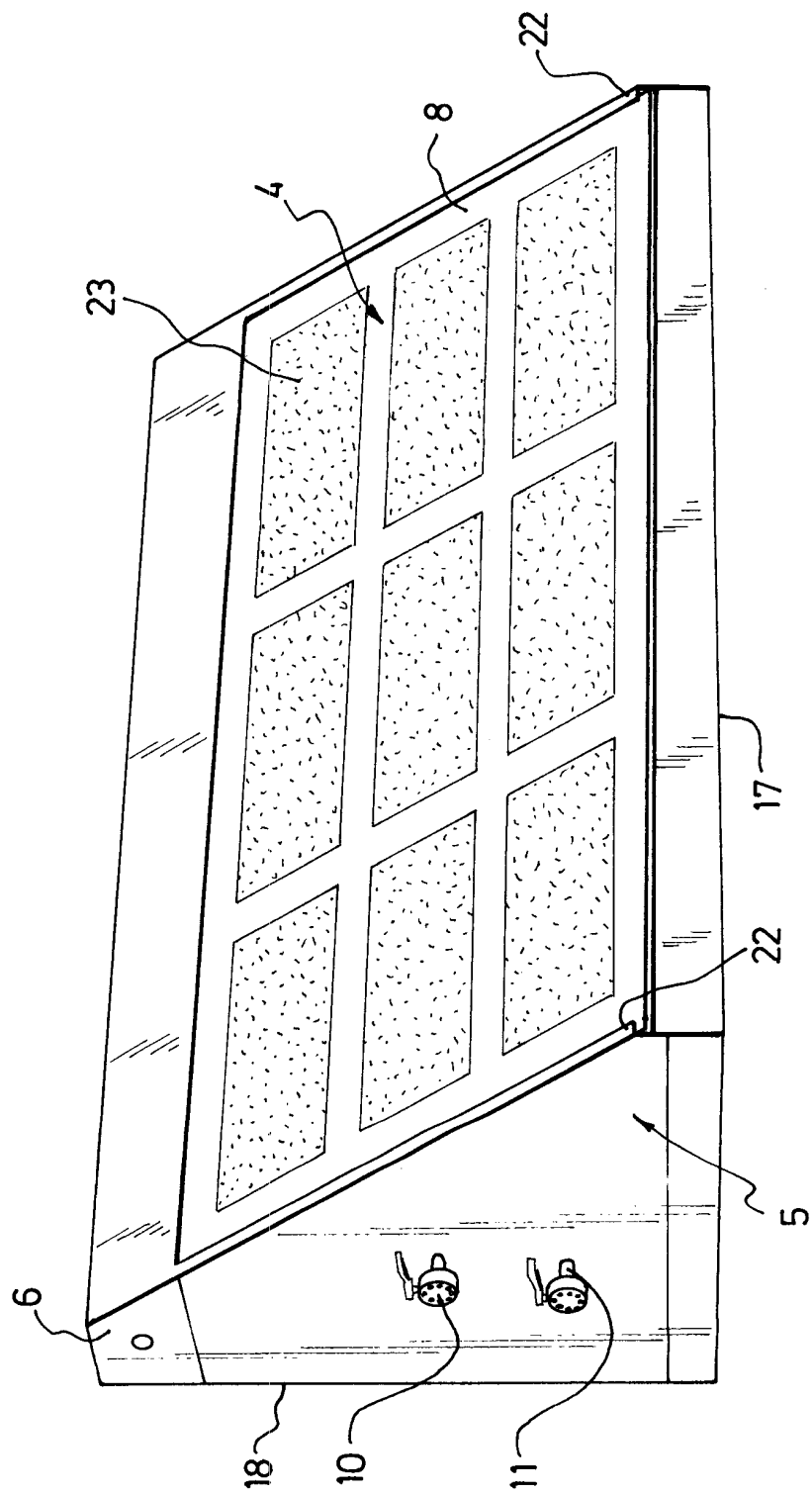
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Fig 3



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Fig 4



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Fig 5

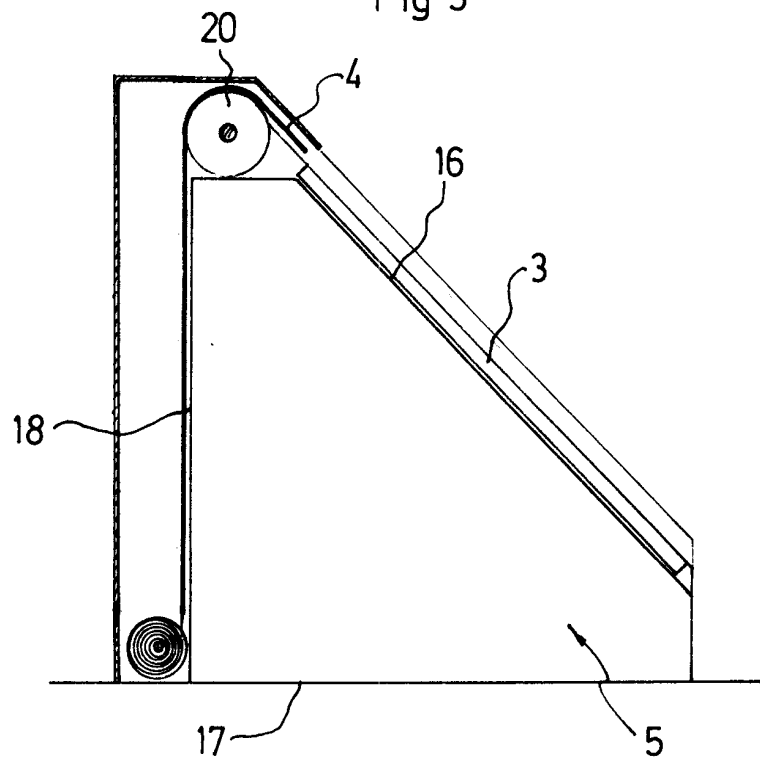
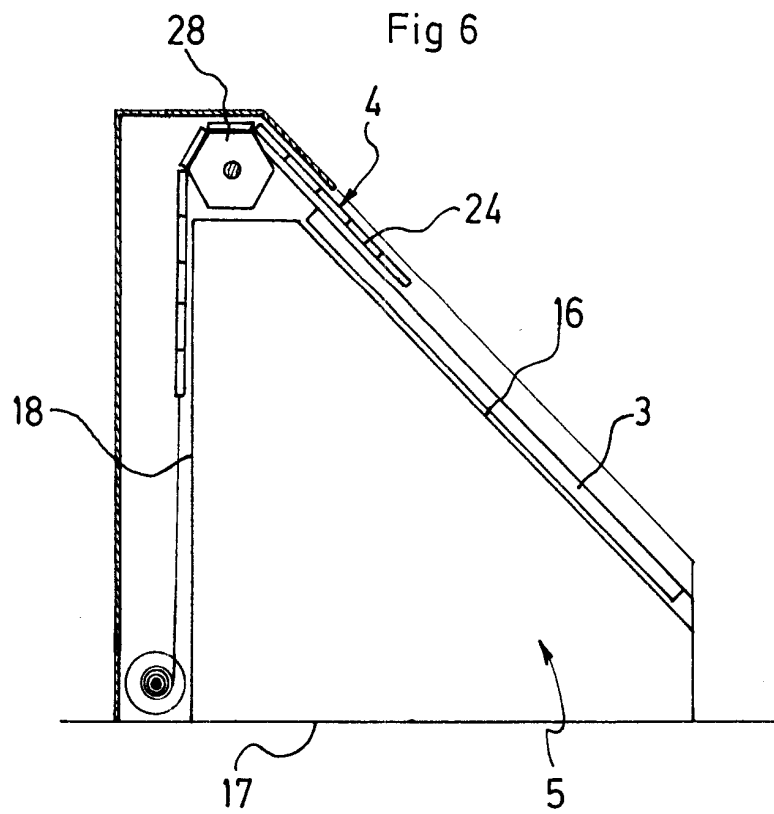
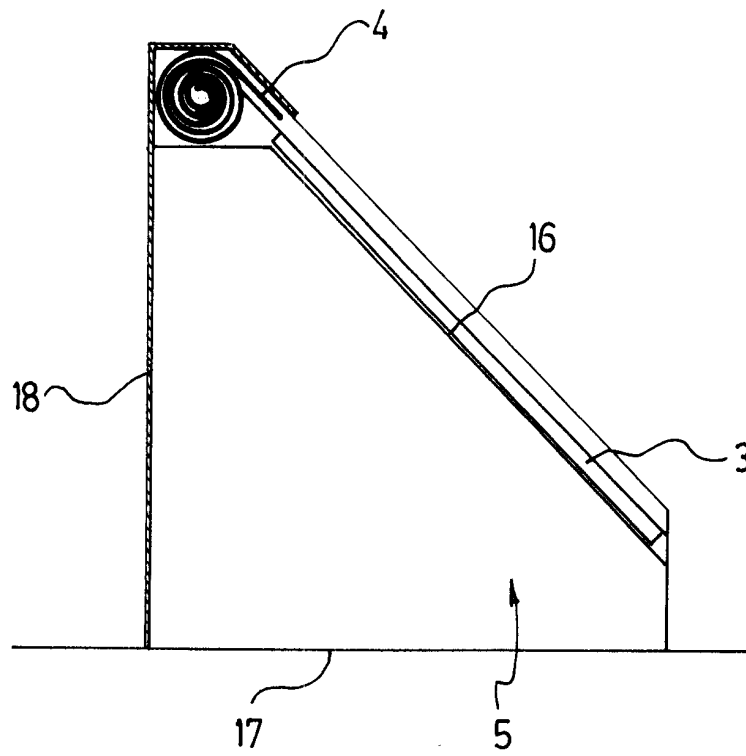


Fig 6



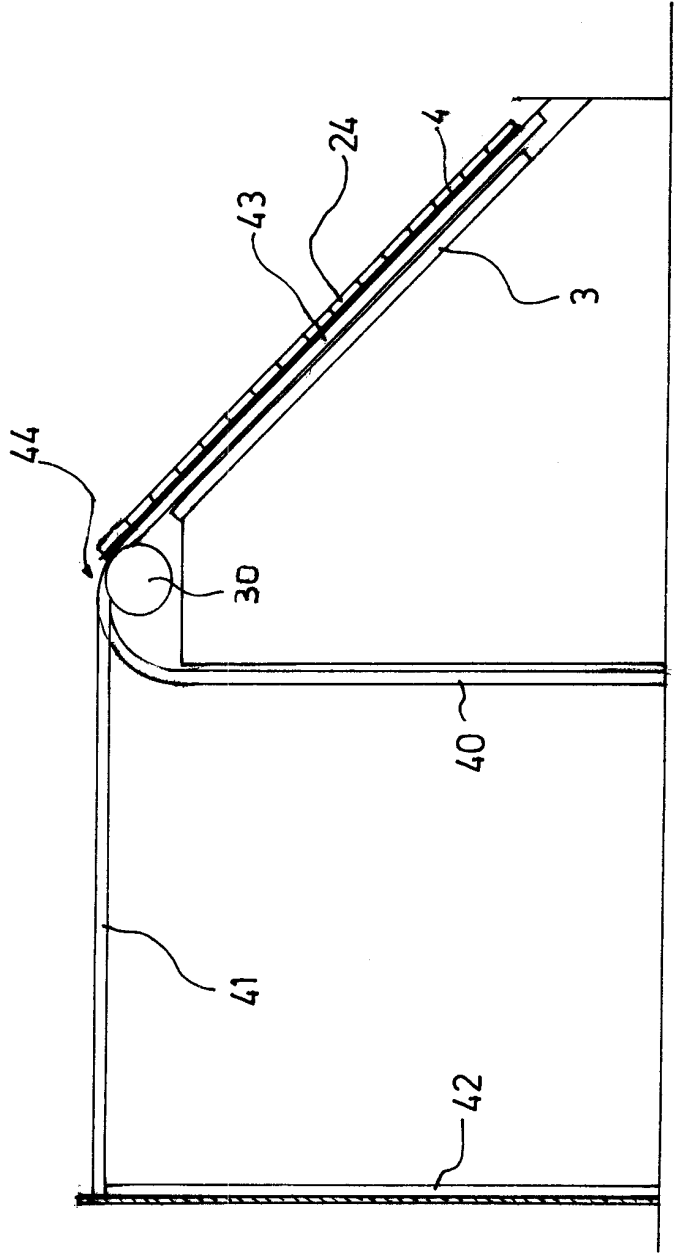
6/8

Fig 7



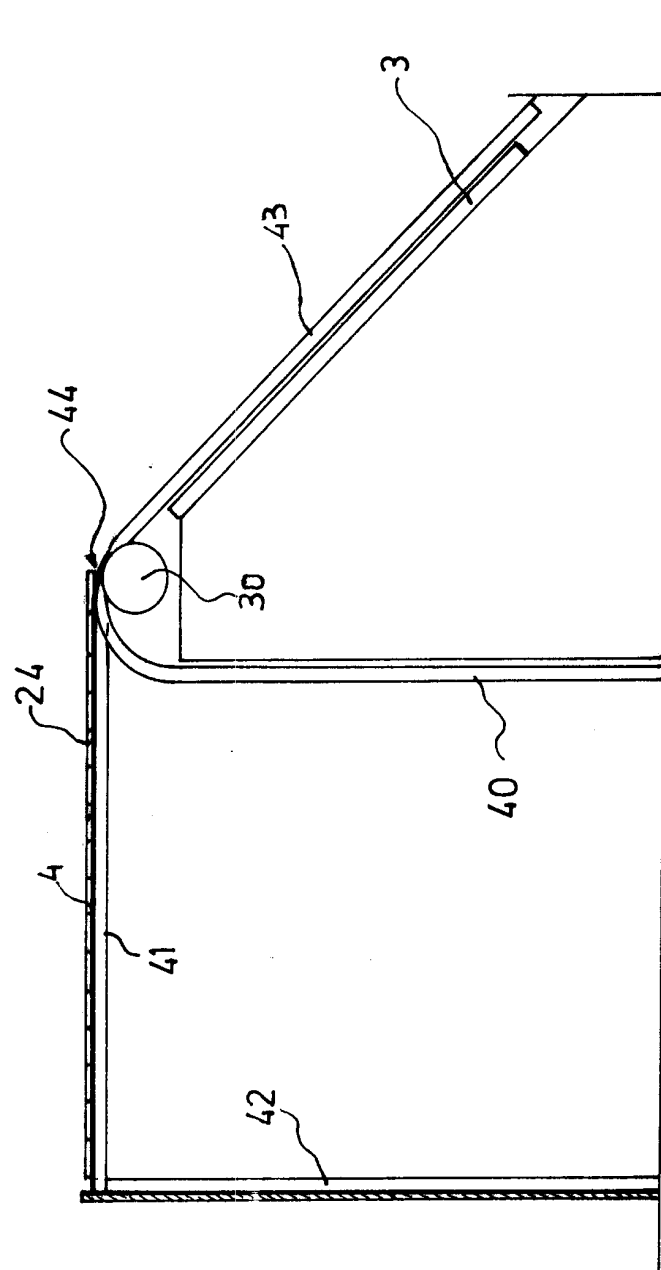
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Fig 8



8/8

Fig 9





RAPPORT DE RECHERCHE PRÉLIMINAIRE

établi sur la base des dernières revendications
déposées avant le commencement de la recherche

N° d'enregistrement
national

FA 689990
FR 0701441

DOCUMENTS CONSIDÉRÉS COMME PERTINENTS		Revendication(s) concernée(s)	Classement attribué à l'invention par l'INPI
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes		
X	DE 20 2005 002198 U1 (MATHIEU HANS [DE]) 14 avril 2005 (2005-04-14) * le document en entier *	1-12,14	F24J2/04 F24J2/46 H01L31/058
A	US 4 636 579 A (HANAK JOSEPH J [US] ET AL) 13 janvier 1987 (1987-01-13) * le document en entier *	6-8	
X	DE 30 19 242 A1 (BERTOLIS WASSILIOS DIPL ING) 4 mars 1982 (1982-03-04) * page 5 - page 6; revendications 1-6; figures 1-3 *	1-5,9-12	
X	DE 100 32 227 A1 (KRUMPE ALFRED [DE]) 17 janvier 2002 (2002-01-17) * le document en entier *	1-5,9-12	
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E	EP 1 757 873 A (MATHIEU HANS [DE]) 28 février 2007 (2007-02-28) * le document en entier *	1-5,9-14	DOMAINES TECHNIQUES RECHERCHÉS (IPC)
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7 février 2008		Leclaire, Thomas	
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**ANNEXE AU RAPPORT DE RECHERCHE PRÉLIMINAIRE
RELATIF A LA DEMANDE DE BREVET FRANÇAIS NO. FR 0701441 FA 689990**

La présente annexe indique les membres de la famille de brevets relatifs aux documents brevets cités dans le rapport de recherche préliminaire visé ci-dessus.

Les dits membres sont contenus au fichier informatique de l'Office européen des brevets à la date du **07-02-2008**

Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office européen des brevets, ni de l'Administration française

Document brevet cité au rapport de recherche	Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
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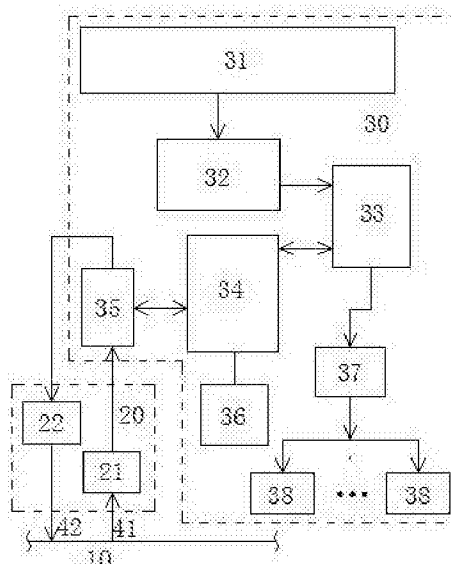
权利要求书1页 说明书3页 附图1页

(54)发明名称

一种基于电池梯次利用的分布式微电网系统

(57)摘要

本发明公开了一种基于电池梯次利用的分布式微电网系统,包括外部供电交流总线、若干个用户光伏发电用电单元和能量输入输出监控单元;每个所述用户光伏发电用电单元包括太阳能电池板组件、直流电分配管理器、微电网蓄能电池以及光伏发电逆变器;所述光伏发电逆变器连接有交流用电设备,所述微电网蓄能电池包括梯次利用动力蓄电池组和BMS控制器,所述梯次利用动力蓄电池组为电动车用动力锂电池单体构成,且所述电动车用动力锂电池单体的电池容量为额定容量的40%以下。本发明能够提高太阳能光伏发电的稳定输出,便于同公共电力系统或相邻其它交流总线微电网并网,且提高光伏发电和并网供电的电能质量。



1. 一种基于电池梯次利用的分布式微电网系统,其特征在于:包括一用于提供外部供电的外部供电交流总线(10)、若干个用户光伏发电用电单元(30),每个所述用户光伏发电用电单元(30)和所述外部供电交流总线(10)之间设置有能量输入输出监控单元(20);每个所述用户光伏发电用电单元(30)包括用于接受太阳光照射进行光伏发电的太阳能电池板组件(31)、用于将所述太阳能电池板组件(31)输出的直流电进行分配管理的直流电分配管理器(33)、用于将所述太阳能电池板组件(31)输出的直流电转化为化学能进行储存的微电网蓄能电池、以及用于将所述太阳能电池板组件(31)输出的直流电转换为交流电的光伏发电逆变器(37);所述光伏发电逆变器(37)连接有交流用电设备(38),所述微电网蓄能电池包括梯次利用动力蓄电池组(34)和BMS控制器(36),所述梯次利用动力蓄电池组(34)为电动车用动力锂电池单体构成,且所述电动车用动力锂电池单体的电池容量为额定容量的40%以下。

2. 根据权利要求1所述的一种基于电池梯次利用的分布式微电网系统,其特征在于:每个所述用户光伏发电用电单元(30)还包括用于汇集所述太阳能电池板组件(31)发电量的光伏发电接入盒(32),所述光伏发电接入盒(32)连接所述太阳能电池板组件(31),所述光伏发电接入盒(32)、所述微电网蓄能电池和所述光伏发电逆变器(37)均连接所述直流电分配管理器(33),所述光伏发电接入盒(32)、所述微电网蓄能电池和所述光伏发电逆变器(37)之间相互并联。

3. 根据权利要求2所述的一种基于电池梯次利用的分布式微电网系统,其特征在于:所述微电网蓄能电池还连接设置有外接整流逆变器(35),所述外接整流逆变器(35)通过多余电能输出线路(42)和外部电能输入线路(41)连接所述外部供电交流总线(10),且所述多余电能输出线路(42)和所述外部电能输入线路(41)之间相互并联;所述多余电能输出线路(42)用于将过剩的光伏发电量输出至所述外部供电交流总线(10),所述外部电能输入线路(41)用于将所述外部供电交流总线(10)的电能输送至所述微电网能量管理装置;所述能量输入输出监控单元(20)包括光伏发电功率表(22)和外部供电功率表(21),所述光伏发电功率表(22)设置于所述多余电能输出线路(42)上且用于监测输出功率,所述外部供电功率表(21)设置于所述外部电能输入线路(41)上且用于监测输入功率。

一种基于电池梯次利用的分布式微电网系统

技术领域

[0001] 本发明涉及一种动力锂电池梯次利用和光伏微电网系统技术领域,特别是一种基于电池梯次利用的分布式微电网系统。

背景技术

[0002] 我国对于微电网的定义为:微电网是以分布式电源为主,利用储能和控制装置进行实时调节,实现网络内部电力电量平衡的供电网络,可并网运行也可离网独立运行。微电网利用一次能源,使用微型电源,通常配有储能装置,使用电力电子装置进行能量调节,是一种根据用户需求提供电能的小型系统。微电网内部的电源主要由电力电子器件负责能量的转换,并提供必要的控制;微电网相对于主电网表现为单一的受控单元,并可同时满足用户对供电可靠和安全方面的需求。

[0003] 太阳能是人类取之不尽用之不竭的可再生能源,具有充分清洁、绝对安全、相对广泛、资源充足、经济实用、长寿命和免维护性等一系列突出优点。太阳能的存储主要通过一定的技术将新能源转化为化学能、势能、动能、电磁能等形态,使转化后的能量具有空间上可转移或时间上可转移或质量可控制的特点,可以在适当的时间、地点以适合的方式释放出来;其中最为常见的储能方式为电池储能,但是电池储能成本较高。

[0004] 按照国家标准规定,动力电池的容量下降到额定容量的80%就意味着其寿命的终结,如果直接将电池淘汰将造成资源的严重浪费;因此当动力电池不宜在现有车辆上继续使用时,可对其进行梯次利用将其回收再利用于电池储能系统中,进行电力系统中的削峰填谷,从而提高太阳能等可再生能源的稳定输出,并提高光伏发电的电能质量,不仅可以节约资源还可以降低成本,能取一定的经济效益。

发明内容

[0005] 为了克服现有技术的不足,本发明提供了一种基于电池梯次利用的分布式微电网系统,将动力锂电池梯次利用技术和光伏微电网系统技术相结合,提高太阳能光伏发电的稳定输出,并提高光伏发电的电能质量,同时降低电池储能的应用成本。

[0006] 本发明解决其技术问题所采用的技术方案是:

一种基于电池梯次利用的分布式微电网系统,包括一用于提供外部供电的外部供电交流总线、若干个用户光伏发电用电单元,每个所述用户光伏发电用电单元和所述外部供电交流总线之间设置有能量输入输出监控单元;每个所述用户光伏发电用电单元包括用于接受太阳光照射进行光伏发电的太阳能电池板组件、用于将所述太阳能电池板组件输出的直流电进行分配管理的直流电分配管理器、用于将所述太阳能电池板组件输出的直流电转化为化学能进行储存的微电网蓄能电池、以及用于将所述太阳能电池板组件输出的直流电转换为交流电的光伏发电逆变器;所述光伏发电逆变器连接有交流用电设备,所述微电网蓄能电池包括梯次利用动力蓄电池组和BMS控制器,所述梯次利用动力蓄电池组为电动车用动力锂电池单体构成,且所述电动车用动力锂电池单体的电池容量为额定容量的40%以下。

[0007] 作为上述技术方案的进一步改进,每个所述用户光伏发电用电单元还包括用于汇集所述太阳能电池板组件发电量的光伏发电接入盒,所述光伏发电接入盒连接所述太阳能电池板组件,所述光伏发电接入盒、所述微电网蓄能电池和所述光伏发电逆变器均连接所述直流电分配管理器,所述光伏发电接入盒、所述微电网蓄能电池和所述光伏发电逆变器之间相互并联。

[0008] 作为上述技术方案的进一步改进,所述微电网蓄能电池还连接设置有外接整流逆变器,所述外接整流逆变器通过多余电能输出线路和外部电能输入线路连接所述外部供电交流总线,且所述多余电能输出线路和所述外部电能输入线路之间相互并联;所述多余电能输出线路用于将过剩的光伏发电量输出至所述外部供电交流总线,所述外部电能输入线路用于将所述外部供电交流总线的电能输送至所述微电网能量管理装置;所述能量输入输出监控单元包括光伏发电功率表和外部供电功率表,所述光伏发电功率表设置于所述多余电能输出线路上且用于监测输出功率,所述外部供电功率表设置于所述外部电能输入线路上且用于监测输入功率。

[0009] 与现有技术相比较,本发明的有益效果是:

本发明所提供的一种基于电池梯次利用的分布式微电网系统,将动力锂电池梯次利用技术和光伏微电网系统技术相结合,能够提高太阳能光伏发电的稳定输出,并提高光伏发电的电能质量,同时还可以降低电池储能的应用成本;另外本发明便于同公共电力系统或相邻其它交流总线微电网并网,且并网供电的电能质量较稳定。

附图说明

[0010] 下面结合附图和实施例对本发明进一步说明。

[0011] 图1是本发明所述的一种基于电池梯次利用的分布式微电网系统的结构示意图;
图2是本发明所述的用户光伏发电用电单元的结构示意图。

具体实施方式

[0012] 参照图1至图2,图1至图2是本发明一个具体实施例的结构示意图。

[0013] 如图1至图2所示,一种基于电池梯次利用的分布式微电网系统,包括一用于提供外部供电的外部供电交流总线10、若干个用户光伏发电用电单元30,每个所述用户光伏发电用电单元30和所述外部供电交流总线10之间设置有能量输入输出监控单元20;每个所述用户光伏发电用电单元30包括用于接受太阳光照射进行光伏发电的太阳能电池板组件31、用于将所述太阳能电池板组件31输出的直流电进行分配管理的直流电分配管理器33、用于将所述太阳能电池板组件31输出的直流电转化为化学能进行储存的微电网蓄能电池、以及用于将所述太阳能电池板组件31输出的直流电转换为交流电的光伏发电逆变器37;所述光伏发电逆变器37连接有交流用电设备38,所述微电网蓄能电池包括梯次利用动力蓄电池组34和BMS控制器36,所述梯次利用动力蓄电池组34为电动车用动力锂电池单体构成,且所述电动车用动力锂电池单体的电池容量为额定容量的40%以下。进一步地,每个所述用户光伏发电用电单元30还包括用于汇集所述太阳能电池板组件31发电量的光伏发电接入盒32,所述光伏发电接入盒32连接所述太阳能电池板组件31,所述光伏发电接入盒32、所述微电网蓄能电池和所述光伏发电逆变器37均连接所述直流电分配管理器33,所述光伏发电接入盒

32、所述微电网蓄能电池和所述光伏发电逆变器37之间相互并联。

[0014] 进一步改进地,所述微电网蓄能电池还连接设置有外接整流逆变器35,所述外接整流逆变器35通过多余电能输出线路42和外部电能输入线路41连接所述外部供电交流总线10,且所述多余电能输出线路42和所述外部电能输入线路41之间相互并联;所述多余电能输出线路42用于将过剩的光伏发电量输出至所述外部供电交流总线10,所述外部电能输入线路41用于将所述外部供电交流总线10的电能输送至所述微电网能量管理装置;所述能量输入输出监控单元20包括光伏发电功率表22和外部供电功率表21,所述光伏发电功率表22设置于所述多余电能输出线路42上且用于监测输出功率,所述外部供电功率表21设置于所述外部电能输入线路41上且用于监测输入功率。

[0015] 所述太阳能电池板组件31工作时,光伏发电量通过所述光伏发电接入盒32输送至所述直流电分配管理器33,所述直流电分配管理器33优先通过所述光伏发电逆变器37将直流电转换为交流电,并向所述交流用电设备38供电,当所述交流用电设备38的总用电功率大于光伏发电提供的交流电时,所述外部供电线路10进行供电补充,当所述交流用电设备38的总用电功率小于光伏发电提供的交流电时,所述直流电分配管理器33开始对所述梯次利用动力蓄电池组34进行充电,当所述梯次利用动力蓄电池组34充电饱满时,多余的交流电输送至所述外部供电线路10进行剩余电量并网,所述光伏发电功率表22和所述外部供电功率表21可以实时监测居民用户的供电量和用电量;所述微电网蓄能电池通过设置所述外接整流逆变器35连接所述外部供电交流总线10,从而可以提高外部并网电能的质量和稳定性。

[0016] 以上对本发明的较佳实施进行了具体说明,当然,本发明还可以采用与上述实施方式不同的形式,熟悉本领域的技术人员在不违背本发明精神的前提下所作的等同的变换或相应的改动,都应该属于本发明的保护范围内。

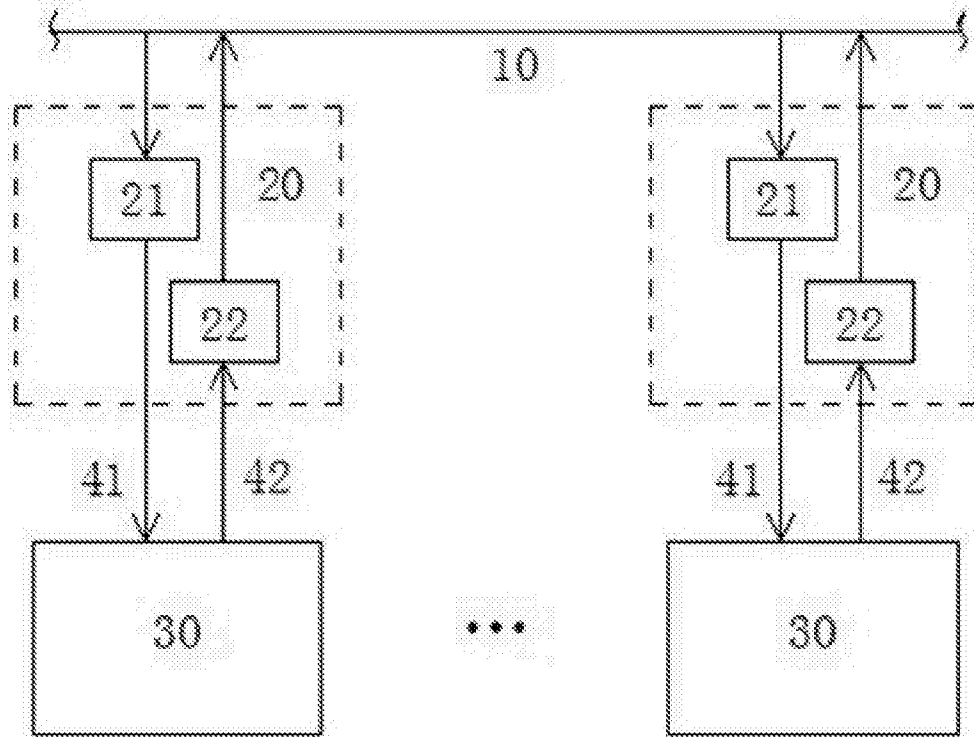


图1

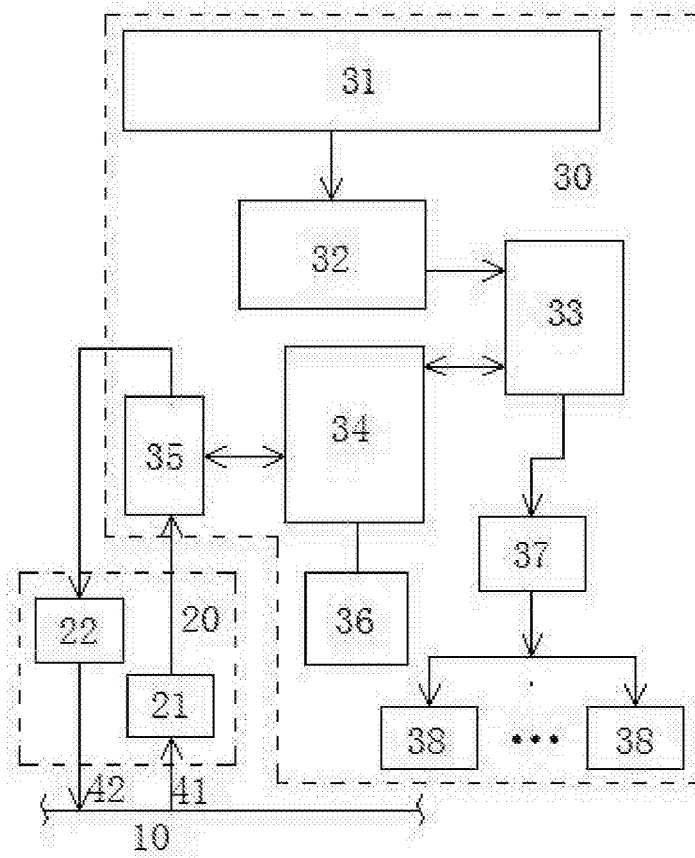


图2



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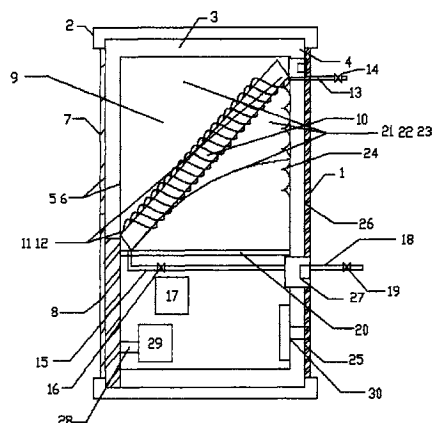
权利要求书 1 页 说明书 3 页 附图 1 页

(54) 发明名称

太阳能蓄热方法

(57) 摘要

一种太阳能蓄热方法,由金属框架,带有聚光放大镜的透光玻璃及太阳能光伏板、金属翅片夹套管及固定装置、热导出管及控制阀、回流管及控制阀、聚光反射板、吸热板、保温板、金属板、管道锁紧密闭装置、蓄电池、控制器组成蓄热体,金属翅片夹套管放在中空夹层中间,蓄热体可拼装组合成墙体也可独立置放供热和光伏供电,可广泛应用于建筑墙体、取暖、照明,广泛适用于家庭、宾馆、酒店、办公场所,可系列化、标准化生产。



1. 一种太阳能蓄热方法,其特征是:由金属框架,周边密闭板、分子筛吸潮条、密闭胶带、带有多点排列聚光放大镜的透光玻璃及太阳能光伏板、中空夹层、金属翅片夹套管及固定装置、热导出管及控制阀、回流引出管、控制阀、贮液蓄热罐、回流管及控制阀、隔离截断、多面聚光反射板、吸热板、保温板、金属板、管道锁紧密闭装置、蓄电池、控制器组成蓄热体。

2. 根据权利要求1所述的太阳能蓄热方法,其特征是:金属框架、周边密闭板组成的蓄热体可以拼装组合成墙面,分子筛吸潮条放置在上部,吸潮介质可更换活化,蓄热体可拼装组合成墙体也可独立置放供热和光伏供电。

3. 根据权利要求1所述的太阳能蓄热方法,其特征是:朝阳侧面上部为带有多点排列聚光放大镜的透光玻璃,下部为太阳能光伏板。

4. 根据权利要求1所述的太阳能蓄热方法,其特征是:金属翅片夹套管放在中空夹层中间,自朝阳侧带有聚光放大镜的透光玻璃下部向夹层另一侧上部倾斜,金属翅片管外套为真空注入介质,内套管注入可循环导热介质。

5. 根据权利要求1所述的太阳能蓄热方法,其特征是:吸热板为黑色吸热的金属距弦波纹板,多面反射板为反光弧度镜面。

6. 根据权利要求1所述的太阳能蓄热方法,其特征是:管道锁紧密闭装置为耐热橡胶密封垫通过螺旋压板,将管道紧固在金属板上。

太阳能蓄热方法

技术领域

[0001] 本发明是一种太阳能蓄热方法,更具体地说,运用这种新方法可以在光电转换同时完成光热转换和蓄热,属于太阳能应用技术领域。

背景技术

[0002] 现今太阳能应用技术,大多是独立的光伏转换、独立的光热转换系统,一些二者兼容系统,采用聚光跟踪,大容量蓄电池,投资大,使用环境参数要求复杂,故障率高、占地多。

[0003] 本发明,是一种光伏、光热同步转换,综合利用的太阳能蓄热方法,应用于建筑领域,可以拼装组成墙面,热、电一体;应用与采暖,可悬置放于朝阳面,适用于烹饪、烘烤、淋浴、照明。带有多点排列聚光放大镜的透光玻璃,多点聚焦,照射在金属翅片圆管上,太阳自东南偏移至正西之间,连续聚光照射,光照时间长,金属翅片圆管吸收面积大,多面反射镜增加光反射和夹层空间温升,金属翅片圆管表面可达 100 摄氏度以上的高温光热转换。

发明内容

[0004] 本发明是一种太阳能蓄热方法,由金属框架,周边密闭板、分子筛吸潮条、密闭胶带、带有多点排列聚光放大镜的透光玻璃及太阳能光伏板、中空夹层、金属翅片夹套管及固定装置、热导出管及控制阀、回流引出管、控制阀、贮液蓄热罐、回流管及控制阀、隔离截断、多面聚光反射板、吸热板、保温板、金属板、管道锁紧密闭装置、蓄电池、控制器组成蓄热体,应用该方法实现的墙体和独立置放蓄热体,建造成本低、运行成本低,节能减排。

[0005] 本发明具有以下特征:

[0006] 1. 金属框架、周边密闭板组成的蓄热体可以拼装组合成墙面,分子筛吸潮条放置在上部,吸潮介质可更换活化,蓄热体可拼装组合成墙体也可独立置放供热和光伏供电。

[0007] 2. 朝阳侧面上部为带有多点排列聚光放大镜的透光玻璃,下部为太阳能光伏板。

[0008] 3. 金属翅片夹套管放在中空夹层中间,自朝阳侧带有聚光放大镜的透光玻璃下部向夹层另一侧上部倾斜,金属翅片管外套为真空注入介质,内套管注入可循环导热介质。

[0009] 4. 吸热板为黑色吸热的金属正弦波纹板,多面反射板为反光弧度镜面。

[0010] 5. 管道锁紧密闭装置为耐热橡胶密封垫通过螺旋压板,将管道紧固在金属板上。

附图说明

[0011] 图 1、实施装置示意图

[0012] 图 2、金属翅片夹套管示意图

[0013] 结合附图说明如下:

[0014] 1、太阳能蓄热方法实施装置示意如图 1 所示,金属框架 1,周边密闭板 2,分子筛吸潮条 3,分子筛活化端口 4,密闭胶带 5、6,带有多点排列聚光放大镜的透光玻璃 7,太阳能光伏板 8,中空夹层 9,金属翅片夹套管 10,固定装置 11、12,热导出管 13,控制阀 14,回流引出管 15,控制阀 16,贮液蓄热罐 17,回流管 18,控制阀 19,隔离截断 20,多面聚光反射板 21、

22、23,吸热板 24,保温板 25,金属板 26,管道锁紧密闭装置 27,光伏连接线 28,蓄电池 29,控制器 30。

[0015] 2、金属翅片夹套管结构示意图如图 2 所示,金属翅片管外套 1,内套管 2,热导出管 3,控制阀 4,回流引出管 5,控制阀 6。

具体实施方式

[0016] 1、如图 1 所示太阳能蓄热方法实施装置材料加工说明：

[0017] 1.1 金属框架采用通用的铝合金或钢材方管加工成型。

[0018] 1.2 周边密闭板采用铝合金或镀锌板冲压成型,留有组装凹凸配合插槽。

[0019] 1.3 分子筛吸潮条采用铝合金筛眼型材使用通用的中空玻璃用分子筛,留有活化端口。

[0020] 1.4 密闭胶带采用通用的丁基高粘性密封胶带。

[0021] 1.5 多点排列聚光放大镜的透光玻璃,钢化玻璃在上部间隔加工聚光放大镜,下部复合封装太阳能光伏板,也可分段拼接。

[0022] 1.6 金属翅片夹套管采用夹套双层,外层为焊接翅片管,内部为挤压翅片管,外层真空密闭注入 60 摄氏度沸点介质,内层翅片管穿透外层上下,留出连接端口,注入 35 摄氏度相变介质或循环水。

[0023] 1.7 固定装置采用通用的紧固装置,与金属框架螺栓连接。

[0024] 1.8 热导出管、回流引出管、回流管、控制阀采用通用的金属管和管道控制阀们。

[0025] 1.9 贮液蓄热罐采用双层中空夹层保温桶,外层做保温防护,内部置放相变蓄热储能材料,冬季可直接使用热交换器,用于室内取暖,夏季蓄热用于烹饪、淋浴等生活热源。

[0026] 1.10 多面聚光反射板采用金属箔板,弧度置放在夹层光反射部位,最少分布在下部和立侧面两个面。

[0027] 1.11 吸热板采用铝箔附图黑色加工为正弦波纹。

[0028] 1.12 保温板采用超细玻璃棉复合玻璃丝铝箔布,隔离截断用金属板材作支撑,保温板材做温度隔离。

[0029] 1.13 金属板为镀锌板材或铝合金板材。

[0030] 1.14 管道锁紧密闭装置采用金属或阻燃塑料材料做成螺旋压紧卡箍,中间填充橡胶密封材料。

[0031] 1.15 光伏连接线、蓄电池、控制器采用通用的导线、蓄电池和控制器。

[0032] 2、如图 1 所示太阳能蓄热方法实施装置的使用方法

[0033] 以双板建筑安装使用为例：

[0034] 2.1 蓄热体两个接触周边之间用密封胶带密闭连接,其他周边镶嵌安装后周边做密闭封装；

[0035] 2.2 光照时,吸热板吸收热量,空间夹层温度上升,太阳照通过透光玻璃上的多点排列聚光放大镜照射金属翅片套管,在小于平角的范围内,金属翅片管不同位置随太阳照射角变化,依据多点排列聚光放大镜聚光的不同位置产生不同的聚光温度点,多点分布,吸热热效率高；反射板将阳光反射到金属翅片管上,增加热辐射效果。

[0036] 2.3 蓄热体与蓄热旁通管、热源连接导管、暖气片通过控制阀连接,在夏季,热介质

通过旁通管积蓄在贮液蓄热罐内,使用时,可以实现人工或自动控制,热介质流经热源连接导管和热交换器,用于烹饪、淋浴等;在冬季,直接通过暖气片进行换热。

[0037] 2.4 热量蓄积,内翅片管内热介质循环散热,吸收金属翅片套管外管的相变潜热,经过贮液蓄热罐积蓄热能并可经过外界热交换器,转换贮存热能。

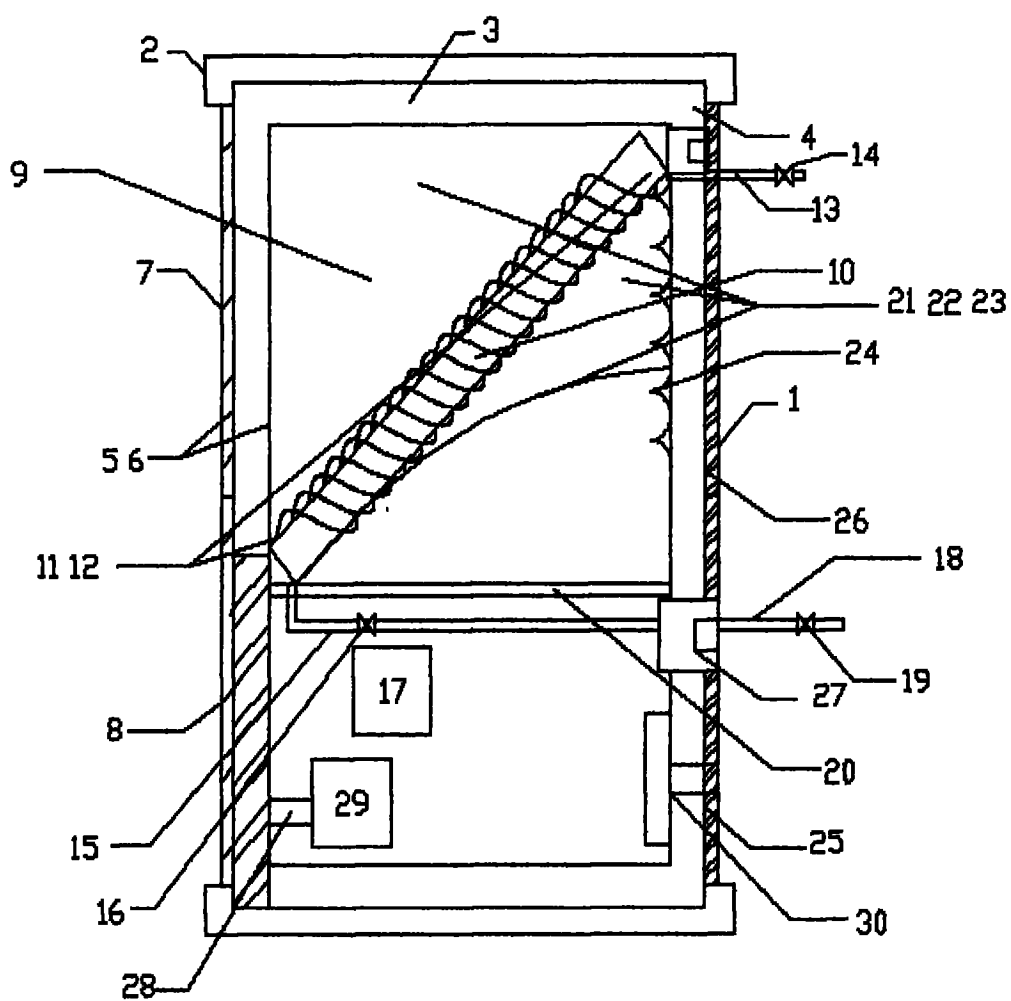


图 1

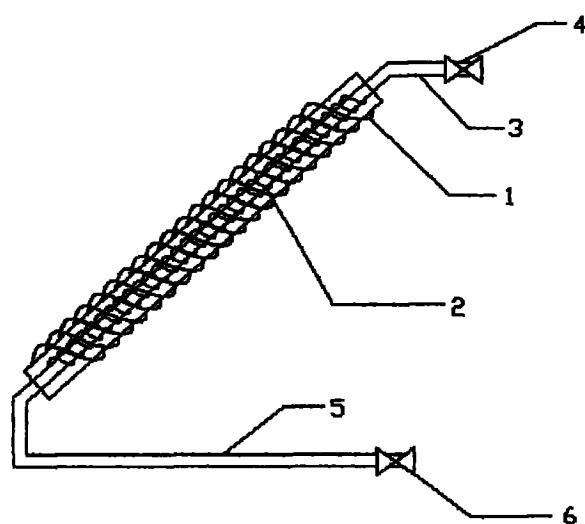


图 2