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(54) SELF-CONTAINED RENEWABLE BATTERY CHARGER
ERNEUERBARE AUTONOME BATTERIELADEVORRICHTUNG
CHARGEUR DE BATTERIE AUTONOME À ÉNERGIE RENOUVELABLE

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Description

FIELD OF THE INVENTION

[0001] The present invention pertains generally to electric charging systems for vehicles and devices. More particularly, the present invention pertains to systems and methods for charging electric vehicles using solar energy. The present invention is particularly, but not exclusively, useful as a portable, self-contained charging system for efficiently storing energy from solar arrays and using the stored energy to charge the batteries of an electric vehicle.

BACKGROUND OF THE INVENTION

[0002] Electric vehicles (EV), which can include all-electric vehicles and hybrids such as gas / electric vehicles, are growing in popularity among consumers. These vehicles offer an environmentally friendly alternative to vehicles powered exclusively by petroleum products. In particular, EV's have lower emissions of smog precursor gases, and they emit little to no greenhouse gases which have been linked to 'global warming'. In addition, as the cost of petroleum products has increased, the use of electric vehicles has become more economically beneficial.

[0003] Modernly, nearly all EV's include one or more on-board batteries for storing the electrical energy that is necessary to drive one or more electric motors and produce vehicle locomotion. One technique for recharging the on-board batteries includes connecting the vehicle to a permanently installed recharging station which receives its power from the electrical grid. For example, most EV operators have a charging station at the location where the car is usually stored, such as the operator's home or business. Unfortunately, access to additional recharge stations is somewhat limited at the present time in most areas. Although the range that an EV is able to travel before its battery must be recharged has improved in recent years, EV's still require a recharge during trips of moderate to long duration.

[0004] As electric vehicles become more common, for many EV operators, their electric vehicle may be their only vehicle. As such, many of these EV operators will desire to use their electric vehicle for all of their transportation needs including relatively long trips such as vacations, etc. To increase the useful range of the electric vehicle, operators will need to access charging stations at locations other than their primary vehicle storage sites. In some cases, there may be a need to provide a charging station on a temporary basis, for example, to provide coverage at a particular event. Alternatively, it may be desirable to provide a temporary charging station at a remote location while a more permanent charging station is being installed. In some instances, the temporary location requiring a charging station may not have ready access to the electrical grid. In other instances, the cost of providing a permanently installed charging station may be prohibitive or the lead-time associated with a permanent installation may be unsatisfactory.

[0005] In light of the above, it is an object of the present invention to provide a system for effectively and efficiently charging electric vehicles that can be flexibly moved to a variety of different locations where EV charging is needed. Another object of the present invention is to provide a system and method for quickly establishing an EV charging station at a location without requiring access to power from the electrical grid. Yet another object of the present invention is to provide a portable, self-contained system that is capable of providing renewable energy from solar arrays to charge an EV. An additional object of the present invention is to provide a self-contained renewable battery charger that is easy to use, is relatively simple to manufacture, and is comparatively cost effective. XP 040510112 discloses a local photovoltaic charging station for electric vehicles.

SUMMARY OF THE INVENTION

[0006] Aspects of the invention are disclosed in independent claim 1.

[0007] In a first embodiment of the present invention, the solar array is configured to produce a direct current (DC) output. For this embodiment, the current from the solar array is fed to the storage battery using charge management electronics. The battery, in turn, is connected to an EV charge station which produces a charging current to charge an external battery, such as the battery of an electric vehicle. An inverter can also be provided in the portable unit to generate alternating current (AC) from the DC battery output. The AC power from the inverter can be fed to the EV charge station and / or other AC loads in the portable unit such as lights, 120VAC outlets, USB outlets, etc.

[0008] In another embodiment of the present invention, the solar array is configured to produce an AC output. For example, each photovoltaic module in the solar array can include a micro-inverter. For this embodiment, the combined current from the photovoltaic modules is converted to DC at an inverter/charger and fed to the storage battery. In addition, AC power from the solar array can be fed to an EV charge station through the inverter/charger. Finally, the inverter/charger can convert DC power from the battery storage to AC power for the EV charge station. The storage battery can also connect directly to the EV charge station. With this arrangement, the EV charge station can produce a charging current for the EV battery from the AC solar array power which is supplemented with power from the storage battery.

[0009] Also for the present invention, a tracking mechanism can be integrated into the column for moving the solar array to adjust the solar array orientation and maximize the incidence of sunlight on the photovoltaic modules. More specifically, the tracking mechanism can be positioned to interconnect a stationary portion of the column with the solar array. With this arrangement, the
tracking mechanism can be used to selectively move the solar array relative to the stationary docking pad. In some cases, the solar array movements can be in accordance with a predetermined cycle that is developed based on the position and movements of the sun.

[0010] To assist in transporting the portable unit, a pivot mechanism can be provided between the column and docking pad to selectively pivot the solar array between a deployed configuration and a stowed configuration. In the deployed configuration, the solar array extends from the column to a free end and overlays the base. In the deployed configuration, the solar array and docking pad are arranged to provide ballast to the portable unit to prevent tipping in adverse weather conditions. The ballast against tipping is further increased by the weight and arrangement of the storage batteries in the docking pad compartment. In the stowed configuration, the solar array is folded about the pivot point such that the free end of the solar array is adjacent to the docking pad. Once adjacent to the docking pad, the free end can be attached to the docking pad to secure the solar array for transport.

[0011] In a particular arrangement of the portable EV battery charging unit, the docking pad is shaped substantially as a right rectangle with long sides and shorter ends. In some cases, the docking pad can be formed with wheel blocks to stabilize the vehicle on the docking pad. To provide for an alignment of the vehicle on the docking pad, a portion of the docking pad can be formed to extend upwardly from the docking pad base and is centered on the docking pad base.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The novel features of this invention, as well as the invention itself, both as to its structure and its operation, will be best understood from the accompanying drawings, taken in conjunction with the accompanying description, in which similar reference characters refer to similar parts, and in which:

Fig. 1 is a front perspective view of a self-contained renewable battery charger in an operational environment;

Fig. 2 is rear perspective view of the self-contained renewable battery charger shown in Fig. 1;

Fig. 3 is a schematic illustration showing an arrangement of electrical components for use in a self-contained renewable battery charger in which the solar array provides a DC output;

Fig. 4 is a schematic illustration showing a second arrangement of electrical components for use in a self-contained renewable battery charger in which the solar array provides a AC output; and

Fig. 5 is a perspective view of a self-contained renewable battery charger loaded on a carriage for transport with the solar array positioned in a stowed configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Referring initially to Fig. 1, a system in accordance with the present invention is shown and is generally designated 10. As shown, the system 10 includes a portable unit 12 for charging an electric vehicle 14. As described herein, the portable unit 12 can be transported, after assembly, to a location such as the parking lot shown, where it can operate to charge an electric vehicle 14 without necessarily being connected to the electrical grid (not shown) or another source of electrical power.

[0014] Cross-referencing Figs. 1 and 2, it can be seen that the portable unit 12 includes a moveable docking pad 16 having a base 18 and a compartment 20 for holding at least one storage battery 22 and electronics (see Fig. 3). It is to be appreciated that the term ‘battery’ as used herein includes a battery bank having one or more batteries and / or battery cells that are operatively connected together. As shown, the base 18 of the docking pad 16 may be of suitable construction to support the weight of a vehicle 14 and formed with bumps to help hold the vehicle 14 on the base 18. Typically, as shown, the base 18 can include a generally flat, horizontal portion and a ramp to allow the vehicle 14 to access and park on the horizontal portion. It can further be seen that the portable unit 12 includes a column 24 having a first end 26 that is mounted onto the docking pad 16 and a second column end 28. As shown, the column 24 is oriented to extend upwardly, and in some cases vertically, from the docking pad 16.

[0015] Continuing with reference to Figs 1 and 2, it can be seen that a solar array 30 is affixed to the second end 28 of the column 24. For the arrangement shown, a structural canopy having a beam 32 and cross members 34 is attached to the column 24 to support a plurality of photovoltaic modules 36 (best seen in Fig. 2) that are arranged in the array 30. For the present invention, the photovoltaic modules 36 can include any type of photovoltaic cell known in the pertinent art.

[0016] Fig. 3 shows an embodiment of the present invention in which the solar array 30 is configured to produce a direct current (DC) output. As shown, an exemplary string(s) of photovoltaic modules 36 are electrically connected in parallel to produce an electrical output that is fed to a Charge Controller 38 which includes a Maximum Power Point Tracker. The CC 38 functions as a DC to DC converter that provides the most efficient power draw from solar array 30 using maximum power point tracking logic while managing DC battery charging. The output of the CC 38 is fed to the storage battery 22 using Battery Management System (BMS 40). The battery 22 is sized with a capacity to store enough energy for EV charging, e.g. level 1 (110V) or level 2 (220V) EV charging, and to provide continuous system functionality. The BMS 40 ensures correct battery charging, discharging, balancing, and may be included or excluded depending on battery chemistry. Inverter 42 receives and converts a DC battery output to alternating current (AC), which is
turn, is directed to an electric vehicle charging station 44 (see also Fig. 2). In addition, as shown in Fig. 3, auxiliary AC loads 48, which can include, for example, lights and 120VAC and USB outlets, can be powered from the inverter 42 or through an optional transformer 46.

[0017] As shown in Fig. 3, the Electric Vehicle Charging Station 44 receives DC power from the battery 22 and can also receive AC power from the inverter 42. Typically, the components are sized to allow the Electric Vehicle Charging Station 44 to provide Level 2 EV charging. In level 2 EV charging, AC energy is provided to the onboard charger of the vehicle 14. The AC energy is in the range of 208 - 240 volts, single phase, with a maximum current of 32 amps (continuous) and a branch circuit breaker rated at 40 amps.

[0018] Fig. 3 also shows that one or more DC/DC converters 50 can be provided to produce a constant DC voltage from a battery 22 output that is suitable for auxiliary DC loads 52. These DC loads can include, for example, motors, controllers, network hardware, and USB outlets. In addition to the components shown in Fig. 3, it is to be appreciated that one or more breakers and/or relays (not shown) may be included for proper system control and safety.

[0019] For some applications, an all DC arrangement may be used. For this arrangement, the components of Fig. 3 can be used without the AC components (box 54). For this arrangement, the vehicle charging station 44 receives DC power from the battery 22 and provides DC energy to an on-board charger of the vehicle 14. In some cases, the all-DC system may be more energy efficient because DC to AC conversion losses are eliminated.

[0020] Fig. 4 shows another embodiment of the present invention in which the solar array 30' is configured to produce an AC output. As shown, each photovoltaic module 36a'-36i' in the solar array 30' includes a respective micro-inverter 56a-i. For the embodiment shown in Fig. 4, each micro-inverter contains maximum power point tracking logic to ensure that the most efficient power draw is obtained from solar array 30'. As shown, a string(s) of photovoltaic modules 36 are electrically connected in parallel to produce an electrical output that is fed to the inverter / charger 58. In an optional embodiment, a charge controller as described above with reference to Fig. 3 can be connected to the output of the solar array 30'. MPPT 38'. Alternatively, the solar array 30' can feed a string inverter (not shown) replacing the micro-inverters 56a-f shown in Fig. 4.

[0021] Continuing with Fig. 4, it can be seen that AC from the solar array 30' can be converted to DC at an inverter / charger 58 and fed to the storage battery 22' using a battery management system 40' (as described above). In addition, the inverter / charger 58 can tunnel AC power from the solar array 30' to the EV charge station 44' and/or convert DC from the battery 22' to AC and feed the AC to the charge station 44'.

[0022] For the Fig. 4 embodiment, the battery 22' is sized with a capacity to store enough energy for EV charging, e.g. level 1 (110V) or level 2 (220V) EV charging, and to provide continuous system functionality. In addition, as shown in Fig. 4, auxiliary AC loads 48', which can include, for example, motors, controllers, network hardware, USB outlets, lights and 120VAC and USB outlets, can also be powered from the inverter / charger 58 or through an optional transformer 46'. Also shown, the Electric Vehicle Charging Station 44' may receive DC power from the battery 22'.

[0023] Fig. 4 also shows that one or more DC/DC converters 50' can be provided to produce a constant DC voltage from a battery 22' output that is suitable for auxiliary DC loads 52'. These DC loads can include, for example, motors, controllers, network hardware, and USB outlets. In addition to the components shown in Fig. 4, it is to be appreciated that one or more breakers and/or relays (not shown) may be included for proper system control and safety.

[0024] Referring back to Fig. 1, it can be seen that the portable unit 12 can also include a tracking mechanism 60 that is integrated into the column 24 for moving the solar array 30. This mechanism can be performed to adjust to the orientation of the solar array 30 to maximize the incidence of sunlight on the solar array 30 (i.e. point the solar array 30 toward the sun). This adjustment can be made initially during setup and installation and/or during operation. As shown, the tracking mechanism 60 can be positioned to interconnect a stationary portion 62 of the column 24 with a moveable portion 64 of the column 24, which in turn, is attached to the solar array 30. For example, a suitable tracking mechanism for use in the present invention is disclosed and claimed in co-owned US Patent Application No. 13/099,152, titled, "Device for Continuously Orienting a Solar Panel", filed May 2, 2011 for inventors Robert L. Noble and Desmond Wheatley (Attorney Docket Number 11472.4), the entire contents of which are hereby incorporated by reference herein. With the arrangement shown in Fig. 1, the tracking mechanism 60 can be used to selectively move the solar array 30 relative to the stationary docking pad 16. In some cases, the movements of the solar array 30 can be in accordance with a predetermined cycle that is developed based on the position and movements of the sun.

[0025] Fig. 5 shows that the portable unit 12 can include a pivot mechanism 66 located between the column 24 and docking pad 16. Cross-referencing Figs. 1 and 5, it can be seen that the pivot mechanism 66 allows the solar array 30 and column 24 to be pivoted between a deployed configuration (Fig. 1) and a stowed configuration (Fig. 5). In the deployed configuration shown in Fig. 1, the solar array 30 extends from the column 24 to a free end 68 and overlays the docking pad 16. More specifically, the solar array 30 is positioned above the docking pad 16. Regardless whether the solar array 30 is in the deployed configuration (Fig. 1), or in the stowed configuration (Fig. 5), the docking pad 16 provides ballistic (i.e. balance) to the portable unit 12 to prevent tipping. This ballast against tipping is further increased due to
Continuing with Fig. 5, it can be seen that the solar array 30 can be secured for transport. The free end 68 can be attached to the docking pad 16 to ensure that it is stowed configuration (Fig. 5), the solar array 30 is folded about the pivot mechanism 66 such that the free end 68 opposite the pivot mechanism 66 is adjacent to the docking pad 16. Once adjacent to the docking pad 16, the free end 68 can be attached to the docking pad 16 to secure the solar array 30 for transport.

In the stowed configuration (Fig. 5), the solar array 30 is folded about the pivot mechanism 66 such that the free end 68 opposite the pivot mechanism 66 is adjacent to the docking pad 16. Once adjacent to the docking pad 16, the free end 68 can be attached to the docking pad 16 to secure the solar array 30 for transport.

[0026] Continuing with Fig. 5, it can be seen that the docking pad 16 can be shaped substantially as a right rectangle with long sides 70 and shorter ends 68, 72 and includes a housing 74 for holding some or all of the electrical components shown in Figs. 3 or Fig. 4. As shown, the docking pad 16 is sized to accommodate an electric vehicle 14 (see Fig. 1) and can be formed with wheel blocks 76 to stabilize the vehicle 14 on the docking pad 16. Also shown, the docking pad compartment 20 can be formed to extend upwardly from the docking pad base 18. In addition, the raised compartment 20 can be centered on the docking pad 16 between the sides 70 to provide for an alignment of the vehicle 14 (see Fig. 1) on the docking pad 16 to reduce the risk of a vehicle 14 accidently driving off the side of the docking pad 16.

[0027] Fig. 5 further illustrates that the portable unit 12 can be transported on a carriage 78 having wheels 80 and a ball-hitch receiver 82 for attachment to a tow vehicle such as a truck (not shown). For example, the portable unit 12 can be lifted from the carriage 78 using jacks, e.g., four jacks (not shown). Once lifted, the carriage can be rolled out from underneath the portable unit 12 and the portable unit 12 can be lowered into an operational position using the jacks. Once properly positioned, the pivot mechanism 66 can be used to deploy the solar array 30. To transport the portable unit 12 from a site, the portable unit 12 can be jacked up, the carriage 78 rolled underneath and the jacks used to lower the portable unit 12 onto the carriage 78. Alternatively, a crane (not shown) or forklift (not shown) may be used to load or unload the portable unit 12 onto / from a carriage 78 or truck (not shown).

[0028] As envisioned for the system 10, the portable unit 12 can be remotely monitored in any manner well known in the pertinent art. Stated differently, the health, performance and environmental condition pertinent to the operation of system 10 can be monitored on a continuous basis.

[0029] While the particular Self-contained Renewable Battery Charger as herein shown and disclosed in detail is fully capable of obtaining the objects and providing the advantages herein before stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as described in the appended claims.

Claims

1. A transportable unit (12) for providing a self-contained renewable battery charger (58) for an electric vehicle (14) which comprises:

   a movable docking pad (16) having a base (18) with an access ramp for parking the electric vehicle (14) on the base (18) wherein the docking pad (16) is also formed with a compartment (20) for holding at least one storage battery (22) therein;

   a column (24) mounted on the docking pad (16) for movement therewith and oriented substantially perpendicular thereto, with the column (24) extending away from the docking pad (16) and terminating at an attachment point;

   a substantially flat panel (30) affixed to the attachment point on the column (24) for movement with the column (24);

   an array of photovoltaic modules (36) supported on the panel (30) for movement therewith to convert solar energy from sun light into electrical energy, for transfer of the electrical energy from the photovoltaic modules (36) to the storage battery (22) in the compartment (20); and

   a charging station (44) selectively positioned on the docking pad (16) for movement therewith, and electrically connected with the storage battery (22) in the compartment (20) to establish a source for recharging an external battery in the electric vehicle (14).

2. A transportable unit as recited in claim 1 further comprising a charging management system electrically interconnecting the array of photovoltaic modules with the storage battery.

3. A transportable unit as recited in claim 1 further comprising an inverter electrically interconnecting the storage battery with the charging station to selectively convert direct current from the storage battery into an alternating current for the charging station.

4. A transportable unit as recited in claim 1 further comprising a tracking mechanism integrated into the column to interconnect a stationary portion of the column with the panel for moving the panel relative to the docking pad in accordance with a predetermined cycle to maximize the incidence of sunlight on the photovoltaic modules.

5. A transportable unit as recited in claim 1 wherein the docking pad is shaped substantially as a right rectangle with long sides and shorter ends, and wherein...
the column is located at an end of the docking pad to provide ballast for the unit, with the panel extending over the docking pad from the attachment point on the column to a free end of the panel.

6. A transportable unit as recited in claim 5 further comprising a pivot mechanism to selectively pivot the panel and column relative to the docking pad about a pivot point for lowering and securing the free end of the panel to the docking pad for transport of the unit.

7. A transportable unit as recited in claim 6 further comprising a carriage, wherein the carriage is selectively engaged with the docking pad to facilitate transport of the unit.

Patentansprüche

1. Transportable Einheit (12) zum Vorsehen eines in sich geschlossenen, erneuerbaren Batterieladegeräts (58) für ein elektrisches Fahrzeug (14), die Folgendes aufweist:

   ein bewegbares Andockpad (16), das eine Basis (18) mit einer Zugangsrampe zum Parken des elektrischen Fahrzeugs (14) an der Basis (18) aufweist, wobei das Andockpad (16) auch mit einem Fach (20) zum Halten wenigstens einer Speicherbatterie bzw. eines Akkus darin ausgebildet ist;

   eine Säule (24), die an dem Andockpad (16) zur Bewegung damit montiert ist und im Wesentlichen senkrecht dazu ausgerichtet ist, wobei sich die Säule von dem Andockpad (16) weg erstreckt und an einem Befestigungspunkt endet;

   eine im Wesentlichen flache Platte (30), die an dem Befestigungspunkt an der Säule (24) zum Bewegen mit der Säule (24) befestigt ist;

   eine Anordnung von Photovoltaikmodulen (36), die auf der Platte (30) zum Bewegen damit getragen ist, um Solarenergie aus Sonnenlicht in elektrische Energie umzuwandeln, um die elektrische Energie von den Photovoltaikmodulen (36) zur Speicherbatterie (22) in dem Fach (20) zu übertragen; und

   eine Ladestation (44), die selektiv an dem Andockpad (16) zur Bewegung damit positioniert ist und elektrisch mit der Speicherbatterie (22) in dem Fach (20) verbunden ist, um eine Quelle zum Aufladen einer externen Batterie in dem elektrischen Fahrzeug (14) herzustellen.

2. Transportable Einheit nach Anspruch 1, die ferner ein Lademanagementsystem aufweist, das die Anordnung von Photovoltaikmodulen mit der Speicherbatterie elektrisch verbindet.

3. Transportable Einheit nach Anspruch 1, die ferner einen Inverter aufweist, der die Speicherbatterie elektrisch mit der Ladestation verbindet, um selektiv Gleichstrom von der Speicherbatterie in einen Wechselstrom für die Ladestation umzuwandeln.

4. Transportable Einheit nach Anspruch 1, die ferner einen in die Säule integrierten Verfolgungsmechanismus aufweist, um einen stationären Abschnitt der Säule mit der Platte zu verbinden, um die Platte relativ zu dem Andockpad gemäß einem vorbestimmten Zyklus zu bewegen, um den Sonnenlichteinfall an den Photovoltaikmodulen zu maximieren.

5. Transportable Einheit nach Anspruch 1, wobei das Andockpad im Wesentlichen als ein Rechteck mit langen Seiten und kürzeren Enden geformt ist, und wobei die Säule an einem Ende des Andockpads angeordnet ist, um einen Ballast für die Einheit vorzusehen, wobei sich die Platte über dem Andockpad vom Befestigungspunkt an der Säule zu einem freien Ende der Platte erstreckt.

6. Transportable Einheit nach Anspruch 5, die ferner einen Schwenkmechanismus zum selektiven Schwenken der Platte und der Säule relativ zu dem Andockpad um einen Drehpunkt zum Absenken und Sichern des freien Endes der Platte an dem Andockpad zum Transportieren der Einheit aufweist.

7. Transportable Einheit nach Anspruch 6, die ferner einen Wagen aufweist, wobei der Wagen selektiv mit dem Andockpad in Eingriff steht, um den Transport der Einheit zu erleichtern.

Revendications

1. Unité transportable (12) pour procurer un chargeur de batterie renouvelable autonome (58) pour un véhicule électrique (14), qui comprend :

   un bloc d’accostage mobile (16) comportant une base (18) avec une rampe d’accès pour stationner le véhicule électrique (14) sur la base (18), le bloc d’accostage (16) étant également formé avec un compartiment (20) pour supporter au moins une batterie de stockage (22) à l’intérieur de celui-ci ;

   une colonne (24) montée sur le bloc d’accostage (16) pour un mouvement avec celui-ci, et orientée de façon sensiblement perpendiculaire à celui-ci, la colonne s’éloignant du bloc d’accostage (16) et s’achevant en un point de fixation ;

   un panneau sensiblement plat (30) fixé au point de fixation sur la colonne (24) pour un mouvement avec la colonne (24) ;

   un groupement de modules photovoltaïques
supportés sur le panneau (30) pour un mouvement avec celui-ci afin de convertir de l’énergie solaire à partir de la lumière solaire en énergie électrique, pour le transfert de l’énergie électrique des modules photovoltaïques (36) à la batterie de stockage (22) dans le compartiment (20) ; et une station de charge (44) positionnée de façon sélective sur le bloc d’accostage (16) pour un mouvement avec celui-ci, et électriquement connectée à la batterie de stockage (22) dans le compartiment (20) de façon à établir une source pour recharger une batterie externe dans le véhicule électrique (14).

2. Unité transportable selon la revendication 1, comprenant de plus un système de gestion de charge interconnectant électriquement le groupement de modules photovoltaïques à la batterie de stockage.

3. Unité transportable selon la revendication 1, comprenant de plus un onduleur interconnectant électriquement la batterie de stockage à la station de charge de façon à convertir de façon sélective un courant continu à partir de la batterie de stockage en un courant alternatif pour la station de charge.

4. Unité transportable selon la revendication 1, comprenant de plus un mécanisme de suivi intégré dans la colonne de façon à interconnecter une partie fixe de la colonne et le panneau afin de déplacer le panneau par rapport au bloc d’accostage selon un cycle prédéterminé de façon à maximiser l’incidence de la lumière solaire sur les modules photovoltaïques.

5. Unité transportable selon la revendication 1, dans laquelle le bloc d’accostage est formé sensiblement sous la forme d’un rectangle avec des longueurs et des extrémités plus courtes, et dans laquelle la colonne est disposée à une extrémité du bloc d’accostage de façon à constituer un ballast pour l’unité, le panneau s’étendant au-dessus du bloc d’accostage du point de fixation sur la colonne à une extrémité libre du panneau.

6. Unité transportable selon la revendication 5, comprenant de plus un mécanisme de pivot pour faire pivoter de façon sélective le panneau et la colonne par rapport au bloc d’accostage autour d’un point de pivot de façon à abaisser et à fixer l’extrémité libre du panneau vers le bloc d’accostage pour le transport de l’unité.

7. Unité transportable selon la revendication 6, comprenant de plus un chariot, dans laquelle le chariot vient en prise de façon sélective avec le bloc d’accostage de façon à faciliter le transport de l’unité.
FIG. 3
REFERENCES CITED IN THE DESCRIPTION

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