

PLANTING STRUCTURE WITH SOLAR PHOTOVOLTAIC POWER GENERATION
FUNCTION

BACKGROUND OF THE INVENTION

Field of the Invention

[0001]

The present disclosure relates to a planting structure having a solar photovoltaic power generation function.

Related Art

[0002]

As a method for effectively utilizing a building roof, solar photovoltaic power generation is carried out by installing solar cell panels on the roof. Solar photovoltaic power generation is regarded as important for generating renewable energy. Furthermore, as a method of effectively utilizing a building roof, rooftop greenery has also been carried out (e.g., Japanese Unexamined Patent Application, Publication No. 2005-198517). By carrying out the rooftop greenery, effects such as an improvement in thermal insulation of buildings, improvement in landscape, global warming countermeasures, and heat island effect countermeasures can be expected. Both a solar cell panel and rooftop greenery can be easily installed and carried out together. However, this will not increase the efficiency of roof use. If the rooftop greenery can also be carried out beneath the solar cell panel, the efficiency of roof utilization could be dramatically

increased. Furthermore, it is also known that the power generation efficiency of a solar cell panel generally decreases when the temperature becomes high. If the solar cell panel is installed above the rooftop greenery, it is expected that the rise in ground surface temperature in the daytime will be suppressed by the rooftop greenery, a result of which the power generation efficiency of the solar cell panel will improve by suppressing the temperature rise of the solar cell panel.

[0003]

Since an external force such as wind pressure caused by weather phenomena affects the solar cell panel, it is required to firmly install the solar cell panels above the building roof. Therefore, a base is required for installing a support mount and racking of the solar cell panel above the building roof. On the other hand, with regard to the rooftop greenery, it is necessary to supply water such as rainwater for plant growth maintenance. However, the rainwater is shielded by the solar cell panel when the solar cell panel is provided above the rooftop greenery, a result of which the water will not be supplied to the plants under the solar cell panel. As a means to solve this, a means for installing irrigation pipes on the surface of planting has been considered. However, depending on the type of planting, or when the grass height is low, such irrigation pipes are exposed on the surface of planting, which impairs the aesthetic appearance in greening. Furthermore, as another method for supplying water to such rooftop greenery, a

method in which a tray-shaped water reserving member is provided to supply water from the bottom thereof has also been considered. However, in a case of carrying out the rooftop greenery also beneath the solar cell panel, the base of the solar cell panel is supposed to be disposed on the upper side of the tray-shaped water reserving member, and is also disposed on the planar inside thereof. In such a case, the base of the solar cell panel cannot be installed directly on the building roof, which makes it difficult to firmly install the solar cell panel. Therefore, in reality, it is not possible to carry out the rooftop greenery beneath the solar cell panel. Furthermore, in a case of carrying out the rooftop greenery after the installation of the solar cell panel as well, the problem has not been solved in that the rainwater supply to the greening surface is shielded by the solar cell panel still.

[0004]

Patent Document 1: Japanese Unexamined Patent
Application, Publication No. 2005-198517

SUMMARY

[0005]

It is an object of the present disclosure to provide a planting structure having a solar photovoltaic power generation function in which a base of a solar cell panel can be installed directly and firmly above the roof of a building, and the flooding property in tray-shaped members can improve.

[0006]

The present disclosure solves the above problem by way of the following solution means. In order to facilitate understanding, reference numerals corresponding to embodiments of the present disclosure will be given and described. However, the present disclosure is not limited thereto.

[0006a]

In an aspect, the present disclosure provides a planting structure having a solar photovoltaic power generation function, the planting structure comprising: a building that includes a building upper part; a planting base that is disposed above an upper surface of the building upper part; and a solar cell panel supported with a structure that includes a base and a leg provided to the upper surface of the building upper part, and the solar cell panel is provided to be sloped at a predetermined angle at a position covering at least a portion of the planting base, wherein the planting base includes: a plurality of tray-shaped members that are disposed to surround the base and retain water inside, a water receiver that is disposed at a position at which water on the solar cell panel flows down; and a replenishing member that replenishes the tray-shaped members disposed at a position at which water is not directly supplied from the water receiver with water from adjacent other tray-shaped members, and wherein the replenishing member includes a lower portion along a bottom face of the tray-shaped member and an upper portion provided along both upper ends of adjacent tray-shaped members, with a portion extending in a

vertical direction as a center.

[0007]

A first embodiment of the present disclosure relates to a planting structure (1) having a solar photovoltaic power generation function, the planting structure (1) including: a building that includes a building upper part; a planting base (2) that is disposed above an upper surface (RT) of the building upper part; and a solar cell panel (11) that includes a base (13) and a leg (12) provided to the upper surface (RT) of the building upper part, and is provided to be sloped at a predetermined angle at a position covering at least a portion of the planting base (2), in which the planting base (2) includes: a plurality of tray-shaped members (30) that is disposed to surround the base (13) and retain water inside, a water receiver (60) that is disposed at a position at which water on the solar cell panel (11) flows down; and a replenishing member (52) that replenishes the tray-shaped members (30) disposed at a position at which water is not directly supplied from the water receiver (60) with water from adjacent other tray-shaped members (60).

[0008]

A second embodiment of the present disclosure relates to the

planting structure (1) having a solar photovoltaic power generation function according to the first embodiment, in which the tray-shaped member (30) is substantially in a rectangular shape when viewed from above.

[0009]

A third embodiment of the present disclosure relates to the planting structure (1) having a solar photovoltaic power generation function according to the first embodiment or the second embodiment, in which the water receiver (60) is disposed at a position at which water falls down from a lower end which is on a lower side of the slope of the solar cell panel (11).

[0010]

A fourth embodiment of the present disclosure relates to the planting structure (1) having a solar photovoltaic power generation function according to the third embodiment, in which the water receiver (60) is provided to intersect the plurality of tray-shaped members (30) over substantially an entire length of a side of the lower end of the solar cell panel (11).

[0011]

A fifth embodiment of the present disclosure relates to the planting structure (1) having a solar photovoltaic power generation function according to the third embodiment or the fourth embodiment, in which the upper surface (RT) of the building upper part is sloped, and the side of the lower end of the solar cell panel (11) is disposed to face a higher side

of the upper surface (RT) of the building upper part which is sloped.

[0012]

According to the present disclosure, it is possible to provide a planting structure having a solar photovoltaic power generation function in which a base of a solar cell panel can be installed directly and firmly above the roof of a building, and the flooding property in tray-shaped members can improve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a plan view (top view) showing an embodiment of a planting structure 1 according to the present disclosure; Fig. 2 is a cross-sectional view obtained by cutting the planting structure 1 at a position along arrow A-A in Fig. 1; Fig. 3 is a diagram for explaining a weir 73; Fig. 4 is a cross-sectional view obtained by cutting the planting structure 1 at a position along arrow B-B in Fig. 1; Fig. 5 is a cross-sectional view obtained by cutting the planting structure 1 at a position along the long and short dashed line indicated by arrow C-C in Fig. 1; Fig. 6 is an enlarged view of the region D in Fig. 5; Fig. 7 is a diagram showing an exploded view of each member in the vicinity of a first replenishing member 51; and Fig. 8 is a diagram for explaining the operation of the first replenishing member 51 and a second replenishing member 52.

DETAILED DESCRIPTION OF THE INVENTION

[0014]

Hereinafter, the best mode for carrying out the present invention will be described as an exemplary embodiment with reference to the drawings, etc.

[0015]

(Embodiment)

Fig. 1 is a plan view (top view) showing an embodiment of a planting structure 1 according to the present disclosure. In Fig. 1, for clarity of illustration, a filler 40, a root barrier sheet 80, planting soil 90, and plants 91 are omitted in order to show a state in which a tray-shaped member 30 is visible. Fig. 2 is a cross-sectional view obtained by cutting the planting structure 1 at a position along arrow A-A in Fig. 1. Fig. 2 also shows the members which are omitted in Fig. 1. It should be noted that each figure described below including Figs. 1 and 2 is a schematic diagram, and the size or the shape of each member is exaggerated as appropriate or omitted for ease of understanding. Furthermore, in the following, a description will be given with reference to specific numerical values, shapes, materials, or the like; however, these can be changed where appropriate.

[0016]

The planting structure 1 having a solar photovoltaic power generation function according to the present embodiment (simply referred to as planting structure 1) includes a solar cell panel 11, legs 12, bases 13, and a planting base 2.

[0017]

The solar cell panel 11 is a panel that generates power

by receiving sunlight, and may be of any type, such as silicon-based, compound-based, organic-based, or the like. The solar cell panel 11 has a substantially rectangular shape in a plan view, and is provided to be sloped (inclined) at a predetermined angle by the legs 12 and the bases 13. The direction of this slope is usually set so that the south side is lower than the north side. In this embodiment as well, the south side is lower than the north side. Therefore, in the following description, the directions of east, west, north, and south are shown in Fig. 1, and a description of each part will be given using these directions. It should be noted that the arrangement of the planting structure 1 according to these directions is merely an example, and the planting structure 1 may be disposed in a different direction with respect to these directions. The solar cell panel 11 according to the present embodiment is not provided with a gutter or the like at the end on the lower side of the panel, i.e. at the end on the south side. Therefore, rainwater falling on the solar cell panel 11 falls directly from the end of the lower side of the panel.

[0018]

The solar cell panel 11 of the present embodiment has the size of 2 m × 2 m. It should be noted that the size of the solar cell panel 11 is not limited thereto, and may be changed where appropriate. The solar cell panel 11 is disposed so as to cover most of the outer peripheral region of the planting base 2 except for a portion thereof. It should be noted that a

state in which the solar cell panel 11 covers the planting base 2 indicates that the planting base 2 is hidden by the solar cell panel 11 when viewing the planting structure 1 from above in the vertical direction.

[0019]

The legs 12 are struts for connecting the solar cell panel 11 and the bases 13. In the present embodiment, four legs 12 extend in the vertical direction.

[0020]

The bases 13 are base portions for stably installing the solar cell panel 11 via the legs 12, for example, and are integrally configured with a rooftop RT by concrete. The bases 13 are integrally configured with the rooftop RT, and hence, have a firm structure having sufficient strength even if an external force such as wind pressure caused by weather phenomena affects the bases 13.

[0021]

The planting base 2 is installed on the rooftop RT, and includes a protective layer 20, a tray-shaped member 30, a filler 40, a first replenishing member 51, a second replenishing member 52, a water receiver 60, an outer peripheral flow path 71, an outer peripheral wall 72, a weir 73, a water supply pipe 74, a root barrier sheet 80, and planting soil 90. The planting base 2 according to the present embodiment has the size of 3 m × 3 m when viewed from above in the vertical direction. It should be noted that the size of the planting base 2 is not limited thereto, and can be

appropriately changed.

[0022]

The rooftop RT is an upper surface of the building roof, and has a drainage slope for drainage. In Fig. 2, the horizontal plane HP is denoted by a two-dot chain line for comparison. It is common for a drainage slope to be sloped by approximately 1/50 to 1/100; however, the illustration in Fig. 2 is exaggerated. The drainage slope according to the present embodiment is higher on the south side of the rooftop RT than on the north side, as shown in Fig. 2. Therefore, in the present embodiment, the side of the south end of the solar cell panel 11 (low end) is provided to face the higher side (south side) of the sloped rooftop RT.

[0023]

The protective layer 20 is a layer that prevents the rooftop RT from being deteriorated or flooded by the presence of the planting base 2, thereby protecting the rooftop RT. The protective layer 20 may be applied, for example, by bonding a sheet-shaped member having a protective function to the rooftop RT, or may be further applied by coating a paint or the like for forming a protective layer on the surface of the rooftop RT. In the present embodiment, as the protective layer 20, a surface protective sheet is bonded and fixed to the rooftop RT. The surface protective sheet for use in the protective layer 20 is not particularly limited so long as it has a water barrier function that does not allow water to permeate; however, it is desirable to be an inorganic material

that withstands a wet environment. Examples of the surface protective sheet include a thermoplastic resin such as polyethylene, polypropylene, polyvinyl chloride, and ethylene vinyl acetate resin. Furthermore, a nonwoven fabric material may be used as the surface protective sheet.

[0024]

The tray-shaped member 30 is a tray-shaped member in the state of its finished product where the bottom face is substantially flat and the outer edge is formed to rise, whereby the tray-shaped member 30 can retain (reserve) water therein. A plurality of tray-shaped members 30 is arranged. In particular, the plurality of tray-shaped members 30 is arranged to surround the bases 13, thereby being arranged without any substantial gap in most areas of the planting base 2. Furthermore, the tray-shaped member 30 is in a substantially rectangular shape when viewed from above.

[0025]

For the tray-shaped member 30, a metal press-processed product or resin molded product or the like as in a bathtub may be used. However, in the present embodiment, the tray-shaped member 30 is provided using a waterproof sheet by on-site installation as an inexpensive form with a simpler form and high responsiveness in various sites.

[0026]

In a case of manufacturing the tray-shaped member 30 using the waterproof sheet, a frame material (edge material) as a frame of the tray-shaped member 30 is assembled in

advance by wood, steel material, or the like. It should be noted that the edge member is not shown. The waterproof sheet is provided in the space surrounded by the edge material, and the end of the waterproof sheet is provided to rise so as to cover the upper portion of the edge material. The end of the raised waterproof sheet is fixed to the edge material by appropriately selecting an adhesive, a nail, a screw, or the like, or combining these. The waterproof sheet by installed in this way becomes in a tray-shape (dish-shape), and serves as the tray-shaped member 30 capable of reserving water. The waterproof sheet for use in the tray-shaped member 30 is not particularly limited so long as it has a water barrier function that does not allow water to permeate; however, it is desirable to be an inorganic material that withstands a wet environment. Examples of the surface protective sheet include a thermoplastic resin such as polyethylene, polypropylene, polyvinyl chloride, and ethylene vinyl acetate resin. As shown in Fig. 1, in the present embodiment, nine pieces of the tray-shaped members 30 (the tray-shaped members 31 to 39) are arranged. It should be noted that, when referring to the tray-shaped members 31 to 39 collectively, they are referred to as the tray-shaped member 30.

[0027]

Since the bottom face of the tray-shaped member 30 is disposed along the rooftop RT, the bottom face follows the drainage slope of the rooftop RT, a result of which the bottom face has the same slope as the drainage slope. Therefore,

water in the tray-shaped member 30 flows along the sloped face of the bottom face, and is reserved within the tray-shaped member 30.

[0028]

The filler 40 is provided inside the tray-shaped member 30 to maintain the space for water storage provided by the tray-shaped member 30 so as not to be crushed by the weight of planting soil 90. For the filler 40, the material is not limited so long as it is an inorganic material capable of withstanding a gravimetric pressure and forming a space in which water can be stored. For example, a molded article of a thermoplastic resin (polyethylene, polypropylene, polyvinyl chloride, ABS resin, AS resin, acrylic resin, or the like) can be utilized. Furthermore, as the filler 40, a highly water-permeable drainage material such as pumice, perlite, or volcanic gravel may be used. Furthermore, as the filler 40, a water collecting and draining material made of resin for an underdrain may be utilized. In the present embodiment, as shown in Fig. 7 to be described later, as the filler 40, a plurality of substantially rectangular parallelepiped net-shaped materials which is also used as a drainage material is provided so as to fill the inner space of the tray-shaped member 30.

[0029]

The first replenishing member 51 and the second replenishing member 52 are each a member for supplying water to an appropriate site inside the tray-shaped member 30. The

details of the first replenishing member 51 and the second replenishing member 52 will be described later.

[0030]

The water receiver 60 is provided at a position at which water on the solar cell panel 11, i.e., rainwater during rainfall, flows down. As described above, in the solar cell panel 11 of the present embodiment, since the end of the lower side, i.e. the end of the south side, is not provided with a gutter or the like, rainwater falling on the solar cell panel 11 falls directly from the end of the lower side. Therefore, in the present embodiment, the water receiver 60 is disposed at a position at which water flows down from the lower end located on the lower side of the slope of the solar cell panel 11. Furthermore, the water receiver 60 is provided to intersect the plurality of tray-shaped members 30 substantially over the entire length of the lower end, i.e., the side of the south end, of the solar cell panel 11. More specifically, the water receiver 60 is provided to intersect the tray-shaped member 31, the tray-shaped member 34, the tray-shaped member 35, the tray-shaped member 38, and the tray-shaped member 39. For example, the water receiver 60 can be configured by being filled with crushed stones or the like inside a substantially rectangular parallelepiped-shaped container having a net-shaped bottom surface and an open top face. Alternatively, the water receiver 60 may be configured by using a member similar to that of the filler 40. The rainwater that the water receiver 60 has received flows and is

distributed to the tray-shaped member 31, the tray-shaped member 34, the tray-shaped member 35, the tray-shaped member 38, and the tray-shaped member 39 which are disposed to intersect the water receiver 60.

[0031]

The outer peripheral flow path 71 is disposed to surround the entire tray-shaped member 30, and is provided between a region where the tray-shaped member 30 is disposed and the outer peripheral wall 72 to be described later. The outer peripheral flow path 71 may be configured as a mere space. However, in the present embodiment, the outer peripheral flow path 71 is filled with the same material as the filler 40 so that the planting soil 90 can be provided on the outer peripheral flow path 71. In normal rainfall, rainwater is stored within the tray-shaped member 30. However, during heavy rainfall or long rainfall, since the rainwater exceeding the amount that can be stored in the tray-shaped member 30 flows from the water receiver 60 to the tray-shaped member 30, the rainwater overflows from the tray-shaped member 30 (overflow). The overflowing water is received in the outer peripheral flow path 71, and is drained from a drain port 72a provided on the north side of the outer peripheral wall 72.

[0032]

The outer peripheral wall 72 is provided on the outermost periphery of the planting base 2, and is configured to surround the entire circumference of the planting base 2. The outer peripheral wall 72 may be configured as a block or

concrete structure. Furthermore, the outer peripheral wall 72 is provided with the drain port 72a. The drain port 72a is provided near the bottom of the outer peripheral wall 72 on the lower side of the drainage slope of the rooftop RT. That is, in the present embodiment, the drain port 72a is disposed on the north side.

[0033]

The weir 73 is provided for the tray-shaped member 31, the tray-shaped member 35, and the tray-shaped member 39 among the plurality of tray-shaped members 30. The weir 73 is not provided for the remaining tray-shaped member 32, the tray-shaped member 33, the tray-shaped member 34, the tray-shaped member 36, the tray-shaped member 37, and the tray-shaped member 38.

[0034]

If the storage volume is sufficient, water can be stored over the entire area of the tray-shaped member 30. However, if there is no rain for a while, the water level becomes low, a result of which the water collects on the lower side of the bottom surface of the tray-shaped member 30. With such a configuration, if the length in the slope direction (in the present embodiment, the south-north direction) is relatively longer as in the tray-shaped member 31, the tray-shaped member 35, and the tray-shaped member 39, it is assumed that the higher side lacks the water. Therefore, in the present embodiment, the tray-shaped member 31, the tray-shaped member 35, and the tray-shaped member 39 are provided with the weir

73, whereby even when the water level becomes low, the water can be stored in a wide region as much as possible.

[0035]

Fig. 3 is a diagram for explaining the weir 73. Fig. 3 shows water W1 and water W2 stored in a small amount, without illustrating the filler 40. The weir 73 divides the water storage spaces inside the tray-shaped member 31, the tray-shaped member 35, and the tray-shaped member 39 into a plurality of spaces (in the present embodiment, two). More specifically, the weir 73 is provided substantially near the center of the tray-shaped member 31, the tray-shaped member 35, and the tray-shaped member 39 in the slope direction (south-north direction), and protrudes from the respective bottom faces to extend in a direction perpendicular to the slope direction (east-west direction). The protrusion height of the weir 73 is set to be lower than the height of the outer peripheral portion of each tray-shaped member.

[0036]

By providing the weir 73, the water storage space of the tray-shaped member 35 as shown in Fig. 3 is divided into two. With such a configuration, even when the water level is lowered, it is still possible to maintain a state of storing water in both of the water storage spaces. It should be noted that the water supplied from the water receiver 60 flows into the bottom surface directly below the water receiver 60 (high-level side, i.e., the bottom surface of the south side); therefore, the water is supplied to the water storage space on

the south side in Fig. 3. However, when the water supplied to the water storage space on the south side exceeds the height of the weir 73, the water flows into the water storage space on the north side, whereby the water is stored in both spaces. It should be noted that the weir 73 is not limited to one weir with respect to one tray-shaped member 30, and that two or more weirs may be provided to one tray-shaped member 30. Furthermore, the weir 73 may be provided in the other tray-shaped members (32, 33, 34, 36, 37, and 38) which are not provided with the weir 73 in the present embodiment.

[0037]

The water supply pipe 74 is provided as an auxiliary so as to be able to supply water when days with a small amount of precipitation continues. The water supply pipe 74 is disposed on or in the water receiver 60, and has a plurality of small holes (not shown) at intervals so as to allow for water supply in the same manner as rainfall to the water receiver 60. In the present embodiment, although the water supply pipe 74 is provided so as to be exposed on the water receiver 60, it is better to install inside the water receiver 60 in terms of landscape aesthetics. One end of the water supply pipe 74 is connected to a water supply facility or the like having a water stop valve (not shown), and can supply water as necessary. It should be noted that, since it is also possible to replenish the water using a hose or the like on the water receiver 60, the water supply pipe 74 may be omitted.

[0038]

The root barrier sheet 80 is provided on or above the filler 40 over substantially the entire area more to an inner side than the outer peripheral wall 72. For the root barrier sheet 80, any material may be used which is water permeable, strong enough to prevent intrusion of roots, and has less deterioration over time. For example, a water-permeable synthetic resin sheet (polyethylene, polypropylene, polyvinyl chloride sheet, or the like), or a nonwoven fabric (aramid, glass, nylon, vinylon, polyester, polyolefin, or the like) can be used for the root barrier sheet 80

[0039]

The root barrier sheet 80 is desirably open at the portion at which the water receiver 60 is provided. This is because, although water permeates the root barrier sheet 80, there is a possibility that the permeation amount of the water cannot catch up with the amount of rainfall. It is desirable for the root barrier sheet 80 to be provided to rise along the vicinity of the bases 13 and the inner wall surface of the outer peripheral wall 72. This is because, by filling the gap of this portion by the root barrier sheet 80, it is possible to prevent the intrusion of roots from the plants 91 to the filler 40 or the like.

[0040]

The planting soil 90 is soil for growing the plants 91, and is provided on the root barrier sheet 80. Although there is no particular limitation for the soil available as the planting soil 90, an artificial lightweight soil which is

lighter in weight than natural soil is preferred because it is used for rooftop greenery.

[0041]

The plants 91 are plants grown by the planting soil 90. The planting 91 may be basically any plant. However, for example, since medium-high trees of high height make the pruning work complicated, plants other than those are desirable. Furthermore, there is a possibility that an area directly below the solar cell panel 11 is not exposed by direct sunlight. Therefore, plants that prefer shading may be arranged in such an area.

[0042]

Fig. 4 is a cross-sectional view obtained by cutting the planting structure 1 at a position along arrow B-B in Fig. 1. Rain water is supplied directly from the water receiver 60 to the tray-shaped member 31, the tray-shaped member 34, the tray-shaped member 35, the tray-shaped member 38, and the tray-shaped member 39, in each of which the water receiver 60 is provided to intersect. However, since the bases 13 are provided as shown in Fig. 4, even if water is supplied to the tray-shaped member 38, the water cannot directly flow into the tray-shaped member 37 and the tray-shaped member 36. Therefore, the planting structure 1 of the present embodiment is provided with the second replenishing member 52.

[0043]

Fig. 5 is a cross-sectional view obtained by cutting the planting structure 1 at a position along the long and short

dashed line indicated by arrow C-C in Fig. 1;

Fig. 6 is an enlarged view of the region D in Fig. 5. It should be noted that, in Fig. 6, etc., the first replenishing members 51 and the second replenishing members 52 are shown at a slight interval from the filler 40 and the root barrier sheet 80 for the purpose of facilitating understanding of the drawings. However, in practice, these are in close contact with each other by the weight of the upper planting soil 90. As shown in Figs. 1, 5, and 6, the first replenishing members 51 and the second replenishing members 52 are installed to the filler 40 inside the tray-shaped member 30.

[0044]

The material of the first replenishing members 51 and the second replenishing members 52 are not limited as long as having a function of pumping by capillary phenomenon. However, it is desirable to be an inorganic material having less deterioration over time which can withstand a wet environment. For example, a nonwoven fabric, a woven fabric, a specially treated paper, or the like made of synthetic fibers (nylon-based, vinylon-based, polyester-based, acrylic-based, polyphyrin-based, polyurethane-based, or the like) can be used. In the present embodiment, a sheet which is designated a so-called capillary sheet and is commercially available is used as the first replenishing members 51 and the second replenishing members 52.

[0045]

The first replenishing member 51 is a member for

supplying water to the planting soil 90 even when the water level in the tray-shaped member 30 becomes lowered. In the first replenishing member 51, a portion 51a extending on the lower side face of the filler 40 is disposed so as to face a portion 51b extending on the upper face side of the filler 40, and furthermore, the first replenishing member 51 is provided with a portion 51c that connects the portion 51a and the portion 51b in the vertical direction. The first replenishing member 51 is formed in a substantially C-shape. It should be noted that, in any of the drawings, although the first replenishing member 51 is illustrated in a C-shape, the first replenishing member 51 is originally not recognized as being in the C-shape or inverted C-shape, depending on the direction of the cross-section. In the present embodiment, the direction of all of the first replenishing members 51 are arranged to align so as to appear in a C-shape in the cross-section in the direction shown in Fig. 6. Therefore, in the direction of the cross section from Fig. 2 to Fig. 4, although the first replenishing member 51 is not originally viewed as being in a C-shape or inverted C-shape, the first replenishing member 51 is illustrated here in a C-shape for ease of understanding. It should be noted that the direction of placing the first replenishing member 51 may be arranged at random without aligning.

[0046]

The second replenishing member 52 is a member for supplying water from the other tray-shaped member 30 (31, 35,

39) to the tray-shaped member 30 (32, 33, 36, 37) which is disposed at a position where the water is not supplied directly from the water receiver 60. In the second replenishing member 52, a portion 52a extending on the lower side face of the filler 40 is disposed so as not to face a portion 52b extending to the upper face side of the filler 40 with a portion 52c extending in the vertical direction as a center. The second replenishing member 52 is formed in a substantially Z-shape (crank shape). It should be noted that, depending on the direction in which observing, it appears in an inverted Z-shape.

[0047]

Fig. 7 is a diagram showing an exploded view of each member in the vicinity of the first replenishing member 51. Fig. 7 exemplifies a portion of the tray-shaped member 36 shown in the region E near the center of Fig. 6. As shown in Fig. 7, the first replenishing member 51 is attached in a form in which the first replenishing member 51 is wound a half circumference around the filler 40 which is constituted by a plurality of substantially rectangular parallelepiped-shaped lumps. Furthermore, the filler 40 to which the first replenishing member 51 is attached is housed in the tray-shaped member 36 (30) together with the other filler 40. Thereafter, the root barrier sheet 80 is placed thereon. It should be noted that the second replenishing member 52 is similarly arranged when the tray-shaped member 30 is filled with the filler 40 (when the filler 40 is disposed in the

tray-shaped member 30).

[0048]

Fig. 8 is a diagram for explaining the operation of the first replenishing member 51 and the second replenishing member 52. In Fig. 8 illustrates by omitting, the filler 40, etc. from Fig. 6, and represents a state in which water W3 is accumulated in a small amount. The portion 51a of the first replenishing member 51 is provided along the bottom face of the tray-shaped member 30. Therefore, even when the amount of water is reduced as shown in Fig. 8, it is still possible to pump up the water by the capillary phenomenon. Thereafter, water transmitted to the upper portion 52b is supplied to the planting soil 90 through the root barrier sheet 80. It should be noted that a portion of the water transmitted to the upper portion 52b falls downward and returns to the tray-shaped member 30.

[0049]

The portion 52a of the second replenishing member 52 is provided along the bottom face of the tray-shaped member 30. Therefore, even when the amount of water is reduced as shown in Fig. 8, it is still possible to pump up the water by the capillary phenomenon. Furthermore, the upper portion 52b is provided over both upper ends of the adjacent tray-shaped member 30. With such a configuration, water transmitted to the upper portion 52b falls by its own weight, whereby the tray-shaped member 30 next to the tray-shaped member 30, from which water has been pumped up, is replenished with the water. In

the example of Fig. 8, water is supplied to the tray-shaped member 36 by the second replenishing member 52 from each of the tray-shaped member 35 and the tray-shaped member 39. It should be noted that a portion of the water transmitted to the upper portion 52b is supplied to the planting soil 90 through the root barrier sheet 80.

[0050]

Thus, in the planting structure 1 of the present embodiment, by providing the second replenishing member 52, it is possible to replenish the tray-shaped member 30 (32, 33, 36, 37) which is located at a position shielded by the base 13 when viewed in the direction in which water flows and at which the water is not directly supplied from the water receiver 60 with the water from the other tray-shaped member 30 (31, 35, 39). Therefore, it is possible to supply sufficient water substantially over the entire surface of the planting soil 90.

[0051]

Here, for example, it may be considered that it is possible to spread the water over the entire surface by using a single large tray-shaped member without configuring to arrange a plurality of tray-shaped members of rectangular shape in a plan view when viewed from above as in the present embodiment. It is assumed that simple consideration may lead to such a configuration first. However, in a case of such a configuration, it is substantially impossible to configure the tray-shaped member 30 simply by utilizing a waterproof sheet as in the present embodiment. Furthermore, it is actually

impossible to utilize a tray-shaped member molded in advance without using such a waterproof sheet, since this molding becomes difficult.

[0052]

In the present disclosure, a cell configuration is adopted in which the tray-shaped members 30 each having a rectangular shape in a plan view when viewed from above are arranged to surround the bases 13. This makes it possible to dramatically increase the workability. Furthermore, even when the above-described cell configuration is adopted, it is possible to store water in all of the tray-shaped members 30 by providing the second replenishing member 52, a result of which the flooding property improves, and water can be supplied to the entire planting soil 90 without unevenness.

[0053]

(Modification Embodiments)

Various modifications and changes can be made without being limited to the embodiments described above, and they are also within the scope of the present disclosure.

[0054]

(1) In the embodiment, the configuration of the tray-shaped member 30 having the rectangular shape in a plan view when viewed from above is exemplified. However, the present disclosure is not limited thereto and, for example, the shape of the tray-shaped member in a plan view when viewed from above may be in another shape such as triangular or hexagonal shape, or may be mixed with a plurality of the other shapes.

[0055]

(2) In the embodiment, a configuration is exemplified in which the longitudinal direction of the rectangular shape in a plan view of the tray-shaped member 30 as viewed from above coincides with the sloping direction of the rooftop RT. However, the present disclosure is not limited thereto and, for example, the longitudinal direction of the rectangular shape in a plan view of the tray-shaped member as viewed from above may be arranged in a direction perpendicular to the sloping direction of the rooftop RT.

[0056]

(3) In the embodiment, a configuration is exemplified in which the water receiver 60 is provided at a position at which water directly falls from the lower end of the solar cell panel 11. However, the present disclosure is not limited thereto and, for example, rainwater collected at the lower end of the solar cell panel may be received by a rain gutter, thereby falling to the water receiver through piping. In a case of an existing building, the direction of the drainage slope of the rooftop and the direction of the slope (inclination) of the solar cell panel do not necessarily have a relationship as in the above-described embodiment. Therefore, in such a case, this modification embodiment is effective.

[0057]

(4) In the embodiment, a configuration is exemplified in which the water supply pipe 74 is provided on or inside the

water receiver 60. However, the present disclosure is not limited thereto and, for example, the water supply pipe 74 may be provided at the top of the solar cell panel 11 so that the water is supplied to the water receiver 60 after the supplied water flows above the solar cell panel 11. In this case, since the solar cell panel 11 is cooled while the water supply is performed, it is possible to prevent the power generation efficiency from lowering due to high temperature. Therefore, water for water supply can also be used for cooling. In other words, it is possible to effectively use the water.

[0058]

It should be noted that each embodiment and modification embodiment may be used in combination as appropriate; however, a detailed description thereof will be omitted. The present disclosure is not limited to the embodiments described above.

EXPLANATION OF REFERENCE NUMERALS

[0059]

1 planting structure
2 planting base
11 solar cell panel
12 leg
13 base
20 protective layer
30(31 to 39) tray-shaped member
40 filler
51 first replenishing member

52 second replenishing member

60 water receiver

71 peripheral flow path

72 outer peripheral wall

72a drain port

73 weir

74 water supply pipe

80 root barrier sheet

90 planting soil

91 plants

What is claimed is:

1. A planting structure having a solar photovoltaic power generation function, the planting structure comprising:
 - a building that includes a building upper part;
 - a planting base that is disposed above an upper surface of the building upper part; and
 - a solar cell panel supported with a structure that includes a base and a leg provided to the upper surface of the building upper part, and the solar cell panel is provided to be sloped at a predetermined angle at a position covering at least a portion of the planting base,wherein the planting base includes:
 - a plurality of tray-shaped members that are disposed to surround the base and retain water inside,
 - a water receiver that is disposed at a position at which water on the solar cell panel flows down; and
 - a replenishing member that replenishes the tray-shaped members disposed at a position at which water is not directly supplied from the water receiver with water from adjacent other tray-shaped members, andwherein the replenishing member includes a lower portion along a bottom face of the tray-shaped member and an upper portion provided along both upper ends of adjacent tray-shaped members, with a portion extending in a vertical direction as a center.

2. The planting structure having a solar photovoltaic power generation function according to claim 1,

wherein the tray-shaped member is substantially in a rectangular shape when viewed from above.

3. The planting structure having a solar photovoltaic power generation function according to claim 1 or 2,

wherein the water receiver is disposed at a position at which water falls down from a lower end which is on a lower side of the slope of the solar cell panel.

4. The planting structure having a solar photovoltaic power generation function according to claim 3,

wherein the water receiver is provided to intersect the plurality of tray-shaped members over substantially an entire length of a side of the lower end of the solar cell panel.

5. The planting structure having a solar photovoltaic power generation function according to claim 3 or 4,

wherein the upper surface of the building upper part is sloped, and

the side of the lower end of the solar cell panel is disposed to face a higher side of the upper surface of the building upper part which is sloped.