

DESCRIPTION

Title of Invention: SOLAR CELL MODULE

5 Technical Field

[0001]

The present invention relates to a photovoltaic module.

Background Art

[0002]

10 In recent years, the use of a photovoltaic module comprising a plurality of photovoltaic cells has been promoted in order to make use of natural energy. In a photovoltaic module comprising a plurality of photovoltaic cells, in order to extract electric power generated by the photovoltaic cells to the outside of the photovoltaic module, wiring
15 lines connected to the photovoltaic cells are led (e.g., wired) from the inside of the photovoltaic module to the outside thereof. Further, the wiring lines led to the outside as described above are connected to electrode terminals provided in a junction box.

[0003]

20 Patent Literature 1 discloses a technology for extending the service life of a junction box for a photovoltaic module. In the technology disclosed in Patent Literature 1, the junction box is fixed on the surface of a solar cell panel.

Citation List

25 Patent Literature

[0004]

[Patent Literature 1] Japanese Unexamined Patent Application Publication No. 2018-74805

Summary of Invention

30 Technical Problem

[0005]

In a photovoltaic module, electric power generated by photovoltaic cells is extracted to the outside through a junction box.

Components such as electrode terminals, output cables, and bypass diodes are provided in the junction box. In the technology disclosed in Patent Literature 1, the junction box is fixed on the surface of the solar cell panel.

5 [0006]

However, the junction box may break down or deteriorate over time. Therefore, when the junction box is fixed on the surface of the solar cell panel as in the technology disclosed in Patent Literature 1, there is a problem that the junction box cannot be replaced.

10 [0007]

In view of the above-described problem, an object of the present invention is to provide a photovoltaic module in which a junction box can be replaced.

Solution to Problem

15 [0008]

A photovoltaic module according to an aspect of the present invention is as follows.

[0009]

[1]

20 A photovoltaic module comprising:

a first translucent member;

a second translucent member disposed so as to be opposed to the first translucent member;

25 an intermediate adhesive layer disposed between the first and second translucent members;

a photovoltaic cell disposed between the first and second translucent members;

a hole formed in the second translucent member;

30 a sealing material disposed between the first and second translucent members around the hole, and configured to seal the space between the hole and the intermediate adhesive layer;

a bus bar of which one end in a longitudinal direction is connected to the photovoltaic cell and the other end in the longitudinal

direction is led to outside of the second translucent member through the hole; and

a junction box comprising an electrode terminal connected to the other end of the bus bar, wherein

5 the other end of the bus bar is detachably connected to the electrode terminal, and

the junction box is detachably attached to the second translucent member.

[0010]

10 [2]

The photovoltaic module according to Item [1], wherein the bus bar is sandwiched, in the hole, between the sealing material disposed on the first translucent member side and the sealing material disposed on the second translucent member side, and is led to the outside of the

15 second translucent member through the sealing material and the hole.

[0011]

[3]

The photovoltaic module according to Item [1] or [2], wherein the junction box is disposed so as to overlap the hole in a plan view of

20 a main surface of the second translucent member.

[0012]

[4]

The photovoltaic module according to any one of Items [1] to [3], wherein the other end of the bus bar is fixed to the electrode

25 terminal by using a clip.

[0013]

[5]

The photovoltaic module according to any one of Items [1] to [3], wherein the other end of the bus bar is fixed to the electrode

30 terminal by using a screw.

[0014]

[6]

The photovoltaic module according to any one of Items [1] to

[3], wherein the other end of the bus bar is fixed to the electrode terminal by using solder.

[0015]

[7]

5 The photovoltaic module according to any one of Items [1] to [6], wherein the junction box is fixed to a main surface on an outer side of the second translucent member by using a screw.

[0016]

[8]

10 The photovoltaic module according to any one of Items [1] to [6], further comprising:

 a fixing jig configured to fix the junction box; and

 an adhesive member adapted to fix the fixing jig on a main surface on an outer side of the second translucent member, wherein

15 the junction box is fixed on the main surface on the outer side of the second translucent member by using the fixing jig.

[0017]

[9]

 The photovoltaic module according to Item [8], wherein

20 the fixing jig comprises a first fixing jig and a second fixing jig configured to sandwich and fix the junction box therebetween,

 a recess extending in a direction parallel to the main surface on the outer side of the second translucent member is formed in each of the first and second fixing jigs, and

25 the junction box is fixed to the first and second fixing jigs by sliding the junction box along the recesses of the first and second fixing jigs.

[0018]

[10]

30 The photovoltaic module according to any one of Items [1] to [9], wherein the sealing material is at least one type of material selected from the group consisting of butyl, a silicon resin, a urethane resin, and an epoxy resin.

Advantageous Effects of Invention

[0019]

According to the present invention, it is possible to provide a photovoltaic module in which a junction box can be replaced.

5 Brief Description of Drawings

[0020]

Fig. 1 is a front view of a photovoltaic module according to an embodiment;

Fig. 2 is a cross-sectional view of the photovoltaic module
10 according to the embodiment;

Fig. 3 is an enlarged front view showing the photovoltaic module according to the embodiment;

Fig. 4 is a cross-sectional view of a part of the photovoltaic module according to the embodiment near a hole thereof;

Fig. 5 is a front view of a junction box provided in the
15 photovoltaic module according to the embodiment;

Fig. 6 is a cross-sectional view showing a state where a bus bar is connected to electrode terminal;

Fig. 7 is a cross-sectional view showing a state where a bus bar
20 is connected to electrode terminal;

Fig. 8 is a cross-sectional view showing a state where a bus bar is connected to electrode terminal;

Fig. 9 is a cross-sectional view showing a state where a bus bar is connected to electrode terminal;

Fig. 10 is a cross-sectional view showing a state where the
25 junction box is fixed to the photovoltaic module; and

Fig. 11 is a cross-sectional view showing a state where the junction box is fixed to the photovoltaic module.

Description of Embodiments

30 [0021]

Embodiments according to the present invention will be described hereinafter with reference to the drawings.

Fig. 1 is a front view showing a photovoltaic module according

to an embodiment. Fig. 2 is a cross-sectional view showing the photovoltaic module according to the embodiment.

[0022]

As shown in Fig. 1, a photovoltaic module 1 according to an
5 embodiment comprises a plurality of photovoltaic cells 21, tab wiring
lines 22, bus bars 23_1 to 23_3 and 25_1 to 25_2, and a junction box
30. The plurality of photovoltaic cells 21 are arranged side by side in
the x-axis direction and in the y-axis direction on a transparent plate-
like member 10. For example, the transparent plate-like member 10 is
10 a plate-like member comprising a first translucent member 11, a second
translucent member 12 disposed so as to be opposed to the first
translucent member 11, and an intermediate adhesive layer 13 disposed
between the first and second translucent members 11 and 12 (see Fig.
2). Each of the first and second translucent members 11 and 12 can be
15 formed of a glass plate or a resin sheet. For example, when both the
first and second translucent members 11 and 12 are formed of glass
plates, the transparent plate-like member 10 is formed as a laminated
glass. A case where a laminated glass 10 is used as the transparent
plate-like member will be described hereinafter. The photovoltaic
20 module 1 (laminated glass) according to this embodiment can be
suitably used as a building material such as a window glass of a
building.

[0023]

As shown in Fig. 2, the laminated glass 10 comprises a first
25 glass plate 11, a second glass plate 12, and an intermediate adhesive
layer 13 disposed between the first and second glass plates 11 and 12.
The plurality of photovoltaic cells 21_1 and 21_2 are disposed inside
the intermediate adhesive layer 13. Note that in this specification, the
photovoltaic cells 21_1 and 21_2 are also collectively referred to as
30 photovoltaic cells 21. The same applies to other components.

[0024]

The laminated glass 10 is formed by laminating the first glass
plate 11, the intermediate adhesive layer 13, and the second glass plate

12 in the z-axis direction, and the first and second glass plates 11 and 12 are bonded to each other by using the intermediate adhesive layer 13. The plurality of photovoltaic cells 21_1 and 21_2 are sealed between the first and second glass plates 11 and 12, i.e., inside the intermediate adhesive layer 13.

[0025]

The thickness of each of the first and second glass plates 11 and 12 is, for example, 4 mm or larger and 12 mm or smaller. For example, a chemically-strengthened glass may be used as each of the first and second glass plates 11 and 12. When chemically-strengthened glasses are used, the weight of the first and second glass plates 11 and 12 can be reduced while maintaining the strength of the first and second glass plates 11 and 12. Further, in this embodiment, an air-cooling-strengthened glass may be used as each of the first and second glass plates 11 and 12.

[0026]

The intermediate adhesive layer 13 is disposed so as to be sandwiched between the first and second glass plates 11 and 12. In other words, the first and second glass plates 11 and 12 are bonded to each other by using the intermediate adhesive layer 13. For example, a photovoltaic module 1 is formed by laminating a first glass plate 11, an intermediate adhesive layer 13, photovoltaic cells 21, another intermediate adhesive layer 13, and a second glass plate 12 in this order, and heating, pressurizing, and thereby press-bonding the obtained laminate. Note that the intermediate adhesive layer 13 disposed below the photovoltaic cells 21 and the intermediate adhesive layer 13 disposed above them are heated and melted, so that these intermediate adhesive layer 13 become (i.e., are fused into) one intermediate adhesive layer 13 in the finished photovoltaic module 1.

[0027]

The thickness of the intermediate adhesive layer 13 is, for example, 0.38 mm or larger and 2.28 mm or smaller. For the intermediate adhesive layer 13, an EVA (ethylene-vinyl acetate

copolymer) resin, a PVB (polyvinyl butyral) resin, an ionomer resin, COP (cycloolefin polymer), polyurethane, PVC (polyvinyl chloride), POE (polyolefin elastomer), TPO (olefinic thermoplastic elastomer), or the like may be used. Further, the intermediate adhesive layer 13 may be formed by combining these materials.

[0028]

The photovoltaic cells 21 may be formed by using photovoltaic cells of a silicon-based single crystal type, a silicon-based polycrystal type, an amorphous silicon type, a thin-film silicon type, a CIGS type, an organic thin-film type, a dye-sensitization type, a perovskite type, or the like. In the example of the configuration shown in Fig. 1, each photovoltaic cell 21 has a rectangular shape. For example, the shape of each photovoltaic cell 21 may be square, rectangular, or circular. Further, for example, single-sided light-receiving-type photovoltaic cells may be used as the photovoltaic cells 21. In this case, the photovoltaic cells 21 are disposed so that their light-receiving surfaces faces the outside (the negative side in the z-axis direction). Alternatively, double-sided light-receiving photovoltaic cells may be used as the photovoltaic cells 21.

[0029]

As shown in Fig. 1, the plurality of photovoltaic cells 21 are electrically connected to each other by using tab wiring lines 22. Specifically, the photovoltaic cell 21 (i.e., each photovoltaic cell 21) comprises a semiconductor substrate in which a pn junction is formed. For example, in the photovoltaic cell 21, an n-type semiconductor is disposed on the light-receiving surface, and a p-type semiconductor is disposed on the surface opposite to the light-receiving surface (i.e., the rear surface). In this embodiment, the plurality of photovoltaic cells 21 arranged in the y-axis direction are connected to each other in series by using tab wiring lines 22.

[0030]

That is, as shown in Fig. 2, a tab wiring line 22_1 is connected to the light-receiving surface (surface on the negative side in the z-

axis direction) of a photovoltaic cell 21_1, and a tab wiring line 22_2 is connected to the rear surface (surface on the positive side in the z-axis direction) of the photovoltaic cell 21_1. Further, a tab wiring line 22_2 is connected to the light-receiving surface (surface on the negative side in the z-axis direction) of a photovoltaic cell 21_2 adjacent to the photovoltaic cell 21_1, and a tab wiring line 22_3 is connected to the rear surface (surface on the positive side in the z-axis direction) of the photovoltaic cell 21_2. By the above-described configuration, the plurality of photovoltaic cells 21 arranged in the y-axis direction can be connected to each other in series by using the tab wiring lines 22. In the example of the configuration shown in Fig. 1, the plurality of photovoltaic cells 21 arranged in the y-axis direction form four photovoltaic cell groups 20_1 to 20_4 connected to one another by the tab wiring lines 22. Copper or aluminum can be used as the material of the tab wiring lines 22.

[0031]

The four photovoltaic cell groups 20_1 to 20_4 are connected to each other in series by using the bus bars 23_1 to 23_3. Specifically, the photovoltaic cell groups 20_1 and 20_2 are connected to each other by using the bus bar 23_1 on the positive side in the y-axis direction. The photovoltaic cell groups 20_2 and 20_3 are connected to each other by using the bus bar 23_2 on the negative side in the y-axis direction. The photovoltaic cell groups 20_3 and 20_4 are connected to each other by using the bus bar 23_3 on the positive side in the y-axis direction.

[0032]

The negative side in the y-axis direction of the photovoltaic cell group 20_1 is connected to one end of the bus bar 25_1, and the negative side in the y-axis direction of the photovoltaic cell group 20_4 is connected to one end of the bus bar 25_2. The other end of the bus bar 25_1 is connected to an electrode terminal 31_1 provided in the junction box 30 (see Fig. 5). The other end of the bus bar 25_2 is connected to an electrode terminal 31_2 provided in the junction box

30 (see Fig. 6). For example, the bus bar 25_1 is a bus bar on the negative side, and the bus bar 25_2 is a bus bar on the positive side. Further, the electrode terminal 31_1 is an electrode terminal on the negative side, and the electrode terminal 31_2 is an electrode terminal on the positive side. Copper or aluminum can be used as the material of the bus bars 23 and 25. By the above-described configuration, electric power generated by the plurality of photovoltaic cells 21 can be extracted to the outside.

[0033]

Note that although Fig. 1 shows an example of a configuration in which the plurality of photovoltaic cells 21 are connected to each other by using three tab wiring lines 22, the number of tab wiring lines 22 for connecting the plurality of photovoltaic cells 21 to each other may be any number other than three. Further, although Fig. 1 shows an example of a configuration in which all the photovoltaic cells 21 are connected to each other in series, some of the photovoltaic cells 21 may be connected in parallel in this embodiment.

[0034]

Fig. 3 is an enlarged front view showing the photovoltaic module according to the embodiment. Fig. 4 is a cross-sectional view of a part of the photovoltaic module according to the embodiment located near the hole. In this embodiment, holes 26_1 and 26_2 are formed in the second glass plate 12, and the bus bars 25_1 and 25_2 are led (e.g., wired) from the inside of the laminated glass 10 to the outside thereof through the holes 26_1 and 26_2. Further, as shown in Figs. 3 and 4, sealing materials 27_1 and 27_2 for sealing space between the holes 26_1 and 26_2 and the intermediate adhesive layer 13 are provided between the first and second glass plates 11 and 12 around the holes 26_1 and 26_2. As shown in Fig. 4, the bus bar 25 (i.e., each bus bar 25) is sandwiched between the sealing material 27 disposed on the first glass plate 11 side and the sealing material 27 disposed on the second glass plate 12 side in the hole 26, and is led (e.g., wired) to the outside of the laminated glass 10 through the

sealing material 27 and the hole 26. By the above-described configuration, the space between the hole 26 and the intermediate adhesive layer 13 can be appropriately sealed. For example, for the sealing material 27, at least one type of material selected from the group consisting of butyl, a silicon resin, a urethane resin, and an epoxy resin can be used.

[0035]

Fig. 5 is a front view of a junction box provided in the photovoltaic module according to the embodiment. Fig. 6 is a cross-sectional view showing a state where the bus bar is connected to the electrode terminal. Note that Fig. 5 shows a state where the lid is removed in order to show the inside of the junction box. As shown in Fig. 5, the junction box 30 comprises electrode terminals 31_1 and 31_2, a terminal strip 33, output cables 34_1 and 34_2, and a bypass diode 35. The junction box 30 is attached to the main surface on the outer side of the second glass plate 12.

[0036]

As shown in Figs. 5 and 6, the electrode terminals 31_1 and 31_2 are fixed to the terminal strip 33. The bus bars 25_1 and 25_2 led (e.g., wired) to the outside through the holes 26_1 and 26_2 are connected to the electrode terminals 31_1 and 31_2, respectively. As shown in Fig. 5, the electrode terminals 31_1 and 31_2 are electrically connected to the output cables 34_1 and 34_2, respectively. Therefore, electric power generated in the photovoltaic module 1 is output to the outside thereof by using the output cables 34_1 and 34_2.

[0037]

Further, the bypass diode 35 is provided between the electrode terminals 31_1 and 31_2. In this way, when the photovoltaic cells 21 (e.g., one of the photovoltaic cells 21) have broken down, an electric current can flow through the bypass diode 35 without flowing through the photovoltaic cells 21. That is, in the case where the output cables 34_1 and 34_2 are connected to another photovoltaic module, when the photovoltaic cells 21 (e.g., one of the photovoltaic cells 21) provided

in the photovoltaic module 1 break down, an electric current does not flow through the photovoltaic module 1 any longer, and the other photovoltaic module is also affected. In contrast, in the case where the bypass diode 35 is provided, when the photovoltaic cells 21 (e.g., one of the photovoltaic cells 21) break down, an electric current flows through the bypass diode 35 without flowing through the photovoltaic cells 21, thus making it possible to prevent the other photovoltaic module from being affected.

[0038]

Further, in this embodiment, as shown in Fig. 5, the junction box 30 is preferably disposed so as to overlap the holes 26_1 and 26_2 in a plan view of the second glass plate 12. By the above-described arrangement, it is possible to prevent the holes 26_1 and 26_2 from being visible from the outside. Therefore, the design of the photovoltaic module 1 can be improved.

[0039]

In this embodiment, the bus bars 25_1 and 25_2 are detachably connected to the electrode terminals 31_1 and 31_2, respectively. For example, as shown in Figs. 5 and 6, the bus bars 25_1 and 25_2 may be fixed to the electrode terminals 31_1 and 31_2 by using clips 32_1 and 32_2. The clips 32_1 and 32_2 are configured so that the tips of the clips 32_1 and 32_2 can be displaced to the positive side in the z-axis direction. In the case where the bus bars 25_1 and 25_2 are fixed to the electrode terminals 31_1 and 31_2 by using the clips 32_1 and 32_2, firstly, the bus bars 25_1 and 25_2 are placed over the electrode terminals 31_1 and 31_2. Then, the tips of the clips 32_1 and 32_2 are displaced to the negative side in the z-axis direction, and the bus bars 25_1 and 25_2 are pressed onto the electrode terminals 31_1 and 31_2. As a result, the bus bars 25_1 and 25_2 are fixed to the electrode terminals 31_1 and 31_2 by using the clips 32_1 and 32_2. Further, when the bus bars 25_1 and 25_2 are detached from the electrode terminals 31_1 and 31_2, the bus bars 25_1 and 25_2 are released by displacing the tips of the clips 32_1 and 32_2 to the positive side in

the z-axis direction. The clips 32_1 and 32_2 can be formed of a metal material such as copper, iron, stainless steel, or aluminum. For example, in this embodiment, the electrode terminals 31_1 and 31_2 and the clips 32_1 and 32_2 may be integrally formed. When the above-described structure is adopted, the bus bars 25_1 and 25_2 can be fixed to the electrode terminals 31_1 and 31_2 by using the clips 32_1 and 32_2, i.e., by bending parts of the electrode terminals 31_1 and 31_2 (in which the bent parts correspond to the clips 32_1 and 32_2).

10 [0040]

Further, in this embodiment, as shown in Fig. 7, the bus bar 25 (i.e., each bus bar 25) may be fixed to the electrode terminal 31 by using a screw 38. Specifically, when the bus bar 25 is fixed to the electrode terminal 31, the bus bar 25 is placed over the electrode terminal 31, and then the bus bar 25 is fixed to the electrode terminal 31 by tightening the screw 38. Further, when the bus bar 25 is detached from the electrode terminal 31, the screw 38 is loosened and thereby removed from the electrode terminal 31. Note that screw holes through which screws 38 are inserted are preferably formed in the bus bars 25 in advance.

20

[0041]

Further, in this embodiment, as shown in Fig. 8, the bus bar 25 may be fixed to the electrode terminal 31 by using solder 39. Specifically, when the bus bar 25 is fixed to the electrode terminal 31, the bus bar 25 is placed over the electrode terminal 31, and then the bus bar 25 is fixed to the electrode terminal 31 by using solder 39. Further, when the bus bar 25 is detached from the electrode terminal 31, the bus bar 25 is detached from the electrode terminal 31 by melting the solder 39. A lead-free solder or a leaded solder may be used as the solder 39. A lead-free solder is preferably used in view of the durability.

30

[0042]

Further, in this embodiment, as shown in Fig. 9, the bus bar 25

and the electrode terminal 31 may be fixed to each other by using a clip 40. Specifically, as shown in Fig. 9, the tip 41 of the electrode terminal 31 is bent toward the positive side in the z-axis direction in advance. Further, the tip 42 of the bus bar 25 is bent so as to be
5 opposed to the tip 41 of the electrode terminal 31 in advance. Then, the tip 41 of the electrode terminal 31 and the tip 42 of the bus bar 25 are sandwiched and fixed by a clip 40. When the bus bar 25 is detached from the electrode terminal 31, the clip 40 is removed. The clip 40 can be formed of a metal material such as copper, iron,
10 stainless steel, or aluminum. In the structure shown in Fig. 9, the bus bar 25 can be detached from the electrode terminal 31 by pulling out the clip 40, so that the bus bar 25 can be easily detached therefrom.
[0043]

Further, in this embodiment, the junction box 30 is detachably
15 attached to the second glass plate 12. For example, as shown in Fig. 10, the junction box 30 may be fixed on the main surface on the outer side of the second glass plate 12 by using screws. Specifically, as shown in Fig. 10, screw holes are formed in the junction box 30 and the laminated glass 10 in advance. Then, bolts 52_1 and 52_2 are
20 inserted through the screw holes in the junction box 30 and the laminated glass 10, and the bolts 52_1 and 52_2 are fixed by using nuts 53_1 and 53_2 provided on the first glass plate 11 side. In this way, the junction box 30 can be fixed on the main surface on the outer side of the second glass plate 12. Note that when the junction box 30
25 is detached from the main surface on the outer side of the second glass plate 12, the bolts 52_1 and 52_2 are loosened and the junction box 30 is thereby detached from the main surface on the outer side of the second glass plate 12.

[0044]

30 Further, in this embodiment, as shown in Fig. 11, the junction box 30 may be fixed on the main surface on the outer side of the second glass plate 12 by using fixing jigs 55_1 and 55_2. That is, the junction box 30 may be fixed on the main surface on the outer side of

the second glass plate 12 by using fixing jigs 55_1 and 55_2 (first and second fixing jigs) for sandwiching and fixing the junction box 30 therebetween.

[0045]

5 Specifically, as shown in Fig. 11, the fixing jigs 55_1 and 55_2 are fixed on the main surface on the outer side of the second glass plate 12 by using adhesive members 56_1 and 56_2. Recesses 57_1 and 57_2 extending in the z-axis direction are formed in the fixing jigs 55_1 and 55_2, respectively, in advance, and the junction box 30 is
10 fixed to the fixing jigs 55_1 and 55_2 by sliding the junction box 30 along the recesses 57_1 and 57_2 in the z-axis direction. For example, the fixing jigs 55_1 and 55_2 may be formed by using structures such as clips in which recesses 57_1 and 57_2 are widened when a force is applied. In this case, the junction box 30 is slid along the recesses
15 57_1 and 57_2 in the z-axis direction in the state where the recesses 57_1 and 57_2 are widened by applying a force. After that, the force applied to the fixing jigs 55_1 and 55_2 is released, so that the junction box 30 is sandwiched and fixed in the recesses 57_1 and 57_2. In this way, the junction box 30 can be fixed on the main surface on
20 the outer side of the second glass plate 12. The fixing jigs 55_1 and 55_2 can be formed of a metal material or a resin material.

[0046]

 Note that when the junction box 30 is detached from the main surface on the outer side of the second glass plate 12, the junction box
25 30 is detached from the fixing jigs 55_1 and 55_2 by sliding the junction box 30 along the recesses 57_1 and 57_2 of the fixing jigs 55_1 and 55_2 in the z-axis direction in the state where the recesses 57_1 and 57_2 of the fixing jigs 55_1 and 55_2 are widened by applying a force. In this case, the junction box 30 can be detached
30 from the second glass plate 12 without detaching the fixing jigs 55_1 and 55_2 from the main surface on the outer side of the second glass plate 12.

[0047]

As described above, in this embodiment, the bus bars 25 are detachably connected to the electrode terminals 31 of the junction box 30. Further, the junction box 30 is detachably attached to the second glass plate 12. Therefore, according to the present invention, it is possible to provide a photovoltaic module in which a junction box can be replaced.

[0048]

As described in Background Art, in a photovoltaic module, electric power generated by photovoltaic cells is extracted to the outside through a junction box. Although the junction box comprises components such as electrode terminals, output cables, and bypass diodes, the junction box may break down or deteriorate over time. Therefore, when such a junction box is fixed on the surface of a solar cell panel, there is a problem that the junction box cannot be replaced. That is, when bus bars and electrode terminals of such a junction box are connected in such a manner that they cannot be detached, or when such a junction box is directly bonded to a photovoltaic module with an adhesive material, there is a problem that the junction box cannot be detached, thus impairing its maintainability.

[0049]

For this matter, in this embodiment, the bus bars 25 are detachably connected to the electrode terminals 31 of the junction box 30. Further, the junction box 30 is detachably attached to the second glass plate 12. Therefore, according to the present invention, it is possible to provide a photovoltaic module in which a junction box can be replaced.

[0050]

For example, components such as electrode terminals 31, output cables 34, and bypass diodes 35 are provided in the junction box 30. In this embodiment, when any of these components breaks down, the whole junction box 30 can be replaced. Therefore, the photovoltaic module can be used for a long period of time.

[0051]

Note that in this embodiment, at least one of the first and second translucent members 11 and 12 may be formed of a resin sheet. In this case, for the resin sheet, an ETFE (ethylene-tetrafluoroethylene copolymer), an ECTFE (ethylene-chlorotrifluoroethylene copolymer),
5 PVF (polyvinyl fluoride), PVDF (polyvinylidene fluoride), PET (polyethylene terephthalate), PS (polystyrene), PC (polycarbonate), or the like can be used.

[0052]

Although the present invention has been described with
10 reference to the above-described embodiments, the present invention is not limited to the structures of the above-described embodiments, but includes various modifications, corrections, and combinations that can be made by a person skilled in the art within the scope of the invention specified by the claims.

15 [0053]

This application is based upon and claims the benefit of priority from Japanese Patent Application 2023-192390 filed on November 10, 2023, the disclosure of which is incorporated herein in its entirety by reference.

20 **Reference Signs List**

[0054]

1 PHOTOVOLTAIC MODULE

10 LAMINATED GLASS (TRANSPARENT PLATE-LIKE MEMBER)

11 FIRST GLASS PLATE (FIRST TRANSLUCENT MEMBER)

25 12 SECOND GLASS PLATE (SECOND TRANSLUCENT MEMBER)

13 INTERMEDIATE ADHESIVE LAYER

20_1 TO 20_4 PHOTOVOLTAIC CELL GROUP

21 PHOTOVOLTAIC CELL

22, 22_1, 22_2 TAB WIRING LINE

30 23, 23_1 TO 23_3 BUS BAR

25, 25_1, 25_2 BUS BAR

26, 26_1, 26_2 HOLE

27, 27_1, 27_2 SEALING MATERIAL

	30	JUNCTION BOX
	31, 31_1, 31_2	ELECTRODE TERMINAL
	32, 32_1, 32_2	CLIP
	33	TERMINAL STRIP
5	34_1, 34_2	OUTPUT CABLE
	35	BYPASS DIODE
	38	SCREW
	39	SOLDER
	40	CLIP
10	41, 42	TIP
	52, 52_1, 52_2	BOLT
	53, 53_1, 53_2	NUT
	55, 55_1, 55_2	FIXING JIG
	56, 56_1, 56_2	ADHESIVE MEMBER
15	57, 57_1, 57_2	RECESS

CLAIMS

[Claim 1]

A photovoltaic module comprising:

5 a first translucent member;

a second translucent member disposed so as to be opposed to the first translucent member;

an intermediate adhesive layer disposed between the first and second translucent members;

10 a photovoltaic cell disposed between the first and second translucent members;

a hole formed in the second translucent member;

a sealing material disposed between the first and second translucent members around the hole, and configured to seal the space
15 between the hole and the intermediate adhesive layer;

a bus bar of which one end in a longitudinal direction is connected to the photovoltaic cell and the other end in the longitudinal direction is led to outside of the second translucent member through the hole; and

20 a junction box comprising an electrode terminal connected to the other end of the bus bar, wherein

the other end of the bus bar is detachably connected to the electrode terminal, and

the junction box is detachably attached to the second translucent
25 member.

[Claim 2]

The photovoltaic module according to claim 1, wherein the bus bar is sandwiched, in the hole, between the sealing material disposed on the first translucent member side and the sealing material disposed
30 on the second translucent member side, and is led to the outside of the second translucent member through the sealing material and the hole.

[Claim 3]

The photovoltaic module according to claim 1 or 2, wherein the

junction box is disposed so as to overlap the hole in a plan view of a main surface of the second translucent member.

[Claim 4]

5 The photovoltaic module according to claim 1 or 2, wherein the other end of the bus bar is fixed to the electrode terminal by using a clip.

[Claim 5]

10 The photovoltaic module according to claim 1 or 2, wherein the other end of the bus bar is fixed to the electrode terminal by using a screw.

[Claim 6]

The photovoltaic module according to claim 1 or 2, wherein the other end of the bus bar is fixed to the electrode terminal by using solder.

15 [Claim 7]

The photovoltaic module according to claim 1 or 2, wherein the junction box is fixed to a main surface on an outer side of the second translucent member by using a screw.

[Claim 8]

20 The photovoltaic module according to claim 1 or 2, further comprising:

a fixing jig configured to fix the junction box; and

an adhesive member adapted to fix the fixing jig on a main surface on an outer side of the second translucent member, wherein

25 the junction box is fixed on the main surface on the outer side of the second translucent member by using the fixing jig.

[Claim 9]

The photovoltaic module according to claim 8, wherein

30 the fixing jig comprises a first fixing jig and a second fixing jig configured to sandwich and fix the junction box therebetween,

a recess extending in a direction parallel to the main surface on the outer side of the second translucent member is formed in each of the first and second fixing jigs, and

the junction box is fixed to the first and second fixing jigs by sliding the junction box along the recesses of the first and second fixing jigs.

[Claim 10]

- 5 The photovoltaic module according to claim 1 or 2, wherein the sealing material is at least one type of material selected from the group consisting of butyl, a silicon resin, a urethane resin, and an epoxy resin.