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To whom it may concern:

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"To the best of my knowledge, the aforementioned documents are a true, full and accurate translation of the specified documents."

A handwritten signature in black ink, reading "Emily Paras", written over a horizontal line.

Signature of Emily Paras

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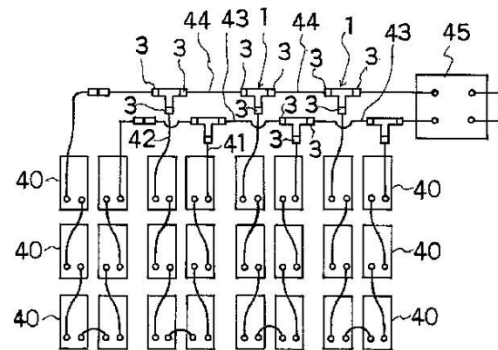
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(54) [Title of the Invention] Method for Connecting Solar Cell Module Wiring

(57) [Abstract]

[Problem] To make wiring connecting work for solar cell modules less time-consuming and safer.

[Solution] Plugs 3, which have been inserted into the receptacle portions of a three-way connector 1, are attached to the ends of the electrical wires 41, 42 connected to the two electrodes of a block formed by connecting a plurality of solar cell modules 40 in series, and a plurality of such blocks are prepared. Meanwhile, plugs 3 are also attached to the connection points of each electrical wire constituting a base wire 43, 44 leading to a terminal box 45 linked to an inverter, and each plug is inserted into each receptacle of the connector 1 at the connection points to complete the wiring connection work. In this way, work can be carried out quickly and easily even if there are many blocks. In addition, insulators are attached to the tip of the contact pin inside the outer sleeve of the receptacles and positioned behind the end of the outer sleeve so that workers cannot touch the charged portions, ensuring safe installation.



[Claims]

[Claim 1]

A method for connecting solar cell module wiring comprising a plurality of blocks of solar cell modules connected in series, and a base wire for connecting the outputs of the plurality of blocks in parallel to transmit power, the method comprising:

using three-way connectors to connect the outputs of the plurality of blocks to the base wire at connection points, the three-way connectors extending in three directions from the main body and having receptacle portions or plug portions connected to each other inside the main body;
attaching a plug portion or receptacle portion to the wire terminals constituting the base wire, and completing the insertion and connection so that the base wire is relayed using two of the three receptacle portions or plug portions of the three-way connectors; and
attaching, inserting, and connecting the other plug portion or receptacle portion to the wire terminals from the outputs of each of the blocks.

[Claim 2]

The method for connecting solar cell module wiring according to claim 1, wherein the three-way connectors are T-shaped.

[Claim 3]

The method for connecting solar cell module wiring according to claim 1, wherein the three-way connectors are disk-shaped.

[Claim 4]

The method for connecting solar cell module wiring according to claim 1, wherein the three-way connectors are polygonal.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a method for connecting the wiring of solar cell modules used in solar power generation.

[0002]

[Prior Art]

The use of solar energy is progressing rapidly. Solar cell modules used in solar power generation have been standardized, with regulations governing voltage and current capacity, such as a maximum output current of 20A for the output circuitry, a maximum voltage of DC350V for the circuit breakers, and a maximum current of 30A.

[0003]

FIG. 5 is a configuration diagram of conventional wiring connections for solar cell modules. A plurality of solar cell modules 50 (six in this example) are connected in series to form a single block, a plurality of blocks are formed (five blocks in this example), a plurality of blocks are connected in parallel by connecting electrical wires 51, 52 from solar cell modules forming the two poles of each block to base wires 53, 54, and the two base wires 53, 54 are connected to a terminal box 55 leading to an inverter (not shown).

[0004]

[Problem to Be Solved by the Invention]

Here, 56 and 57 are the connection points at which the electrical wires 51 and 52 from the solar cell modules are connected to the base wires 53, 54. In order to connect the electrical wires 51, 52 to the base wires 53, 54 at these connection points 56, 57, first, a long electrical wire measuring 20 to 40 meters must be brought to the construction site. This is cut the required length to make base wires 53, 54, the insulating coating is stripped from the ends of electrical wires 51, 52 from the solar cell module at the connection points to the base wires 53, 54 to expose the conductor, and the electrical wires and base wires are connected using soldering or some other specified procedure. Then, insulating tape is wrapped around these portions to provide insulation and waterproofing and complete the connection points 56, 57. This work is extremely time-consuming.

[0005]

During this work, the solar module surface is covered with a light-blocking sheet to prevent the generation of electromotive force and prevent electric shocks. After the work is completed, the sheet is removed. However, since there is no guarantee that the sheet will not come off during the work, it is necessary to complete the work as quickly as possible to prevent accidents.

[0006]

It is an object of the present invention to complete the task of connecting electrical wires from solar cell modules to the base wires, which is time-consuming and involves the risk of electric shock due to a long working period as mentioned above, safely and reliably, and in as little time as possible.

[0007]

[Means for Solving the Problem]

The present invention solves this problem by providing a method for connecting solar cell module wiring comprising a plurality of blocks of solar cell modules connected in series, and a base wire for connecting the outputs of the plurality of blocks in parallel to transmit power, the method comprising: using three-way connectors to connect the outputs of the plurality of blocks to the base wire at connection points, the three-way connectors extending in three directions from the main body and having receptacle portions or plug portions connected to each other inside the main body; attaching a plug portion or receptacle portion to the wire terminals constituting the base wire, and completing the insertion and connection so that the base wire is relayed using two of the three receptacle portions or plug portions of the three-way connectors; and attaching, inserting, and connecting the other plug portion or receptacle portion to the wire terminals from the outputs of each of the blocks.

[0008]

In the present invention, the three-way connectors may be T-shaped, the three-way connectors may be disk-shaped, or the three-way connectors may be polygonal.

[0009]

[Embodiment of the Invention]

In the method for connecting solar cell module wiring of the present invention, a three-way connector is used at each connection point.

[0010]

The electrical wires that supply power from the solar cell modules to the power supply destination are called base wires. A plurality of solar cell modules are connected in series to form a single block, and a plurality of blocks are connected to the base wires and arranged in parallel. Three-way connector are used at these parallel connection points.

[0011]

For the base wires connecting connection points, an electrical wire is divided into predetermined lengths, receptacles or plugs are attached to each terminal, and plugs or receptacles are attached to the electrical wire terminals of both poles of blocks composed of solar cell modules. The base wires between connection points are connected to each other using two of the three receptacles or plugs. The circuit is completed by inserting one of the three plugs or receptacles to the wire terminals at both poles of the blocks composed of solar cell modules.

[0012]

The three-way connectors used at the connection points are easy to understand in terms of wiring structure if they are T-shaped. However, the main body may also be disk-shaped or polygonal.

[0013]

The receptacles and plugs that constitute a connector are set in a proper mating position, and adequate waterproofing is ensured by using an uneven ring shape relationship for both components.

[0014]

Insulators are attached to the tips of the contact pins constituting the plugs, and these are recessed so that they are positioned further back than the end of the outer sleeve of the plug. This prevents electric shocks in the event that a test finger comes into contact with the tip of the pin during work.

[0015]

[Examples]

FIG. 2 is a front view of a three-way connector used for wiring connections of solar cell modules in the present invention. In this figure, 1 is a connector, and the connector as a whole forms a T-shaped three-way branch receptacle, with the outer shell formed from a soft vinyl chloride material by insert molding of the wire processing product described below. Here, 11, 12, and 13 are receptacle portions that are T-shaped and divided into three branches, and have a structure for receiving the appropriate plug.

[0016]

FIG. 3 is a front view of the wire processing product inserted into the connector 1 during molding. In this figure, 2 is an electrical wire product which forms a T-shape overall, and 24 is the electrical wire corresponding to the portion constituting the horizontal segment of the T-shape. A cable of approximately CV 3.5 mm² or CV 2.0 mm² is used, and the insulating sheath is removed to the specified dimensions at both ends. Here, 25 is a wire corresponding to the portion that forms the vertical segment of the T-shape, and is made of a cable of the same thickness as above, with the insulating sheath removed at both ends to the specified length.

[0017]

Here, 21 is a cylindrical sleeve formed of phosphor bronze with a nickel-plated surface, having an inner diameter of approximately 3φ. One end of the sleeve receives the end portion 24-1 of electrical wire 24 with its insulation coating removed, which is then electrically connected using soldering or some other specified means. The other end receives the contact pin on the plug side. Also, 21a is a ring sleeve for maintaining strength, which is fitted over the outer circumference of the sleeve 21 and has a structure that crimp-connects and reinforces the portion where end portion 24-1 of electrical wire 24 is connected to the sleeve 21.

[0018]

Here, 22 is also a cylindrical sleeve formed of phosphor bronze with a nickel-plated surface and an inner diameter of approximately 3ϕ . One end of the sleeve receives the other end portion 24-2 of electrical wire 24, and is electrically connected by soldering or some other means, while the other end is structured to receive the contact pin on the plug side. Also, 22a is a ring sleeve for maintaining strength, which is fitted over the outer circumference of the sleeve 22 and has a structure that crimp-connects and reinforces the portion where end portion 24-2 of electrical wire 24 is connected to the sleeve 22.

[0019]

Here, 25 is the wire corresponding to the portion that forms the vertical segment of the T shape. Also, 23 and 23a are sleeves and ring sleeves similar to those described above, provided at one end 25-1 of electrical wire 25 with its insulation removed. Because they are similar, further description of these components has been omitted.

[0020]

The other end 25-2 of electrical wire 25, which is different from the one end 25-1 of electrical wire 25, has its insulating sheath removed, and is bent so that it runs parallel to the end portion 24-1 of electrical wire 24, which also has its insulating sheath removed. The two wires are connected by soldering. This portion is passed through the ring sleeve 26 and reinforced by crimping from the outer circumference of the ring sleeve 26.

[0021]

The connector shown in FIG. 2 is formed by insert molding the wire processing product 2 described above. As described above, the whole structure forms a T-shaped triple-branched receptacle, into which the wire processing product 2 is inserted and molded using a soft vinyl chloride material. Here, 1a is the main body, from which the receptacle portions are extended in a T-shaped three-way branch configuration at 11, 12, and 13. Each sleeve 21, 22, and 23 of the wire processing products 2 is exposed at the opening to each receptacle. Here, 11a, 12a, and 13a are ring-shaped projections formed on the outer periphery of each receptacle portion, which engage with the ring-shaped grooves on the plug side described below to lock the plug in place when inserted.

[0022]

FIG. 4 shows a cross-sectional view of the connector during use, with a plug inserted. Here, 3 is a connector plug, 31 is an outer sleeve formed of an insulating resin, and 32 is a contact pin formed of a conductor and positioned at the center of the inner diameter. Also, 33 is an insulator formed of an insulating material and fixed to the tip of the contact pin 32. This is a chip-shaped component having a diameter equal to or slightly smaller than the outer diameter of contact pin 32. The tip of insulator 33 is positioned so as to be slightly recessed relative to the tip of outer sleeve 31.

[0023]

Here, 31a is a ring-shaped recessed portion formed in the inner diameter of the outer sleeve 31. When a plug is inserted into one of the three receptacles of the connector to a predetermined position, the recessed portion 31a engages with the ring-shaped projections 11a, 12a, and 13a formed on the outer periphery of the receptacle portions 11, 12, and 13, thereby locking the plug and the receptacle in place.

[0024]

FIG. 4 shows a plug 3 inserted into a receptacle portion 11. As described above, when the plug 3 is inserted to a predetermined position, the ring-shaped protrusion 11a formed on the outer periphery of receptacle portion 11 engages with the ring-shaped recessed portion 31a provided on the inner diameter portion of the outer sleeve 31, thereby locking it in the inserted state. The contact pin 32 is inserted into the sleeve 21 to maintain electrical contact.

[0025]

FIG. 1 is a configuration diagram of the wiring connections for solar cell modules using the connector described above. A plurality of solar cell modules 40 (six in this example) are connected in series to form a single block, a plurality of blocks are formed (five blocks in this example), a plurality of blocks are connected in parallel by connecting electrical wires 41, 42 from solar cell modules forming the two poles of each block to base wires 43, 44, and the two base wires 43, 44 are connected to a terminal box 45 leading to an inverter (not shown).

[0026]

The connector 1 described above is used at the connection points at which the electrical wires 41, 42 from the solar module blocks are connected to the base wires 43, 44. When connecting the electrical wires 41, 42 to the base wires 43, 44 at the connection points, the base wires 43, 44 are first cut to a predetermined length, and plugs 3 are attached to each terminal. Usually, the distance between connection points is 40 to 50 cm, so the cut lengths correspond to this. Plugs 3 should also be attached to the terminals of the electrical wires 41, 42 from the solar cell module.

[0027]

As many connectors 1 as connection points are prepared, and to connect electrical wires, the plugs 3 of the terminals of the base wires 43, 44 are inserted and connected using the receptacle portions 11, 12 that form a T-shaped parallel segment of the connector 1, and then the plugs 3 at the terminals of the electrical wires 41, 42 from a solar module block are inserted into the receptacle portions 13 that form the vertical segment of the T-shape of the connectors 1 to connect them to the base wires 43, 44.

[0028]

This process is repeated to complete the connection wiring shown in FIG. 1. The work can be done quickly because all that is required is to insert plugs into the receptacle portions of connectors.

[0029]

The plugs have an insulator attached to the tip of the contact pin, which is recessed from the tip of the outer sleeve of the plug to prevent accidents such as electric shocks during work.

[0030]

The plugs and receptacles the connectors are designed to mate properly and, because they have an uneven ring-shaped relationship, adequate waterproofing is provided to completely prevent water penetration.

[0031]

The plugs that are used are not necessarily limited to those described above, and any structure may be used as long as the plug has a waterproof structure and a structure that keeps fingertips and tools, etc. from touching the plug tip during connection work, or a structure does not cause an electric shock if accidentally touched.

[0032]

In the example described above, a connector with a three-way branch is a receptacle and a plug is attached on the electrical wire side for insertion. However, the reverse relationship may be used, that is, the connector of the three-way branch may be a plug and the electrical wire side a receptacle.

[0033]

[Effect of the Invention]

As explained above, the present invention significantly reduces work time because the connection of electrical wires from solar cell modules to the base wires, which previously required a great deal of labor,

is now performed using a three-way connector and coupling the receptacles of the connector to plugs. In addition, the plugs for the connector have a waterproof structure and are designed to keep fingertips and tools, etc. from touching the plug tip during connection work, or to prevent electric shocks even if accidentally touched.

[Brief Description of the Drawings]

[FIG. 1]

FIG. 1 is a configuration diagram of the wiring connections in an example of the present invention.

[FIG. 2]

FIG. 2 is a front view of an example of a connector used in the wiring connections of the present invention.

[FIG. 3]

FIG. 3 is a front view of an example of the internal wiring of a connector used in the wiring connections of the present invention.

[FIG. 4]

FIG. 4 is a cross-sectional view of a connector of the present invention in use.

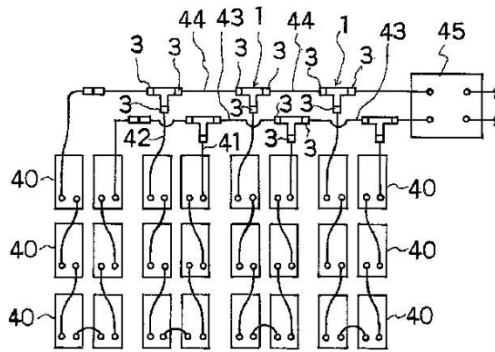
[FIG. 5]

FIG. 5 is a configuration diagram of conventional wiring connections.

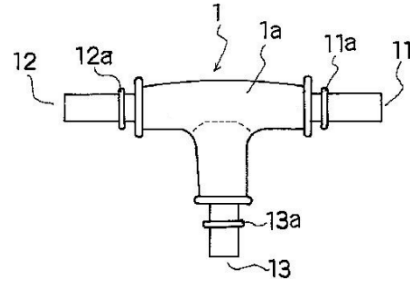
[Reference Numbers]

- 1: Connector
- 11: Receptacle
- 12: Receptacle
- 13: Receptacle
- 3: Plug
- 40: Solar cell module
- 41: Electrical wire
- 42: Electrical wire
- 43: Base wire
- 44: Base wire

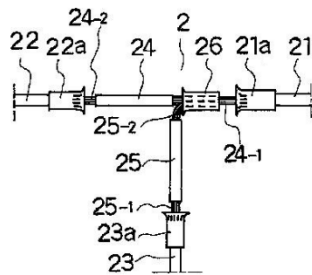
[FIG. 1]



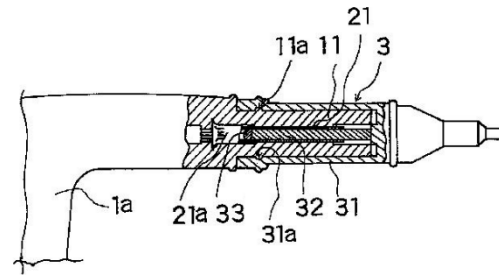
[FIG. 2]



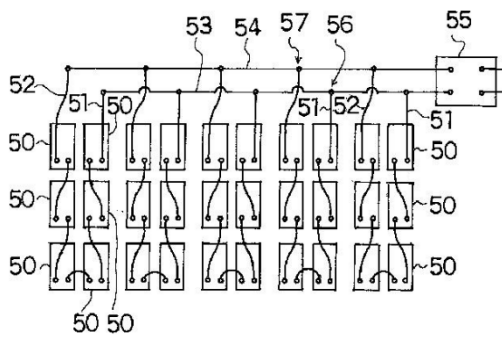
[FIG. 3]



[FIG. 4]



[FIG. 5]



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