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(54) Connector for Power Generator Modules

(57) A connector device (1) for connecting a plurality of power generator modules (22) in parallel comprises (i) a first connector (3) having a number of electric contacts, (ii) a second connector (2) fitting the first connector (3) and having the same number of electric contacts as the first connector (3), (iii) at least one cable section (8) extending between the first connector (3) and the second connector (2) and comprising a plurality of leads, (iv) a plurality of electric bus lines, each of the plurality of electric bus lines continuously extending from one of the electric contacts of the first connector (3) up to a corresponding one of the electric contacts (22-26) of the second connector (2), each of the plurality of electric bus lines including one of the plurality of leads of the at least one cable section (8), and the plurality of electric bus lines including at least two electric bus power lines, and (v) a module connector (9) shaped to be accepted by one of the plurality of power generator modules (22) and having at least the same number of electric contacts as the first connector (3) and the second connector (2), each of the electric contacts of the module connector (9) being electrically connected to one of the plurality of electric bus lines extending from the first connector (3) up to the second connector (2).

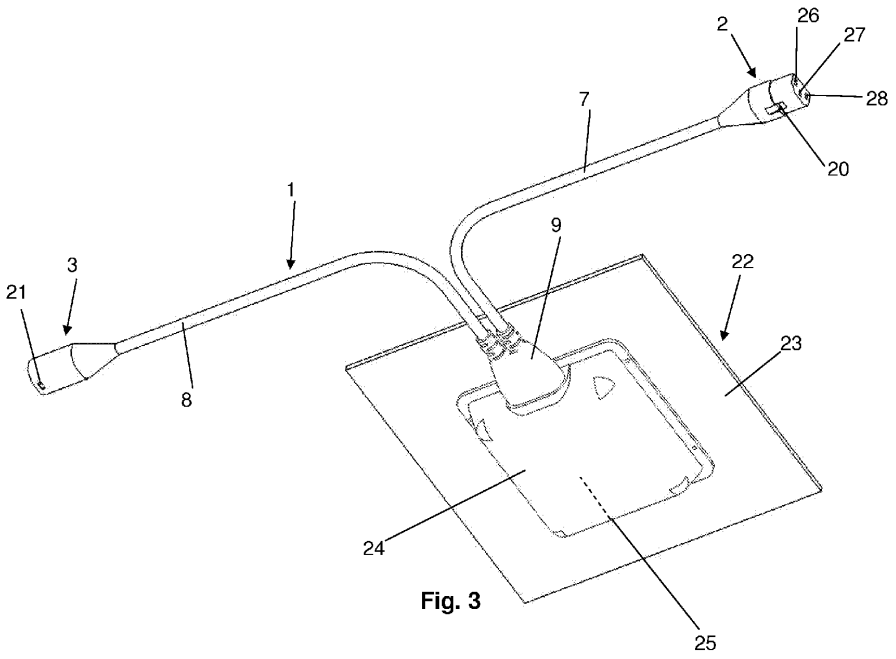

Fig. 3

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a connector device for connecting a plurality of power generator modules in parallel. Further, the invention relates to a plurality of such connector devices, and to a plurality of power generator modules connected in parallel, preferable using said plurality of connector devices.

[0002] Particularly, the power generator modules comprise a photovoltaic power generator. Generally, however, the power generator modules may also comprise other power generators like wind power generators or even batteries, for example.

[0003] Further, the power generator modules particularly include a DC/AC-converter or inverter for forming an alternating current from the direct current provided by the power generator. Additionally or alternatively, the power generator modules may also comprise DC/DC-converters for converting the direct current provided by the power generator to another voltage, for example.

[0004] Although, the invention particularly relates to connecting a plurality of power generator modules each having an inverter, the power inverter modules may completely be without any inverter or converter.

[0005] Most particularly, the plurality of power generator modules provide an alternating current being the sum of the alternating currents provided by each of the plurality of the power generator modules, or a direct current being the sum of the direct currents provided by each of the plurality of power generator modules. In the first case, the alternating current may have a voltage and frequency suitable for directly feeding the alternating current into a power grid. In the latter case, the direct current will typically be fed to a central inverter inverting the direct current into an alternating current to be fed into a power grid or to be directly supplied to electric loads.

[0006] Dividing up a power plant, like for example a photovoltaic power plant, into separate power generator modules allows for easy installing and enlarging the photovoltaic power plant, and keeps the power to be handled by each power generator module low.

BACKGROUND OF THE INVENTION

[0007] DE 196 09 189 A1 discloses a photovoltaic power generator module comprising a DC/DC-converter converting the direct current supplied by a photovoltaic power generator with regard to the output current or output voltage, so that the power generator module may be directly connected to an electric load like, for example, a motor. Further, this document discloses connecting a plurality of such power generator modules both in series and in parallel. In case of the parallel connection, the two output terminals of each power generator module are connected to two separate bus lines connected to the motor. No details are given with regard to how these connections are actually made.

[0008] Connecting power generator modules in parallel results in an increase of the current supplied by the plurality of power generator modules. According to Joule's law, the ohmic losses in the electric lines connecting the power generator modules increases with $I^2 \times R$, wherein I is the current and R is the ohmic resistance of the electric lines. This is the reason, why often the voltage is increased to reduce the current with the same electric power being forwarded. However, an increased voltage requires additional security measures; and if each power generator module outputs an alternating current at a voltage and frequency suitable for directly feeding the alternating current into a power grid, the voltage between the electric bus lines connecting the power generator modules in parallel may not be increased at all to the end of reducing the current flowing through these electric lines.

PROBLEM OF THE INVENTION

[0009] Thus, it is the problem of the invention to provide a connector device for connecting a plurality of power generator modules in parallel, a plurality of connector devices of this kind and a plurality of power generator modules connected in parallel in which the ohmic losses in forwarding the electric power generated by each power generator module are delimited. At the same time, the installation of the plurality of power generator modules, particularly when using the connector device, should be easy and reliable.

SOLUTION

[0010] The problem of the invention is solved by a connector device according to independent claim 1, a plurality of connector devices according to claim 12 or 13, and a plurality of power generator modules according to independent claim 14. Preferred embodiments of the new connector device are defined in dependent claims 2 to 11, and dependent claim 15 defines a preferred embodiment of the new plurality of power generator modules.

DESCRIPTION OF THE INVENTION

[0011] In a first aspect, the invention provides a connector device for connecting a plurality of power generator modules in parallel, the connector device comprising a first connector having a number of electric contacts; a second connector fitting the first connector and having the same number of electric contacts as the first connector; at least one cable section extending between the first connector and the second connector and comprising a plurality of leads; a plurality of electric bus lines, each of the plurality of electric bus lines continuously extending from one of the electric contacts of the first connector up to a corresponding one of the electric contacts of the second connector, each of the plurality of electric bus

lines including one of the plurality of leads of the at least one cable section, and the plurality of electric bus lines including at least two electric bus power lines; and a module connector shaped to be accepted by one of the plurality of power generator modules and having at least the same number of electric contacts as the first connector and the second connector, each of the electric contacts of the module connector being electrically connected to one of the plurality of electric bus lines extending from the first connector up to the second connector.

[0012] The first and the second connector of the new connector device may be a male connector and a female connector, respectively, or two hermaphrodite, i. e. identical, connectors. Male and female connectors may, however, be preferred to avoid any problems caused by an erroneous combination of connectors, like for example by the direct combination of the two connectors of the same new connector device.

[0013] The first and the second connector of the new connector device allow for easily forming a chain of new connector devices by plugging the second connector of one connector device together with the first connector of the next connector device. Each member of this chain, i.e. each new connector device, allows for connecting one power generator module via its module connector. The power generator modules may be arranged at any distance covered by at least one cable section and any further cable section of the new connector device extending between the first connector and the second connector.

[0014] In the new connector device, the electric bus lines continuously extend from the electric contacts of the first connector to the electric contacts of the second connector. I.e. the bus lines do not extend through the single power generator modules, to which they are connected. Instead, the electric contacts of the module connector are connected to the continuous electric bus lines via tap lines, for example. These electric connections are integrated parts of the new connector device which will be manufactured with special purpose equipment. Thus, the electric conductivity or the ohmic resistance of the electric bus lines will not depend on any manual connection operation when connecting one of the power generator modules to the leads of the cable. Using the new connector device, a power generator module may be simply connected by plugging it to the module connector.

[0015] The at least one cable section of the new connector device allows for easy installation both of the new connector device and of the power generator modules connected by means of a plurality of the new connector devices. This particularly applies, if the at least one cable section is flexible. A flexible cable section may thus be preferred. It is, however, also possible to use rigid cable sections which could be integrated in a support frame for the power generator modules, for example. The at least one cable section may extend from the first connector or the second connector up to the module connector. The remaining second connector or first connector, respectively, may be one integral part with the module connector. In a preferred embodiment, however, a further cable section, through which the electric bus lines also extend, extends from the module connector up to the remaining second connector or first connector. This further cable section allows for connecting the second connector of one connector device connected to one power generator module to the first connector of another connector device connected to another power generator module at a distance to both power generator modules which may be much easier with photovoltaic power generator modules already attached to a roof construction, for example. The further cable section may also be either flexible or rigid.

[0016] In a particular embodiment of the new connector device, the leads of the at least one cable section and the leads of the further cable section are electrically connected one to one via connecting members within a housing of the module connector. Generally, the leads of both cable sections may also be connected one to one via connecting members within a separate housing. However, the number of parts of the new connector device and the efforts to manufacture it will be reduced, when the leads of both cable sections are connected within the housing of the module connector. The kind of connection of the single leads to the single connecting members within the housing of the module connector may be various. They may be crimped together, they may be soldered together, they may also be glued together, as appropriate.

[0017] Preferably, the arrangement of the cables, their leads and the connecting members within the housing of the module connector are finally fixed by an injection molding process filling all free spaces within the housing with plastic or resin. This step of injection molding may also be used to make the housing of the module connector.

[0018] The connecting members connecting the leads of the two cable sections may advantageously be used to also provide electric connections to the electric contacts of the module connector. This may be done, for example, by means of tap lines each connected to one of the connecting members at its one end and to one of the electric contacts of the module connector at its other end. These tap lines may have a smaller specific conductivity per length unit than the electric bus lines between the second connector and the first connector including the connecting members. The current supplied by each power generator module to the bus lines via the tap lines will be comparatively small as compared to the maximum current flowing through the bus lines with a higher number of power generator modules connected in parallel.

[0019] In another particular embodiment of the new connector device, the at least one cable section and the further cable section are parts of one continuous cable, and the electric contacts of the module connector may be connected to the continuous leads of this cable via an insulation displacement connector (IDC).

[0020] The electric bus lines of the new connector device comprise at least two electric bus power lines for forwarding the electric current fed to the electric bus power lines by the single power generator modules. These electric bus power lines preferably include a neutral line and at least one phase line or two phase lines. This corresponds to a single phase alternating current according to the European standard or a two phase alternating current according to the US standard being forwarded via the electric bus power lines. There may, however, also be more than two electric bus power lines. If there are three phase lines in addition to the neutral line, the alternating current forwarded by the electric bus power lines may be a three phase alternating current.

[0021] Preferably, the electric bus lines of the new connector device also include an earth line. This allows for connecting basic parts, like for example the housing of the power generator module connected to the module connector, to earth. Further, an additional earth line provides an additional reference potential for a high frequency power line communication via the electric bus power lines of the new connector device between a central control or monitoring station and the single power generator modules connected in parallel via a plurality of the new connector devices. In case of two phase lines for forwarding a two phase alternating current according to the US standard, the electric bus lines may also comprise a neutral line in addition to the earth line.

[0022] In a particular embodiment of the new connector device, the module connector comprises two separate electric contacts both electrically connected to the same earth line. This allows for a particularly easy connection of both a housing and a PCB of the power generator module to earth.

[0023] The new connector device is easily designed for outdoor applications, like for example on a roof of a house. This includes a water-tight fit between the second connector and the first connector. It also includes that the module connector is shaped to be water-tightly fitted to the power generator module. To this end, the power generator module may comprise a suitable socket for the module connector. The module connector may also form or comprise a part of a water-tight housing of the power generator module, particularly of an inverter included in the power generator module.

[0024] As already indicated above, more than one new connector device will typically be used at one time to connect a plurality of power generator modules in parallel. In addition to this plurality of new connector devices which have identical first connectors and second connectors and which may even be completely identical, a terminal connector cable for connecting the parallel connection of the plurality of power generator modules to at least one of an electric load and a power transit station, i. e. to an electric load and/or a power transit station, and an end cap fitting the free connector at the far end of the parallel connection may be provided. The terminal connector cable may be much longer than the maximum distance of the second connector from the first connector of each single connector device to cover a longer distance between the parallel connection of the power generator modules and the electric load and/or the power transit station.

[0025] In a preferred embodiment, however, there is no end cap fitting the free connector at the far end of the parallel connection of the power generator modules but a second terminal connector cable, so that this free connector may also be connected to the electric load and/or the power transit station. In this way, all electric bus lines extending through the single connector devices run in a closed loop from and to the power transit station. This ring being formed by each electric bus line has essential advantages. Any single disruption of the electric bus lines does not disconnect any of the power generator modules from the power transit station. As long as there is no asymmetric disruption of any bus line the current flowing from the plurality of the power generator modules is distributed over the two terminal connector cables so that each terminal connector cable and about one half of the plurality of connector devices connected to it will only forward one half of the total current. Due to Joule's law, the reduction in the maximum current forwarded results in a reduction of the ohmic losses. This reduction will typically be at least 50 % and may come close to 75 %. Further, the maximum ohmic resistance between the power transit station and any power generator module also decreases due to Joule's law, which reduces the maximum excess voltage to be provided by the power generators to provide the desired output voltage at the power transit station. This reduction is of the same order as the reduction of the ohmic losses.

[0026] It is to be understood that these advantages will also be achieved, if other connecting devices are used to connect a plurality of power generator modules in parallel as long as the electric bus power lines are each running in a closed loop from and to the electric load and/or the power transit station.

[0027] As already indicated before, the ohmic losses due to an increasing current are particularly relevant with power generator modules outputting alternating current at a power grid voltage and frequency so that this current may be directly fed into the power grid. Thus, the present invention is particularly suited to reduce these ohmic losses.

[0028] Advantageous developments of the invention result from the claims, the description and the drawings. The advantages of features and of combinations of a plurality of features mentioned at the beginning of the description only serve as examples and may be used alternatively or cumulatively without the necessity of embodiments according to the invention having to obtain these advantages. Further features may be taken from the drawings, in particular from the illustrated designs and the dimensions of a plurality of components with respect to one another as well as from their relative arrangement and their operative connection. The combi-

nation of features of different embodiments of the invention or of features of different claims independent of the chosen references of the claims is also possible, and it is motivated herewith. This also relates to features which are illustrated in separate drawings, or which are mentioned when describing them. These features may also be combined with features of different claims. Furthermore, it is possible that further embodiments of the invention do not have the features mentioned in the claims.

SHORT DESCRIPTION OF THE DRAWING

[0029] The invention will now be further described and explained with reference to the attached drawings.

Fig. 1 is a perspective view on one embodiment of the new connector device.

Fig. 2 is an enlarged perspective view on a module connector of another embodiment of the new connector device.

Fig. 3 is a perspective view on a further embodiment of the new connector device connected to the housing of an inverter of a power generator module.

Fig. 4 shows a plurality of power generator modules connected in parallel via a plurality of connector devices, and connected to a power transit station via a terminal connector cable; and

Fig. 5 shows the same plurality of power generator modules connected in parallel via connector devices as in Fig. 4, but here connected to the power transit station via two terminal connector cables.

DESCRIPTION OF THE DRAWING

[0030] **Fig. 1** shows a connector device 1 in a perspective view. The connector device 1 comprises a female first connector 2 and a male second connector 3. The male connector 3 fits the female connector 2, but it is not intended to plug the female connector 2 together with the male connector 3. Instead, it is intended to form a chain of a plurality of connector devices 1 by plugging the female connector 2 of one connector device 1 together with the male connector 3 of a next connector device 1. Doing this, an end cap 4 depicted in Fig. 1 may be used to cover the female connector 2 of the final connector device 1 of the chain. A security plate 5 with openings 6 for contact pins of the male connector 3 may be provided for covering these contact pins as long as no female connector 2 is plugged together with the male connector 3 to avoid touching these contact pins. Both connectors 3 and 3 are each connected to a flexible cable section 7 and 8, respectively. The cable sections 7 and 8 each include three leads of a typical cross-sectional area of 2.5 mm^2 each. Two of these leads are used to provide for electric power bus lines, one power bus line being a neutral line and the other power bus line being a phase line. The third lead of the flexible cable sections 7 and 8 provides for an earth line. All electric bus lines extending through the flexible cable sections 7 and 8 continuously extend from the electric contacts of the female connector 2 to the electric contacts of the male connector 3. Thus, the electric bus lines pass through a module connector 9 to which both flexible cable sections 7 and 8 are attached and in which the leads of both flexible cable sections 7 and 8 are electrically connected one to one via connecting members (not shown here). Further, tap lines 10 to 12 connected to the electric contacts 13 to 15 of the module connector 9 within a connector element 16 are connected to the electric bus lines at these connecting elements. The tap lines 10 to 12 typically have a cross-sectional area of 0.75 mm^2, i.e. a much smaller cross-sectional area than the leads of the flexible cable sections 7 and 8. A snap ring 17 depicted in Fig. 1 may be used to water-tightly fix the module connector 9 to the housing of a power generator module. The female connector 2 and the male connector 3 are provided with cooperating parts 20 and 21 of a snap-in lock locking the female connector 2 to the male connector 3. The part 20 of the snap-in lock is a latch snapping into a corresponding recess or opening 21 in the male connector 3. Such openings 21 are also provided in the end cap 4 to lock the end cap 4 to the female connector 2.

[0031] The variant of the module connector 9 depicted in **Fig. 2** comprises an additional tap line 18 connected to a further electric contact 19 of the module connector 9. This additional tap line 18 is connected to the same continuous earth line of the connector device 1 as the tap line 11. The further electric contact 19 allows for easily connecting the housing of the power generator module to earth in addition to connecting the PCB of the power generator module to earth by means of the connector element 16 fits.

[0032] **Fig. 3** depicts a unit consisting of the connector device 1 and of parts of a power generator module 22 connected to the module connector 9 of the connector device 1. These parts include the base plate 23 to which a housing 24 of an inverter 25 of the power generator module is mounted in a water-tight way. The module connector 9 is water-tightly attached to this housing 24. The inverter 25 outputs an alternating current on the electric bus lines of the connector device 1 which are continuously extending from the electric contacts 26 to 28 of the female connector 2 to the corresponding electric contacts of the male connector 3.

[0033] **Fig. 4** shows a plurality of the units of Fig. 3 connected together by plugging the female connector 2 of one connector device 1 together with the male connector 3 of the next connector device 1. This chain looks like a series connection of the generator modules 22. However, their inverters 25 are in fact connected in parallel as the interconnected connector devices 1 provide

for continuous electric bus lines to which the inverters 25 are connected by tap lines. The male connector 3 on one end of the chain of connector devices 1 and power generator modules 22 may be covered with the end cap 4 depicted in Fig. 4. At the other end of the chain, a terminal connector cable 29 is connected to the male connector 3 by a female connector 30 which is identical to the female connector 2 of the connector devices 1. At its other end, the flexible terminal connector cable 29 is connected to a power transit station 31 forwarding the sum of the alternating currents from the power generator modules 22 to a power grid 32. Further, the power transit station 31 allows for power line communication between a control or monitoring unit 33 and the single power generator modules 22, which does not affect the alternating current supplied to the power grid 32.

[0034] The parallel connection of power generator modules 22 via connector devices 1 according to **Fig. 5** differs from that one according to Fig. 4 in that a further flexible terminal connector cable 34 is connected to the female connector 2 at the one end of the chain of power generator modules which is closed by the end cap 4 in Fig. 4. For this purpose, the terminal connector cable 34 comprises a male connector 35 identical to the male connectors 3 of the connector devices 1 at its one end. At its other end, the terminal connector cable 34 is also connected to the power transit station 31 in such a way that the electric bus lines extending through the terminal connector cables 29 and 34 and the connector devices 1 are closed to a loop within the power transit station 31. In this way, the currents forwarded by each terminal connector cable 29 and 34 and by the attached connector devices 1 are reduced by a factor of about 1/2. This results in a reduction both of the ohmic losses and of the necessary excess voltages to be produced by the power generator modules 22 to provide the desired output voltage at the power transit station 31 by 50 % at minimum and about 75 % at maximum. Further, a single interruption of one of the bus lines within one connector device or between two connector devices does not disconnect any of the power generator modules 22 from the power transit station 31.

LIST OF REFERENCE NUMERALS

[0035]

1 connector device

2 connector

3 connector

4 end cap

5 security plate

6 opening

7 flexible cable section

8 flexible cable section

9 module connector

10 tap line

11 tap line

12 tap line

13 electric contact

14 electric contact

15 electric contact

16 connector element

17 snap ring

18 tap line

19 electric contact

20 latch

21 opening

22 power generator module

23 base plate

24 housing

25 inverter

26 electric contact

27 electric contact

28 electric contact

29 terminal connector cable

30 connector

31 power transit station

32 power grid

33 control and monitoring unit

34 terminal connector cable

35 connector

Claims

1. A connector device (1) for connecting a plurality of power generator modules (22) in parallel, the connector device (1) comprising:

   - a first connector (3) having a number of electric contacts;
   - a second connector (2) fitting the first connector (3) and having the same number of electric contacts (26-28) as the first connector (3);
   - at least one cable section (8) extending between the first connector (3) and the second connector (2) and comprising a plurality of leads;
   - a plurality of electric bus lines,

     o each of the plurality of electric bus lines continuously extending from one of the electric contacts of the first connector (3) up to a corresponding one of the electric contacts (26-28) of the second connector (2),
     o each of the plurality of electric bus lines including one of the plurality of leads of the at least one cable section (8), and
     o the plurality of electric bus lines including at least two electric bus power lines; and

   - a module connector (9) shaped to be accepted by one of the plurality of power generator modules (22) and having at least the same number of electric contacts (13 to 15, 19) as the first connector (3) and the second connector (2),

     o each of the electric contacts (13-15, 19) of the module connector (9) being electrically connected to one of the plurality of electric bus lines extending from the first connector (3) up to the second connector (2).

2. The connector device (1) of claim 1, wherein the at least one cable section (8) extends from one of the first connector (3) and the second connector (2) up to the module connector (9).

3. The connector device (1) of claim 2, wherein a further cable section (7), through which the electric bus lines extend, extends from the module connector (9) up to the other of the first connector (3) and the second connector (2).

4. The connector device (1) of claim 3, wherein the leads of the at least one cable section (8) and the leads of the further cable section (7) are electrically connected one to one via connecting members within a housing of the module connector (9).

5. The connector device (1) of claim 4, wherein each of the electric contacts (13-15, 19) of the module connector (9) is electrically connected to one of the connecting members.

6. The connector device (1) of claim 5, wherein each of the electric contacts (13-15, 19) of the module connector (9) is electrically connected to one of the connecting members via a tap line (10-12, 18) having a smaller specific conductivity per length unit than the electric bus line including the connecting member to which the tap line (10-12, 19) is connected.

7. The connector device (1) of any of the claims 1 to 6, wherein the electric bus power lines include at least two phase lines or a neutral line and at least one phase line.

8. The connector device (1) of any of the claims 1 to 7, wherein the electric bus lines include an earth line.

9. The connector device (1) of claim 8, wherein the module connector (9) comprises two separate electric contacts (14, 19) both electrically connected to the earth line.

10. The connector device (1) of any of the claims 1 to 9, wherein the module connector (9) is shaped to be water-tightly fitted to the one of the plurality of power generator modules (22).

11. The connector device (1) of claim 10, wherein the module connector (9) comprises a part of a water-tight housing (24) of one of the plurality of power generator modules (22).

12. A plurality of connector devices (1) of any of the claims 1 to 11, having identical first connectors (3) and second connectors (2), and further comprising

    - a terminal connector cable (29)

      - at its one end, having a connector (30) fitting one of the first connectors (3) and the second connectors (2),
      - at its other end, being connectable to at least one of an electric load and a power transit station (31), and
      - having a plurality of leads each extending from an electric contact of the connector (30) at the one end to the other end connectable to the at least one of the electric load and the power transit station (31);

    - and an end cap (4) fitting the connector (30) at the one end for covering the other one of the first connectors (3) and the second connectors (2).

13. A plurality of connector devices (1) of any of the claims 1 to 11, having identical first connectors (3) and second connectors (2), and further comprising

- a first terminal connector cable (29)

  - at its one end, having a connector (30) fitting one of the first connectors (3),
  - at its other end, being connectable to at least one of an electric load and a power transit station (31), and
  - having a plurality of leads each extending from an electric contact of the connector (30) at the one end to the other end connectable to the at least one of the electric load and the power transit station (31); and

- a second terminal connector cable (34)

  - at its one end, having a connector (35) fitting one of the second connectors (2),
  - at its other end, being connectable to the power transit station (31), and
  - having a plurality of leads each extending from an electric contact of the connector (35) at the one end to the other end connectable to the at least one of the electric load and the power transit station (31).

14. A plurality of power generator modules (22) connected in parallel via electric bus power lines, particularly using the plurality of connector devices (1) and the first and second terminal connector cables (29, 34) of claim 13, wherein the electric bus power lines are each running in a closed loop from and to at least one of an electric load and a power transit station (31).

15. The plurality of power generator modules (22) of claim 14, wherein each of the plurality of power generator modules (22) comprises an inverter (25) outputting an AC-current of power grid (32) voltage and frequency on the electric bus power lines.

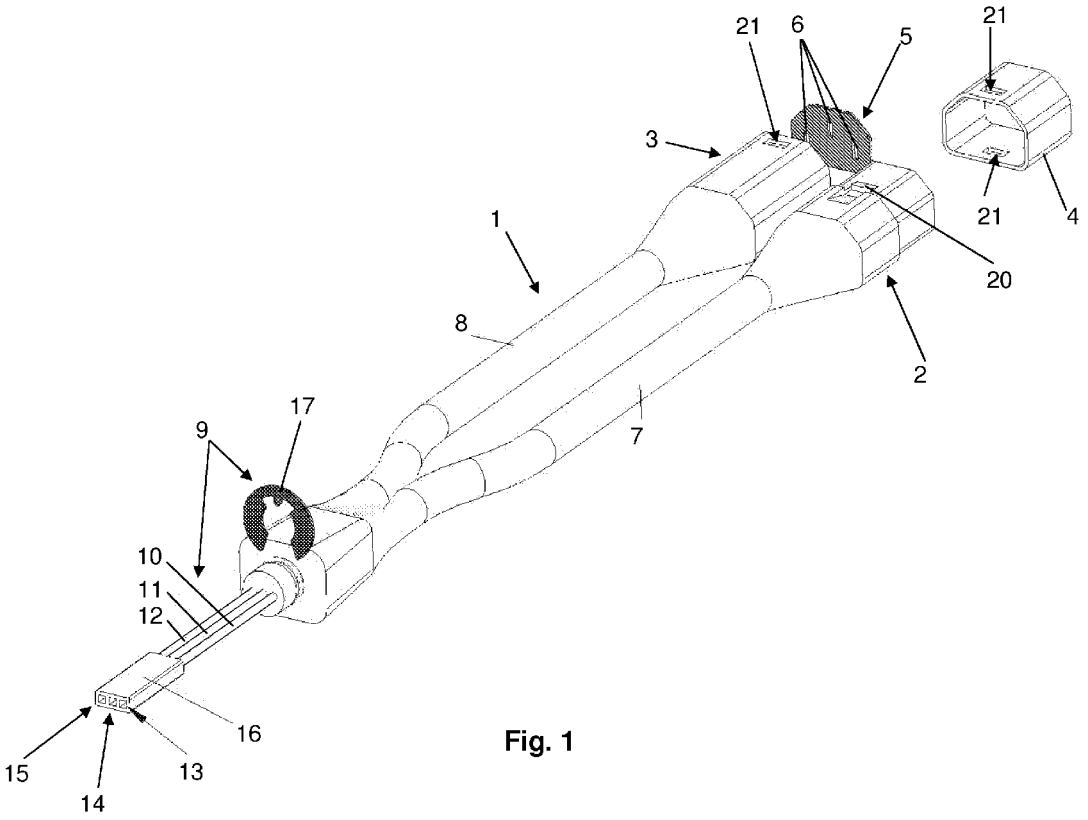

Fig. 1

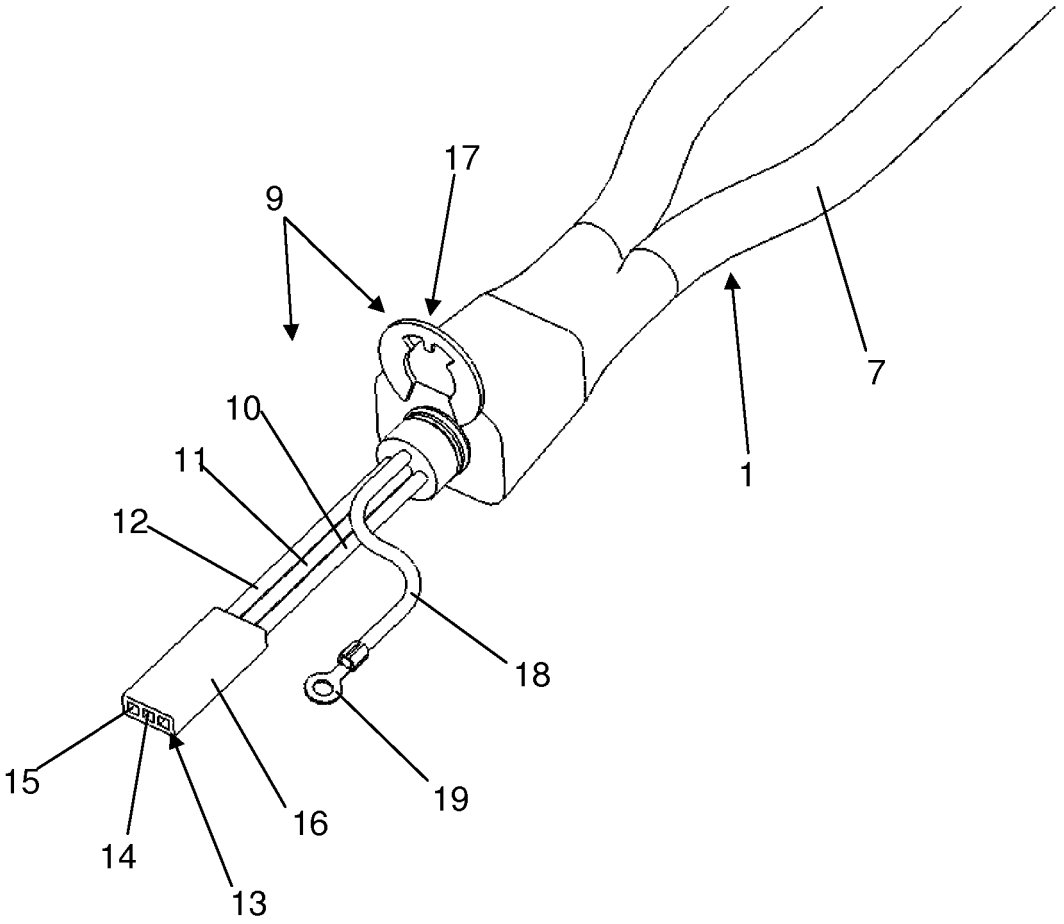

Fig. 2

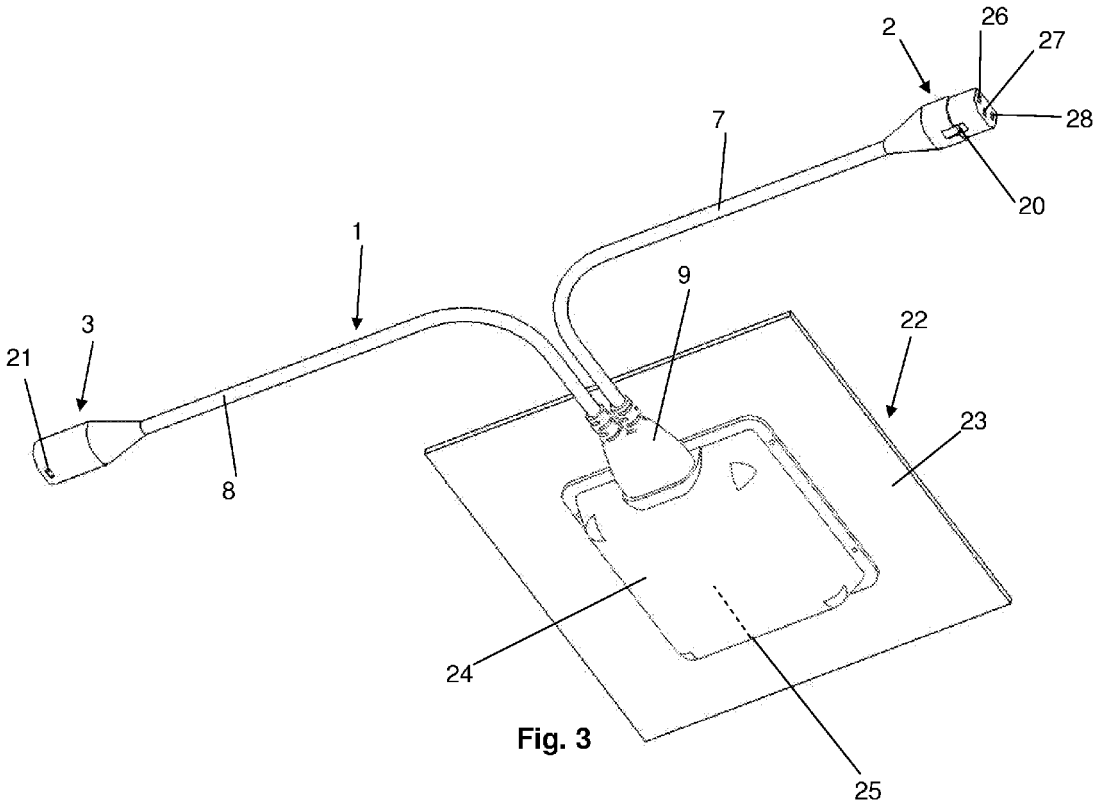

Fig. 3

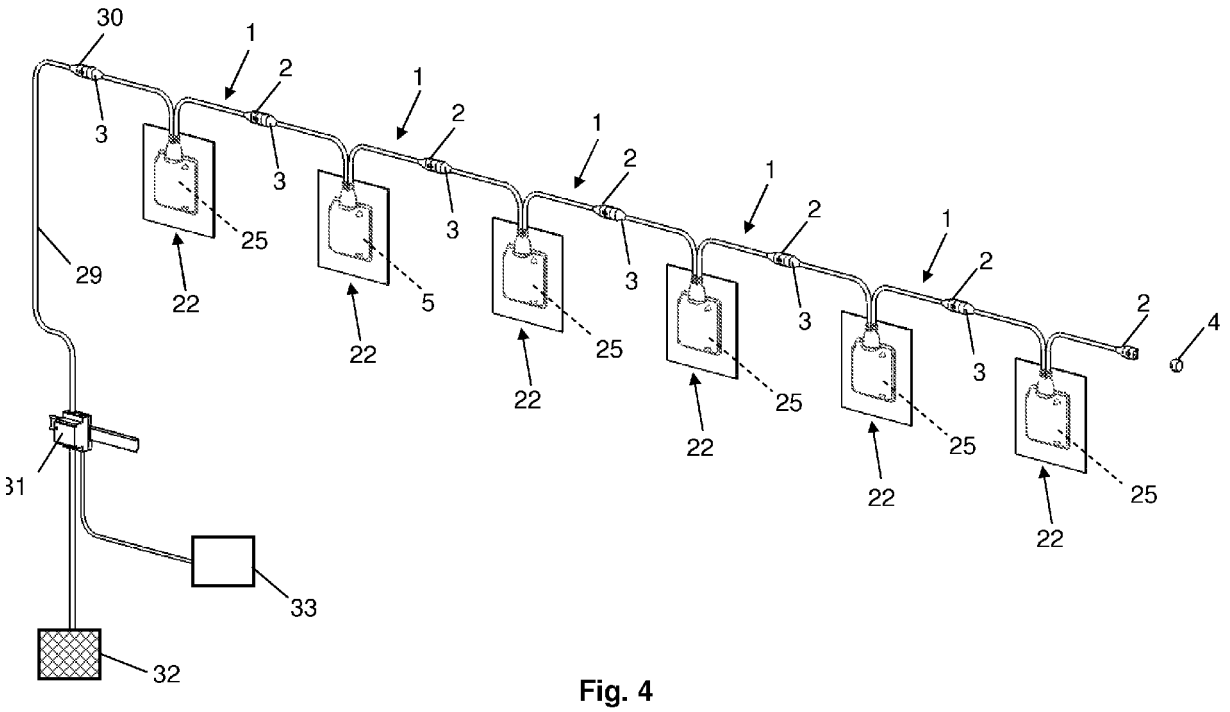

Fig. 4

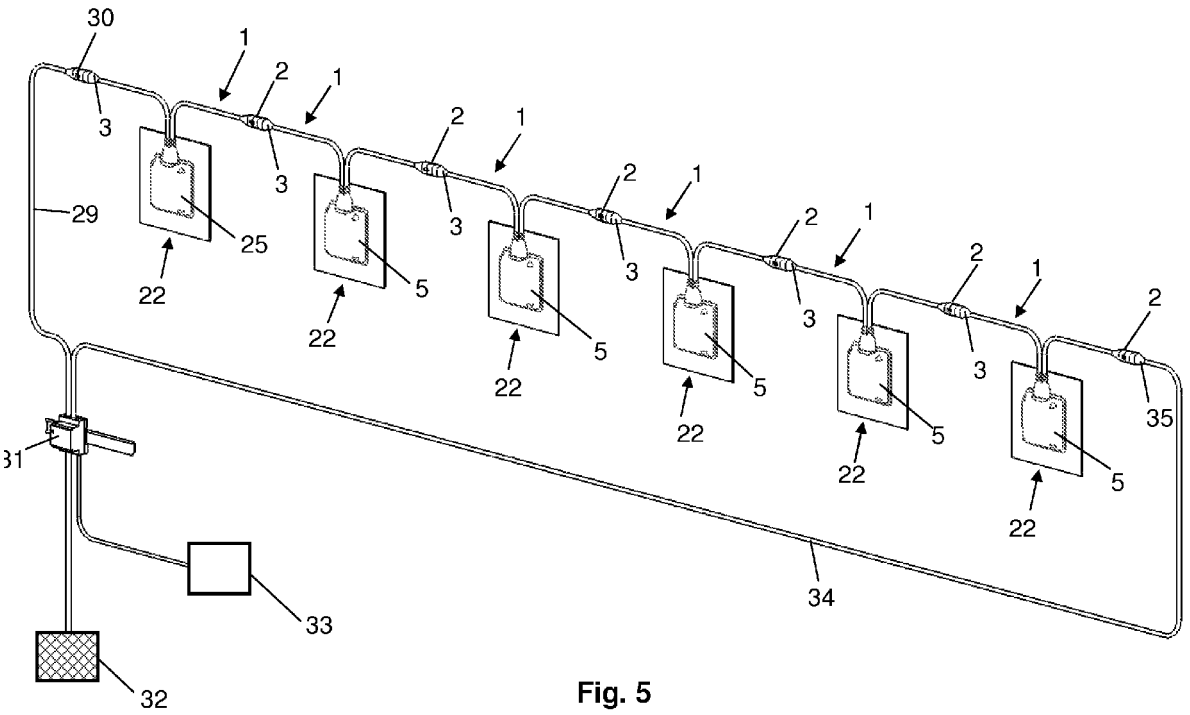
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Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 3147

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ANONYMOUS: "Product catalog: Flex portable solar chargers" Global Solar Energy April 2009 (2009-04), XP002590415 Retrieved from the Internet: URL:http://www.globalsolar.com/index.php?option=com_rubberdoc&view=doc&id=47&format=raw [retrieved on 2010-07-06] * the whole document *	1-15	INV. H01R25/00
X	ANONYMOUS: "PowerFilm Operating Instructions" Affordable-solar 9 June 2003 (2003-06-09), XP002590416 Retrieved from the Internet: URL:http://www.affordable-solar.com/admin/product_doc/Doc_powerfilm%20instructions_20060519164146.pdf [retrieved on 2010-07-06] * the whole document *	1-15	TECHNICAL FIELDS SEARCHED (IPC) H01R
A	US 5 971 799 A (SWADE GEORGE [US]) 26 October 1999 (1999-10-26) * abstract; figure 2 *	1-15	
A	GB 2 334 155 A (CHEN NAN CHEN [TW]) 11 August 1999 (1999-08-11) * the whole document *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 July 2010	Warneck, Nicolas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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US 5971799 A	26-10-1999	NONE	
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REFERENCES CITED IN THE DESCRIPTION

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