

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 November 2010 (04.11.2010)

PCT

(10) International Publication Number
WO 2010/124783 A1

- (51) International Patent Classification:
H02M 7/00 (2006.01)
- (21) International Application Number:
PCT/EP2010/002144
- (22) International Filing Date:
3 April 2010 (03.04.2010)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
09 005 960.1 30 April 2009 (30.04.2009) EP
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))

(54) Title: INVERTER WITH BUILT IN UTILITY METER

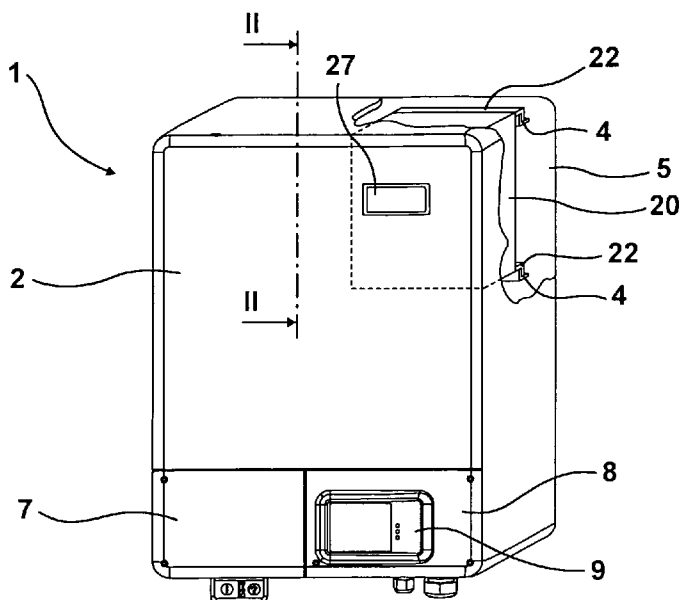


Fig. 1

(57) Abstract: An inverter for power generators, in particular PV generators, comprises a calibratable power meter (20) in the housing (1) of the inverter for the purpose of recording the power output of the generator.

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INVERTER WITH BUILT IN UTILITY METER

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The present invention relates to an inverter intended for use with power generators, particularly PV generators.

10 In the exploitation of energy sources, particularly alternative energy sources such as PV modules, an inverter serves to convert direct current into alternating current. Such an inverter is enclosed within a housing that contains electrical power components as well as other elements such as a communication unit. A circuit board is usually included among the electrical power components. The housing of the inverter also comprises at least one
15 cover for closing the individual compartments, particularly the compartment holding the electrical power components.

Such an inverter has already been documented in EP 2 006 988 A1, for example.

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An inverter may be equipped with circuits designed to record the yield of the device. Due to tolerances of the hardware and the algorithms of the measurement software that have been implemented on the hardware, these yield measurements are not only subject to a margin of error of for
25 example 2%, but also may vary depending on the power range. The yield values measured by the circuits in the inverter may therefore deviate from the values calculated by the calibrated meters of the public utility company given that the latter may likewise have a margin of error of up to 2%. As a result, calibrated public utility meters are connected downstream of the
30 inverter on the power grid side.

This leads to a disadvantage for the user since he needs not only to accept the differences between the meter readings, but also to install separately an extra power meter whose certification has been approved by the public utility company, which consequently increases the amount of installation work involved, and therefore the overall costs.

As a way to minimize installation time, an inverter according to the invention is proposed which is characterized by the inclusion of a calibratable power meter in the housing of the inverter whose purpose is to record the output from the generator. This means that the power meter is installed when the inverter is installed, and the need for an external power meter is eliminated. Furthermore, the power meter in the housing of the inverter is designed to be detachable so as to allow easy replacement when necessary. Since the power meter is installed directly in the inverter, i.e., connected directly to the circuit board, the amount of PV power that the user may be consuming on his own can also be determined by calculating the difference to the power fed into the grid. This may be of benefit given that the user's own consumption of PV power is compensated according to applicable national regulations such as the new German Renewable Energy Sources Act (EEG). Another advantage of integrating the power meter into the housing of the inverter is that the power meter is protected by the housing.

In addition, the power meter may be designed as an electronic power meter, which means the size of the meter's housing can be reduced. Particularly in this context, power meter chips may be used in order to adapt the size of the meter to the mechanical conditions inside the inverter. This means that the power meter can be relatively small in size, which in turn makes it easier to place it inside the housing of the inverter.

According to another feature of the invention, the power meter comes with at least one interface that allows the user to remotely query and/or control

consumer loads. This means that a consumer load can be activated via such an interface depending on the amount of power currently available. The same or an additional interface may also provide accesses to the communication unit of the inverter, for example to monitor not only the inverter, but the power meter as well. "Monitoring" in this context may also involve simply reading the power meter. This way, remote power reading, for example by a power billing service is possible.

More specifically, the power meter may include electrical terminals that offer a detachable connection to the circuit board of the inverter. Such terminals can be, for example, spring-loaded contact pins that come into direct contact with the relevant contact points on the circuit board after the inverter is attached on the power meter's mount in the inverter's housing, or the power meter is attached to the circuit board.

The inverter housing may also include at least one cover as described above. This cover also encloses the power meter and comprises a window for reading the power meter.

The drawings below offer a more detailed description of the invention.

Figure 1 depicts an inverter housing with detached cover.

Figure 2 depicts a cross-section based on Line II – II of Figure 1.

As shown in Fig. 1, the inverter housing 1 comprises the compartment 2, which, among other things, accommodates the circuit board 10 (visible in Fig. 2). The meter 20 is located in the inverter housing 1. As can readily be seen in Figure 2, the power meter 20 shows hook-shaped mounts 22 at one end that are attached to the relevant receptacles 4 on the rear wall 5 of the inverter housing 1. The power meter 20 also comprises electrical terminals 25 on the rear wall that are electrically connected to the circuit

board 10. The electrical terminals 25 can be, for example, spring-loaded pins that come into contact with the relevant connection points on the circuit board 10 when the inverter is inserted. As an example, seven such contacts are provided on the power meter 20 itself, namely, three phases for input, 5 three phases for output and one phase for a neutral conductor. The power meter 20 also features a display 27 on the front that shows the precise amount of power supplied by the generator. The inverter housing 1 furthermore comprises additional compartments 7 and 8 that are intended for other purposes. Compartment 7, for example, is designed as a DC-side 10 terminal compartment, while compartment 8 includes the AC-side grid connection and the communication unit 9 with display.

It is contemplated to connect the communication unit 9 of the inverter to the power meter 20 via an interface 21 in order to allow the power meter 20 to communicate via the communication unit 9 of the inverter.

15 Variations and modifications of the shown embodiments may be made without departing from the spirit and principles of the invention, which is intended to be limited only by the scope of the attached claims.

Claims:

1. Inverter for power generators, comprising a calibratable power meter being installed in a housing of the inverter for the purpose of recording the power output of the generator.
5
2. Inverter as set forth in claim 1, wherein the power meter is installed in the housing of the inverter, and is designed as a detachable unit.
- 10 3. Inverter as set forth in claim 1, wherein the power meter is designed as an electronic power meter.
4. Inverter as set forth in claim 1, wherein the power meter comprises at least one interface.
15
5. Inverter as set forth in claim 1, wherein the power meter comprises electrical terminals as a detachable electrical connection to a circuit board of the inverter.
- 20 6. Inverter as set forth in claim 5, wherein the inverter comprises attachment devices for mounting the power meter in onto the circuit board.
7. Inverter as set forth in claim 6, wherein the attachment devices
25 comprise claw fasteners for mounting the power meter in the housing of the inverter.
8. Inverter as set forth in claim 1, wherein the inverter housing comprises at least one cover, the housing enclosing the power meter and
30 comprising a window for visually reading the power meter.

9. Inverter as set forth in claim 1, wherein the inverter comprises a communication unit, the power meter being connected to the communication unit of the inverter via an interface.
- 5 10. Inverter as set forth in claim 9, wherein the power meter is configured to be monitored via the interface.
11. Inverter as set forth in claim 1, wherein the power generators are PV power generators.
- 10 12. Inverter as set forth in claim 1, wherein the power meter is configured to allow remote query and/or control of consumer loads.

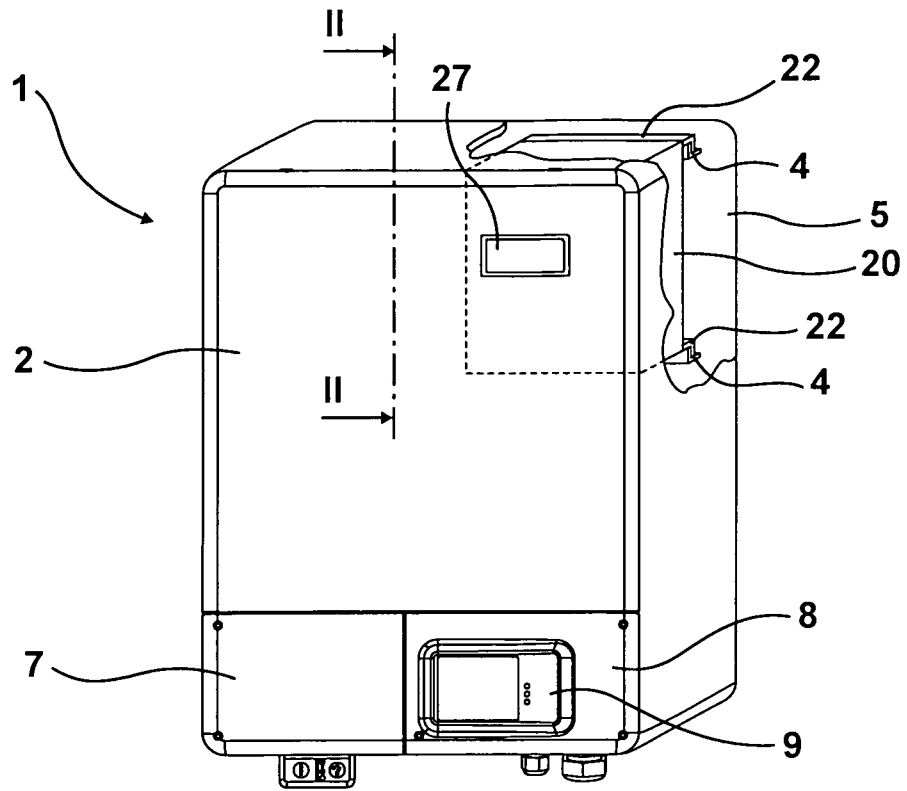


Fig. 1

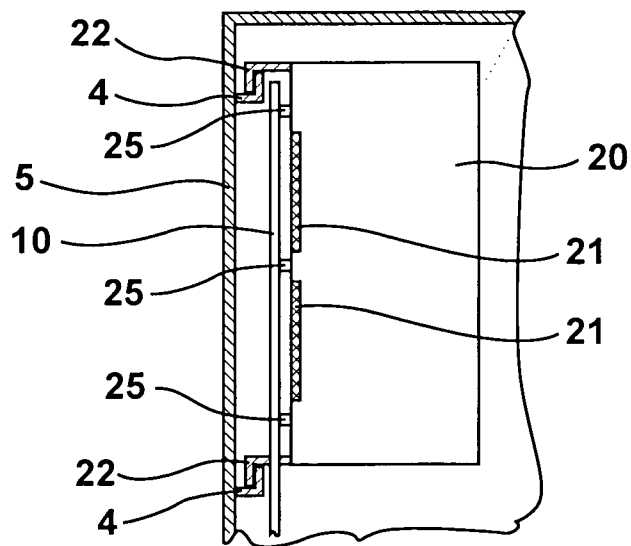


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/002144

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H02M7/00
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 H02M G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
 EPO-Internal

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 903 842 A (STATPOWER TECHNOLOGIES CORP [CA]) 24 March 1999 (1999-03-24) paragraphs [0002], [0020], [0021], [0026]; claim 1; figure 1	1-12
Y	US 2001/019321 A1 (BROOKSBY GLEN WILLIAM [US] ET AL BROOKSBY GLEN WILLIAM [US] ET AL) 6 September 2001 (2001-09-06) paragraphs [0004], [0010]; figure 1	1-10,12
Y	JP 2002 139527 A (CANON KK) 17 May 2002 (2002-05-17) paragraphs [0022], [0023], [0033]; figures 1,3,7	1,3,4,8,9,11
Y	DE 102 61 206 A1 (HAGER ELECTRO GMBH [DE]) 15 July 2004 (2004-07-15) paragraph [0022]; figure 1	1,7
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
<p>* Special categories of cited documents :</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p> <p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>* & * document member of the same patent family</p>	
Date of the actual completion of the international search 29 June 2010	Date of mailing of the international search report 09/07/2010
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kruip, Stephan

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/002144

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 006 988 A (SMA SOLAR TECHNOLOGY AG [DE]) 24 December 2008 (2008-12-24) cited in the application paragraph [0006]; figure 1 -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2010/002144

Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
EP 0903842	A	24-03-1999	CA 2244557 A1 US 5949640 A	19-02-1999 07-09-1999
US 2001019321	A1	06-09-2001	NONE	
JP 2002139527	A	17-05-2002	NONE	
DE 10261206	A1	15-07-2004	NONE	
EP 2006988	A	24-12-2008	KR 20080103422 A US 2008291609 A1	27-11-2008 27-11-2008