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(54) Title: STREET LIGHT DEVICE FOR LIGHTING STREETS AND PUBLIC OR PRIVATE AREAS

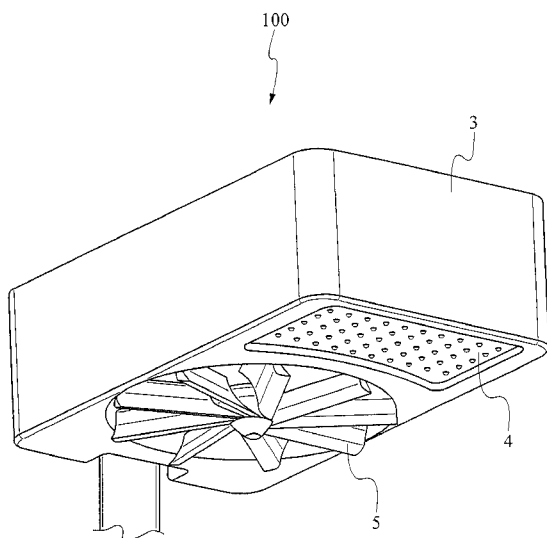


Fig. 1

(57) Abstract: Street light device (100) for lighting streets and public or private areas, comprising: - at least one outer casing (3); - at least one lighting device (4), comprising at least one lamp; - at least one wind generator (5) for producing alternating electric energy with a frequency varying as a function of the wind speed around the street light device; - at least one photovoltaic generator (6) for producing direct electric energy with a voltage varying as a function of the luminous intensity; - at least one thermovoltaic generator (7) for producing direct electric energy with a voltage varying as a function of the thermal gradient; - at least one connection (8) to an electric grid; - at least one primary electric circuit (9) for storing and transferring to the electric grid the electric energy produced by at least one of said wind generator (5), said photovoltaic generator (6) and said thermovoltaic generator (7).

STREET LIGHT DEVICE FOR LIGHTING STREETS AND PUBLIC OR PRIVATE AREAS

FIELD OF THE INVENTION

The present invention relates to the field of street and public or private areas lighting, and more precisely to a street light device for lighting streets and public or private areas.

PRIOR ART

The lighting of streets and public or private areas where people may have access is a need that nowadays causes a large waste of energy.

The development of urban areas and streets occurred during the last decades and the expected further increase in the future decades, will unavoidably cause the lighted areas to expand, with a consequent increase in the abovementioned waste of energy.

The Applicant has thus noted that the problem of the "waste of electric energy" intended for lighting town areas and streets requires a structured solution, capable of substantially reducing the energy consumption and at the same time also the environmental impact caused by the materials used in the known lighting devices, by the manufacturing processes, as well as by the energy required for developing the same processes.

The Applicant has in fact noted that the widespread presence of the known lighting devices also emphasizes management and maintenance problems. These go beyond the economic aspects related to the operating costs and become a serious problem of environmental pollution, because of the related waste of energy caused exactly by the improper management and by the maintenance operations.

The Applicant further noted that usually the devices intended for lighting, particularly those for public lighting, are not provided with specific sensors allowing to automatically detect the actual luminosity.

The Applicant has thus faced the problem of creating a street light device for lighting streets and public or private areas which solves the drawbacks of the prior art.

SUMMARY OF THE INVENTION

5 In a first aspect thereof the invention thus relates to a street light device for lighting streets and public or private areas, comprising:

- at least one outer casing;
 - at least one lighting device, comprising at least one lamp;
 - at least one wind generator for producing alternating electric energy
- 10 with a frequency varying as a function of the wind speed around the street light device;

- at least one photovoltaic generator for producing direct electric energy with a voltage varying as a function of the luminous intensity;

- at least one thermovoltaic generator for producing direct electric

15 energy with a voltage varying as a function of the thermal gradient;

- at least one connection to an electric grid;

- at least one primary electric circuit for storing electric energy produced by at least one of the said generators and transferring it to the electric grid.

The present invention, in the abovementioned aspect, may comprise at

20 least one of the preferred features hereinafter described.

Preferably, the primary electric circuit comprises:

- at least one current inverter for changing direct current into alternating current,

- at least one capacitor for storing electric energy and transferring it to

25 the said inverter.

Advantageously, the lighting device comprises a plurality of LEDs.

Advantageously, the current inverter comprises a buck-boost electronic module.

Preferably, the primary electric circuit comprises at least one

accumulator battery for storing electric current produced by the wind generator and/or the photovoltaic generator and/or the thermovoltaic generator.

Advantageously, the device comprises at least one diode rectifier functionally connected with said wind generator and said at least one capacitor.

5 Conveniently, the device comprises:

- at least one ambient sensor;
- at least one microcontroller; and
- at least one transceiver board.

10 Preferably, the thermovoltaic generator comprises at least two layers of a coating comprising nano-depositions.

Advantageously, the photovoltaic generator comprises at least two layers of a coating comprising nano-depositions.

15 Further features and advantages of the invention shall become more apparent from the detailed description of some preferred, although not exclusive, embodiments of a street light device for lighting streets and public or private areas according to the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Such description shall be presented hereinafter with reference to the accompanying drawings, provided only for indicating, and thus non-limiting, purposes, wherein:

- figure 1 is a schematic perspective view of the street light device for lighting streets and public or private areas according to the present invention;
- figure 2 is a schematic view of the circuit for the street light device for lighting streets and public or private areas according to the present invention.

25 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Referring to the figures, a street light device for lighting streets and public or private areas according to the present invention is indicated with reference

numeral 100.

As shown in figure 1, the device 100 essentially consists of at least one outer casing 3, preferably having a parallelepiped shape, at least one lighting device 4, comprising at least one lamp, at least one wind generator 5 for producing alternating electric energy with a frequency varying as a function of the wind speed around the street light device, at least one photovoltaic generator 6 for producing direct electric energy with a voltage varying as a function of the luminous intensity, at least one thermovoltaic generator 7 for producing direct electric energy with a voltage varying as a function of the thermal gradient, at least one connection 8 to an electric grid, at least one primary electric circuit 9 for storing the electric energy produced by at least one of said generators and transferring it to the electric grid.

Advantageously, the street light device 100 as a lighting device has a plurality of LEDs.

An example of a current circuit of the street light device 100 for lighting streets and public or private areas according to the present invention is shown in figure 2.

As shown in figure 2, the wind generator 5 is connected in series with a diode rectifier 13 for converting the energy produced by the wind generator 5 into direct current, in order to transfer it to suitable banks of capacitors 11 connected in series with said rectifier 13.

Actually, referring to the embodiment shown in figure 2, a choice was made to alternatively charge two banks of capacitors 11 by means of two switches 15 (preferably, electronic switches of the static type), which are automatically controlled by two respective voltage thresholds.

The banks of capacitors 11 are connected in parallel with the photovoltaic generator 6 and the thermovoltaic generator 7.

The banks of capacitors 11 are in turn connected with a Buck-Boost electronic module 12.

Downstream of the said Back-Boost 12 there are a plurality of accumulator batteries 14 connected in series with each other and in parallel with an inverter 10 for supplying current to the grid by means of a suitable connection 8.

5 The Buck-Boost 12 has the task of adapting the voltage value for charging one or more accumulator batteries and/or properly power the inverter 10, which provides for the supply of the electric energy to be used by the LEDs and to be transferred to the grid according to the specific standards, e.g. single-phase, 230 V – 50 Hz, or three-phase, 3 x 380 V – 50 Hz.

10 The Buck-Boost module 12 is essential for allowing even small amounts of energy to be exploited.

In fact, when the air speed is very low, e.g. lower than 1,2 m/sec, the voltage delivered by the kinetic generator must necessarily be raised (by the Boost) to the minimum value required by the single-phase or three-phase
15 inverter.

The opposite situation occurs when the air speed is above e.g. 6 m/sec: in this case the Buck operates.

Operating conditions similar to those of the kinetic generator may also occur for the static generators, i.e. the thermovoltaic generator 7 and the
20 photovoltaic generator 6, and the Buck-Boost module 12 significantly contributes to the increase of the overall efficiency, avoiding a fruitless dispersion of "valuable" energy.

As far as the thermovoltaic generator 7 is concerned, the conversion of all the energy, even in case of a small amount, is important mainly because it
25 cools down the photovoltaic generator 6, greatly increasing also in this case the overall efficiency.

The thermovoltaic generator 7 comprises at least two layers of a coating comprising nano-depositions. In detail, the thermovoltaic generator 7 is made, on the outer surface of the casing 3 of the street light device 100 or of the

kinetic generator 5, by means of a plurality of nano-depositions, each reaching, as non-limiting example, about 100 nm.

In order to adapt the thermal energy transfer capacity as a function of the thermal gradient, said depositions are iterated until a total thickness of about
5 0,006 – 0,007 mm is reached.

The mentioned value may be increased or decreased as a function of the amount of energy and of the coated surface.

Said thickness also affects the production cost, therefore it will be determined based on the kind of application, taking into account the surface
10 extension and the thermal gradient.

For example, a street light placed at a height of 20 m or more, and provided with a plurality of lighting units, will have significant dimensions and thus a large outer surface; in this case the thickness of the nano-deposition may be smaller compared to a street light device placed in a built-up area at a height
15 of about 6 m.

The photovoltaic generator comprises at least two layers of a coating comprising nano-depositions.

The street light device 100 for lighting streets and public or private areas further comprises at least one ambient sensor, at least one microcontroller, and
20 at least one transceiver board.

Each street light device 100 is provided with a microcontroller for collecting and transmitting data detected by the different "ambient" sensors as well as data about the overall operating condition of the unit. The microcontroller controls a transceiver board, preferably in a wireless mode
25 (electric cables in a power line system can also be used), by means of which the individual street light device communicates with a computer directly and/or through other street light devices 100. Basically each individual street light device 100 (possibly provided also with a microcamera) transmits any variation detected by the different sensors, continuously updating the condition in the

surrounding area. The street light devices are individually coded and it is thus easy to effectively and promptly monitor different areas according to predetermined partitions, which, in any case, can be enlarged or restricted at any time with great flexibility. The individual street lamp device also constantly communicates any variation regarding the specific operating condition of each of its devices. As already mentioned, the street light device begins to switch on or off gradually and automatically, based on a luminosity threshold predetermined according to the local norms. The data and actual times are detected and transmitted to the dedicated computer, continuously updating the status. Also the individual circuits are surveyed and any variation of the operating condition of a circuit is immediately transmitted. Similarly, the actual consumption of energy taken from the grid is continuously transmitted as well as the actual production of energy injected into the grid. The same transmission board transfers possible control signals directed to one or more street lights, e.g. the switching on or off of the "lamp", the increase or reduction of the lighting intensity or the switching on or off of the generator, etc. The monitoring can be "customized" and, according to the specific needs, it will be able to provide just a technical survey function or also an actual security surveillance on-line with police, hospitals, etc.

The present invention has been described with reference to some embodiments thereof. Many modifications can be introduced in the embodiments described in detail, still remaining within the scope of protection of the invention, defined by the appended claims.

CLAIMS

1. Street light device (100) for lighting streets and public or private areas, comprising:

- 5 - at least one outer casing (3);
- at least one lighting device (4), comprising at least one lamp;
- at least one wind generator (5) for producing alternating electric energy with a frequency varying as a function of the wind speed around the street light device;
- 10 - at least one photovoltaic generator (6) for producing direct electric energy with a voltage varying as a function of the luminous intensity;
- at least one thermovoltaic generator (7) for producing direct electric energy with a voltage varying as a function of the thermal gradient;
- at least one connection (8) to an electric grid;
- 15 - at least one primary electric circuit (9) for storing and transferring to the electric grid the electric energy produced by at least one of said wind generator (5), said photovoltaic generator (6) and said thermovoltaic generator (7).

2. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized in that said primary electric circuit (9) comprises:

- at least one current inverter (10) for changing direct current into alternating current,
- at least one capacitor (11) for storing electric energy and transferring it
- 25 to the said inverter (10).

3. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized in that said lighting device comprises a plurality of LEDs.

4. Street light device (100) for lighting streets and public or private

areas, according to claim 1, characterized in that said current inverter (10) comprises a buck-boost electronic module (12).

5 5. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized in that said primary electric circuit (9) comprises at least one accumulator battery (14) for storing electric current produced by said wind generator (5), said photovoltaic generator (6) and said thermovoltaic generator (7).

10 6. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized by comprising at least one diode rectifier (13) functionally connected with said wind generator and said at least one capacitor.

7. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized by comprising:

- at least one ambient sensor;
- 15 - at least one microcontroller; and
- at least one transceiver board.

8. Street light device (100) for lighting streets and public or private areas, according to claim 1, characterized in that said thermovoltaic generator (7) comprises at least two layers of a coating comprising nano-depositions.

20 9. Street light device (100) for lighting streets and public or private areas, according to claim 2, characterized in that said photovoltaic generator (6) comprises at least two layers of a coating comprising nano-depositions.

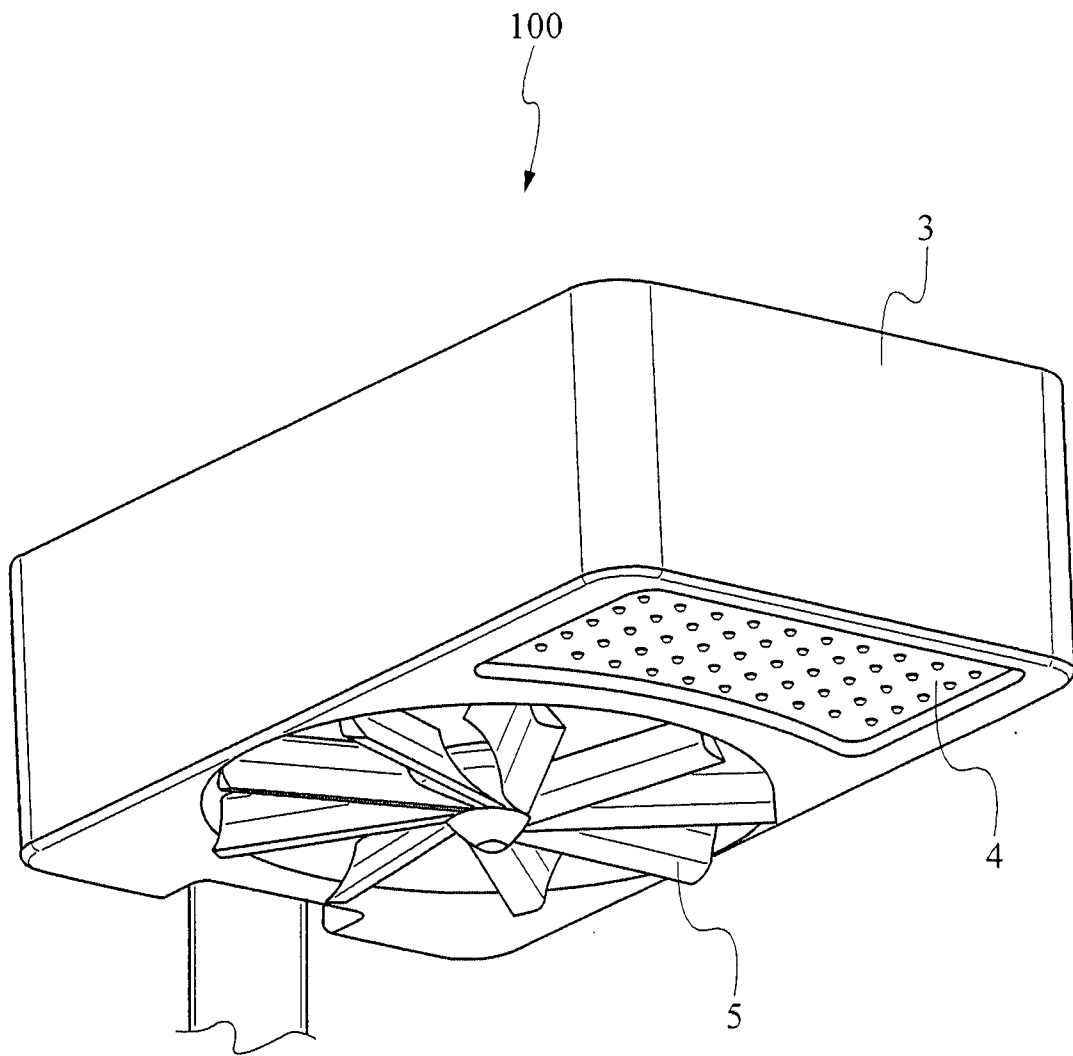


Fig. 1

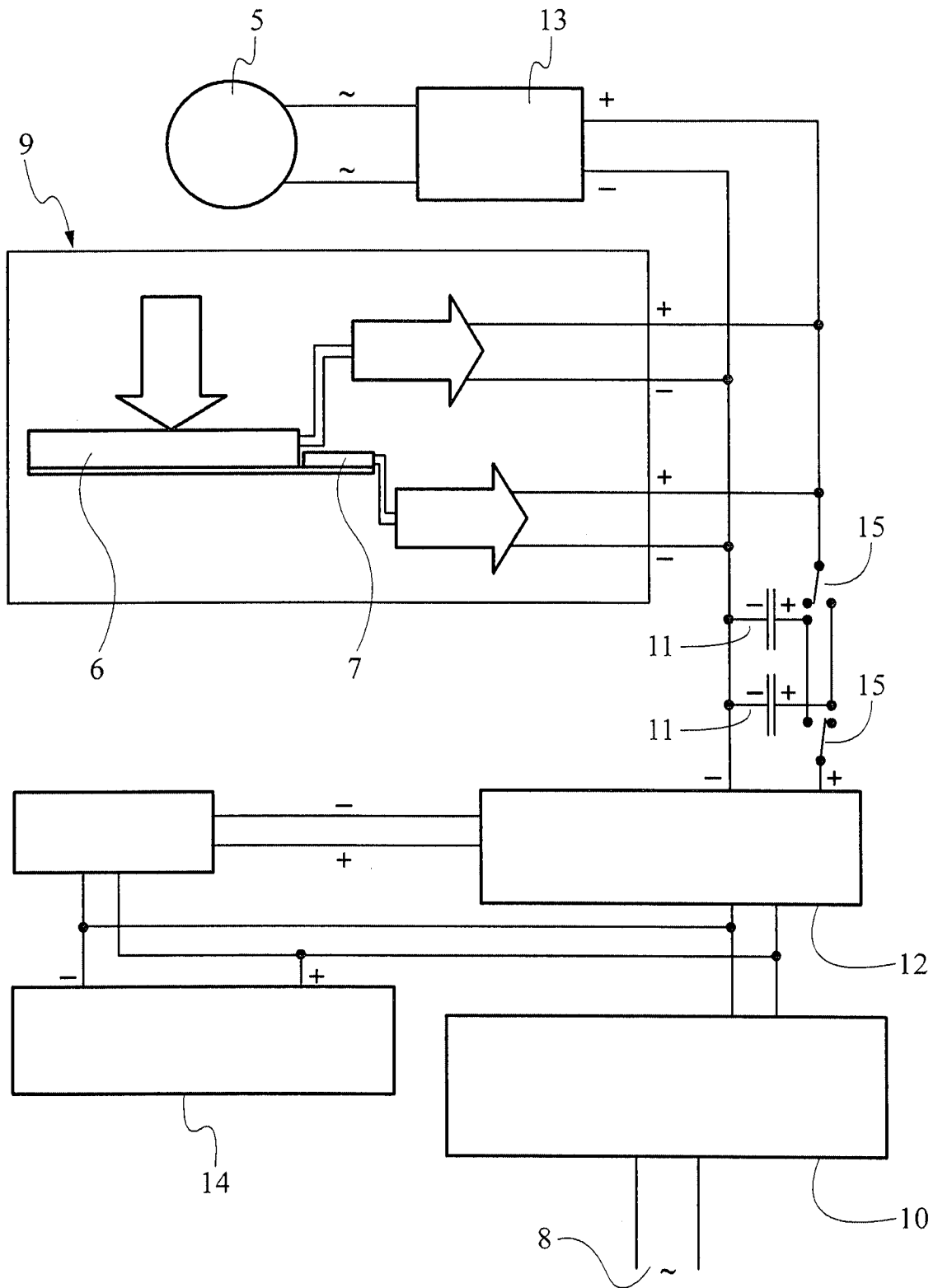


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No PCT/IB2012/001004
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A. CLASSIFICATION OF SUBJECT MATTER INV. F21S8/08 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) F21S		
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 practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 449 102 A (JORDAN CLIVE NICHOLAS [GB]) 12 November 2008 (2008-11-12)	1-6
A	page 1 - page 7; figures 1-5 -----	7-9
A	US 2010/029268 A1 (MYER SETH JAMISON [US] ET AL) 4 February 2010 (2010-02-04) paragraph [0043] - paragraph [0379]; figures 1-30 -----	1-9
A	WO 2011/114284 A1 (SPI TECNO S R L [IT]; PENNISI DARIO [IT]; DE ANGELIS BERARDINO [IT]) 22 September 2011 (2011-09-22) page 4, line 30 - page 13, line 1; figures 1-3 -----	1-9
Y	CN 201 391 819 Y (SHAORYONG CHEN) 27 January 2010 (2010-01-27) the whole document -----	1-6
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search	Date of mailing of the international search report	
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2012/001004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2449102	A	12-11-2008	NONE
US 2010029268	A1	04-02-2010	EP 2308197 A2 13-04-2011
			US 2010029268 A1 04-02-2010
			US 2012020060 A1 26-01-2012
			WO 2010014925 A2 04-02-2010
WO 2011114284	A1	22-09-2011	TW 201200785 A 01-01-2012
			WO 2011114284 A1 22-09-2011
CN 201391819	Y	27-01-2010	NONE