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(72) Inventor; and
(71) Applicant : **DOCI, Violeta** [DE/DE]; Lesserstr. 158, 22049 Hamburg (DE).

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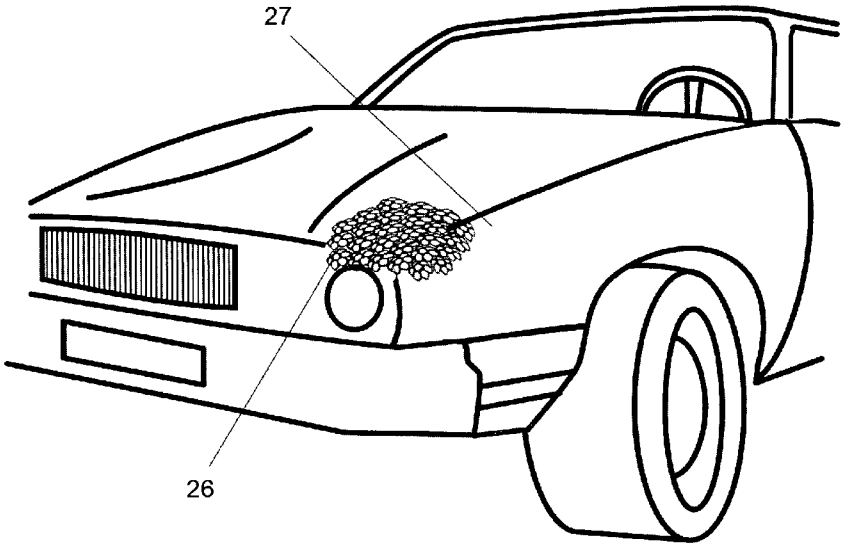
(54) **Title**: SOLAR ELECTRIC COMPOUND FOR CURVED SURFACES

Fig. 3



(57) **Abstract**: For generation of solar energy, in particular from irregularly curved surfaces, like those on cars and airplanes, a system of flat, lentil-shaped concentrators is disclosed, each of which concentrate impinging light on a solar converting chip. These units are interconnected by two layers of flexible conductors, embedded in a semi-rigid silicone, whilst the whole set prefer¬ ably is covered with a transparent plastic film, that can be flush dressed by flue-curing.

Solar Electric Compound for Curved Surfaces

FIELD OF THE INVENTION

The invention relates to photovoltaic energy recovery, particularly from curved surfaces, and more specifically solar energy generation in small, interconnected units having light concentrators and preferably being embedded in a flexible matrix.

BACKGROUND OF THE INVENTION

Energy recovery on cars and airplanes get to be more and more mandatory. Particularly electric and hybrid cars rely on batteries that need to be loaded and the charging be sustained.
Solar energy can do a good part of it - particularly for the latter - if not only the flat sections of roofs and hoods are used for solar energy recovery, but the whole car body.

PROBLEM TO BE SOLVED

But solar cells with high recovery rates, such as crystal silicone units, use to be made from cut silicone flitches and therefore are not flexible, as is the ordinary mounting of it with soldered interconnections.

PRIOR ART

However, there have been some solutions disclosed for arranging solar cells, which could be applied to irregular curved surfaces, as in US 4.311.869, whereas it will be difficult there to arrange the reflecting means effectively due to changing curvatures.
Single concentrator units, as in US 2009 231 739 (A1), are as well known, but not meant for building up clusters of small units - moreover in this case are impractical for layups on whatever kind of surface, due to its open structure.

Moreover quite a few solar arrays are known, having multiple single solar cells and concentrators, mostly Fresnel lenses, as in US 5.123.968, or combination of Fresnel and conventional lenses, as in US 6.804.062 B2, or mirrors and lenses as in WO 03/054317 A2 - but none of those suited for mounting it on curved surfaces.

Other possible solutions, like thin-film solar cells mounted on flexible wire bases, as known from Odersolar (www.odersolar.de) have lower efficiency, which is particularly disadvantageous when only small surfaces can be applied for energy recovery.

SUMMARY OF THE INVENTION

For to overcome the aforementioned problems, the here disclosed system comprises single, lentil-shaped concentrators with a multitude of lenses for gathering light of all directions to direct it to an embedded solar converting chip. Each single unit, particularly the solar cell itself is relatively small (around 10 x 10 Millimeters) and therefore can be mounted on almost all kinds of surfaces.
Said chips are interconnected by at least two layers of conductors in between, for to switch the single units together in parallel and serial groups, for to take-up desired voltages and rated currents suitable for further processing.

In some cases however, the negative pole of each cell or of a connecting lead might be directly connected to metal surfaces, like car's body sheets.

These conductors must have some flexibility when laminated to curved surfaces, they therefore consist preferably of spun wire or metal tape conductors, cut into bends.

One of the main advantages when mounting these units to car bodies is that impinging solar energy is partially converted into electrical current, whereas residual heat can be transferred directly to the sheet metal of the car's body and therefore easily be dissipated. Therefore efficiency loss due to overheating the silicone cell can be avoided.

For to achieve a smooth surface, the set is embedded in semi-cured flexible matrix, preferably of Silicone, that would easily be applied and cling to metal surfaces and build up a natural anti-corrosive layer.
Said compound might further be covered by a transparent plastic film to provide a durable skin, preferably with thermosetting material, that can be smoothed with hot air.

DESCRIPTION OF THE DRAWINGS

Following drawings demonstrate the preferred embodiments of the here disclosed invention:

Fig. 1 shows a single unit **1**, comprising the concentrator lens **2 - 8**, a solar converter chip **9**, bonded to the connector lines at positive **10** and negative **11** leads, which are, together with the concentrator lenses, embedded in a silicone matrix **12** and covered by a durable film **13.**

Fig. 2 demonstrates the distribution of the lens units **14-18** in a complex compound, the leads **19 - 25** later to be interconnected in serial and parallel groups.
In some cases however, the negative pole of each cell or of a connecting lead **19** might be directly connected to metal surfaces, like car's body sheets.

Fig. 3 shows exemplarily the mounting of abovementioned clusters **26** on a stylized curvedsurface, like a car wing **27**. However, in cases of flat surfaces, the compounds may be flatter and possibly arranged in bigger clusters.

WHAT IS CLAIMED IS:

1. A solar electric compound, comprising lentil-shaped units of optical concentrators, directing impinging light onto a photovoltaic chip therein.

2. A solar electric compound as to claim 1, comprising a grid of inter-isolated conductors between the lentils to drain off the electric energy.

3. A solar electric compound as to claim 2, wherein the negative poles or inter-connections are bonded to the metal body of a carrier.

4. A solar electric compound as to claim 2, wherein the single units are grouped in parallel and series connection so to achieve a desired level of electrical tension and current.

5. A solar electric compound as to claim 1-2 and 3 or 4, wherein the inter-connections consist of spun wire.

6. A solar electric compound as to claim 1-2 and 3 or 4, wherein the inter-connections consist or metal tape conductors, cut into bends.

7. A solar electric compound as to claim 1, wherein the single units and interconnections are embedded in a flexible plastic matrix.

8. A solar electric compound as to claim 7, wherein the compound is covered with a transparent plastic film.

9. A solar electric compound as to claim 8, wherein the plastic film is pre-shrunk for thermo-setting, so to be flush dressed by flue-curing.

Fig. 1

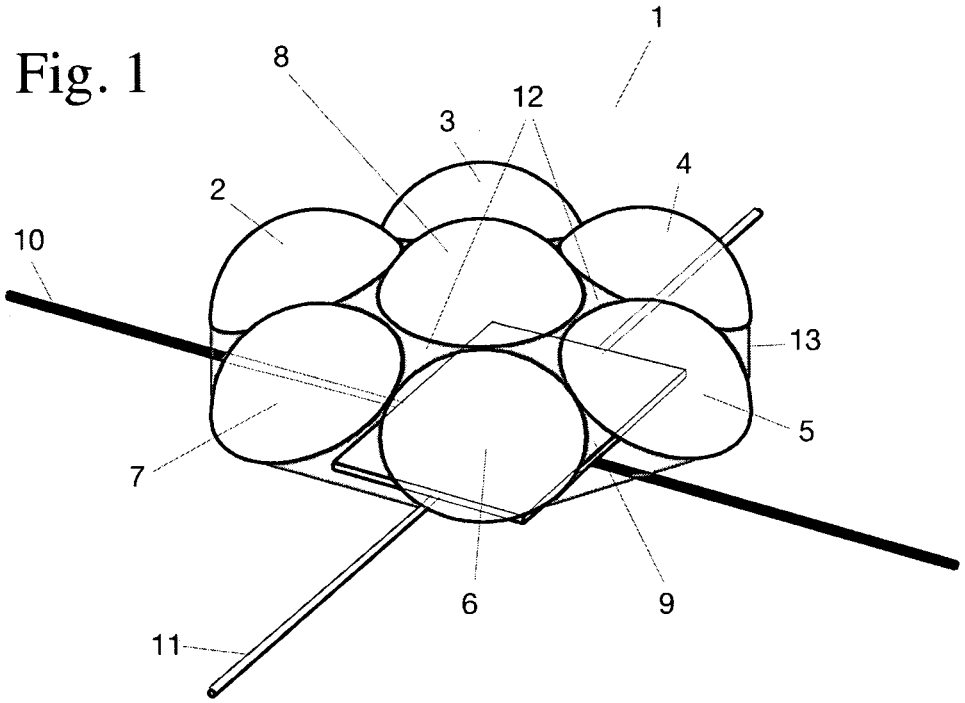


Fig. 2

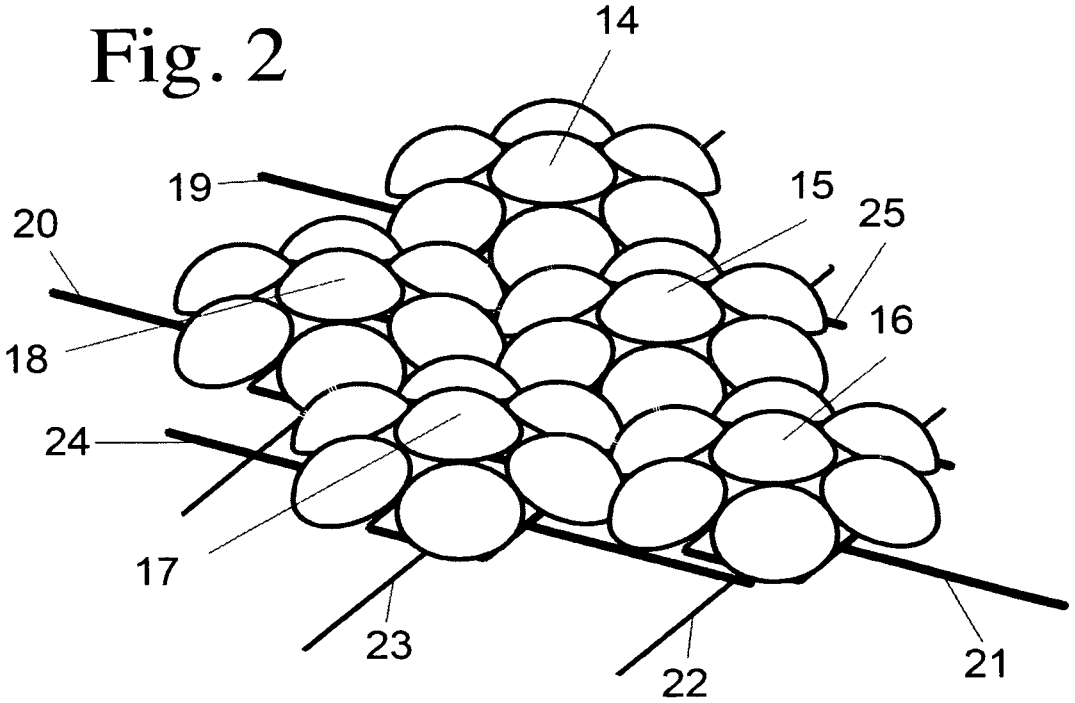
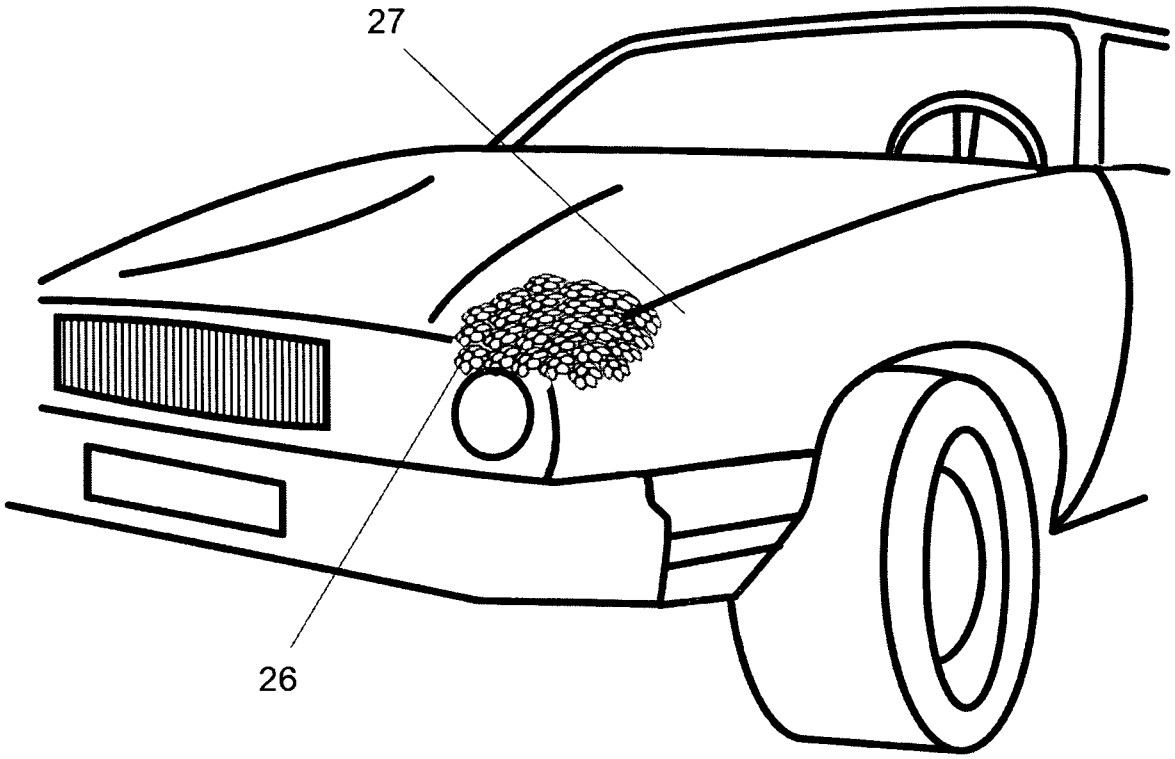


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/000035

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L31/052
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)
H01L

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, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/078249 A1 (LIU TRICIA [US]) 26 March 2009 (2009-03-26) the whole document	1-9
X	US 2002/148497 A1 (SASAOKA MAKOTO [JP] ET AL) 17 October 2002 (2002-10-17) paragraphs [0024], [0025], [0045] - [0104], [0141] - [0145]; figures 1,-4,6,7,8,14,17; examples 1-4	1-9
X	WO 00/05604 A1 (MOSESHVILI ALEKSANDRE S [GE]) 3 February 2000 (2000-02-03) page 1 - page 9; figures 5-8	1-9
A	US 5 118 361 A (FRAAS LEWIS M [US] ET AL) 2 June 1992 (1992-06-02) the whole document	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 December 2010	10/01/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Voignier, Vincent

INTERNATIONAL SEARCH REPORT

Information on patent family members

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