

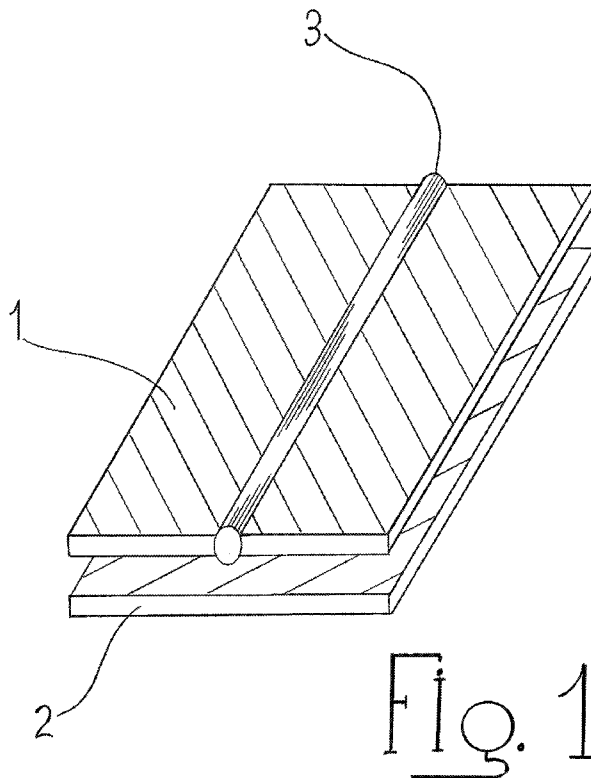


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(54) Title: SOLAR PANEL WITH OPTICAL LIGHT ENHANCEMENT DEVICE



(57) Abstract: A double layered superimposed and parallel solar panels having an optical system comprising cylindrical rods and convex lenses at either end of said rods. Said optical rods are centrally longitudinally and transversely inserted in the upper panel through slits where sunlight rays pass and diffract through said rods and widely diffuse over the entire surface of the lower solar panel. A plurality of optical rods may be used thereby increasing the light transmission to the lower solar panel. The present invention significantly reduces the surface needed to install conventional residential as well as commercial solar panels.

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## SOLAR PANEL WITH OPTICAL LIGHT ENHANCEMENT DEVICE

### FIELD OF THE INVENTION

[0001] The disclosure of this invention relates generally to solar energy panel, and more particularly as a double layered photovoltaic solar panel having light enhancement optical system.

### BACKGROUND OF THE INVENTION

[0002] Solar panels have been commonly in use for several decades. Photovoltaic panels convert light into electricity at the atomic level. French physicist, Edmond Becquerel in 1839, found that certain materials would produce small electric current when exposed to light.

[0003] Later, Albert Einstein in 1905 described in detail the photoelectric effect of certain materials when exposed to light cause them to absorb photons of light and release electrons. When these free electrons are absorbed and captured by adjacent substrate, an electric current results that can be used as electricity. Bell Laboratories built the first photovoltaic module in 1954. It is not until the mid sixties that the space industry began to make the first serious use of the technology to provide power aboard spacecraft. Later, in the early 1970, the photovoltaic technology gained popularity and recognition during the energy crisis.

[0004] Basically photovoltaic cells, also called solar cell, are made of a semiconductor material, such as specially treated silicon, which is wafered between two electrical conductor surfaces. When sunlight strikes the top surface, electrons will be released and captured in a form of electric current, which can be used electricity.

[0005] A number of solar cells are usually connected to each other and mounted in a support structure or frame is called Photovoltaic module. Furthermore, large numbers of modules are electrically connected to form large solar panels or array. Said array can be mounted in large number in open fields generating considerable amount of direct current **electricity**.

[0006] Due to limited space in urban backyards or house roofs, the number of panels required for a particular residential or commercial project can be limited due to small available surface. The present invention overcomes such limitation by providing double-layered solar panels. A major improvement provided by the present invention is a double-layered solar panel whereby the sun light beams strikes the first top layer and significant portion of said beam will penetrate the top layer through longitudinal and transverse slots having cylindrical lenses, which will diverge the incoming light onto the second lower panel. While the conventional devices may be suitable for the particular purpose to which they address, they are not suitable for providing double-layered solar panels that deliver more electrical current while occupying same or smaller surfaces.

#### **BRIEF DESCRIPTION OF THE INVENTION**

[0007] In view of the forgoing surface limitation disadvantages inherent in the known type of conventional solar panels now present in the prior art, the present invention provides a new double-layered solar panel wherein the same can be utilized for providing more electrical output for the same light exposed surface of the solar panel. This improvement is accomplished by using light enhancement optical system consisting of cylindrical lenses having truncated ends. Said lenses will gather sun light from different direction and diffract and diffuse light onto the lower photovoltaic panel.

[0008] The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a novice bi-layered solar panel having optical light enhancing system that will transmit light from the surface of the top solar panel onto the lower panel.

[0009] This novel feature is not anticipated, rendered obvious, suggested or even implied by any of the prior art, either alone or in any combination thereof. To attain this, the present invention generally comprises two solar panels superimposed and paralleled one on top of the other at a variable distance according to the size of the cylindrical lenses of the optical system. Said upper solar panel having longitudinal opening in a form of slots where said cylindrical lenses are laid in and firmly attached hereto. Sunlight will be collected by the cylindrical lenses and pass through the longitudinal slots to be

diffracted and spread onto the lower solar panel. Furthermore, truncation on either ends of the cylindrical rod will act as lenses and further gather ambient light, which will be collected by the rod and transmitted onto the lower solar panel.

**[0010]** There are additional features of the invention that will be described hereinafter. In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

**[0011]** To the accomplishment of the above described and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0012]** Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

**[0013]** **FIG. 1** is a perspective view of the double layered solar panel and longitudinal cylindrical lens.

**[0014]** **FIG. 2** is a cross sectional view of the double layered solar panel and diffraction of the striking sun rays onto the lower solar panel.

**[0015]** **FIG. 3** is a cross section of trunked lens at end of optical rod and refraction of light.

[0016] FIG. 4 is a sectional view at the intersection of transverse and longitudinal optical rod revealing the diffraction and reflection of incident light rays as well as the curved lower solar panel.

[0017] FIG. 5 is a perspective view of the double layered solar panel with longitudinal and transverse optical rods with optical truncation at end of transverse rod.

#### DETAILED DESCRIPTION OF THE INVENTION

[0018] Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, the attached figures illustrate a double-layered solar panel, which comprises two superimposed solar panels 1 and 2. Said panels are placed in parallel configuration as seen in FIG. 1. The top solar panel has at least one longitudinal slot where optical cylindrical rod 3 is firmly secured. In addition, said top solar panel comprises at least one transverse slot where optical cylindrical rods 14 and 15, one on either side of the longitudinal rod in a form of a cross (as seen in FIG. 5), are firmly secured to the top solar panel. The number of longitudinal and transverse rods may vary according to the size of the solar panel 1.

[0019] When sunlight rays 4 strike the round surface of the cylinder rod 3 they become refracted and exit as indirect rays 5 at a divergent angle reaching outer surfaces of the lower solar panel that otherwise cannot be exposed to sunrays (FIG. 2). It is further understood that said transverse rods 14 and 15 having a slant or truncation 16 on either side, thereby forming convex optical lenses that will gather incident sunlight rays 12 (FIG. 4) from a different angle and refract them onto the lower solar panel as indirect beam 19. It is to be noted that some incident rays 10, when they approach the slant lens at certain oblique angle will become reflected rays 11 (FIG. 4) inside the rod lens and ultimately end up projected onto the lower solar panel. It is further understood that the diameter of the cylinder rods may vary with size of the solar panel as well as the distance between the upper and the lower solar panels.

[0020] A variation of the present invention may include a different embodiment where the above described cylindrical rods have two flat parallel sides, or have an oval

cross sectional geometry in order to compensate excessive thickness of the upper solar panel. In that regard a small bevel **18** would increase the angle of light projection allowing refracted light rays **5** to reach out further on the lower solar panel. In a different embodiment, the lower panel may be curved or even semi circular **9** (FIG. 4) in order to shorten the distance between the edge of the lower panel and the central optical rod. Said rods can be made from multiple array of material but not limited to optical quality material such as quartz, Pyrex or Borosilicate. Other hard plastic materials such as polycarbonate or fluorocarbonate may also be used.

**[0021]** As to a further discussion of the manner of usage and operation of the present invention, the same should be apparent from the above description. With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variation in size, materials, shape, form, function and manner of operation, assembly and use, are readily apparent and obvious to one skilled in the art and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention. Therefore, the foregoing is considered as illustrative only of the principles of the invention. Furthermore, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

**CLAIMS**

What is claimed:

1. A modular photovoltaic assembly for converting solar light into electrical current comprising:

an upper and lower solar panel;

a plurality of optical cylindrical rods lenses each having at least one convex lens at one end.

2. The assembly of claim 1, wherein said upper solar panel and said lower solar panel further comprises two or more photovoltaic panels superimposed in a parallel fashion.

3. The assembly of claim 2, wherein said upper panel provides a longitudinal and transverse midline slots to accommodate said cylindrical rod lenses.

4. The assembly of claim 2, wherein said lower panel is curved or semi-circular.

5. The assembly of claim 1, wherein said cylindrical rod lenses can be made from glass, composite, or plastic.

6. The assembly of claim 5, wherein each said longitudinal and transverse midline slot has one or more said cylindrical rod lens.

7. The assembly of claim 5, wherein the number of said cylindrical rod lenses is proportional to the surface of the upper solar panel.

8. The assembly of claim 5, wherein one or more said optical cylindrical rods have a slanted end in a form a convex lens for gather incident light from different directions and transmitting it to the said lower panel.



9. The assembly of claim 5, wherein said optical cylindrical rods have an oval cross- section.

10. The assembly of claim 5, wherein said optical cylindrical rods have two opposed flat surfaces.

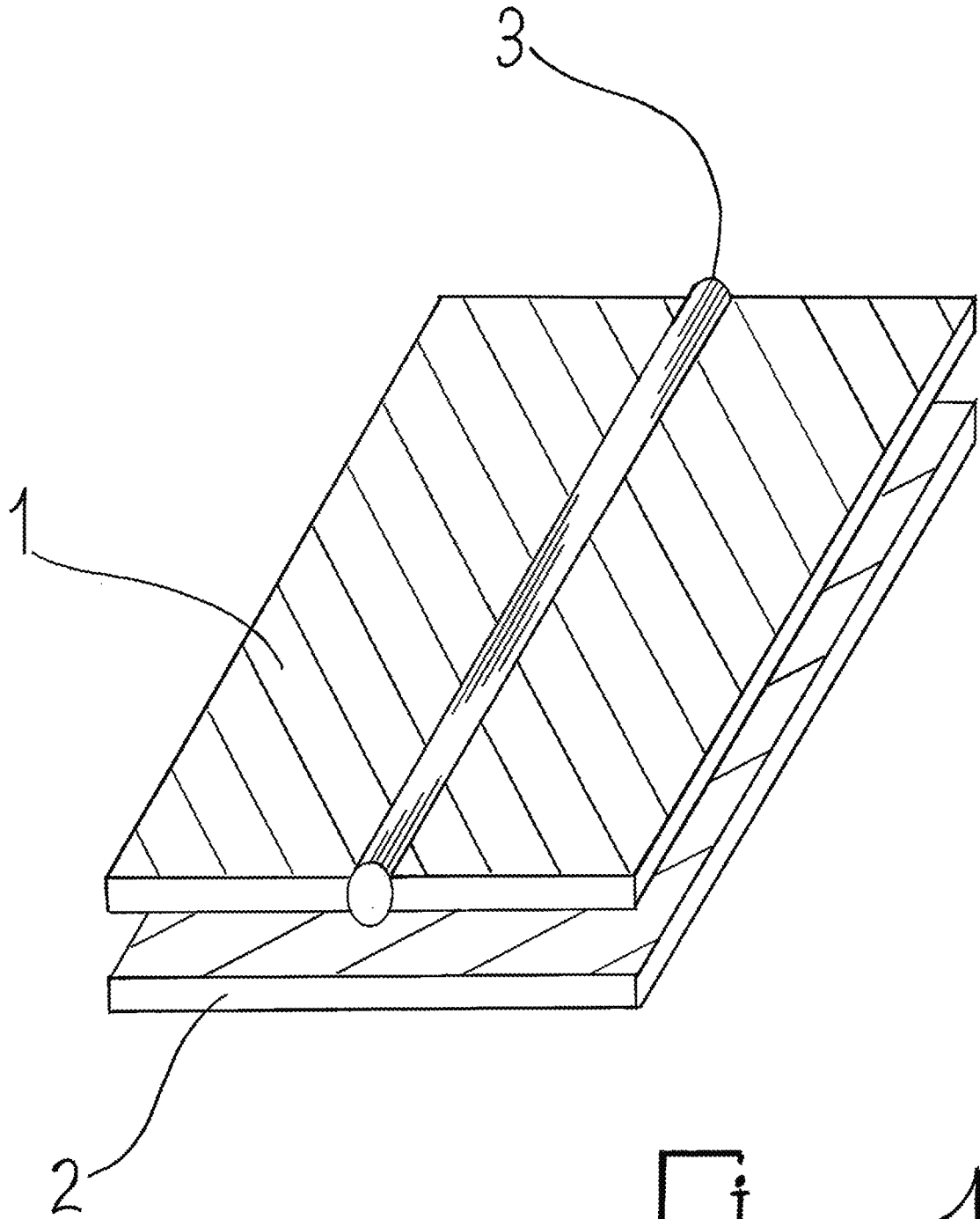


Fig. 1

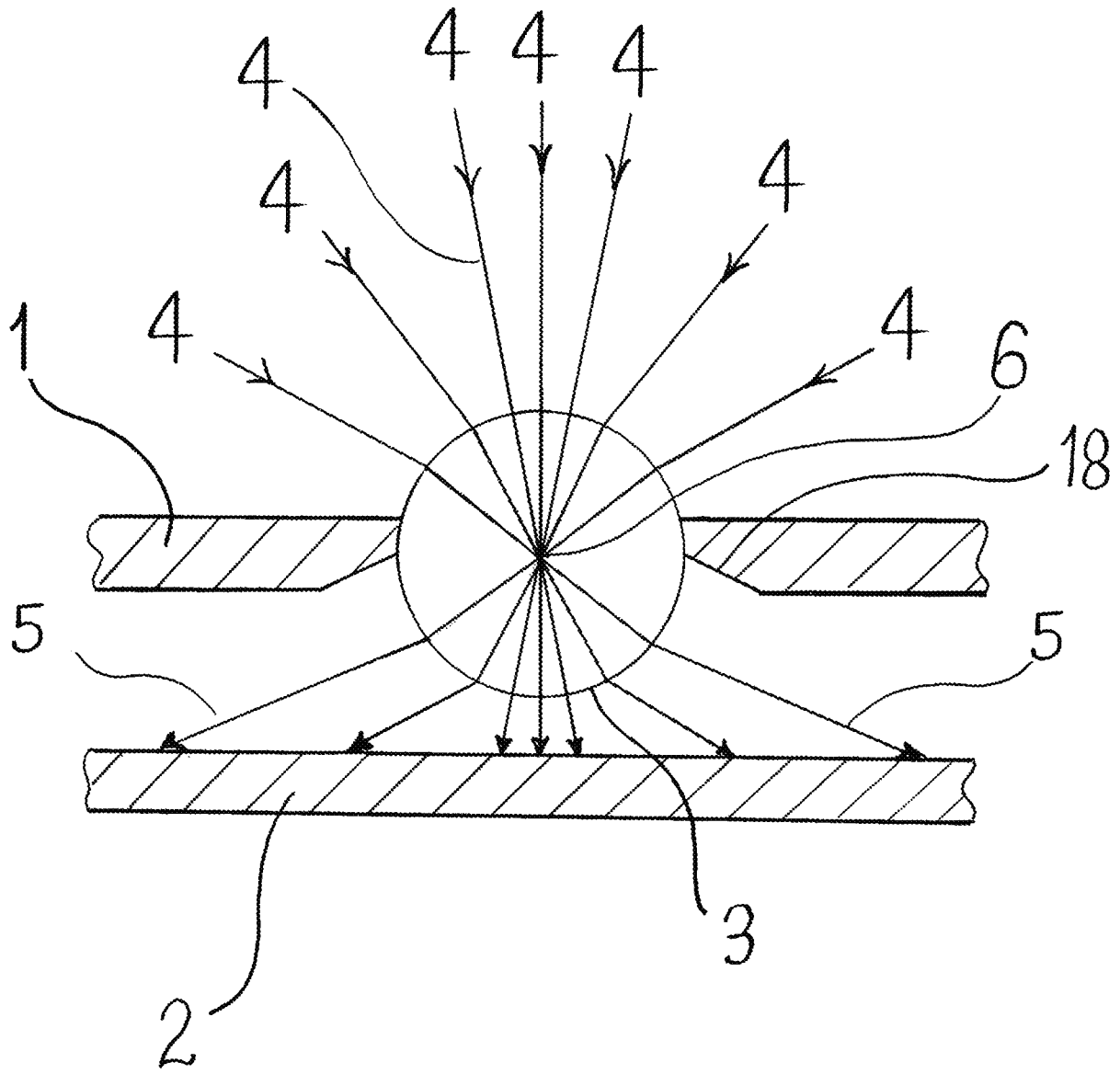


Fig. 2

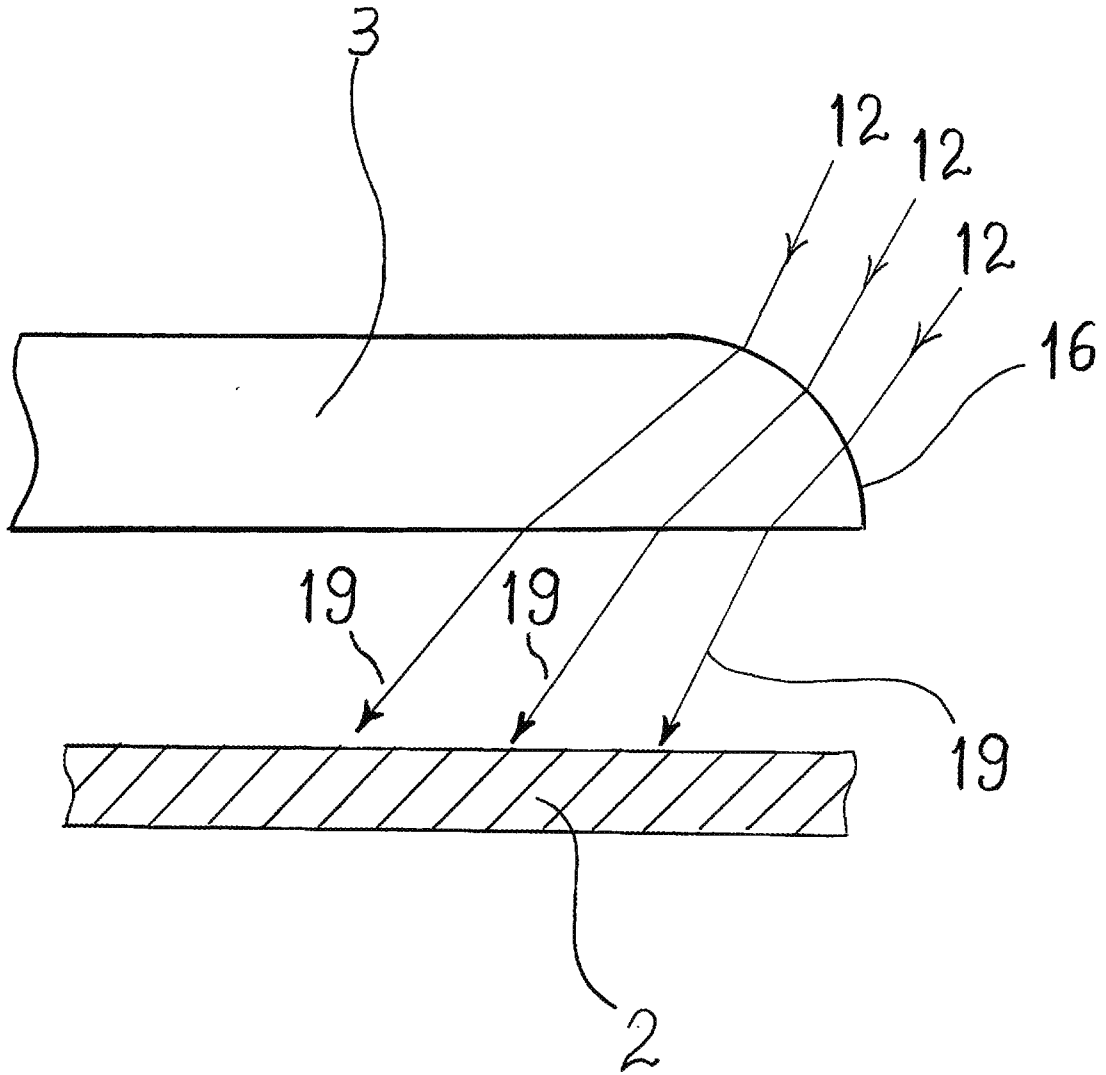


Fig. 3

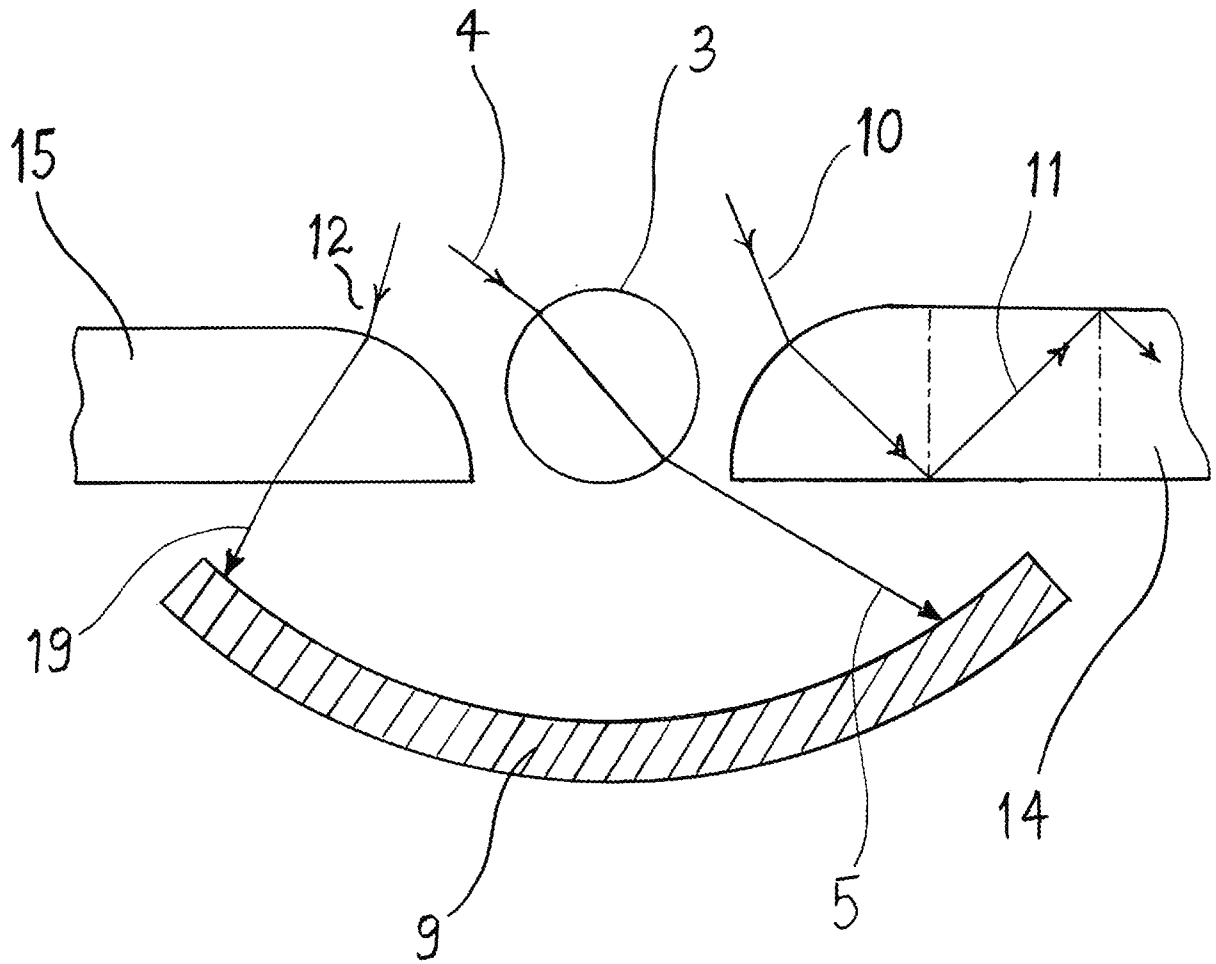


Fig. 4

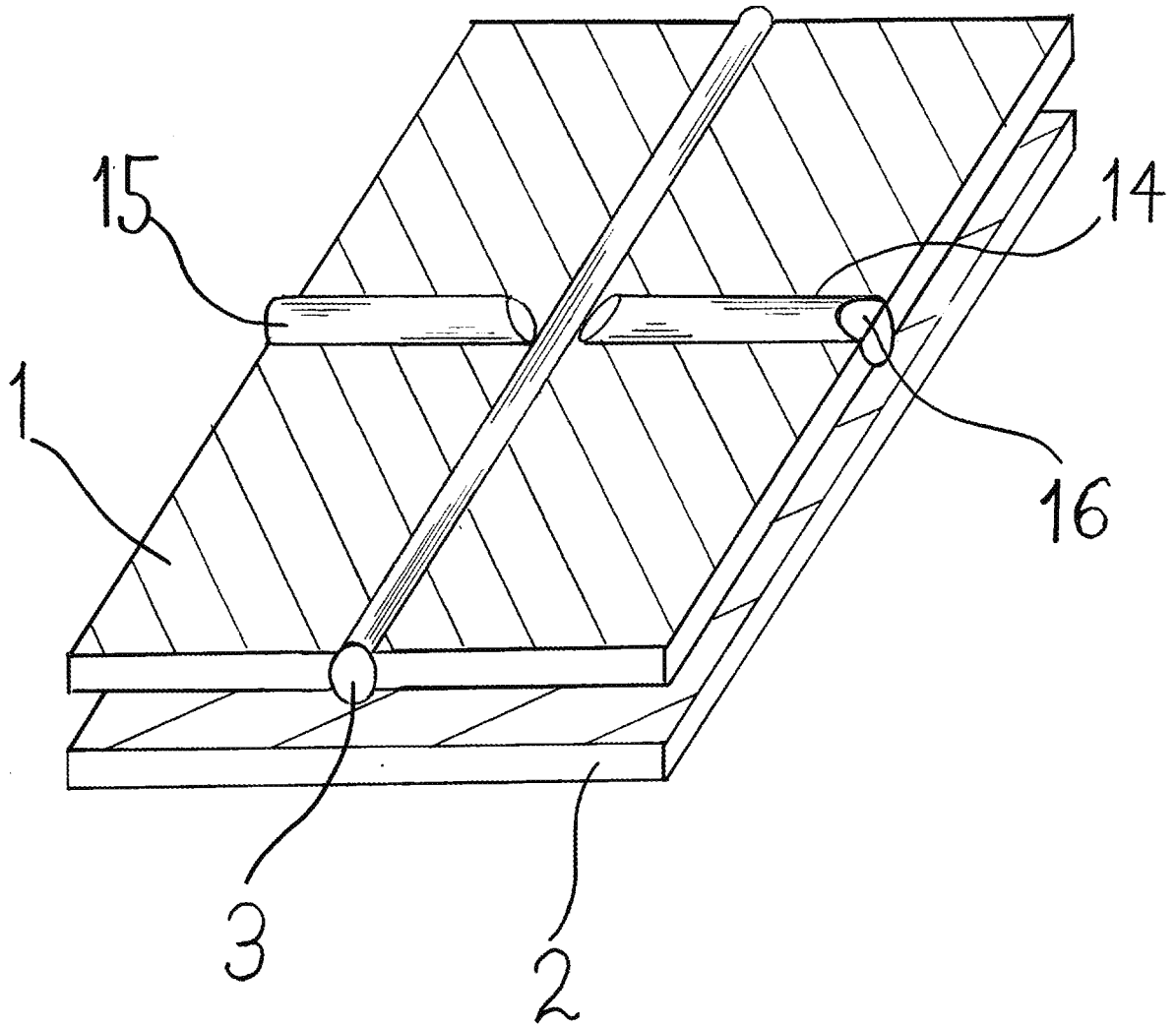


Fig. 5

# INTERNATIONAL SEARCH REPORT

International application No PCT/US2017/017890
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. H01L31/054 H01L31/042  
 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 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.
X A	US 2013/048052 A1 (LAM SIO KUAN [HK] ET AL) 28 February 2013 (2013-02-28) paragraph [0017]; figure 2 paragraph [0015] - paragraph [0016] paragraph [0014]	1,4,5, 7-10 3,6
A	----- US 2009/025779 A1 (HSIAO BOR-YUAN [TW]) 29 January 2009 (2009-01-29) paragraph [0016] - paragraph [0023]; figure 2	1-10
X A	----- US 2009/095340 A1 (HSIAO BOR-YUAN [TW] ET AL) 16 April 2009 (2009-04-16) paragraph [0020] - paragraph [0021]; figure 3 paragraph [0023]	1,2,4,5, 7,9,10 3,6

Further documents are listed in the continuation of Box C.       See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent 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>"&amp;" document member of the same patent family</p>
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Date of the actual completion of the international search  <b>10 April 2017</b>	Date of mailing of the international search report  <b>19/04/2017</b>
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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  <b>Chao, Oscar</b>
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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