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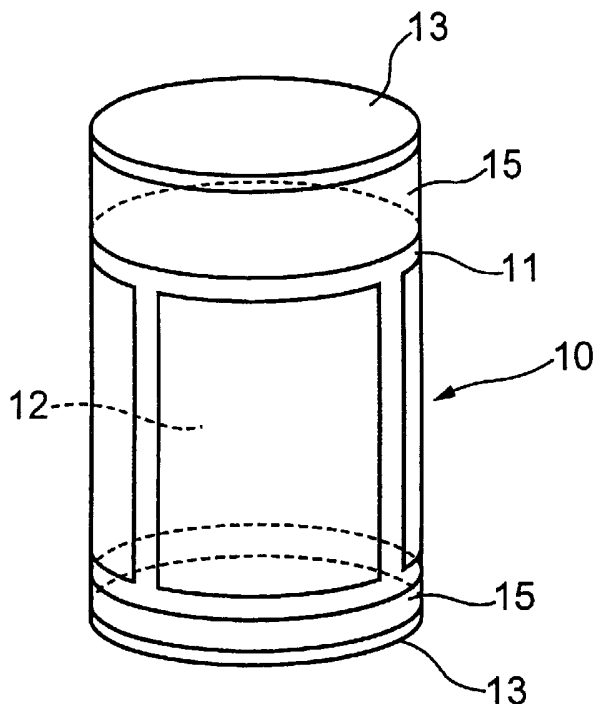
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(54) Title: SOLAR CELL MODULE



(57) Abstract: A solar cell module (10) has a transparent cylindrical container (11) and solar cells (12) housed in the transparent cylindrical container (11). The solar cell module (10) has lids (13) for hermetically sealing the transparent cylindrical container (11). The solar cells (12) are fixed directly on an inner surface of the transparent cylindrical container (11). The solar cell module (10) may have rear supports (14) attached to rear faces of the solar cells (12) for supporting the solar cells (12), and a resin (16) for fixing the rear supports (14).

WO 03/100866 A1

DESCRIPTION

SOLAR CELL MODULE

Technical Field

The present invention relates to a solar cell module, and more particularly to a solar cell module having a transparent cylindrical container and a solar cell disposed in the cylindrical container.

Background Art

Solar cells have heretofore been used widely as clean energy sources. Generally, a solar cell panel has a flat shape and can achieve a maximum efficiency when sunlight is applied in a direction perpendicular to a flat surface of the solar cell panel.

Further, there has been developed another solar cell module having a curved structure which can suitably be disposed on a dome-like roof or the like. Such a solar cell module having a curved structure can be manufactured by depositing a material, such as amorphous silicon, on a sheet having a curved structure.

However, a solar cell module using amorphous silicon or the like is disadvantageous in that efficiency of converting solar radiation into electric power is so low that large electric power cannot be generated in a relatively small area. Additionally, a conventional solar cell module having a curved structure has a limited range of directions for receiving sunlight.

Disclosure of Invention

The present invention has been made in view of the above drawbacks. It is, therefore, an object of the present invention to provide a solar cell module which can reduce dependency of photovoltaic conversion upon incident directions of sunlight and is applicable to a power station floating on water or the like.

According to a first aspect of the present invention, a solar cell module has a transparent cylindrical container and a solar cell housed in the transparent cylindrical container. The solar cell module has a sealing member for hermetically sealing the transparent cylindrical container. It is desirable to dispose the solar cell on an inner surface of the transparent cylindrical container. The solar cell may be fixed directly on the inner surface of the transparent cylindrical container. The solar cell module may have a rear support attached to a rear face of the solar cell for supporting the solar cell, and a resin for fixing the rear support.

According to the present invention, the solar cell is disposed on the inner surface of the transparent cylindrical container. Therefore, according to the present invention, the solar cell module using a cylindrical container can receive light in all directions about its axis and generate electric power at a uniform efficiency of photovoltaic conversion. Thus, the solar cell module is not required to follow the sun during duration of sunlight, and can generate electric power at operating points which do not depend on incident directions of sunlight. Opposite ends of the cylindrical container may hermetically be sealed by a sealing member. In this case, the solar cell module can be floated on water and used as a power station floating on water such as a sea or lake.

In the solar cell module according to the present invention, a resin layer such as ethylene-vinyl acetate (EVA) which is not sufficiently strong against ultraviolet rays is not used, and the solar cell is fixed on the inner surface of the transparent cylindrical container directly or by an adhesive. Therefore, the solar cell module has high durability.

The solar cell module may have a condenser disposed in the transparent cylindrical container for storing electric power generated by the solar cell, and an illuminant disposed in the

transparent cylindrical container for emitting light by electric power supplied from the condenser. In this case, electric power generated by the solar cell during daytime hours can be stored in the condenser, and the stored electric power can be used so
5 that the illuminant emits light at night. Therefore, the solar cell module is applicable to a buoy floating at sea or the like.

The solar cell module may have a reflector plate disposed on an inner surface of the transparent cylindrical container. In this case, the solar cell may have a first photovoltaic surface
10 disposed on the inner surface of the transparent cylindrical container and a second photovoltaic surface facing the reflector plate. The first photovoltaic surface can receive sunlight directly, and the second photovoltaic surface can receive sunlight reflected on the reflector plate. Therefore, both of
15 the first and second photovoltaic surfaces can serve to generate electric power to achieve efficient power generation.

According to a second aspect of the present invention, a solar cell module has an outer transparent cylindrical container and a solar cell housed in the transparent cylindrical container.
20 The solar cell module also has an inner cylindrical container disposed inwardly of the solar cell, and a sealing member for hermetically sealing a space between the outer transparent cylindrical container and the inner cylindrical container. With this arrangement, the solar cell module can be tubular and used
25 as a pipe for introducing water or the like through an interior of the inner cylindrical container.

The solar cell may comprise a monocrystalline or polycrystalline silicon substrate having a thickness of 150 μm or less.

30 The above and other objects, features, and advantages of the present invention will be apparent from the following description when taken in conjunction with the accompanying drawings which illustrate preferred embodiments of the present

invention by way of example.

Brief Description of Drawings

FIG. 1 is a perspective view showing a solar cell module
5 according to a first embodiment of the present invention;

FIG. 2 is a cross-sectional view taken within a plane perpendicular to an axial direction of the solar cell module shown in FIG. 1;

FIG. 3 is a cross-sectional view taken within a plane
10 perpendicular to an axial direction of a solar cell module according to a second embodiment of the present invention;

FIG. 4A is a perspective view showing a solar cell module according to a third embodiment of the present invention; and

FIG. 4B is a cross-sectional view of the solar cell module
15 shown in FIG. 4A.

Best Mode for Carrying Out the Invention

A solar cell module according to embodiments of the present invention will be described below with reference to the
20 accompanying drawings.

FIGS. 1 and 2 show a solar cell module 10 according to a first embodiment of the present invention. As shown in FIGS. 1 and 2, the solar cell module 10 has a transparent cylindrical container 11, solar cells 12 housed in the cylindrical container 11, upper and lower sealing members (lids) 13 for hermetically
25 sealing opposite ends of the cylindrical container 11, and illuminants 15 such as electroluminescence (EL) elements or light-emitting diodes (LED) disposed on axial opposite ends of the solar cells 12 in the cylindrical container 11. The
30 cylindrical container 11 may be made of transparent glass or plastic having weather resistance and impact resistance.

Each of the solar cells 12 may comprise a monocrystalline or polycrystalline silicon substrate having a thickness of 150

μm or less. A monocrystalline silicon substrate having a thickness of 150 μm or less can easily be formed of ribbon-like crystal or web crystal produced with an apparatus disclosed in Japanese patent publication No. 2000-319088 or 2002-087899, the disclosure of which is hereby incorporated by reference. In this manner, each solar cell in the present embodiment is formed of a relatively thin crystalline silicon substrate. Therefore, each solar cell has a higher efficiency of photovoltaic conversion than that of an amorphous silicon solar cell or the like. Further, such a thin substrate is so flexible that it can be formed into a curved structure, and a solar cell module using such a substrate can generate large electric power in a relatively small area. Although a solar cell generally has a flat shape, the solar cells in the present embodiment are so thin that they can be deformed into and held in a curved shape.

In a conventional solar cell module, a resin such as ethylene-vinyl acetate (EVA) is formed on a surface of a solar cell. Such a resin formed on a surface of a solar cell may cause incident loss of sunlight. Further, a resin such as EVA is not sufficiently strong against ultraviolet rays, and thus the resin is deteriorated by sunlight to lower durability of the solar cell module. In the present embodiment, the solar cells are fixed directly on an inner surface of the cylindrical container 11 without a resin being interposed between the inner surface of the cylindrical container 11 and surfaces of the solar cells. Therefore, incident loss of sunlight can be reduced, and durability of the solar cell module 10 can be prevented from being lowered.

As shown in FIG. 2, each of the solar cells 12 is attached to a rear support 14 by an adhesive or the like and supported by the rear support 14. In the illustrated example, the rear supports 14 are fixed by a resin 16. In this manner, a rear face of each solar cell 12 is supported by a respective rear support

14, and the rear supports 14 are fixed and supported by the resin 16. Therefore, the solar cell module 10 has high impact resistance to an extent such that the solar cell module 10 can be used stably for a long term under severe conditions (e.g.,
5 on water). The solar cells 12 may be attached to the inner surface of the cylindrical container 11 by an adhesive. In this case, the resin 16 for fixing and supporting the solar cells 12 may be dispensed with to simplify a structure of the solar cell module 10.

10 Each of the lids 13 may comprise a circular glass plate. Peripheries of the lids are heated and fused to hermetically seal an interior of the cylindrical container 11. The lids 13 can prevent external gas or the like from entering the interior of the cylindrical container 11. Therefore, the solar cell module
15 10 can be floated on water of a sea or lake. Water glass may be used to adhere the glass plates of the lids 13 to ends of the cylindrical container 11 to seal the cylindrical container 11.

As shown in FIG. 2, the cylindrical container 11 of the
20 solar cell module 10 houses a controller 18, a condenser 19, and cables 17 connecting the controller 18 and the condenser 19 to the solar cells 12. Electric power produced by the solar cells 12 during daytime hours is stored through the controller 18 in the condenser 19. The electric power stored in the condenser
25 19 is supplied through the controller 18 to the illuminants 15 such as EL elements or LED so that the illuminants 15 emit light at night.

The solar cells 12 are disposed on an entire inner surface of the cylindrical container 11. Therefore, the solar cells 12
30 can produce electric power from sunlight in all directions around an axis of the cylindrical container 11. Thus, the solar cell module according to the present invention is applicable to, for example, a buoy floating at sea.

The solar cells may be distributed unevenly in the cylindrical container 11. Specifically, a necessary number of solar cells are provided in the cylindrical container 11, and weight distribution is adjusted such that portions where the
5 solar cells are not provided face away from a light source.

In the present embodiment, the solar cell module having illuminants therein has been described. The solar cell module may have no illuminants and simply serve as a power generator. In this case, the solar cell module may have one or more connectors
10 for outputting electric power stored in the condenser 9. The solar cell module may have no controllers and no condensers but one or more connectors for directly outputting electric power generated by the solar cells 12.

As described above, each of the solar cells may be made
15 of a monocrystalline or polycrystalline silicon substrate. Alternatively, the solar cells may be made of a compound semiconductor such as gallium arsenide, an amorphous semiconductor, or an organic compound semiconductor.

For example, a solar cell module 10 according to the present
20 embodiment is produced as follows. Solar cells 12 formed on silicon substrates are fixed on fluorine resin sheets (rear supports) 14 by adhesive materials, respectively. Then, the solar cells 12 are inserted into an interior of a cylindrical container 11 so that photovoltaic surfaces of the solar cells
25 12 are brought into close contact with an inner surface of the cylindrical container 11. In this state, pressing forces are applied to rear faces of the resin sheets 14 to adhere the solar cells 12 to the inner surface of the cylindrical container 11. For example, air is slowly supplied into the interior of the
30 cylindrical container 11 to press the solar cells 12 against the inner surface of the cylindrical container 11. Thus, the solar cells 12 are fixed on the inner surface of the cylindrical container 11. After wiring is formed, the solar cells 12 are

fixed by a resin 16. Then, dry air, nitrogen gas, argon gas, or the like is introduced into the interior of the cylindrical container 11 to remove water vapor therein. Upper and lower lids 13 are mounted on opposite ends of the cylindrical container 11 to hermetically seal the interior of the cylindrical container 11.

FIG. 3 shows a solar cell module 20 according to a second embodiment of the present invention. As with the first embodiment, the solar cell module 20 has a transparent cylindrical container 21 made of glass or plastic, and opposite ends of the cylindrical container 21 are hermetically sealed. A bifacial solar cell is suitable for use as the solar cell 22 in this solar cell module 20, and this solar cell 22 is disposed on an inner surface of the cylindrical container 21. In the illustrated example, the solar cell 22 has top and back photovoltaic surfaces and is disposed at an upper portion of the cylindrical container 21. A reflector plate 23 such as a mirror is disposed at a lower portion of the cylindrical container 21. The solar cell 22 is spaced from the reflector plate 23 by a predetermined distance. Sunlight introduced through the predetermined distance into the interior of the cylindrical container 21 is reflected from the reflector plate 23 and directed to the back photovoltaic surface of the solar cell 22, so that the solar cell 22 generates electric power. Simultaneously, the sunlight is applied onto the top photovoltaic surface of the solar cell 22. Thus, the solar cell 22 receives the sunlight on both photovoltaic surfaces to generate electric power and can generate electric power more efficiently.

In the solar cell module 20, since the opposite ends of the cylindrical container 21 are hermetically sealed, the solar cell module 20 can be used as a power station, floating on water, with a controller, a condenser, and an illuminant. Further, the solar cell module 20 can be used as a buoy or the like which stores electric power generated during daytime hours and emits

light at night via the stored electric power. The solar cell module 20 may have no illuminants to simply serve as a power station floating on water or the like.

FIGS. 4A and 4B show a solar cell module 30 according to a third embodiment of the present invention. In the third embodiment, the solar cell module 30 has a tubular shape. Specifically, the solar cell module 30 has an outer transparent cylindrical container 31 made of glass or plastic, solar cells 32 disposed on an inner surface of the outer cylindrical container 31, rear supports 33 for supporting the solar cells 32, and an inner cylindrical container 34 disposed on an inner side of the rear supports 33. The inner cylindrical container 34 is tubular and may be made of resin, metal, or glass. A space between the cylindrical containers 31 and 34 is hermetically sealed at opposite ends of the cylindrical containers 31 and 34. Electric power from the solar cells 32, 32 is outputted through connectors (not shown). In the illustrated example, two solar cells are disposed on the inner surface of the outer cylindrical container 31. However, the number of solar cells is not limited to the illustrated example.

A solar cell module 30 according to the present embodiment is produced as follows. Solar cells 32 are attached to respective rear supports 33. The rear supports 33 are brought into close contact with and fixed on an outer surface of an inner cylindrical container 34. Then, the solar cells 32 are covered with an outer transparent cylindrical container 31 made of glass or plastic, and mounted to an inner surface of the outer cylindrical container 31. Thereafter, the cylindrical containers 31 and 34 are sealed so as to hold solar cells 32 in a hermetically sealed space between the outer and inner cylindrical containers 31 and 34.

With this arrangement, liquid such as water can be introduced into an interior of the inner cylindrical container 34, and the solar cell module 30 is applicable to various kinds

of purposes. For example, the inner cylindrical container 34 can be used as a pipe extending to a pump. In this case, the solar cells 32 serve to generate electric power, and simultaneously the cylindrical container 34 serves as a pipe.

5 Therefore, electric power can be generated by the solar cells 32, and liquid (water) flowing through the interior of the inner cylindrical container 34 can be heated by collection of solar heat. Further, the liquid flowing through the interior of the inner cylindrical container 34 can cool the solar cells 32 to

10 prevent an efficiency of generating electric power from being lowered due to heating.

In the illustrated example, the solar cell module 30 has solar cells 32 disposed substantially over an entire inner surface of the outer cylindrical container 31. However, the solar cells

15 may be disposed only on an upper half of the outer cylindrical container 31, where sunlight is expected to be applied. In the illustrated example, a plurality of solar cells are distributed along an axial direction of the solar cell module 30. However, the solar cell module 30 may have only one solar cell.

20 As described above, with a solar cell module using a cylindrical container according to the present invention, the solar cell module can receive light in all directions about its axis. Therefore, the solar cell module can be used as a power station floating on water. Further, since a solar cell is not

25 exposed to external air, durability of the solar cell module can be improved. Since it is not necessary to seal the solar cell with an adhesive resin layer such as EVA, the solar cell module is unlikely to be deteriorated by radiation of ultraviolet rays. Thus, the solar cell module has high durability.

30 Additionally, since it is not necessary to use a sealing material containing an adhesive resin layer such as EVA, the solar cell module can easily be disassembled so as to recover used parts without destruction of the solar cell module.

When the cylindrical container houses a condenser and a controller, electric power may be stored during daytime hours, and the stored electric power may be used to emit light at night. Thus, the solar cell module can form an independent power station.

5 Further, when the cylindrical container is hollow, the cylindrical container can be used as a pipe. Specifically, liquid such as water can be introduced through the interior of the cylindrical container to efficiently utilize both sunlight and solar heat. Further, liquid such as water flowing through the
10 interior of the cylindrical container can cool the solar cells to prevent an efficiency of the solar cells from being lowered due to a temperature increase.

Although certain preferred embodiments of the present invention have been shown and described in detail, it should
15 be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.

Industrial Applicability

The present invention is suitable for use in a solar cell
20 module having a transparent cylindrical container and a solar cell disposed in the cylindrical container.

CLAIMS

1. A solar cell module, comprising:
a transparent cylindrical container;
5 a solar cell housed in said transparent cylindrical container; and
a sealing member for hermetically sealing said transparent cylindrical container.
- 10 2. A solar cell module according to claim 1, wherein said solar cell is disposed on an inner surface of said transparent cylindrical container.
- 15 3. A solar cell module according to claim 2, wherein said solar cell is fixed directly on said inner surface of said transparent cylindrical container.
- 20 4. A solar cell module according to claim 1, further comprising:
a rear support attached to a rear face of said solar cell for supporting said solar cell; and
a resin for fixing said rear support.
- 25 5. A solar cell module according to claim 1, further comprising:
a condenser disposed in said transparent cylindrical container for storing electric power generated by said solar cell; and
an illuminant disposed in said transparent cylindrical
30 container for emitting light by electric power supplied from said condenser.

6. A solar cell module according to claim 1, further comprising:

a reflector plate disposed on an inner surface of said transparent cylindrical container,

5 wherein said solar cell has a first photovoltaic surface disposed on said inner surface of said transparent cylindrical container and a second photovoltaic surface facing toward said reflector plate.

10 7. A solar cell module, comprising:

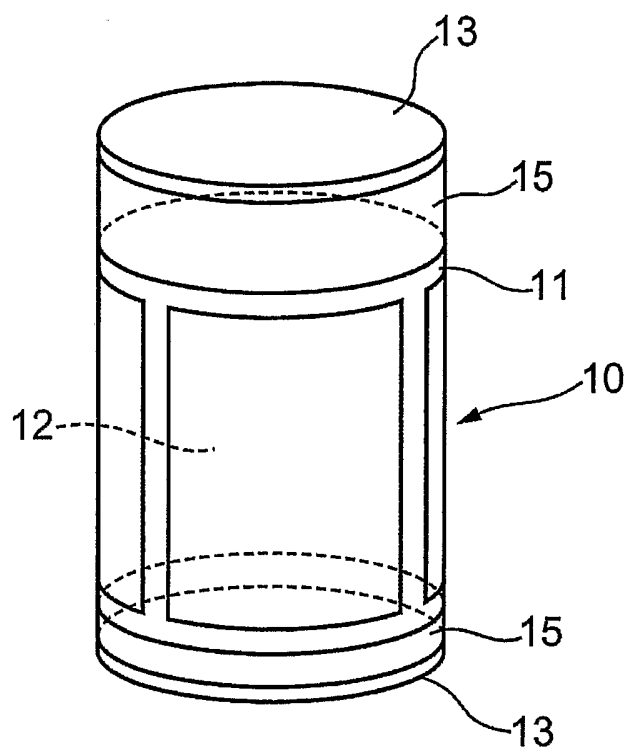
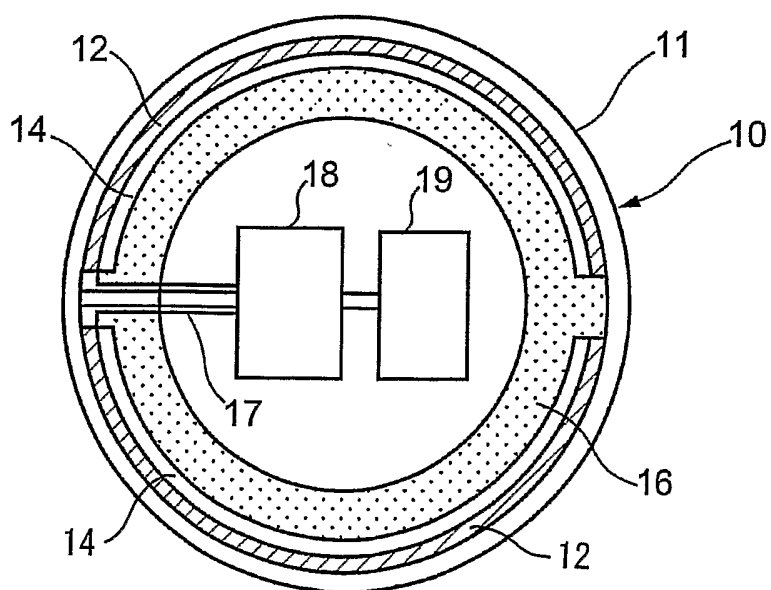
an outer transparent cylindrical container;

a solar cell housed in said transparent cylindrical container;

15 an inner cylindrical container disposed inwardly of said solar cell; and

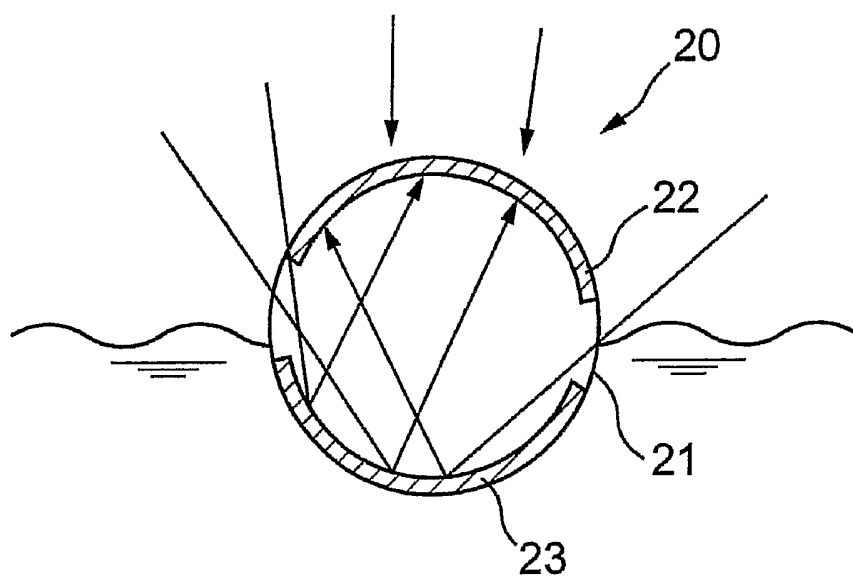
a sealing member for hermetically sealing a space between said outer transparent cylindrical container and said inner cylindrical container.

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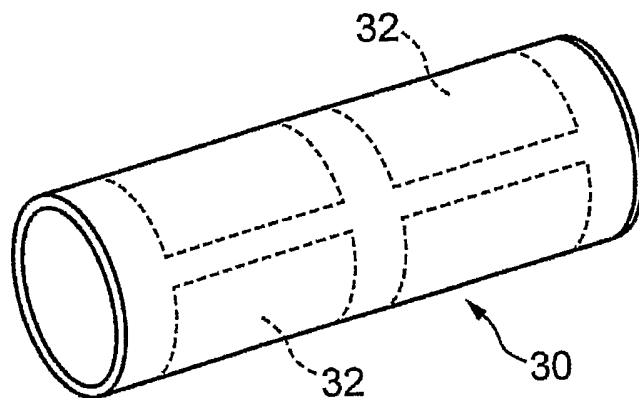
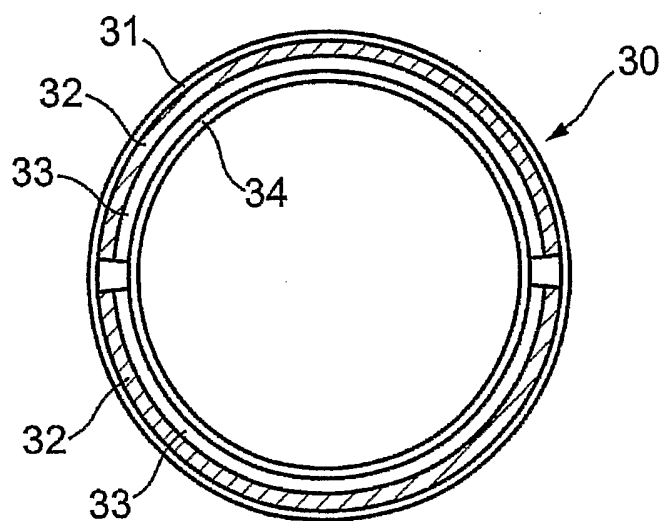
FIG. 1**FIG. 2**

2/3

FIG. 3



3/3

FIG. 4A**FIG. 4B**

INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP 03/04360

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L31/0352 H01L31/052

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)

IPC 7 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, PAJ, 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	PATENT ABSTRACTS OF JAPAN vol. 008, no. 036 (E-227), 16 February 1984 (1984-02-16) & JP 58 192385 A (MITSUI TOATSU KAGAKU KK), 9 November 1983 (1983-11-09) abstract ----	1-3,7
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 247 (E-208), 2 November 1983 (1983-11-02) & JP 58 135683 A (YOSHIMOTO UKITA), 12 August 1983 (1983-08-12) abstract ----	1-3
A	----	6,7
X	US 4 078 944 A (MLAVSKY ABRAHAM I) 14 March 1978 (1978-03-14) the whole document ----	1,4,6,7
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

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P document published prior to the international filing date but later than the priority date claimed

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

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

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.

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Date of the actual completion of the international search

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16/07/2003

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP 03/04360

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 008, no. 139 (E-253), 28 June 1984 (1984-06-28) -& JP 59 047773 A (SANYO DENKI KK), 17 March 1984 (1984-03-17) abstract; figures 2-5,7 ----	1-3
X	EP 0 332 004 A (MINNESOTA MINING & MFG) 13 September 1989 (1989-09-13) the whole document ----	1-3,5,7
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 091 (E-109), 28 May 1982 (1982-05-28) & JP 57 026476 A (SOMA TAKENORI), 12 February 1982 (1982-02-12) abstract ----	1-4,7
A	FR 2 417 188 A (COMMISSARIAT ENERGIE ATOMIQUE) 7 September 1979 (1979-09-07) page 2, line 12-36; figures 2-4 ----	1-4,6,7
A	WO 94 14150 A (KRANZ REINHARD OTTO) 23 June 1994 (1994-06-23) page 6, line 7 -page 10, line 21; figures 1-7,10,11 ----	1,5
A	US 4 143 234 A (JOHNSON GREGORY R ET AL) 6 March 1979 (1979-03-06) the whole document -----	1-3,6

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 03/04360

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 58192385	A	09-11-1983	JP 1764265 C JP 4056474 B	28-05-1993 08-09-1992
JP 58135683	A	12-08-1983	NONE	
US 4078944	A	14-03-1978	US 4144095 A	13-03-1979
JP 59047773	A	17-03-1984	NONE	
EP 0332004	A	13-09-1989	US 4882239 A EP 0332004 A2 JP 2010667 A	21-11-1989 13-09-1989 16-01-1990
JP 57026476	A	12-02-1982	NONE	
FR 2417188	A	07-09-1979	FR 2417188 A1	07-09-1979
* WO 9414150	A	23-06-1994	DE 4309259 A1 DE 9216845 U1 WO 9414150 A1 DE 9320369 U1	29-09-1994 18-03-1993 23-06-1994 19-05-1994
US 4143234	A	06-03-1979	NONE	