

Description

The invention relates to a solar ray collecting device according to the generic clause of claim 1.

A solar ray collecting device of this type has been previously proposed in the EP-A-O 050 189 document. In this device the solar rays are focused by a lens and are guided into an optical conductor cable and transmitted on to an optional desired place for the purpose of illumination or for other uses. This type of solar ray collecting device is one in which a large number of lenses having a diameter of less than about 4 cm (for example, 2000 lenses of the same diameter) are used for collecting solar rays on the light receiving edge of an optical fibre having a diameter of about 0.1 to 0.2 mm. These are precisely positioned on to the focus of each lens, and the solar rays focused by each lens are then guided into them. The focal length of the lens is about 40 cm in the case of the former device while its focal length is about 4 cm or less in the case of the latter. Consequently, the value of the latter is that it makes it possible to create a very thin solar ray collecting device. On the contrary, there exist drawbacks in that the focus position of the lens needs to coincide precisely with the light-receiving edge surface, and as a result, the lens and its supporting member tend to expand due to the extreme heat. This is especially true if the device is used in a desert, in universal space, or in a tropical area where the ambient temperature varies to a great extent. As a result, the positional relationship between the focus position of the lens and the light receiving edge surface of the optical fibre largely deviates from its predetermined relationship, and consequently the lens and its supporting member are apt to be destroyed by the extreme heat.

It is an object of the present invention to provide a solar ray collecting device of the type mentioned above which effectively absorbs the heat expansion of the lens and its supporting member, and which prevents them from being destroyed by extreme heat, and which enables the focus position of each lens always to coincide with the light-receiving edge surface of the optical fibre.

This object is solved with a solar ray collecting device having the features of claim 1.

Preferred embodiments are disclosed in the depending claims.

The features and advantages of the present invention will become apparent from the following detailed description which goes with the accompanying drawings.

Fig 1 is a plane view partly enlarged for explaining an embodiment of the present invention.

Fig 2 is a cross-section view of Fig 1. In Fig 2, 10 is an optical system and 20 is its supporting member. In practice, a large number of optical systems (for example, 2,000 of them) are arranged on a supporting member 20. Basically each optical system 10 is composed of a hexa-

gonal lens 11 having about 4 cm or less in diameter; a truncated hexagonal pyramid 12, the upper surface of which is the lens 11; and an optical fiber 13, the light-receiving edge surface of which is precisely positioned on the focus of the lens 11. The solar ray focused by the lens 11 is guided into the optical fiber 13. A large number of hexagonal recesses 21 for accommodating the optical systems 10 are provided on the supporting member. The upper portion of the side wall 22 forming the recess 21 is formed on the inclined wall having the same slant as the pyramidal surface of the hexagonal pyramid 12. When the lens and the lens supporting member expand due to ambient heat, the hexagonal pyramid 12 of the optical system 10 rises, sliding along with the inclined surface 23 in the direction shown by the arrow at A. On the contrary, when they contract, the pyramid 12 sinks sliding along in the direction as shown by an arrow at B. On that occasion the focal position of the lens 11 does not change at all, and therefore the solar rays are always efficiently guided into the optical fiber 13. However, if the heat expansion rate of the lens is too great, there is a possibility that the neighboring lenses will collide with each other and will be destroyed. Supposing that a protection bar 24 is mounted on the top of the upper surface of the side wall 22, namely the place where the lenses are most probably apt to be destroyed, each lens will then collide with the protection bar first and this area of the lens will only partially be destroyed.

Consequently it may be possible to prevent the lenses from being entirely destroyed by colliding with the sides of the neighboring lenses. The solar ray focused by the lens 11 and guided into the optical fiber 13 is a direct light beam delivered from the sun. On the other hand, an indirect light beam from the sun cannot be guided into the optical fiber. If such an indirect light is utilized it may be possible to suppress the heat expansion of the spectrum system. For this purpose transparent acrylic material hardened at high temperatures is used in the hexagonal pyramid 12 and aluminum evaporation is performed on its external circumferential surface in order to form a light-reflecting film 14. Furthermore a solar battery is mounted on the bottom surface of the hexagonal pyramid 12 and/or an inductive material 16 is provided on the same surface so as to let it circulate there for storing energy generated by an optical reaction due to light energy. In such a manner the indirect light beam delivered by the sun is guided into the hexagonal pyramid 12, and is effectively reflected by the use of an aluminum reflection surface 14. The indirect light guided to the bottom surface of the hexagonal pyramid 12 is converted into electric energy there or stored in the inductive material itself. On that occasion if a fluorescent substance is mixed into the transparent acrylic hexagonal pyramid, it may be possible to convert the light guided into it into a type of light having a certain wave length at which it can react most easily to the solar battery or to the inductive material. This latter possibility

will make the solar ray more effective. Furthermore it may be possible to perform aluminum evaporation on the internal circumferential surface of the hexagonal pyramid in order to form a reflecting surface on it. Since the light guided into the hexagonal pyramid may be deflected on the reflecting surface and be discharged outside, a temperature rise of the entire solar ray collecting device can be suppressed by the amount discharged.

As is apparent from the above-mentioned description, the optical system can be protected from being damaged due to heat expansion and it might be possible to provide a solar ray collecting device having the function of always collecting solar rays effectively even if the solar ray focusing lense moves due to heat expansion.

Claims

1. A solar ray collecting device comprising a supporting base plate (20) having a large number of hexagonal recesses (21) formed therein and a large number of optical systems (10) arranged thereon, with one optical system (11) associated to each of said recesses, which optical system comprises a hexagonal focusing lens (11) having a dimension which is approximately equal to the dimension of the associated recess (21) and an optical conductor (13) having a light receiving surface which is provided at the focus of the focusing lens (11) characterized in that each of the recesses (21) is provided with an inverse truncated pyramid (12), said pyramid facing the base plate at the smaller end thereof, while the outer surface of the top end thereof is in sliding engagement with a side wall (23) of the related recess (21) and that the lens (11) is carried on its outer circumference by the inverse truncated pyramid at the open top end thereof.

2. A solar ray collecting device as defined in claim 1 characterized by a protection bar (24) projecting upwardly from the top portion of said side wall (22).

3. A solar ray collecting device as defined in claims 1 or 2, characterized in that said hexagonal pyramid (12) is composed of transparent acrylic material which is hardened at a high temperature.

4. A solar ray collecting device as defined in claims 1, 2 or 3, characterized by an aluminium layer (14) which is provided by evaporation on the external circumferential surface of said hexagonal pyramid (12).

5. A solar collecting device as defined in claims 3 or 4, characterized by a fluorescent substance which is mixed in said hexagonal pyramid (12).

6. A solar collecting device as defined in one of claims 1 through 5, characterized by a device (15, 16) which converts light into electrical energy and which stores said electrical energy, said device being mounted on the pyramid's bottom surface facing the base plate.

7. A solar collecting device as defined in claims 1 through 6, characterized by an inductive

material (16) being provided at the pyramid's bottom surface facing the base plate for the purpose of storing light energy.

8. A solar collecting device as defined in claims 1 or 2, characterized by an aluminium layer which is provided by evaporation on the internal circumferential surface of the hexagonal pyramid.

Patentansprüche

1. Sonnenkollektorstarrichtung mit einer Trägersockelplatte (20), die eine große Anzahl hexagonaler, darin ausgebildeter Vertiefungen (21) und eine große Anzahl darauf angeordneter optischer Systeme (10) umfaßt, wobei jeweils ein optisches System jeder der Vertiefungen zugeordnet ist, und wobei das optische System eine hexagonale fokussierende Linse (11) umfaßt, die eine Abmessung hat, die im wesentlichen gleich der Abmessung der zugeordneten Vertiefung (21) ist, und mit einem optischen Leiter (13), der eine lichtempfangende Fläche hat, die im Fokus der fokussierenden Linse (11) angeordnet ist, dadurch gekennzeichnet, daß jede Vertiefung (21) mit einer umgekehrten Stumpfpypamide (12) versehen ist, wobei die Pyramide mit ihrem schmalen Ende zur Sockelplatte hinweist, während die Außenfläche des oberen Endes in Gleiteingriff mit einer Seitenwand (23) der zugeordneten Vertiefung (21) steht, und wobei die Linse (11) an ihrem Außenumfang durch das offene obere Ende des Pyramidenstumpfes getragen wird.

2. Sonnenkollektorstarrichtung nach Anspruch 1, gekennzeichnet durch einen Schutzarm (24), der sich aufwärts vom oberen Ende der Seitenwand (22) weg erstreckt.

3. Sonnenkollektorstarrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die hexagonale Pyramide (12) aus einem durchlässigen Acrylmaterial zusammengesetzt ist, das bei einer hohen Temperatur gehärtet wird.

4. Sonnenkollektorstarrichtung nach Anspruch 1, 2 oder 3, gekennzeichnet durch eine Aluminiumschicht (14), die durch Aufdampfen am Außenumfang der Hexagonalpyramide (12) aufgetragen wird.

5. Sonnenkollektorstarrichtung nach Anspruch 3 oder 4, gekennzeichnet durch eine fluoreszierende Substanz, die der Hexagonalpyramide (12) beigemischt ist.

6. Sonnenkollektorstarrichtung nach irgendeinem der Ansprüche 1-5, gekennzeichnet durch eine Einrichtung (15, 16), die Licht in elektrische Energie umwandelt, und die die elektrische Energie speichert, wobei diese Einrichtung in der Bodenfläche der Pyramide, die zur Sockelplatte weist, angeordnet ist.

7. Sonnenkollektorstarrichtung nach den Ansprüchen 1-6, gekennzeichnet durch ein induktives Material (16), das in der zur Sockelplatte weisenden Bodenfläche der Pyramide angeordnet ist, um die Lichtenergie zu speichern.

8. Sonnenkollektorstarrichtung nach Anspruch 1 oder 2, gekennzeichnet durch eine Aluminium-



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will make the solar ray more effective. Furthermore it may be possible to perform aluminum evaporation on the internal circumferential surface of the hexagonal pyramid in order to form a reflecting surface on it. Since the light guided into the hexagonal pyramid may be deflected on the reflecting surface and be discharged outside, a temperature rise of the entire solar ray collecting device can be suppressed by the amount discharged.

As is apparent from the above-mentioned description, the optical system can be protected from being damaged due to heat expansion and it might be possible to provide a solar ray collecting device having the function of always collecting solar rays effectively even if the solar ray focusing lense moves due to heat expansion.

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2. A solar ray collecting device as defined in claim 1 characterized by a protection bar (24) projecting upwardly from the top portion of said side wall (22).

3. A solar ray collecting device as defined in claims 1 or 2, characterized in that said hexagonal pyramid (12) is composed of transparent acrylic material which is hardened at a high temperature.

4. A solar ray collecting device as defined in claims 1, 2 or 3, characterized by an aluminium layer (14) which is provided by evaporation on the external circumferential surface of said hexagonal pyramid (12).

5. A solar collecting device as defined in claims 3 or 4, characterized by a fluorescent substance which is mixed in said hexagonal pyramid (12).

6. A solar collecting device as defined in one of claims 1 through 5, characterized by a device (15, 16) which converts light into electrical energy and which stores said electrical energy, said device being mounted on the pyramid's bottom surface facing the base plate.

7. A solar collecting device as defined in claims 1 through 6, characterized by an inductive

material (16) being provided at the pyramid's bottom surface facing the base plate for the purpose of storing light energy.

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2. Sonnenkollektorstarrichtung nach Anspruch 1, gekennzeichnet durch einen Schutzarm (24), der sich aufwärts vom oberen Ende der Seitenwand (22) weg erstreckt.

3. Sonnenkollektorstarrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die hexagonale Pyramide (12) aus einem durchlässigen Acrylmaterial zusammengesetzt ist, das bei einer hohen Temperatur gehärtet wird.

4. Sonnenkollektorstarrichtung nach Anspruch 1, 2 oder 3, gekennzeichnet durch eine Aluminiumschicht (14), die durch Aufdampfen am Außenumfang der Hexagonalpyramide (12) aufgetragen wird.

5. Sonnenkollektorstarrichtung nach Anspruch 3 oder 4, gekennzeichnet durch eine fluoreszierende Substanz, die der Hexagonalpyramide (12) beigemischt ist.

6. Sonnenkollektorstarrichtung nach irgendeinem der Ansprüche 1-5, gekennzeichnet durch eine Einrichtung (15, 16), die Licht in elektrische Energie umwandelt, und die die elektrische Energie speichert, wobei diese Einrichtung in der Bodenfläche der Pyramide, die zur Sockelplatte weist, angeordnet ist.

7. Sonnenkollektorstarrichtung nach den Ansprüchen 1-6, gekennzeichnet durch ein induktives Material (16), das in der zur Sockelplatte weisenden Bodenfläche der Pyramide angeordnet ist, um die Lichtenergie zu speichern.

8. Sonnenkollektorstarrichtung nach Anspruch 1 oder 2, gekennzeichnet durch eine Aluminium-

schicht, die durch Aufdampfen auf die Innenumfangsfläche der hexagonalen Pyramide aufgetragen ist.

Revendications

1. Un dispositif collecteur de rayons solaires comprenant une plaque de base portante (20), pourvue d'un grand nombre d'évidements hexagonaux (21) formés dans celle-ci et sur laquelle sont disposés un grand nombre de systèmes optiques (10), un système optique (11) étant associé à un évidement respectif, ledit système optique comprenant une lentille hexagonale de concentration (11) ayant une dimension qui est approximativement égale à la dimension de l'évidement associé (21) et un conducteur optique (13) comportant une surface réceptrice de lumière qui est placée au foyer de la lentille de concentration (11), caractérisé en ce que chacun des évidements (21) est pourvu d'une pyramide tronquée inverse (12), ladite pyramide étant dirigée vers la plaque de base par sa petite extrémité tandis que la surface extérieure de son extrémité supérieure est en contact glissant avec une paroi latérale (23) de l'évidement associé (21), et en ce que la lentille (11) est supportée sur sa circonférence extérieure par une pyramide tronquée inverse à son extrémité supérieure ouverte.

2. Un dispositif collecteur de rayons solaires tel que défini dans la revendication 1, caractérisé par une barre de protection (24) faisant saillie vers le haut à partir de la partie supérieure de ladite paroi latérale (22).

3. Un dispositif collecteur de rayons solaires tel que défini dans les revendications 1 ou 2, caractérisé en ce que ladite pyramide hexagonale (12) est composée d'une matière acrylique transparente qui est durcie à haute température.

4. Un dispositif collecteur de rayons solaires tel que défini dans les revendications 1, 2 ou 3, caractérisé par une couche d'aluminium (14) qui est formée par évaporation sur la surface circonférentielle externe de ladite pyramide hexagonale (12).

5. Un dispositif collecteur de rayons solaires tel que défini dans les revendications 3 ou 4, caractérisé par une substance fluorescente qui est mélangée avec ladite pyramide hexagonale (12).

6. Un dispositif collecteur de rayons solaires tel que défini dans une des revendications 1 à 5, caractérisé par un dispositif (15, 16) qui convertit de la lumière en énergie électrique et qui emmagasine ladite énergie électrique, ledit dispositif étant monté sur la surface inférieure de la pyramide qui est dirigée vers la plaque de base.

7. Un dispositif collecteur de rayons solaires tel que défini dans les revendications 1 à 6, caractérisé par une matière inductive (16) qui est disposée sur la surface inférieure de la pyramide qui est dirigée vers la plaque de base dans le but d'emmagasiner de l'énergie lumineuse.

8. Un dispositif collecteur de rayons solaires tel que défini dans les revendications 1 ou 2, caractérisé par une couche d'aluminium qui est formée par évaporation sur la surface circonférentielle interne de la pyramide hexagonale.



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