

Description

This invention relates to a structure for collecting solar rays.

It has been often performed to focus the solar ray by means of the lens, to guide the solar ray into the light conductor and to transmit the solar ray through the light conductor to an optical desired position in order to use the solar ray for illumination or other purposes. One of such methods is to focus the solar ray by means of the Fresnel lens of about 40 cm diameter to guide the solar ray focussed by the lens into the light conductor having an edge surface of about 10 mm diameter arranged at the focus position of the lens, and to transmit the solar ray guided into the light conductor in such a manner through the light conductor to the optional desired position in order to use the solar ray for illumination or other purposes, for instance, as the light source for cultivating the plants in the room or the underground room, the light source for nurturing the plants on the bottom of the sea, or the light source for culturing chlorella, etc. However, according to such method, the focal distance of the lens turns out to be longer, for instance, about 40 cm, and therefore the device becomes large-scaled or voluminous. And further, the light collecting energy per lens increases so that highly heat-proof material needs to be used as the member placed near to the focus position of the lens, and the operator may probably be in danger of suffering from burning the operator's hands, etc. at the focus position when operator performs the adjustment work for positioning the edge surface of the light conductor onto the focus position of the lens, and so on. According to the method, a large number of small lenses having a diameter of about 4 cm is used, and the edge surface of the optical fiber of 1 through 2 mm diameter is arranged at the focus position of each lens. The light collected by each lens is guided into the respective optical fibers, and the lights delivered from the respective optical fibers are guided into the optical conductor having a large diameter, for instance a diameter of 10 through 30 mm and transmitted to the optional desired position through the light conductor.

A structure of the type, as disclosed above, and having the features of the precharacterizing part of claim 1, is known from EP—A 0050189.

According to this method mentioned above, the focal distance of the lens turns out to be small, for instance, about 4 cm. Therefore, it may be possible to realize the device manufactured in the small-scaled and thin style. On the contrary, since a large number of lenses is used, it may be troublesome to position the light-receiving edge surface of the optical fiber onto the focus of each lens and perform its maintenance work.

It is therefore the object of the present invention to provide a structure for collecting solar rays in which the adjustment work of positioning the light receiving end of an optical fiber onto the focus position of the lens is simplified.

This task is solved with a structure for collecting

solar rays having the features as claimed in claim 1.

Preferred embodiments are disclosed in the dependent claims. According to the features claimed in the dependent claims, a large number of lenses and a large number of optical fibers are comprised in the structure, wherein the light-receiving end of each fiber is arranged at the focus position of the corresponding lens. In the base plate, a large number of holes are provided. The single optical fibers are kept in the holes with respective retaining members.

The invention will now be described with reference to the drawings, in which Figure 1 is an outlined perspective view showing a solar ray collecting device for which the solar ray collecting structure, according to the invention, may be applied, and in which Figure 2 is a diagram for explaining the construction of an embodiment according to the present invention.

Fig. 1 is an outlined perspective view showing a solar ray collecting device as an example applied for the present invention. In Fig. 1, 1 is a cylindrical base block, 2 is a dome-shaped head cover, and 3 is a capsule composed of the base block and the head cover for the solar ray collecting device. Under the usage condition, the solar ray collecting device 10 is accommodated in the capsule 3 as shown in Fig. 1. The solar ray collecting device 10 comprises a number of lens groups 11 (for example, in the Figures, 7 lens groups are shown, but 19, 37 or 61 groups may be used) for focussing the solar ray, a direction sensor 12 for detecting the direction of the sun, a supporting frame 13 for unitarily retaining the lens groups and sensor, a first rotating shaft 14 for rotating the supporting frame 13, a supporting arm 16 for rotatably supporting the rotating shaft 14, and a second rotating shaft 17 for rotating the supporting arm 16 around the shaft crossing perpendicularly to the first rotating shaft 14. When the direction sensor 12 detects the direction of the sun, it generates the detection signal which controls the first and second rotating shafts so as to always direct the lens to the direction of the sun. The solar ray focussed by the lens groups is guided into an optical conductor cable or the like not shown, the light-receiving end of which is arranged on the location of the lens focus, and the focussed solar ray is transmitted onto the optical desired place through the optical conductor cable. And then, in the solar ray collecting device as mentioned above, each lens group 11 comprises a large number (for example 61 per one group) of lenses 21 of several centimeters diameter for example 4 cm, and the solar rays collected by each lens 21 are guided into an optical fiber per lens. In order to effectively guide the solar ray focussed by each lens into the optical fiber, it is required that the light-receiving end of the optical fiber is precisely positioned onto the position of lens focus. Especially, in the case of using a large number of lenses as stated heretofore, the positioning works and the following maintenance works turn out to be very troublesome.

The present invention has been done in view of the afore-mentioned situation. In particular, the present invention relates to the structure for accurately positioning the light-receiving end of the optical fiber onto the position of the lens focus and the implement preferably used in the embodiment of the present invention, in the solar ray collecting device using a large number of lenses as mentioned above.

Fig. 2 is a diagram for explaining the construction of an embodiment according to the present invention. In Fig. 2, 21 is a lens for focussing the solar ray, 22 is an optical fiber into which the solar ray collected by the lens 21 is guided, 23 is a retaining member for retaining the optical fiber 22, 24 is a sleeve which is unitarily mounted on the optical fiber 22 at the light-receiving side of the optical fiber 22, 25 is a supporting plate for supporting the lens 21 and the retaining member 23. The supporting plate 25 has a hole 25a on the optical axis of the lens 21. Further, the retaining member 23 has holes 23a for injecting adhesive agent (liquid) in order to bind the retaining member 23 to the supporting plate 25 and another holes 23b for injecting adhesive agent (liquid) in order to bind the sleeve 24 to the retaining member 23. And then, in order to position the light-receiving end 22a of the optical fiber 22 onto the focus of the lens 21, the retaining member 23 is moved within the plane perpendicular to the drawing so as to let the center of the lens 21 coincide with that of the optical fiber 22, and then, adhesive agent liquid is injected inwardly through the hole 23a of the retaining member 23 to bind the member 23 to the supporting plate 24 under that condition kept. Next, the optical fiber 22 is moved to the direction of the Z-axis so as to position the light-receiving end 22a of the optical fiber onto the focus of the lens 21. Keeping that condition, adhesive agent liquid is injected inwardly through the hole 23b of the retaining member 23 to bind the sleeve 24 to the retaining member 23. Furthermore, in order to let the center of the lens 21 coincide with that of the optical fiber 22, through the center of the optical fiber 22 may be positioned onto that of the Fresnel lens' stripe pattern by observing it with the naked eyes in the case of the Fresnel lens, more generally, the side of the light-discharging end of the optical fiber 22 is guided to the photometer or the like, the parallel ray just like laser ray, etc. is radiated onto the lens 21 from the direction shown by an arrow A, the position on which the indication value of the photometer turns out to be maximum is searched by moving the retaining member 23 which the plane perpendicular to the drawing in such manner as mentioned above, and then, adhesive agent liquid is injected inwardly through the hole 23a on that position in order to fix the retaining member 23 to the supporting plate 25. Next, the position of the optical fiber 22 to the Z-axis direction is determined. Positioning of the optical fiber 22 to the Z-axis direction is performed in such a manner as afore-mentioned. That is to say, after fixing the retaining member

23 to the supporting plate 25, the optical fiber 22 is moved to the Z-axis direction for the purpose of searching the position on which the indication value of the photometer turns out to be maximum, and adhesive agent is injected inwardly through the hole 23b on that position in order to fix the sleeve unitarily constructed together with the optical fiber 22 to the supporting member 25.

As is apparent from the above-mentioned description, it might be possible to precisely and securely position the light-receiving end surface of the optical fiber onto the position of the lens focus by use of the simple means and manufacturing process, according to the present invention. And then, since almost all of the portions are constructed unitarily as a whole, there may be no need of the following maintenance.

Claims

1. Structure for collecting solar rays comprising a lens (21) for focussing the light, with an optical fiber (22) having a light-receiving end (22a) arranged on the focus of said lens (21), a supporting plate (25) having a hole (25a) which is coaxial with the optical axis of said lens and which has a diameter greater than the diameter of the optical fiber characterized in that a retaining member (23) is provided for movably retaining said optical fiber (22) along said optical axis, said retaining member (23) being provided with injection holes (23a, 23b) for injecting adhesive agent liquid into the gaps between the retaining member (23) and the supporting plate (25) and the optical fiber (22), respectively, to bind said retaining member to said supporting plate and said optical fiber (22) to said retaining member (23).

2. A structure as claimed in claim 1, wherein said structure comprises a number of lenses (21) and a number of optical fibers (22a).

3: A structure as claimed in claim 2, wherein said supporting plate (25) has a number of holes (25a) in the direction of the optical axis of said lenses (21) and wherein a retaining member (23) is mounted at each hole (25a).

Patentansprüche

1. Sonnenkollektor mit einer Linse (21) zum Fokussieren des Lichts, mit einer optischen Faser (22), deren lichtaufnehmendes Ende (22a) im Fokus der Linse (21) angeordnet ist, mit einer Trägerplatte (25), die ein Loch (25a) aufweist, das koaxial zur optischen Achse der Linse angeordnet ist und dessen Durchmesser größer als der Durchmesser der optischen Faser ist, dadurch gekennzeichnet, daß ein Halteelement (23) vorgesehen ist, in dem die optische Faser entlang der optischen Achse verschiebbar gehalten wird, und daß das Halteelement (23) Einspritzlöcher (23a, 23b) aufweist, um ein flüssiges Klebemittel in die Räume zwischen dem Halteelement (23) und der Tragplatte (25) bzw. die optische Faser (22) einspritzen zu können, um so das Halteelement mit der Tragplatte einerseits und die optische Faser



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The present invention has been done in view of the afore-mentioned situation. In particular, the present invention relates to the structure for accurately positioning the light-receiving end of the optical fiber onto the position of the lens focus and the implement preferably used in the embodiment of the present invention, in the solar ray collecting device using a large number of lenses as mentioned above.

Fig. 2 is a diagram for explaining the construction of an embodiment according to the present invention. In Fig. 2, 21 is a lens for focussing the solar ray, 22 is an optical fiber into which the solar ray collected by the lens 21 is guided, 23 is a retaining member for retaining the optical fiber 22, 24 is a sleeve which is unitarily mounted on the optical fiber 22 at the light-receiving side of the optical fiber 22, 25 is a supporting plate for supporting the lens 21 and the retaining member 23. The supporting plate 25 has a hole 25a on the optical axis of the lens 21. Further, the retaining member 23 has holes 23a for injecting adhesive agent (liquid) in order to bind the retaining member 23 to the supporting plate 25 and another holes 23b for injecting adhesive agent (liquid) in order to bind the sleeve 24 to the retaining member 23. And then, in order to position the light-receiving end 22a of the optical fiber 22 onto the focus of the lens 21, the retaining member 23 is moved within the plane perpendicular to the drawing so as to let the center of the lens 21 coincide with that of the optical fiber 22, and then, adhesive agent liquid is injected inwardly through the hole 23a of the retaining member 23 to bind the member 23 to the supporting plate 24 under that condition kept. Next, the optical fiber 22 is moved to the direction of the Z-axis so as to position the light-receiving end 22a of the optical fiber onto the focus of the lens 21. Keeping that condition, adhesive agent liquid is injected inwardly through the hole 23b of the retaining member 23 to bind the sleeve 24 to the retaining member 23. Furthermore, in order to let the center of the lens 21 coincide with that of the optical fiber 22, through the center of the optical fiber 22 may be positioned onto that of the Fresnel lens' stripe pattern by observing it with the naked eyes in the case of the Fresnel lens, more generally, the side of the light-discharging end of the optical fiber 22 is guided to the photometer or the like, the parallel ray just like laser ray, etc. is radiated onto the lens 21 from the direction shown by an arrow A, the position on which the indication value of the photometer turns out to be maximum is searched by moving the retaining member 23 which the plane perpendicular to the drawing in such manner as mentioned above, and then, adhesive agent liquid is injected inwardly through the hole 23a on that position in order to fix the retaining member 23 to the supporting plate 25. Next, the position of the optical fiber 22 to the Z-axis direction is determined. Positioning of the optical fiber 22 to the Z-axis direction is performed in such a manner as afore-mentioned. That is to say, after fixing the retaining member

23 to the supporting plate 25, the optical fiber 22 is moved to the Z-axis direction for the purpose of searching the position on which the indication value of the photometer turns out to be maximum, and adhesive agent is injected inwardly through the hole 23b on that position in order to fix the sleeve unitarily constructed together with the optical fiber 22 to the supporting member 25.

As is apparent from the above-mentioned description, it might be possible to precisely and securely position the light-receiving end surface of the optical fiber onto the position of the lens focus by use of the simple means and manufacturing process, according to the present invention. And then, since almost all of the portions are constructed unitarily as a whole, there may be no need of the following maintenance.

Claims

1. Structure for collecting solar rays comprising a lens (21) for focussing the light, with an optical fiber (22) having a light-receiving end (22a) arranged on the focus of said lens (21), a supporting plate (25) having a hole (25a) which is coaxial with the optical axis of said lens and which has a diameter greater than the diameter of the optical fiber characterized in that a retaining member (23) is provided for movably retaining said optical fiber (22) along said optical axis, said retaining member (23) being provided with injection holes (23a, 23b) for injecting adhesive agent liquid into the gaps between the retaining member (23) and the supporting plate (25) and the optical fiber (22), respectively, to bind said retaining member to said supporting plate and said optical fiber (22) to said retaining member (23).

2. A structure as claimed in claim 1, wherein said structure comprises a number of lenses (21) and a number of optical fibers (22a).

3. A structure as claimed in claim 2, wherein said supporting plate (25) has a number of holes (25a) in the direction of the optical axis of said lenses (21) and wherein a retaining member (23) is mounted at each hole (25a).

Patentansprüche

1. Sonnenkollektor mit einer Linse (21) zum Fokussieren des Lichts, mit einer optischen Faser (22), deren lichtaufnehmendes Ende (22a) im Fokus der Linse (21) angeordnet ist, mit einer Trägerplatte (25), die ein Loch (25a) aufweist, das koaxial zur optischen Achse der Linse angeordnet ist und dessen Durchmesser größer als der Durchmesser der optischen Faser ist, dadurch gekennzeichnet, daß ein Halteelement (23) vorgesehen ist, in dem die optische Faser entlang der optischen Achse verschiebbar gehalten wird, und daß das Halteelement (23) Einspritzlöcher (23a, 23b) aufweist, um ein flüssiges Klebemittel in die Räume zwischen dem Halteelement (23) und der Tragplatte (25) bzw. die optische Faser (22) einspritzen zu können, um so das Halteelement mit der Tragplatte einerseits und die optische Faser



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(22) mit dem Halteelement (23) andererseits zu verkleben.

2. Kollektor nach Anspruch 1, wobei der Kollektor eine Anzahl von Linsen (21) und eine Anzahl optischer Fasern (22a) aufweist.

3. Kollektor nach Anspruch 2, wobei die Tragplatte (25) eine Anzahl von Löchern (25a) in Richtung der optischen Achsen der Linsen (21) aufweist und wobei an jedem Loch (25a) ein Halteelement (23) angeordnet ist.

Revendications

1. Une structure pour collecter des rayons solaires, comprenant une lentille (21) pour concentrer la lumière, une fibre optique (22) comportant une extrémité réceptrice de lumière (22a) placée au foyer de ladite lentille (21), une plaque portante (25) comportant un trou (25a) qui est coaxial à l'axe optique de ladite lentille et qui a un diamètre supérieur au diamètre de la fibre optique, caractérisée en ce qu'il est prévu un élé-

ment de retenue (23) pour retenir avec possibilité de déplacement ladite fibre optique (22) dans la direction dudit axe optique, ledit élément de retenue (23) étant pourvu de trous d'injections (23a, 23b) servant à l'injection d'un agent adhésif liquide dans les intervalles existant entre l'élément de retenue (23), la plaque portante (25) et la fibre optique (22), respectivement, afin de fixer ledit élément de retenue sur ladite plaque portante, et ladite fibre optique (22) sur ledit élément de retenue (23).

2. Une structure telle que revendiquée dans la revendication 1, caractérisée en ce que ladite structure comportant un certain nombre de lentilles (21) et un certain nombre de fibres optiques (22a).

3. Une structure telle que revendiquée dans la revendication 2, caractérisée en ce que ladite plaque portante (25) comporte un certain nombre de trous (25a) dans la direction de l'axe optique des dites lentilles (21) et en ce qu'un élément de retenue (23) est monté dans chaque trou (25a).

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