

Description

The invention relates to a solar ray collecting device loaded and employed in a spacecraft, comprising a cylindrical container and a plurality of disk shaped solar ray collecting portions movably held to the container.

The present applicant has previously proposed various apparatuses and methods by which solar rays are focused by a lens or the like and guided into an optical conductor, and which are further transmitted through the optical conductor onto an optional desired place for use in illumination or for other purposes, specifically i.e. in order to use solar rays as a light source for nurturing chlorella, etc., or as a light source for photosynthesis.

Cosmic engineering has become highly developed in recent years. As a result of such progress, astronauts are obliged to stay in a spacecraft for longer periods of time. The supplying of oxygen and food to the astronauts inside the spacecraft arises as one of the most important problems. As a matter of course, when a rocket is launched, oxygen containers and an adequate food supply are included in the rocket. It is to be expected that the number of crew members will increase in the future and also the time spent in the spacecraft will increase. At the present time the amount of oxygen and food that can be stored in a spacecraft is limited. It is clear, according to this invention, that solar rays could be effectively collected for use inside of a spacecraft. Solar rays are the most effective light rays as a source of energy for cultivating plant life and for supplying oxygen resulting from plant cultivation.

A solar ray collecting device as mentioned above is disclosed in the Proceedings of the Fourth Intersociety Energy Conversion Engineering Conference, held in Washington D.C. on September 22—26, 1969, pages 271—283 (M. Swerdling) "Impactable Power Subsystems for Mars Landers".

This document discloses a solar ray collecting device loaded and employed in a spacecraft, comprising a cylindrical container and a plurality of disc shaped solar ray collecting portions movably held to the container. The solar ray collecting portions are held to the container by hinges.

It is an object of the present invention to provide a solar ray collecting device of the type mentioned above, that is easy to load and use in a spacecraft.

The task is solved with a solar ray collecting device as mentioned above which is characterized in that each solar ray collecting portion is rotatable around a shaft defining the axis of rotation of the disc and laying along the diameter of the disc, which shaft is supported by a supporting arm, which in turn is supported by the end of a supporting pole, which supporting pole is capable of rotating around and moving reciprocally along its longitudinal axis, said solar ray collecting portions being taken from one end portion of the container at the time of being employed and accommodated in the container at the time not being employed.

Preferred embodiments of the invention are disclosed in the subclaims.

The invention will now be described in the following detailed description which corresponds to the accompanying drawings.

Fig. 1 is a perspective view for explaining an embodiment of the solar ray collecting device according to the present invention;

Fig. 2 is a plane view thereof at the time of being employed;

Fig. 3 is a perspective view in case that the solar rays come from the left-upper side of the drawing;

Fig. 4 is a perspective view in case that the solar rays come from the right-upper side of the drawing; and

Fig. 5 is a side view of the solar ray collecting device at the time of not being employed.

Description of the Preferred Embodiments

Fig. 1 is a perspective view for explaining an embodiment of the solar ray collecting device according to the present invention at the time of being employed. In Fig. 1, 100 is the outer wall of the spacecraft, 10₁ through 10₅ solar ray collecting portions, 20₁ through 20₅ supporting arms for rotating supporting the solar ray collecting portions, 10₁ through 10₅ respectively, 30₁ through 30₅ are supporting poles for supporting said supporting arms 20₁ through 20₅ respectively at the tip end portion thereof and capable of rotating and moving up and down, and 40 a container for accommodating the solar ray collecting portions and other components which is unitarily formed with the spacecraft 100.

The supporting poles 30₁ through 30₅ are arranged rotatably and movably up and down in the container 40, and each supporting arm 20₁ through 20₅ is fixed on the upper end portion of each supporting pole 30₁ through 30₅ respectively. Each solar ray collecting portion 10₁ through 10₅ is mounted on each supporting arm, 20₁ through 20₅, so as to be able to rotate around each rotatable shaft, 11₁ through 11₅, respectively.

Furthermore, as previously proposed by the present application, each solar ray collecting portion of a large number of lenses having a diameter of approximately 4 cm and optical fibers, the light-receiving edge surface of which is precisely positioned at the focal point of each lens. The solar rays focused by each lens are guided into each optical fiber and further transmitted onto an optional desired place for use in illumination or for other purposes.

In the case of employing such a small lens of about 4 cm in diameter, the focal distance of the lens is very small, for instance, about 4 cm. Consequently, it is possible to construct a solar ray collecting device which is made very thinly, and therefore which doesn't need much space. For this reason, such a solar ray collecting device as mentioned heretofore is desirable when it comes to saving storage space in a spacecraft.

Fig. 2 is an outlined plan view showing the solar ray collecting device according to the present invention at the time of being employed. When the

device is in use the supporting poles 30, through 30_s, for supporting each solar ray collecting portion 10, through 10_s, project from the cylindrical container 40, and the solar ray collecting portion is rotated 180° around the above-mentioned supporting pole and is in the position shown in Fig. 2.

A solar ray direction sensor, as previously proposed by the present applicant, is installed on each solar ray collecting portion. The rotatable shafts, 11, through 11_s, and the supporting poles, 30, through 30_s, are rotated in accordance with the output signal of the solar ray direction sensor so that the light-receiving surface of each solar ray collecting portion is controlled so as to be always directed in the direction of the solar rays' propagation.

Under these circumstances, since the front-side solar ray collecting portion facing the sun projects a shadow onto the rear-side solar ray collecting portion, by adjusting the height of each supporting pole, namely by controlling the front-side solar ray collecting portion so as to position it at a place lower than the rear-side solar ray collecting portion, all of the solar ray collecting portions can collect the sun's rays most effectively.

Namely, when the solar rays come from the left-upper side of Fig. 3, the left side solar ray collecting portion is situated at the lower place while the right side solar ray collecting portion is situated at the upper place, as shown in Fig. 3. On the contrary, when the solar rays come from the right-upper side of Fig. 3, the right side solar ray collecting portion is situated at the lower place while the left side solar ray collecting portion is situated at the upper place as shown in Fig. 4 so that all of the solar ray collecting portions are controlled in order to consistently collect the solar rays. With respect to changing the solar ray collecting device's height, when the solar rays come from right overhead, or in other words when the solar ray collecting portions, 10, through 10_s, are in the state as shown in Fig. 2, all of the solar ray collecting portions are exchanged with the others simultaneously. In such a manner, there is no fear that the solar ray collecting portion comes into contact with any other part. As a result the height thereof can be smoothly adjusted with the others.

In the state as shown in Fig. 4, when the solar ray collecting portions are being accommodated in the container, first the solar ray collecting portions are rotated 180° in order around the supporting poles thereof starting from the upper solar ray collecting portions, and secondly all of the solar ray collecting portions are accommodated in the container 40 by contracting the respective supporting poles into the container 40. Each solar ray collecting portion, 10, through 10_s, is constructed so as to fit the shape of the container 40. In the case of the embodiment as shown in Fig. 4, the solar ray collecting portion is formed in a round shape. The diameter D of the solar ray collecting portion is designed so as to make it as large as possible in consideration of

the position of the supporting role in the container and with respect to the total light-receiving square measure versus the accommodation square measure. On that occasion, five solar ray collecting devices can be most effectively arranged in a neighboring area around the accommodating cylinder as shown in Fig. 4.

Fig. 5 is a perspective view of the embodiment at the time of not being in use. When the solar ray collecting device is not being employed, the cover 50 covers and shuts off the cylindrical container in order to protect the solar ray collecting portions contained therein from being destroyed from dust, etc., as shown in Fig. 5.

The solar ray collecting device according to the present invention has been described heretofore. Since the solar ray collecting device according to the present invention, is loaded onto and employed inside a spacecraft, the device is not affected by gravity. Therefore, it is not necessary to have high-powered energy for moving the solar ray collecting portions up and down and for rotating them. Furthermore, each solar ray collecting portion can be supported rotatably on one tip end by means of a cantilevered type support as shown in Figs. 1 through 4.

As is apparent from the foregoing description, according to the present invention, it may be possible to provide a solar ray collecting device which is light, efficient, and convenient for loading and employing in a spacecraft.

Claims

1. A solar ray collecting device loaded and employed in a spacecraft, comprising a cylindrical container (40) and a plurality of disc shaped solar ray collecting portions (10) movably held to the container characterized in that each solar ray collecting portion is rotatable around a shaft (11) defining the axis of rotation of the disc and lying along the diameter of the disc, which shaft is supported by a supporting arm (20), which in its turn is supported by the end of a supporting pole (30), which supporting pole is capable of rotating around and moving reciprocally along its longitudinal axis, said solar ray collecting portions being taken out from one end portion of the container at the time of being employed and accommodated in the container at the time not being employed.

2. A solar ray collecting device as defined in claim 1, is characterized in that there are five said solar ray collecting portions (10).

3. A solar ray collecting device for use in a spacecraft as defined in claim 1 or 2, is characterized in that a lid member (50) for opening and shutting said cylindrical container (46) is provided on the upper end portion thereof.

Patentansprüche

1. Sonnenkollektor, der in einer Raumfähre angeordnet und verwendet wird, mit einem zylindrischen Behälter (40) und mehreren platten-

device is in use the supporting poles 30, through 30_s, for supporting each solar ray collecting portion 10, through 10_s, project from the cylindrical container 40, and the solar ray collecting portion is rotated 180° around the above-mentioned supporting pole and is in the position shown in Fig. 2.

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In the state as shown in Fig. 4, when the solar ray collecting portions are being accommodated in the container, first the solar ray collecting portions are rotated 180° in order around the supporting poles thereof starting from the upper solar ray collecting portions, and secondly all of the solar ray collecting portions are accommodated in the container 40 by contracting the respective supporting poles into the container 40. Each solar ray collecting portion, 10, through 10_s, is constructed so as to fit the shape of the container 40. In the case of the embodiment as shown in Fig. 4, the solar ray collecting portion is formed in a round shape. The diameter D of the solar ray collecting portion is designed so as to make it as large as possible in consideration of

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2. A solar ray collecting device as defined in claim 1, is characterized in that there are five said solar ray collecting portions (10).

3. A solar ray collecting device for use in a spacecraft as defined in claim 1 or 2, is characterized in that a lid member (50) for opening and shutting said cylindrical container (46) is provided on the upper end portion thereof.

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1. Sonnenkollektor, der in einer Raumfähre angeordnet und verwendet wird, mit einem zylindrischen Behälter (40) und mehreren platten-



förmigen Sonnenkollektorbereichen (10), die beweglich an dem Behälter gehalten sind, dadurch gekennzeichnet, daß jeder Sonnenkollektorbereich um eine Welle (11), die die Drehachse der Scheibe bildet, drehbar ist und die entlang der Durchmessers der Scheibe liegt, wobei die Welle von einem Tragarm (20) gehalten ist, der seinerseits an dem Ende einer Stützstange (30) gehalten ist, wobei die Stützstange um ihre Längsachse hin und her verschwenkbar ist, und wobei die Sonnenkollektorbereiche aus dem Endteil des Behälters bei ihrer Anwendung herausgenommen werden und in dem Behälter angeordnet sind, wenn sie nicht benötigt werden.

2. Sonnenkollekturvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß fünf Kollektorbereiche (10) vorgesehen sind.

3. Sonnenkollektor zur Verwendung in einem Raumfahrzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß ein Deckelelement (50) zum Öffnen und Verschließen des zylindrischen Behälters (46) am oberen Ende des Behälters angeordnet ist.

Revendications

1. Un dispositif collecteur de rayons solaires chargé et utilisé dans un engin spatial, compre-

nant un récipient cylindrique (40) et une pluralité de parties collectrices de rayons solaires (10) en forme de disques qui sont maintenues de façon mobile sur le récipient, caractérisé en ce que chaque partie collectrice de rayons solaires peut tourner autour d'un arbre (11) définissant l'axe de rotation du disque et situé le long du diamètre du disque, ledit arbre est supporté par un bras porteur (20), qui est à son tour supporté par l'extrémité d'un montant porteur (30), ledit montant porteur étant capable de tourner autour de son axe longitudinal et de se déplacer alternativement le long de celui-ci, lesdits parties collectrices de rayons solaires étant sorties d'une partie extrême du récipient au moment d'être utilisées et étant rangées dans le récipient lorsqu'elles ne sont pas utilisées.

2. Un dispositif collecteur de rayons solaires tel que défini dans la revendication 1, caractérisé en ce qu'il est prévu cinq parties collectrices de rayons solaires (10).

3. Un dispositif collecteur de rayons solaires utilisable dans un engin spatial comme défini dans les revendications 1 ou 2, caractérisé en ce qu'un couvercle (50) servant à ouvrir et fermer ledit récipient cylindrique (46) est prévu sur sa partie extrême supérieure.

