

Description

The present invention relates to a sunlight collecting and concentrating apparatus, comprising—according to a first general concept:

a lens means for collecting sunlight;
a sensor means for detecting the sun's azimuth and altitude;

an optical conductor means to which the sunlight collected by said lens means is introduced;

a first rotatable shaft for turnably supporting said lens means together with integrally constructed means thereto;

a support arm for turnably supporting said first rotatable shaft;

a second rotatable shaft for turnably supporting said support arm about an axis perpendicular to the axis of said first rotatable shaft; and

a capsule in which all of the above are hermetically sealed, wherein when the sun's azimuth and altitude are detected by said sensor means, the turning of said first and second rotatable shafts is controlled to cause said lens means to face the position of the sun so as to introduce the collected sunlight by said lens means into said optical conductor means.

A sunlight collecting and concentrating apparatus is disclosed in EP—A—0,074,016 which has to be considered as state of art according to Article 54(3) EPC.

Further, the present invention relates to a sunlight collecting and concentrating apparatus which—according to a second general concept—comprises:

a plurality of lenses for collecting sunlight;

a tracking sensor for detecting the sun's azimuth and altitude;

a plurality of optical conductor cables oppositely disposed to respective lenses, into which the sunlight collected by the lenses are introduced;

a single major optical conductor cable connected to said plurality of optical cables, into which the sunlight conveyed through said plurality of optical conductor cables is introduced;

a first rotatable shaft for turnably supporting lenses together with the integrally constructed members thereto;

a support arm for turnably supporting said first rotatable shaft;

a second rotatable shaft for turnably supporting said support arm about an axis perpendicular to the axis of said first rotatable shaft; and

a transparent capsule, in which all of the above are hermetically sealed;

wherein when the sun's azimuth and altitude are detected by said tracking sensor, the turning of said first and second rotatable shafts is controlled to cause lenses to face the position of the sun so as to introduce the collected sunlight by said lenses into said optical conductor cables.

In the previous sunlight collecting and concentrating apparatuses the temperature

within the capsule is raised by sunlight or lowered by the surrounding cold air. Consequently, such sunlight collecting and concentrating apparatuses have suffered from temperature-related breakdowns, and malfunctions of the sensor.

Proceeding on the basis of the prior art concepts it is the object underlying this invention to prevent such breakdowns and malfunctions and also to prevent deterioration of the sensitivity of the sensor by controlling the temperature of the air and the capsule to a proper level.

This object according to the first general concept is accomplished in that a suction pump or blower is provided within said capsule so as to produce an air current around said sensor means and to effectively maintain the temperature around the sensor means to a proper level.

Further, this object is accomplished according to the second general concept in that at the rear side of the space formed by the plurality of lenses and optical conductor cables, a collecting and reflecting plate integrally turnable with said first rotatable shaft is provided and, substantially at the central position of the concentric circles formed by the plurality of lenses, the outlet ends of said optical conductor cables are connected to said single major optical conductor cable with its inlet end facing to the reflecting surface of said collecting and reflecting plate; said optical conductor cables being stripped of their cladding layers at least at portions adjacent to said central position, so as to efficiently introduce uncaptured light at the inlet ends of the optical conductor cables into said cables through the collecting and reflecting plate and thus to effectively maintain the temperature around the tracking sensor to a proper level.

It is an advantage of the inventive solutions which may be employed independently of each other or in combination with each other that the temperature within the capsule can be maintained to a proper level, thus preventing temperature-related breakdowns and malfunctions of the sensor and temperature-related deterioration of the sensitivity of the sensor.

The invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a general perspective view of the structure of a previous sunlight collecting and concentrating apparatus of the type of the present invention;

Figure 2 is a side elevational view, partly in cross-section partly schematic, of an embodiment of the sunlight collecting and concentrating apparatus according to the present invention; and

Figure 3 is a pictorial rear view of the lens system of the embodiment shown in Figure 2.

Description of the preferred embodiment

Figure 1 is a perspective view of a sunlight collecting and concentrating apparatus previously proposed by the present inventor.

(13)

Referring to Figure 1, there is shown a capsule 3 for a sunlight collecting and concentrating apparatus comprised of hollow cylindrical base member 1 and transparent head member 2 formed in the shape of a sphere or dome and mounted on base member 1. The head member 2 has a sunlight collecting and concentrating means 10 enclosed therein.

The sunlight collecting and concentrating means 10 includes a plurality of lenses 11₁, 11₂...11₁₉ (e.g. 19 in number) arranged substantially in the form of concentric circles and integrally connected with each other for collecting sunlight; a tracking sensor 12 for detecting the sun's azimuth and altitude; holding frames 13 integrally holding said lenses 11₁, 11₂...11₁₉ and the tracking sensor 12; first motors 15 for turning the lenses 11₁, 11₂...11₁₉, tracking sensor 12, and holding frames 13 in both directions indicated by double arrow A; a support arm 16 for supporting the lenses 11₁, 11₂...11₁₉, tracking sensor 12, holding frames 13, and first motors 15; a rotatable shaft 17 disposed perpendicularly to a rotational axis of the first motors 15 as well as supporting the support arm 16; and a second motor (not shown) for turning the rotatable shaft 17 in both directions indicated by double arrow B.

When the sun's azimuth and altitude are detected by the tracking sensor 12, the first and second motors are controlled by the output signals produced thereby so that the lenses 11₁, 11₂...11₁₉ can continuously track the movement of the sun. The sunlight collected by the lenses 11₁, 11₂...11₁₉ is introduced into optical conductor cables (not shown) or the like, 19 in number in the example of Figure 1, with inlet ends disposed at the focal positions of each of the lenses, and is propagated through the optical conductor cables to any place desired, for example, to somewhere where illumination is desired.

The sunlight collecting and concentrating means 10 is hermetically sealed in the transparent head member 2 to protect it from wind, rain, and dust. Therefore, the temperature within the head member 2 may considerably rise due to the sunlight or abnormally fall due to the surrounding cold air. This exerts many harmful influences upon devices in the head member 2. In particular, extreme temperature fluctuations hinder the ability of the tracking sensor 12. This results in a lower collecting efficiency of the apparatus.

The present invention overcomes this defect by producing an air current around the tracking sensor so as to protect it from extremes of temperature and to keep the operation of the tracking sensor normally. Therefore, the sunlight collecting and concentrating apparatus can continuously collect sunlight at a high efficiency.

Figure 2 is a side elevational view, partly in cross-section, partly schematic, of an embodiment of the sunlight collecting and concentrating apparatus according to the present invention.

Reference numeral 14 represents a first rotatable shaft driven by first motors 15. Reference numeral 18 represents a second motor for driving a second rotatable shaft 17. Lenses 11₁, 11₂, 11₄, and 11₅ correspond to the lenses 11₁, 11₂, 11₄, and 11₅ shown in Figure 1. The sunlight L collected by these lenses 11₁ to 11₅ (no lens 11₃) is introduced into optical conductor cables 21₁ to 21₅ (no cable 21₃) with inlet ends disposed at focal positions of each of the lenses. In the present invention, the area corresponding to the lens 11₃ shown in Figure 1 is occupied by a single major optical conductor cable 22. The single major optical conductor cable 22 will be fully described later.

Figure 3 is a rear view of the lens system including a plurality of such lenses. As shown in Figure 3, 18 lenses 11₁...11₁₈ (no lens 11₉) are substantially arranged in the form of concentric circles with common axes. The inlet end of each of the optical conductor cables 21₁...21₁₈ (no cable 21₉) is disposed at focal positions of each of the lenses. The outlet ends of the optical conductor cables 21₁ to 21₁₈ are gathered at the central portion of the lens system. The gathered optical conductor cables are connected to a single major optical conductor cable 22 at the central portion. The sunlight is propagated through the single major optical conductor cable 22 to any place desired, for example, to somewhere where illumination is desired.

As mentioned above, the sunlight collected by a plurality of lenses 11₁ to 11₁₉ is introduced to the optical conductor cables 21₁ to 21₁₉ disposed at respective lenses 11₁ to 11₁₉. The outlet ends of the cables are gathered at the central portion of the lens system arranged in the form of concentric circles. Finally, the gathered optical conductor cables are connected to the single major optical conductor cable 22 at the central portion, so as to convey the sunlight to any place desired. Therefore, distribution of the optical conductor cables is considerably easy. For the optical guide, an optical conductor rod can be used in place of the optical conductor cable. This results in low cost of the optical conductor material.

Even with the tracking sensor provided in the sunlight collecting and concentrating apparatus for detecting the sun's azimuth and altitude and for enabling the lenses to continuously track the movement of the sun, it is almost impossible for the lenses to collect all of the sunlight incident with the head member enclosing the sunlight collecting and concentrating means. Left to itself, the sunlight would raise the temperature within the head member and exert a harmful influence upon the apparatus, in particular upon the tracking sensor. As shown in Figure 2, when the axis of the lenses is directed to the meridian sun, the tracking sensor is positioned at the apex point within the capsule. In such a case, the temperature at the apex point is raised considerably.

Reference numerals 31 and 32, are air supply passages formed inside the support arm 16. One

end of each of these passages 31 and 32 is opened within the head member 2. Each other end is opened within the base member 1. On the passage 31, there is provided a suction pump 30. Reference numeral 33 denotes a heat exchanger provided within the base member 1.

When the air within the head member 2 is heated by the sunlight incident therethrough, the suction pump 30 operates to introduce the hot air from the head member 2 into the base member 1 through the passage 31 formed inside the support arm 16. Then, the introduced hot air is cooled by the heat exchanger 33 provided within the base member 1. The cooled air is returned from the base member 1 into the head member 2 through the passage 32 formed inside the support arm 16, this operation is caused by the vacuum produced around the tracking sensor 12. At that time, as shown by arrow C in Figure 2, the cooled air passed through the passage 32 will be blown against the tracking sensor 12.

The above produces a strong air current in the region of the tracking sensor 12 and disperses the hot air therearound, preventing an unwanted rise of the air temperature around the tracking sensor 12. As already described, the dispersed hot air is introduced into the base member 1, within which the air is cooled by the heat exchanger 33. Accordingly, the air temperature around the tracking sensor 12 can be maintained at a predetermined level.

Within the base member 1, a control circuit 34 is provided. The control circuit 34 operates, as well known, to receive signals indicating the sun's azimuth and altitude from the tracking sensor 12 and to control the motors 15 and 18 for driving the apparatus to precisely track the movement of the sun. If the hot air supplied through the passage 31 were to blow against the control circuit 34, this would cause circuit malfunctions. The present invention overcomes this defect by providing a partition 35 dividing the space of the base member 1 into two compartments.

In addition to the problem with sunlight not collected by the lenses, there is a problem with sunlight collected by the lenses but not captured by the optical conductor cables. Furthermore, the focal image of skylight is too large to introduce into the optical conductor cables. Such sunlight and skylight are also transformed into heat energy to raise the temperature within the head member 2. To reduce such harmful influences, a collecting and reflecting plate 36 in the form of concave mirror is provided within the head member 2. In Figure 2, L', L'... represent light from the skylight which could not be captured by the optical conductor cables and were reflected by the plate 36. The collecting and reflecting plate 36 is disposed at the rear side of the plurality of lenses 11,... and the optical conductor cables 21,... and is integrally formed with the first rotatable shaft 14.

On the other hand, outlet ends of the optical conductor cables 21,... are gathered and connected to the single major optical conductor cable

22 at the center position of the plurality of lenses 11,... The gathered optical conductor cables 21,... are stripped of their cladding layers (not shown) at least at portions adjacent to the central position. Thus, reflected light L', L'... are completely captured into outlet ends of the respective optical conductor cables 21, 21₂, 21₄, 21₅, ..., then of the single major optical conductor cable 22. This further prevents extreme temperature rises within the head member 2, and allows a further increase of the collecting efficiency of the apparatus.

In this embodiment, the suction pump 30 is provided on the passage 31. It will be noted, however, that the present invention is not limited to this embodiment. Instead of the suction pump 30, a blower or both a suction pump and blower may be provided on the passage 31.

Also in this embodiment, the passages 31, 32 are formed inside the support arm 16, and the tracking sensor 12 is provided at the center of the lens system. However, the passages do not necessarily have to be inside the support arm, also the tracking sensor does not always have to be provided at the center of the lens system.

Generation of the air current may be effected continuously or intermittently. Furthermore, a temperature sensitive sensor may be provided within the head member 2 advantageously, adjacent to the tracking sensor 12, so as to generate the air current only when the temperature within the head member differs from the predetermined level.

When the tracking sensor is provided at the central portion of the lens system and when the axis of the lens system is directed to the meridian sun, the temperature around the tracking sensor will reach its highest degree, i.e., at midday, the tracking sensor will most approach the apex within the capsule, which has the highest temperature. To detecting when the axis of the lens system is closest to the meridian sun and start the air current blowing against the tracking sensor, a microswitch or the like may be provided on the first or second rotatable shafts.

The above-mentioned embodiment was mainly described in reference to air cooling within the head member. However, it can readily be understood that the heat energy can be positively extracted from the head member both for lowering of the temperature therein and utilization for other purposes. Further, if the temperature of the ambient air surrounding the head member is very low, the temperature therein becomes abnormally low, which may also cause breakdowns and malfunctions of the tracking sensor 12. In such a case, heat energy from an outside heat source (not-shown) may be supplied through the passages 31, 32 and heat exchanger 33 into the head member to maintain the temperature at the proper level.

As can readily be understood from the above, according to the present invention, the temperature within the head member, particularly, extremes of temperature around the tracking sen-

5 sor, may be effectively controlled so as to prevent breakdowns and malfunctions. Thus, the efficiency of the apparatus can be increased.

Furthermore, according to the special arrangement of the optical conductor cables and the collecting and reflecting plate of the present invention, the sunlight collected by the lens system may be efficiently introduced into the optical conductor cables.

Claims

1. A sunlight collecting and concentrating apparatus comprising:

a lens means for collecting sunlight;

a sensor means (12) for detecting the sun's azimuth and altitude;

an optical conductor means to which the sunlight collected by said lens means is introduced;

a first rotatable shaft (14) for turnably supporting said lens means together with integrally constructed means thereto;

a support arm (16) for turnably supporting said first rotatable shaft;

a second rotatable shaft (17) for turnably supporting said support arm about an axis perpendicular to the axis of said first rotatable shaft; and

a capsule (3), in which all of the above are hermetically sealed; wherein when the sun's azimuth and altitude are detected by said sensor means, the turning of said first and second rotatable shafts is controlled to cause said lens means to face the position of the sun so as to introduce the collected sunlight by said lens means into said optical conductor means; characterized in that:

a suction pump or blower (30) is provided within said capsule (3) so as to produce an air current around said sensor means (12), and to effectively maintain the temperature around the sensor means to a proper level.

2. The sunlight collecting and concentrating apparatus as claimed in Claim 1, in which said lens means comprises a plurality of lenses (11, to 11₁₉) substantially arranged in the form of concentric circles, and in which said optical conductor means comprises a plurality of optical conductor cables (21, to 21₁₉), the inlet end of said cables disposed at the focal positions of each of the lenses and the outlet ends connected to a single major optical conductor cable (22) provided coaxially through the inside of the first rotatable shaft.

3. The sunlight collecting and concentrating apparatus as claimed in Claim 2, in which said single major optical conductor cable (22) is provided through the support arm (16) and coaxially through the inside of the second rotatable shaft (17).

4. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 2 and 3, in which said sensor means (12) is disposed substantially at the central portion of the concentric circles formed by the plurality of lenses (11, to 11₁₉).

5. The sunlight collecting and concentrating apparatus as claimed in Claim 4, in which said air

current begins to be produced around said sensor means when the axis of the lens means is directed to a meridian sun.

6. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 1 through 5, in which the suction pump or blower (30) is provided on said support arm (16) to effect the air current around the sensor means through passages formed inside the support arm (16).

7. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 1 through 6, in which said capsule (3) comprises a transparent head member (2) formed in the shape of sphere for enclosing a sunlight collecting and concentrating means (10) and a base member (1) for supporting the head member (2), said base member (1) being provided with a heat exchanger (33), whereby the air within the head member (2) may be cooled or heated within the base member (1) and be returned again into the head member (2).

8. The sunlight collecting and concentrating apparatus as claimed in Claim 7, in which said base member is provided with an isolated compartment for receiving said heat exchanger (33), so as to effect heat exchanging between said compartment and the ambient air.

9. A sunlight collecting and concentrating apparatus comprising:

a plurality of lenses (11, to 11₁₉) for collecting sunlight;

a tracking sensor (12) for detecting the sun's azimuth and altitude;

a plurality of optical conductor cables (21, to 21₁₉) oppositely disposed to respective lenses (11, to 11₁₉) into which the sunlight collected by the lenses are introduced;

a single major optical conductor cable (22) connected to said plurality of optical cables (21, to 21₁₉), into which the sunlight conveyed through said plurality of optical conductor cables is introduced;

a first rotatable shaft (14) for turnably supporting lenses together with the integrally constructed members thereto;

a support arm (16) for turnably supporting said first rotatable shaft (14);

a second rotatable shaft (17) for turnably supporting said support arm (16) about an axis perpendicular to the axis of said first rotatable shaft (14); and

a transparent capsule (3), in which all of the above are hermetically sealed;

wherein when the sun's azimuth and altitude are detected by said tracking sensor (12), the turning of said first and second rotatable shafts (14, 17) is controlled to cause lenses to face the position of the sun so as to introduce the collected sunlight by said lenses into said optical conductor cables (21, to 21₁₉); characterized in that:

at the rear side of the space formed by the plurality of lenses (11, to 11₁₉) and optical conductor cables (21, to 21₁₉), a collecting and reflecting plate (36) integrally turnable with said first rotatable shaft (14) is provided and, substantially at the

sor, may be effectively controlled so as to prevent breakdowns and malfunctions. Thus, the efficiency of the apparatus can be increased.

Furthermore, according to the special arrangement of the optical conductor cables and the collecting and reflecting plate of the present invention, the sunlight collected by the lens system may be efficiently introduced into the optical conductor cables.

Claims

1. A sunlight collecting and concentrating apparatus comprising:

a lens means for collecting sunlight;

a sensor means (12) for detecting the sun's azimuth and altitude;

an optical conductor means to which the sunlight collected by said lens means is introduced;

a first rotatable shaft (14) for turnably supporting said lens means together with integrally constructed means thereto;

a support arm (16) for turnably supporting said first rotatable shaft;

a second rotatable shaft (17) for turnably supporting said support arm about an axis perpendicular to the axis of said first rotatable shaft; and

a capsule (3), in which all of the above are hermetically sealed; wherein when the sun's azimuth and altitude are detected by said sensor means, the turning of said first and second rotatable shafts is controlled to cause said lens means to face the position of the sun so as to introduce the collected sunlight by said lens means into said optical conductor means; characterized in that:

a suction pump or blower (30) is provided within said capsule (3) so as to produce an air current around said sensor means (12), and to effectively maintain the temperature around the sensor means to a proper level.

2. The sunlight collecting and concentrating apparatus as claimed in Claim 1, in which said lens means comprises a plurality of lenses (11, to 11₉) substantially arranged in the form of concentric circles, and in which said optical conductor means comprises a plurality of optical conductor cables (21, to 21₉), the inlet end of said cables disposed at the focal positions of each of the lenses and the outlet ends connected to a single major optical conductor cable (22) provided coaxially through the inside of the first rotatable shaft.

3. The sunlight collecting and concentrating apparatus as claimed in Claim 2, in which said single major optical conductor cable (22) is provided through the support arm (16) and coaxially through the inside of the second rotatable shaft (17).

4. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 2 and 3, in which said sensor means (12) is disposed substantially at the central portion of the concentric circles formed by the plurality of lenses (11, to 11₉).

5. The sunlight collecting and concentrating apparatus as claimed in Claim 4, in which said air

current begins to be produced around said sensor means when the axis of the lens means is directed to a meridian sun.

6. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 1 through 5, in which the suction pump or blower (30) is provided on said support arm (16) to effect the air current around the sensor means through passages formed inside the support arm (16).

7. The sunlight collecting and concentrating apparatus as claimed in any one of Claims 1 through 6, in which said capsule (3) comprises a transparent head member (2) formed in the shape of sphere for enclosing a sunlight collecting and concentrating means (10) and a base member (1) for supporting the head member (2), said base member (1) being provided with a heat exchanger (33), whereby the air within the head member (2) may be cooled or heated within the base member (1) and be returned again into the head member (2).

8. The sunlight collecting and concentrating apparatus as claimed in Claim 7, in which said base member is provided with an isolated compartment for receiving said heat exchanger (33), so as to effect heat exchanging between said compartment and the ambient air.

9. A sunlight collecting and concentrating apparatus comprising:

a plurality of lenses (11, to 11₉) for collecting sunlight;

a tracking sensor (12) for detecting the sun's azimuth and altitude;

a plurality of optical conductor cables (21, to 21₉) oppositely disposed to respective lenses (11, to 11₉) into which the sunlight collected by the lenses are introduced;

a single major optical conductor cable (22) connected to said plurality of optical cables (21, to 21₉), into which the sunlight conveyed through said plurality of optical conductor cables is introduced;

a first rotatable shaft (14) for turnably supporting lenses together with the integrally constructed members thereto;

a support arm (16) for turnably supporting said first rotatable shaft (14);

a second rotatable shaft (17) for turnably supporting said support arm (16) about an axis perpendicular to the axis of said first rotatable shaft (14); and

a transparent capsule (3), in which all of the above are hermetically sealed;

wherein when the sun's azimuth and altitude are detected by said tracking sensor (12), the turning of said first and second rotatable shafts (14, 17) is controlled to cause lenses to face the position of the sun so as to introduce the collected sunlight by said lenses into said optical conductor cables (21, to 21₉); characterized in that:

at the rear side of the space formed by the plurality of lenses (11, to 11₉) and optical conductor cables (21, to 21₉), a collecting and reflecting plate (36) integrally turnable with said first rotatable shaft (14) is provided and, substantially at the



central position of the concentric circles formed by the plurality of lenses (11, to 11₁₉), the outlet ends of said optical conductor cables (21, to 21₁₉) are connected to said single major optical conductor cable (22) with its inlet end facing to the reflecting surface of said collecting and reflecting plate (36); said optical conductor cables (21, to 21₁₉) being stripped of their cladding layers at least at portions adjacent to said central position, so as to efficiently introduce uncaptured light at the inlet ends of the optical conductor cables into said cables through the collecting and reflecting plate and thus to effectively maintain the temperature around the tracking sensor to a proper level.

Patentansprüche

1. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, umfassend:

Linseneinrichtungen zum Sammeln von Sonnenlicht;

Sensoreinrichtungen (12) zum Erfassen von Azimut und Höhe der Sonne;

optische Leitereinrichtungen, in die das von den Linseneinrichtungen gesammelte Licht eingeführt wird;

eine erste drehbare Achse (12) zum drehbaren Haltern der Linseneinrichtungen gemeinsam mit damit einstückig konstruierten Einrichtungen;

einen Tragarm (16) zum drehbaren Haltern der ersten drehbaren Achse;

eine zweite drehbare Achse (17) zum drehbaren Haltern des Tragarms derart, daß dieser um eine zu der Achse der ersten drehbaren Achse senkrechte Achse drehbar ist; und

eine Kapsel (3), in der sämtliche vorstehend genannten Einrichtungen hermetisch versiegelt sind; wobei, wenn der Azimut und die Höhe der Sonne von den Sensoreinrichtungen erfaßt werden, das Drehen der ersten und der zweiten drehbaren Achse so gesteuert wird, daß die Linseneinrichtungen veranlaßt werden, in die Sonnenposition zu blicken, derart, daß das von den Linseneinrichtungen gesammelte Sonnenlicht in die optischen Leitereinrichtungen eingeführt wird,

dadurch gekennzeichnet, daß:

innerhalb der Kapsel (3) eine Saugpumpe oder ein Gebläse (30) vorgesehen ist, um um die Sensoreinrichtungen (12) herum eine Luftströmung zu erzeugen und um die Temperatur um die Sensoreinrichtungen herum wirksam auf einem richtigen Pegel zu halten.

2. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in Anspruch 1, beansprucht ist, bei der die Linseneinrichtungen eine Anzahl von Linsen (11, bis 11₁₉) umfassen, die im wesentlichen in Form von konzentrischen Kreisen angeordnet sind und bei der die optischen Leitereinrichtungen mehrere optische Leiterkabel (21, bis 21₁₉) umfassen, wobei das Einlassende der Kabel an den Brennpunktpositionen jeder der Linsen angeordnet ist und wobei die Auslassenden mit einem einzigen optischen

Hauptleiterkabel (22) verbunden sind, welches das Innere der ersten drehbaren Achse koaxial durchgreifend angeordnet ist.

3. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in Anspruch 2 beansprucht ist, bei der das einzige optische Hauptleiterkabel (22) den Tragarm (16) und die zweite drehbare Achse (17) koaxial durchgreifend angeordnet ist.

4. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in einem der Ansprüche 2 und 3 beansprucht ist, bei der die Sensoreinrichtungen (12) im wesentlichen in einem zentralen Teil der konzentrischen Kreise angeordnet sind, die durch die Vielzahl von Linsen (11, bis 11₁₉) gebildet werden.

5. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in Anspruch 4 beansprucht ist, bei der die Erzeugung der Luftströmung um die Sensoreinrichtungen herum beginnt, wenn die Linseneinrichtungen auf einen Sonnenmeridian ausgerichtet werden.

6. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in einem der Ansprüche 1 bis 5 beansprucht ist, bei der die Saugpumpe oder das Gebläse (30) an dem Tragarm (16) vorgesehen ist, um die Luftströmung um die Sensoreinrichtungen herum durch Kanäle zu bewirken, die im Inneren des Tragarms (16) ausgebildet sind.

7. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in einem der Ansprüche 1 bis 6 beansprucht ist, bei der die Kapsel (3) einen transparenten Kopfteil (2) umfaßt, der in der Form einer Kugel ausgebildet ist, um die Einrichtungen (10) zum Sammeln und Konzentrieren des Sonnenlichts zu umschließen, sowie ein Basiselement (1) zum Tragen des Kopfteils (2), wobei das Basiselement (1) mit einem Wärmetauscher (33) versehen ist, wodurch die Luft in dem Kopfteil (2) in dem Basiselement (1) gekühlt oder beheizt werden und erneut in den Kopfteil (2) zurückgeleitet werden kann.

8. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, wie sie in Anspruch 7, beansprucht ist, bei der das Basiselement mit einem isolierten Abteil zum Aufnehmen des Wärmetauschers (33) versehen ist, um einen Wärmeaustausch zwischen diesem Abteil und der Umgebungsluft zu bewirken.

9. Vorrichtung zum Sammeln und Konzentrieren von Sonnenlicht, umfassend:

eine Anzahl von Linsen (11, bis 11₁₉) zum Sammeln von Sonnenlicht;

einen vergolgenden Sensor (12) zum Erfassen von Azimut und Höhe der Sonne;

mehrere optische Leiterkabel (21, bis 21₁₉), die den betreffenden Linsen (11, bis 11₁₉) gegenüberliegend angeordnet sind und in die das von den Linsen gesammelte Sonnenlicht eingeführt wird;

ein einziges optisches Hauptleiterkabel (22), welches mit den mehreren optischen Kabeln (21, bis 21₁₉) verbunden ist und in welches das durch die mehreren optischen Leiterkabel transportierte Sonnenlicht eingeführt wird;



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eine erste drehbare Achse (14) zum drehbaren Haltern der Linsen zusammen mit den damit einstückig konstruierten Elementen;

einen Tragarm (16) zum drehbaren Haltern der ersten drehbaren Achse (14);

eine zweite drehbare Achse (17) zum drehbaren Haltern des Tragarms (16) derart, daß dieser um eine Achse drehbar ist, welche senkrecht zur Achse der ersten drehbaren Achse (14) verläuft; und

eine transparente Kapsel (3), in der alle oben genannten Elemente hermetisch versiegelt sind;

wobei das Drehen der ersten und der zweiten drehbaren Achse (14, 17), wenn Azimut und Höhe der Sonne von dem verfolgenden Sensor (12) erfaßt werden, derart gesteuert wird, daß die Linsen veranlaßt werden, auf die Position der Sonne ausgerichtet zu werden, derart, daß das von den Linsen gesammelte Sonnenlicht in die optischen Leiterkabel (21, bis 21₁₉) eingeführt wird,

dadurch gekennzeichnet, daß an der Rückseite des Raums, der durch die Vielzahl von Linsen (11, bis 11₁₉) und die optischen Leiterkabel (21, bis 21₁₉) gebildet wird, eine Sammel- und Reflexionsplatte (31) vorgesehen ist, welche einstückig mit der ersten drehbaren Achse (14) drehbar ist, und zwar im wesentlichen im mittleren Teil der konzentrischen Kreise, die durch die Vielzahl von Linsen (11, bis 11₁₉) gebildet werden, daß die Auslassenden der optischen Leiterkabel (21, bis 21₁₉) mit einem einzigen optischen Hauptleiterkabel (22) verbunden sind, wobei dessen Einlassende der reflektierenden Oberfläche der Sammel- und Reflexionsplatte (36) zugewandt ist, daß von den optischen Leiterkabeln (21, bis 21₁₉), deren Umhüllung zumindest in den Bereichen abgestreift ist, die in der Nähe des zentralen Bereichs angeordnet sind, um Licht, welches von den Einlassenden der optischen Leiterkabel nicht eingefangen wurde, mit Hilfe der Sammel- und Reflexionsplatte wirksam in diese Kabel einzuführen und damit die Temperatur rings um den verfolgenden Sensor auf einem richtigen Pegel zu halten.

Revendications

1. Dispositif pour collecter et concentrer la lumière solaire comprenant:

un moyen à lentille pour collecter la lumière solaire,

un moyen détecteur (12) pour détecter l'azimut et la hauteur du soleil,

un moyen à conducteur optique dans lequel est introduite la lumière solaire collecter par ledit moyen à lentille,

un premier arbre rotatif (14) pour supporter de manière rotative ledit moyen à lentille avec les moyens qui sont construits de manière à faire bloc avec celui-ci,

un bras de support (16) pour supporter de manière rotative ledit premier arbre rotatif,

un second arbre rotatif (17) pour supporter de manière rotative ledit bras de support autour d'un

axe perpendiculaire à l'axe dudit premier arbre rotatif, et

une capsule (3) dans laquelle sont enfermés de manière étanche tous les éléments ci-dessus, l'entraînement en rotation desdits premier et second arbres rotatifs étant commandé, lorsque l'azimut et la hauteur du soleil sont détectés par ledit moyen détecteur, de manière à amener ledit moyen à lentille à faire face à la position du soleil de façon à introduire dans ledit moyen conducteur optique la lumière solaire collectée par ledit moyen à lentille.

caractérisé en ce que:

il est prévu à l'intérieur de ladite capsule (3) une pompe aspirante ou un ventilateur (30) de manière à produire un courant d'air autour dudit moyen détecteur (12) et à maintenir de manière efficace à un niveau convenable la température régnant autour du moyen détecteur.

2. Dispositif pour concentrer et collecter la lumière solaire tel que revendiqué dans la revendication 1, dans lequel ledit moyen à lentille comprend un ensemble de lentilles (11, à 11₁₉) disposé sensiblement suivant la forme de cercles concentriques, et dans lequel ledit moyen conducteur optique comprend un ensemble de câbles conducteurs optiques (21, à 21₁₉), l'extrémité d'entrée desdits câbles étant disposée aux positions focales de chacune des lentilles et les extrémités de sortie étant reliées à un câble conducteur principal unique (22) prévu coaxialement à travers l'intérieur du premier arbre rotatif.

3. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans la revendication 2, dans lequel ledit câble conducteur optique principal unique (22) est prévu à travers le bras de support (16) et coaxialement à travers l'intérieur du second arbre rotatif (17).

4. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans l'une quelconque des revendications 2 et 3, dans lequel ledit moyen détecteur (12) est disposé sensiblement à l'endroit de la partie centrale des cercles concentriques formés par l'ensemble de lentilles (11, à 11₁₉).

5. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans la revendication 4, dans lequel ledit courant d'air commence à être produit autour dudit moyen détecteur lorsque l'axe du moyen à lentille est dirigé vers le zénith.

6. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans l'une quelconque des revendications 1 à 5, dans lequel la pompe aspirante ou le ventilateur (30) est prévu sur ledit bras de support (16) afin de fournir un courant d'air autour du moyen détecteur en passant par des passages ménagés à l'intérieur du bras de support (16).

7. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans l'une quelconque des revendications 1 à 6, dans lequel ladite capsule (3) comprend un élément transparent de tête (2) conformé suivant la forme d'une sphère afin d'enfermer un moyen pour collecter



concentrer la lumière solaire (10), et un élément de base (1) pour supporter l'élément de tête (2), ledit élément de base (1) étant muni d'un échangeur de chaleur (33), de façon que l'air situé à l'intérieur de l'élément de tête (2) puisse être refroidi ou réchauffé à l'intérieur de l'élément de base (1) et être renvoyé à nouveau dans l'élément de tête (2).

8. Dispositif pour collecter et concentrer la lumière solaire tel que revendiqué dans la revendication 7, dans lequel ledit élément de base est muni d'un compartiment isolé pour recevoir ledit échangeur de chaleur (3), afin de réaliser un échange de chaleur entre ledit compartiment et l'air ambiant.

9. Dispositif pour collecter et concentrer la lumière solaire comprenant:

un ensemble de lentilles (11, à 11₉) pour recueillir la lumière solaire, un détecteur à poursuite (12) pour détecter l'azimut et la hauteur du soleil,

un ensemble de câbles conducteurs optiques (21, à 21₉) disposé en regard de lentilles respectives (11, à 11₉) et dans lequel est introduite la lumière solaire collectée par les lentilles,

un câble conducteur optique principal unique (22) relié audit ensemble de câbles optiques (21, à 21₉) et dans lequel est introduite la lumière solaire transmise par ledit ensemble de câbles conducteurs, optiques,

un premier arbre rotatif (14) pour supporter de manière rotative les lentilles en commun avec les éléments qui sont construits de manière à faire bloc avec elles,

un bras du support (16) pour supporter de manière rotative ledit premier arbre rotatif (14),

un second arbre rotatif (17) pour supporter de manière rotative ledit arbre de support (16) autour

d'un axe perpendiculaire à l'axe du-dit premier arbre rotatif (14), et

une capsule transparente (3) dans laquelle sont enfermés de manière étanche tous les éléments ci-dessus,

L'entraînement en rotation desdits premier et second arbres rotatifs (14, 17) étant commandé, lorsque l'azimut et la hauteur du soleil sont détectés par ledit détecteur à poursuite (12), de façon à amener les lentilles à faire face à la position du soleil de manière à introduire dans lesdits câbles conducteurs optiques (21, à 21₉) la lumière solaire collectée par lesdites lentilles.

caractérisé en ce que:

il est prévu, sur le côté arrière de l'espace formé par l'ensemble de lentilles (11, à 11₉) et de câbles conducteurs optiques (21, à 21₉), une plaque collectrice et réflectrice (36) pouvant tourner d'une pièce avec ledit premier arbre rotatif (14), et, sensiblement dans la position centrale des cercles concentriques formés par l'ensemble de lentilles (11, à 11₉) les extrémités de sortie desdits câbles conducteurs optiques (21, à 21₉) sont reliés audit câble conducteur optique principal unique (22) présentant son extrémité d'entrée faisant face à la surface réflectrice de ladite plaque collectrice et réflectrice (36), lesdits câbles conducteurs optiques (21, à 21₉) étant dénudés de leurs couches de gainage au moins sur les parties adjacentes à ladite position centrale, de façon à introduire de manière efficace, dans lesdits câbles et à l'aide de la plaque collectrice et réflectrice, la lumière non capturée aux extrémités d'entrée des câbles conducteurs optiques, et à maintenir ainsi efficacement à un niveau convenable la température régnant autour du détecteur à poursuite.



* C L M S *