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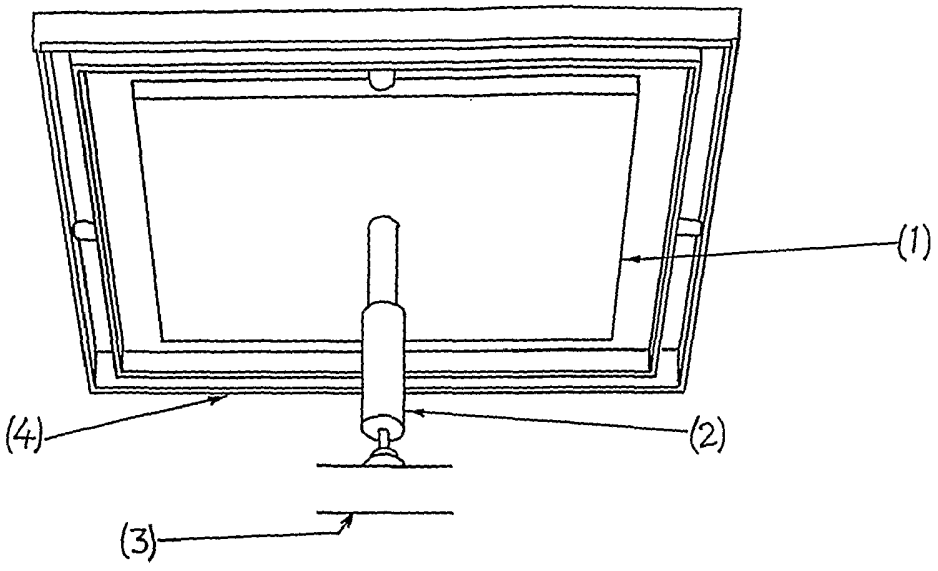
(54) Title: NOVEL SUN-TRACKER MECHANISM FOR A SET OF MIRRORS



(57) Abstract: An improved sun-tracker device having a plurality of mirrors (1) for reflecting incident sunlight on a fixed target, comprising at least two mirrors (1) each pivotable and orientable in respect of at least two axis; at least one tube (2) having a first end and a second end, the first end being detachably attached to a backsurface of one of the at least two mirrors (1), the second end of the at least one tube pivotably attached to a single master member (3), a movement of the master member (3) causing an orientation of the at least two mirrors (1), wherein the at least one tube (2) correspondingly retracting and/or forwardly opening out; means supporting the at least two mirrors (1) to provide orientation in at least two directions about the center of the at least two mirrors (1).

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FIELD OF INVENTION

The invention relates to an improved sun-tracker device having a plurality of mirrors for reflecting incident sunlight on a fixed target.

BACKGROUND OF THE INVENTION

When a mirror of fixed location is required to reflect incident sunlight on to a fixed target, the mirror, in order to accommodate the movement of the sun, has to undergo continual re-orientation; in other words, it has to "track" the sun. This may not be difficult for a single mirror, but becomes a complex task when a set of mirrors is involved. This is so because no two mirrors undergo identical reorientation. The prior art Sun-tracker mechanisms used to steer a set of mirrors, include (i) individual, motorized reorientation controlled by sun sensors via microprocessors, and (ii) complicated lever and transmission mechanisms to deliver individual steering to individual mirrors. These mechanisms are technologically complex and financially expensive.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide an improved sun-tracker device having a plurality of mirrors for reflecting incident of sunlight on a fixed target.

Another object of the invention is to provide an improved sun-tracker device having a plurality of mirrors for reflecting incident of sunlight on a fixed target which uses a single master member to cause continual orientation of a plurality of mirrors.

A further object of the invention is to provide an improved sun-tracker device having a plurality of mirrors for reflecting incident of sunlight on a fixed target which is inexpensive and achieves efficient result in tracking the sunlight.

SUMMARY OF THE INVENTION

Accordingly, there is provided an improved Sun-tracker device having a plurality of mirrors for reflecting incident sunlight on a fixed target, comprising: atleast two mirrors each pivotable and orientable in respect of atleast two axis. Atleast one tube having a first end and a second end, the first end being detachably attached to a backsurface of one of the atleast two mirror. The second end of the atleast one tube is pivotably attached to a single master member, a movement of the master member causing an orientation of the atleast two mirrors wherein the atleast one tube correspondingly retracting and / or forwardly opening out. Means supporting the atleast two mirrors is arranged to provide orientation in atleast two directions about the center of the atleast two mirrors.

BRIEF DESCRIPTION OF THE ACCOMPANYING FIGURE

Figure 1 – shows a Sun-tracking device according to the present invention.

Figure 2 – depicts an operational method by way of a line diagram of the device with atleast two mirrors according to the invention.

Figure 3 – a line diagram showing the operational method of the device with three mirrors according to the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

The description of the invention is provided hereinafter with reference to Figures 1, 2 and 3. First, the elements of the device are described below.

Each mirror (1) is so supported that it has a two-axis freedom of orientation, that is to say, the mirror (1) can orient itself in any direction, about its center; this is achieved by using a ball-and-socket support, or a gimbals mounting, or any other appropriate means (4). This is depicted in Figure 1 where a gimbals mounting is shown for a typical mirror-and-tube assembly (1 and 2) and only a portion of a master member (3) is shown.

To the center of the back surface of the mirror (1), that is to say, the surface away from the sun, is fixed, perpendicularly, a telescopic tube (2).

The other end of the telescopic tube (2) is pivoted on a movable member, which is the master member (3), in such a manner as to give the tube (2) a two-axis freedom of orientation about such pivot; this, again, is achieved by using a ball-and-socket support, or a gimbals mounting, or any other appropriate means (4).

The mirror (1) is reoriented by moving the master member (4); the tube (2) retracts or opens out, as necessary, to accommodate such movement. A spring or elastic string or sprung string may be used, too, in place of the telescopic tube.

As is explained hereinbelow, the length of the tube (2) and the location of the point on the master member (3) where the tube (2) is pivoted relative to the location of the mirror (1), determine the orientation of the mirror (1).

The working principle is now described with reference to Figures 2 and 3, where only side views of the mirrors (1) are shown and, for the sake of clarity, the mirrors (1) and the tubes (2) are represented by lines, and the gimbals (4) are not shown. In Figure 2, P is the mirror pivot and Q is the tube pivot on the master member (3). Only a portion of the master member (3) is shown. F is the target, i. e., the point to which reflected light is to be directed. The direction of incident sunlight (DS) is represented by the set of parallel arrows. PR is a straight (imaginary) line such that RP, when extended, reaches F. RQ is another straight (imaginary) line such that the length of RQ equals that of PR, and RQ is parallel to the direction of incident sunlight (DS). It is clear that, because the tube (2) is capable of expanding and contracting, and the mirror (1) and the tube (2) have a two-axis freedom of orientation at P and Q, respectively, the above conditions of PR and RQ can stand satisfied for any inclination of the sun and any location of the mirror (1) relative to the target. PS is an extension of QP, and TP is parallel to the direction of incident sunlight (DS). Because the tube (2) is perpendicular to the (back) surface of the mirror (1), and QP represent the tube (2), PS represents a surface normal of the mirror (1). Also, because PR equals QR, angle QPR equals angle PQR. It follows, therefore that an angle FPS equals angle TPS. So, sunlight incident on the mirror parallel to TP gets reflected parallel to PF and thus towards the target.

Figure 3 shows a set of three mirror-and-tube assemblies (1 and 2). Only three mirrors are shown for the sake of clarity even though any number of mirrors can be accommodated by this invention. Also, the invention works with almost any two- or three- dimensional distribution of any contour of the set of mirror-and-tube assemblies. The mirror mounting, the pivoting of the telescopic tubes on the master member (3), and the geometry of all the mirror-and-tube assemblies (1 and 2) are identical to, and the same as, that shown in Figure 2, and described in the preceding paragraph, with all the tubes (2) pivoted on the same master member (3), and with the same two-axis freedom of orientation. However, now there is an additional condition, as follows: the (imaginary) straight line (PR) is of the same length for all the mirror-and-tube assemblies (1 and 2), and so, the same is true of the lines QR which are equal to PR; consequently, all the lines PR and QR are of the same length. This condition determines the location of the tube pivots, Q, for all the mirror-and-tube assemblies (1 and 2), and, thereby, the contour of the master member (3). For instance, even if the mirror set is on a flat plane, the contour of the master member will be curved and not flat. The principle enunciated in the preceding paragraph for a single-and-tube assembly now holds equally and simultaneously for all the assemblies, and, so, the movement of the single master member (3) that always keeps the (imaginary) lines QR aligned parallel to the direction of the incident sunlight causes all the slave mirrors to reflect the sunlight always towards the target. Since the lines QR are all equal and parallel to each other, one method of giving the appropriate movement to the master (3) is to hold the master by pivoted rods which are of the same length as QR, and which are kept always aligned parallel to the direction of incident sunlight (DS).

We Claim

1. An improved sun-tracker device having a plurality of mirrors for reflecting incident sunlight on a fixed target, comprising:
   - atleast two mirrors each pivotable and orientable in respect of atleast two axis;
   - atleast one tube having at first end and a second end, the first end being detachably attached to a backsurface of one of the atleast two mirror, the second end of the atleast one tube pivotably attached to a single master member, a movement of the master member causing an orientation of the atleast two mirrors wherein the atleast one tube correspondingly retracting and / or forwardly opening out;
   - means supporting the atleast two mirrors to provide orientation in atleast two directions about the center of the atleast two mirrors.

2. The device as claimed in claim 1, wherein the means for supporting and providing orientation to the atleast two mirrors is selected from a group comprising a ball-and-socket and a gimble mounting.

3. The device as claimed in claim 1, wherein the atleast one tube is a telescopic tube.

4. The device as claimed in claim 1, wherein the atleast one tube is optionally provided with one of a spring, elastic string, and sprung string when the tube is not telescopic.

5. The device as claimed in claim 1, wherein the backsurfaces of the atleast two mirrors constitute the surfaces away from the sun.

6. The device as claimed in any one of the preceding claims, wherein the atleast one tube is detachably attached to the backsurface of one of the atleast two mirrors.

7. An improved sun-tracker device having a plurality of mirrors for reflecting incident sunlight on a fixed target as substantially described herein with reference to the accompanying drawings.

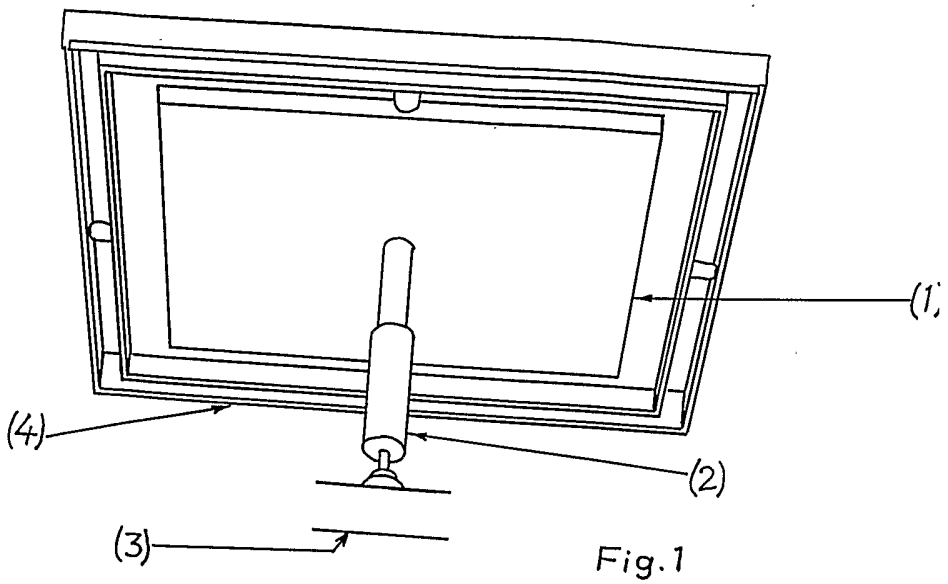

Fig.1

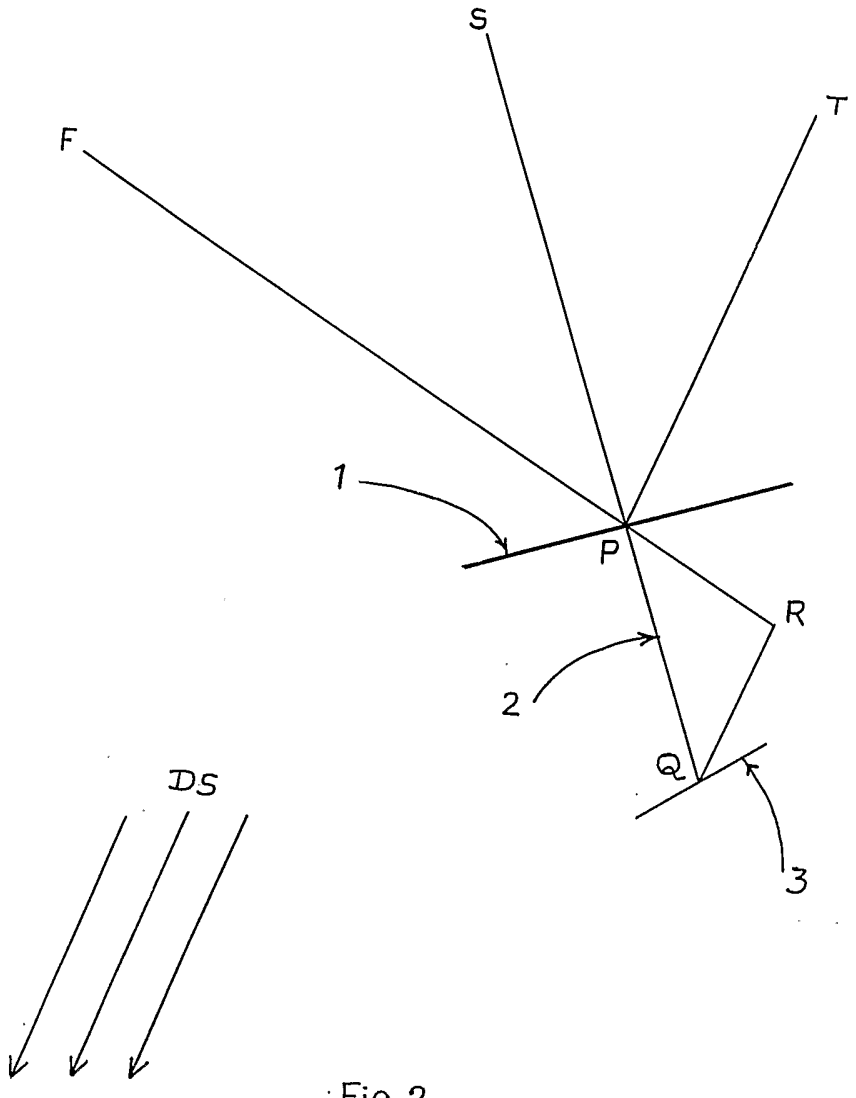

Fig. 2

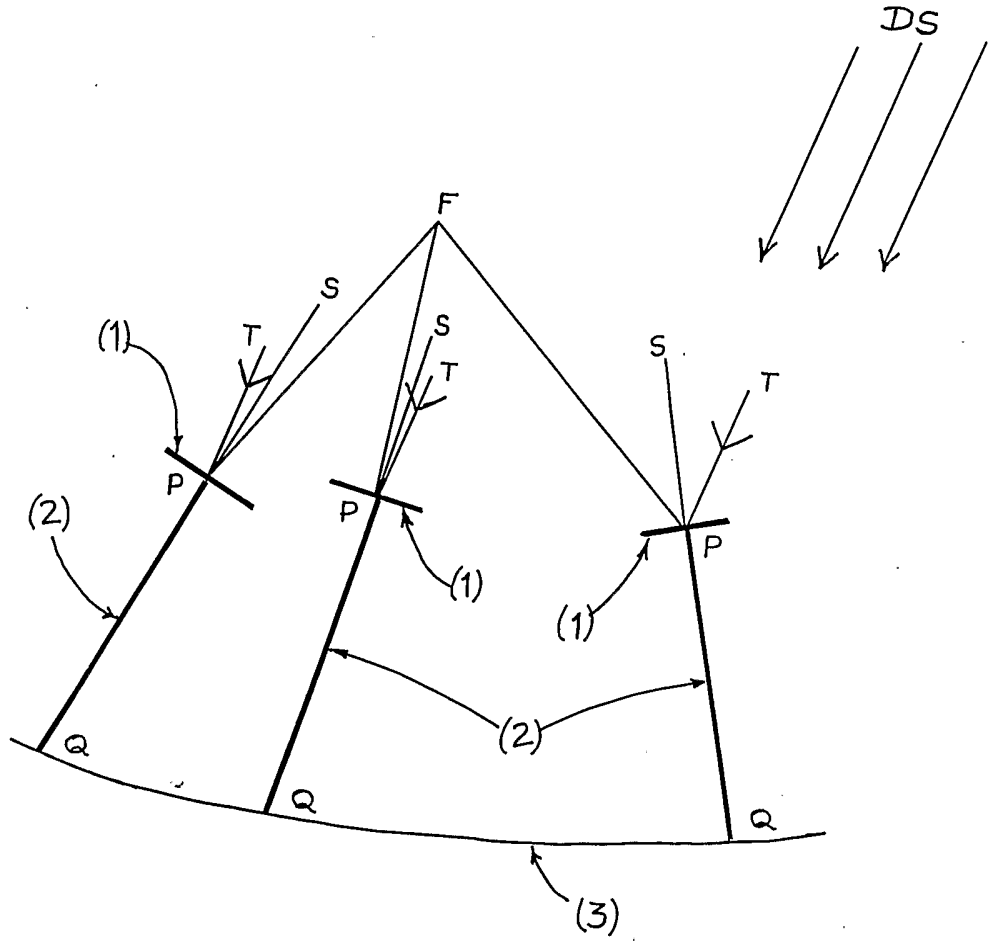

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN 2005/000283

A. CLASSIFICATION OF SUBJECT MATTER
IPC[7]: F24J 2/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[7]: F24J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 218 114 A (BUNCH) 19 August 1980 (19.08.1980) *figures 3, 4, 6, 9.*	1, 2, 4, 5
X	US 4 110 010 A (HILTON) 29 August 1978 (29.08.1978) *figures 1 to 7.*	1, 5
A	US 3 906 927 A (CAPLAN) 23 September 1975 (23.09.1975) *figures 2, 4.*	1, 5
A	US 4 373 512 A (HIRT) 15 February 1983 (15.02.1983) *figure 2.*	1, 5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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