



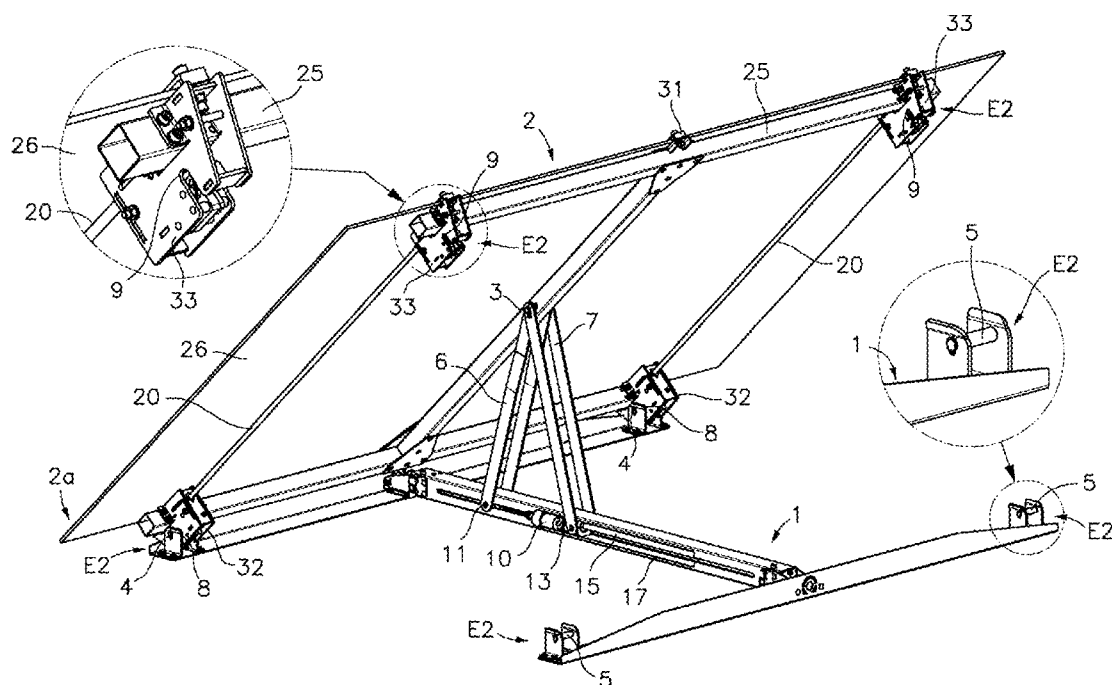
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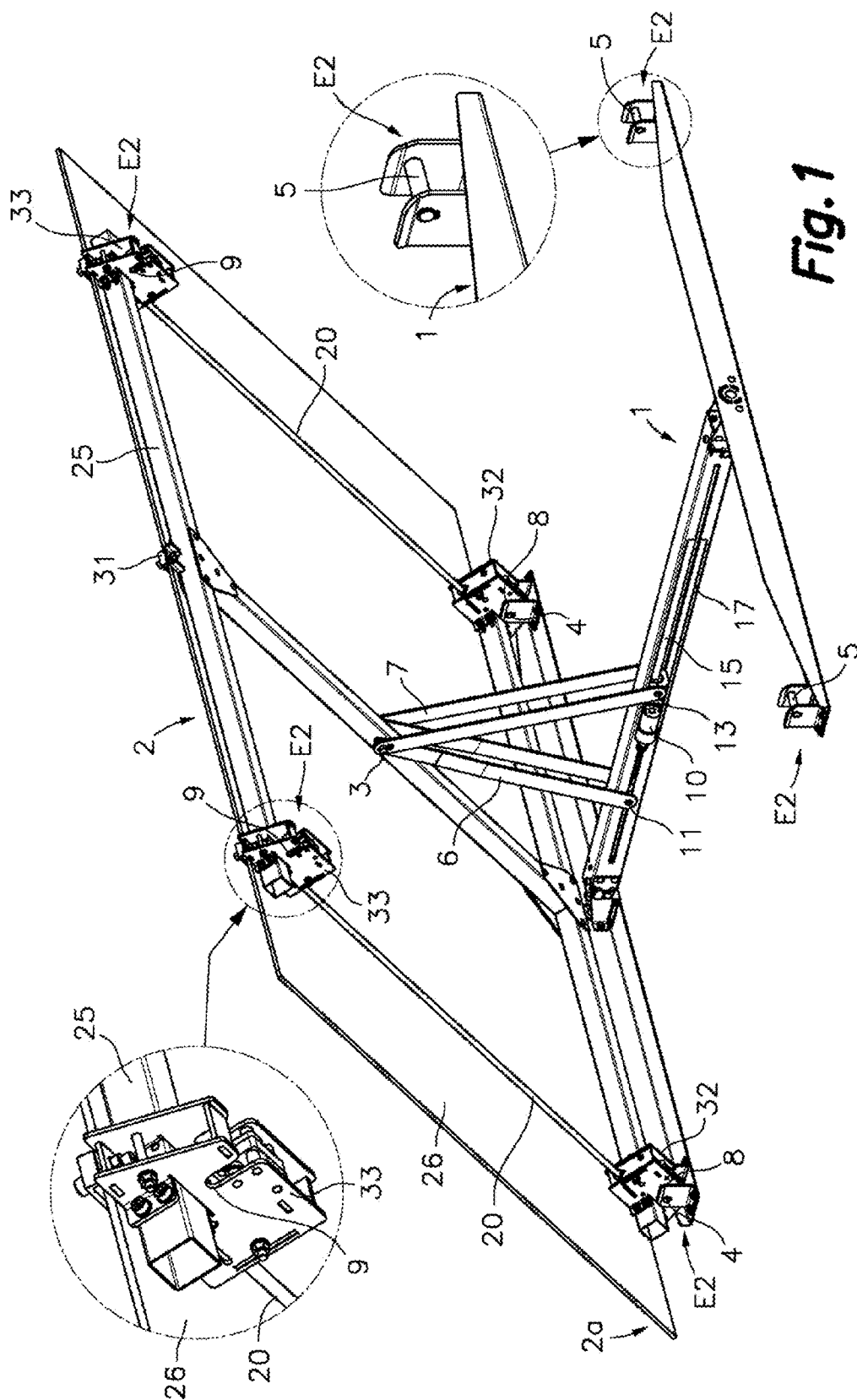
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Grant(10) **Pub. No.: US 2013/0037081 A1**(43) **Pub. Date: Feb. 14, 2013**(54) **SOLAR TRACKER**(52) **U.S. Cl. 136/246**(75) **Inventor: Thomas Grant, Molina De Segura (ES)**(57) **ABSTRACT**(73) **Assignee: SOLTEC ENERGÍAS**
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Segura (ES)(21) **Appl. No.: 13/221,210**(22) **Filed: Aug. 30, 2011**(30) **Foreign Application Priority Data**

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The solar tracker comprises a base (1) and a solar panel (2) having first and second opposite ends (2a, 2b). The first end (2a) can be connected to the base (1) by a first shaft (E1) and the second end (2b) can be connected to the base (1) by a second shaft (E2), such that said solar panel (2) can pivot with respect to the base (1) alternately around the first shaft (E1) and around the second shaft (E2) under the drive of a lifting mechanism. An automatic connection/disconnection device connects the second end (2b) of the solar panel (2) to the base (1) while at the same time disconnecting the first end (2a) of the solar panel (2) from the base (1), and vice versa, every time the solar panel (2) reaches a position parallel to the base (1) for inverting the inclination of the solar panel (2) with respect to the base (1).





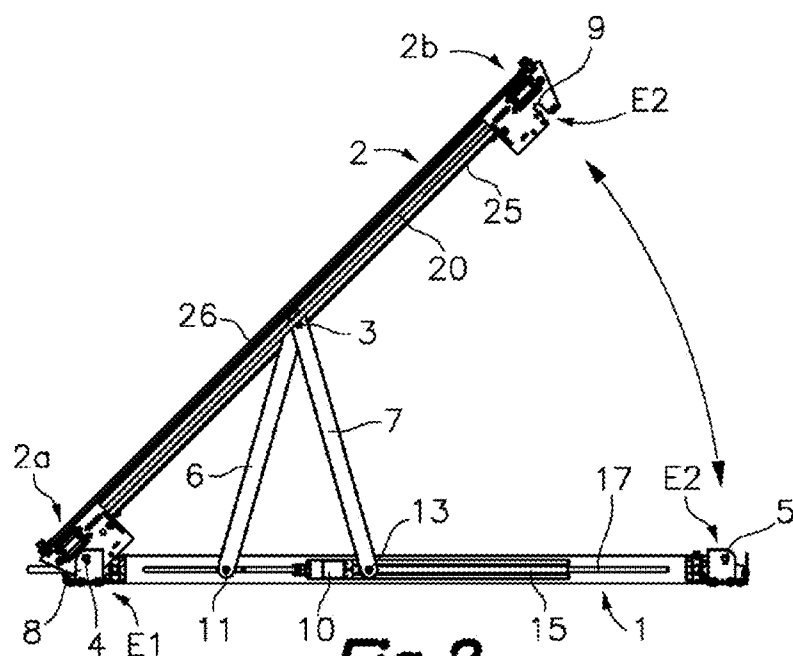


Fig. 2

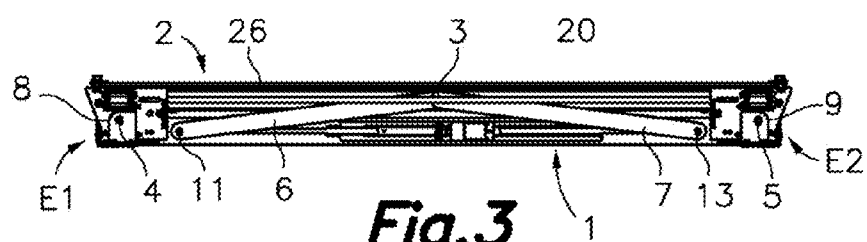


Fig. 3

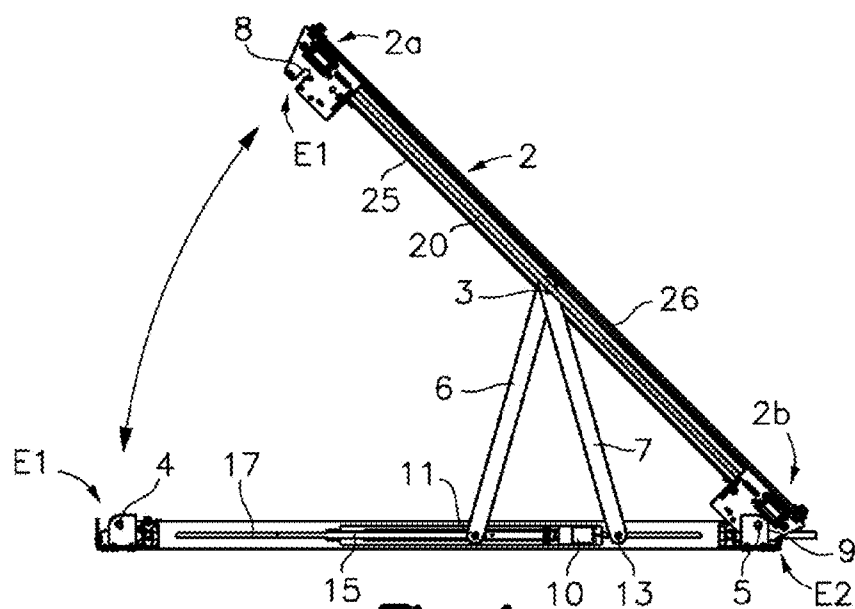
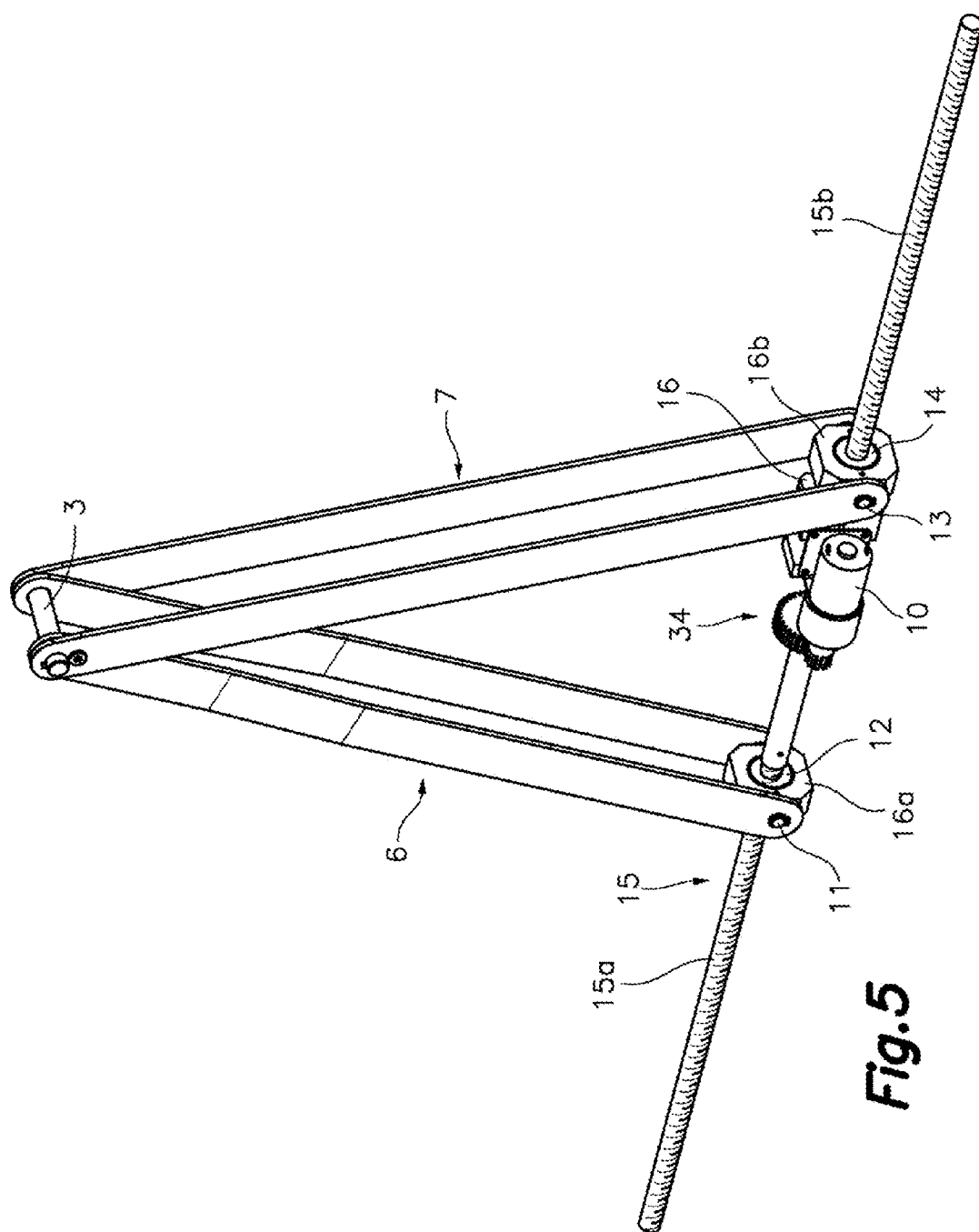
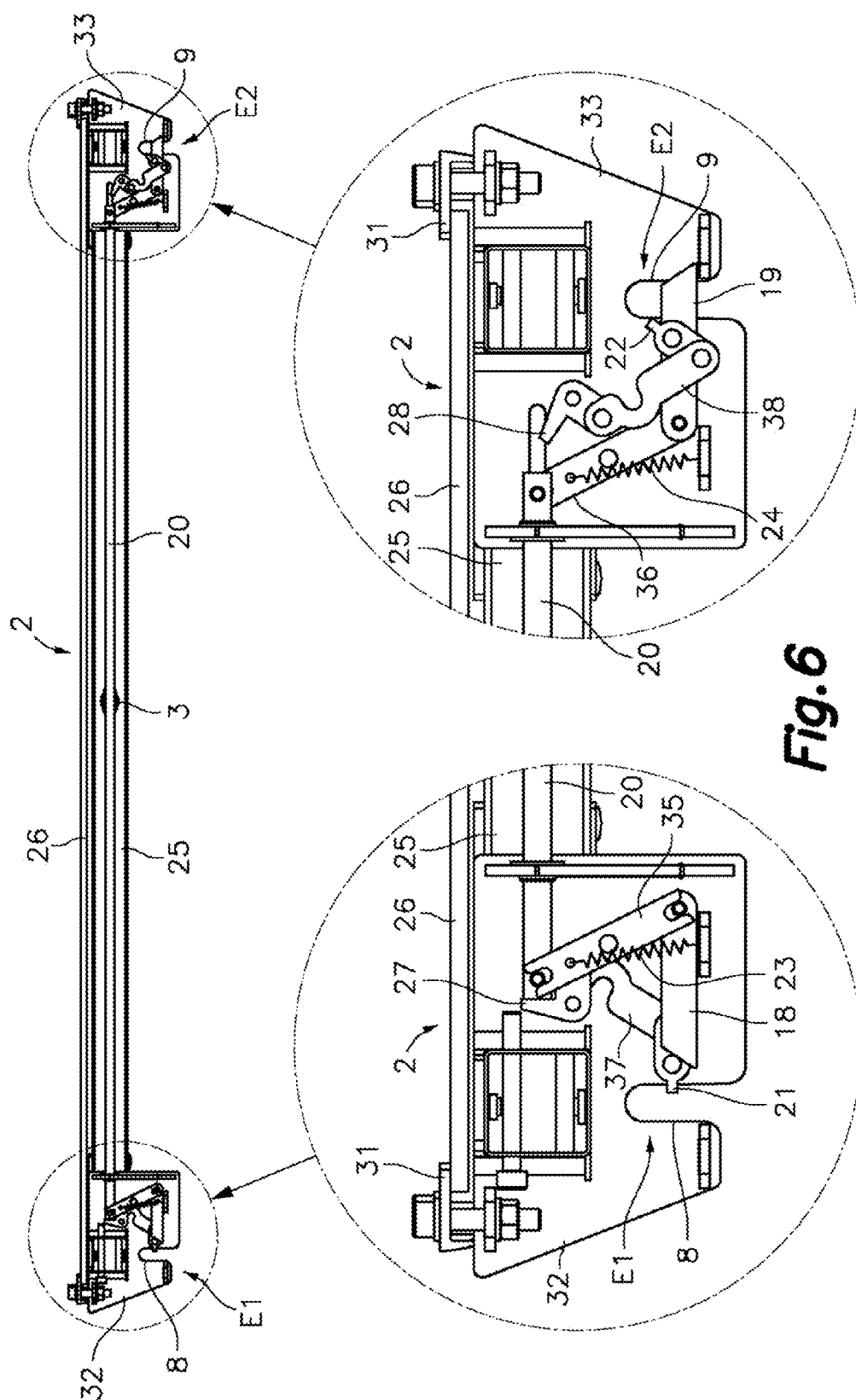
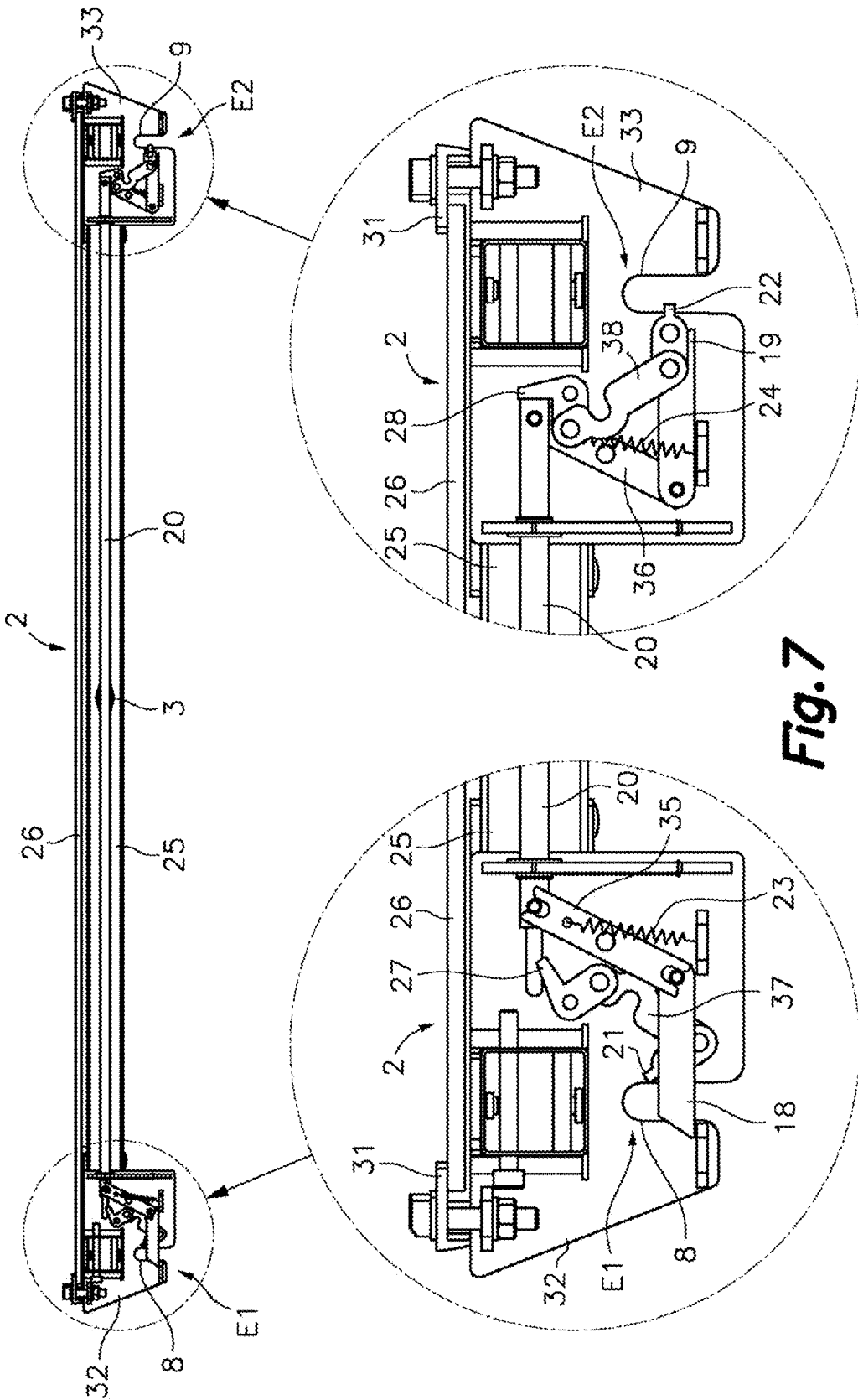


Fig. 4







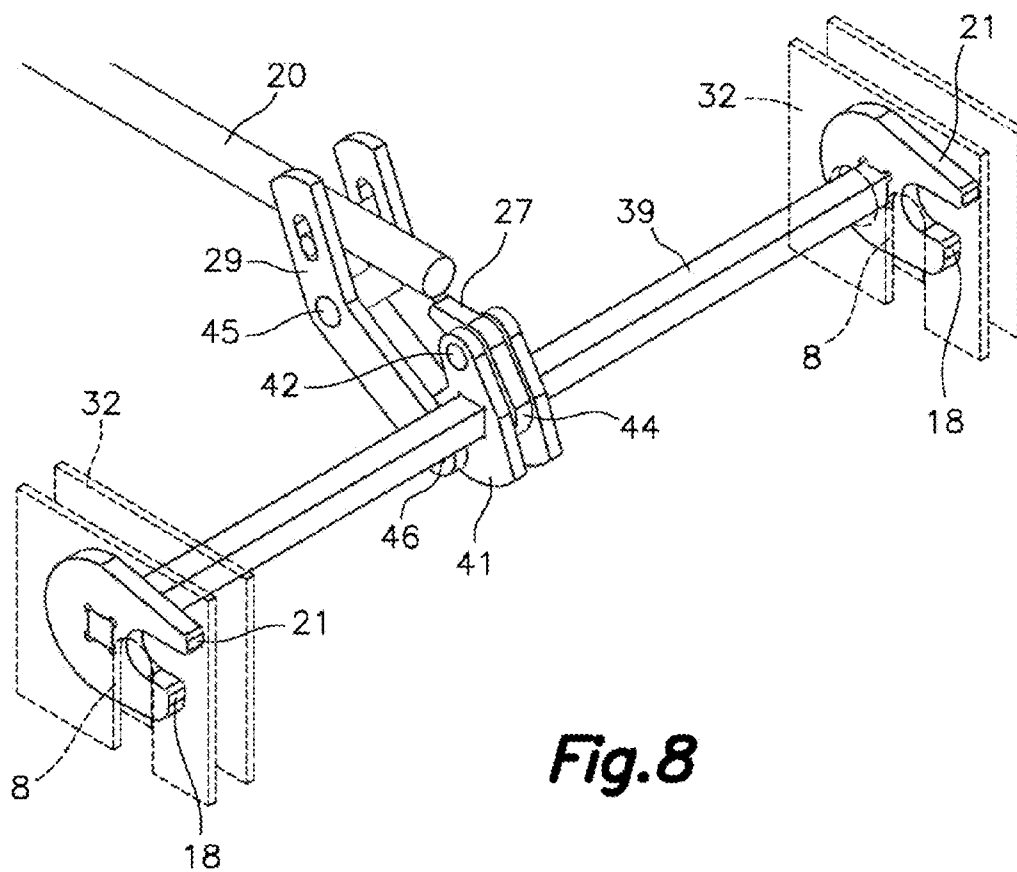


Fig. 8

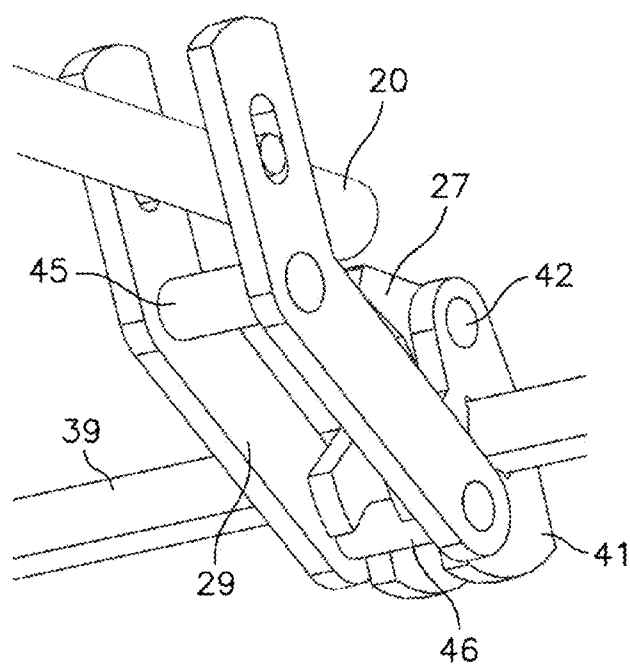


Fig. 9

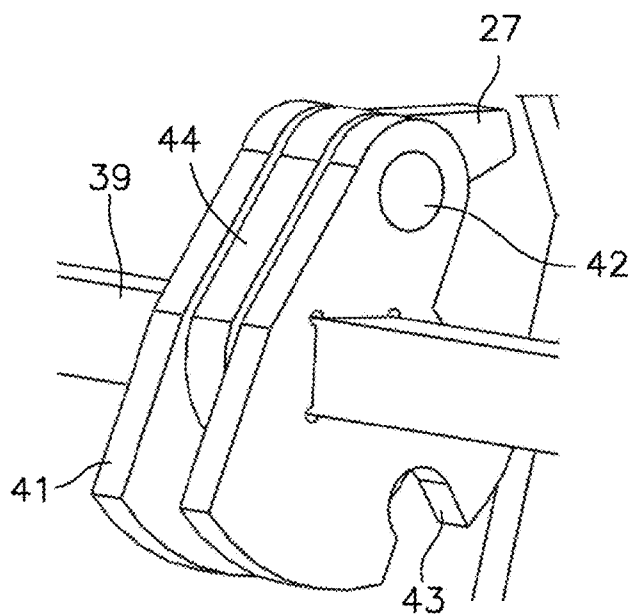


Fig. 10

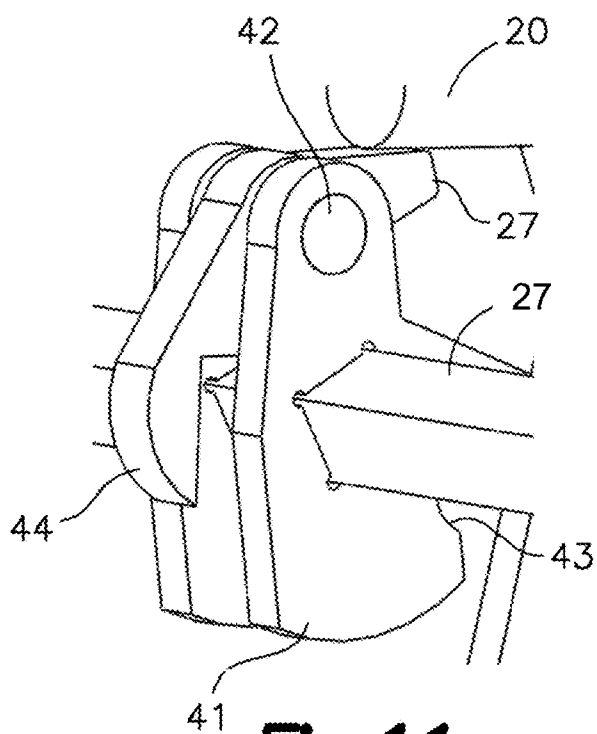


Fig. 11

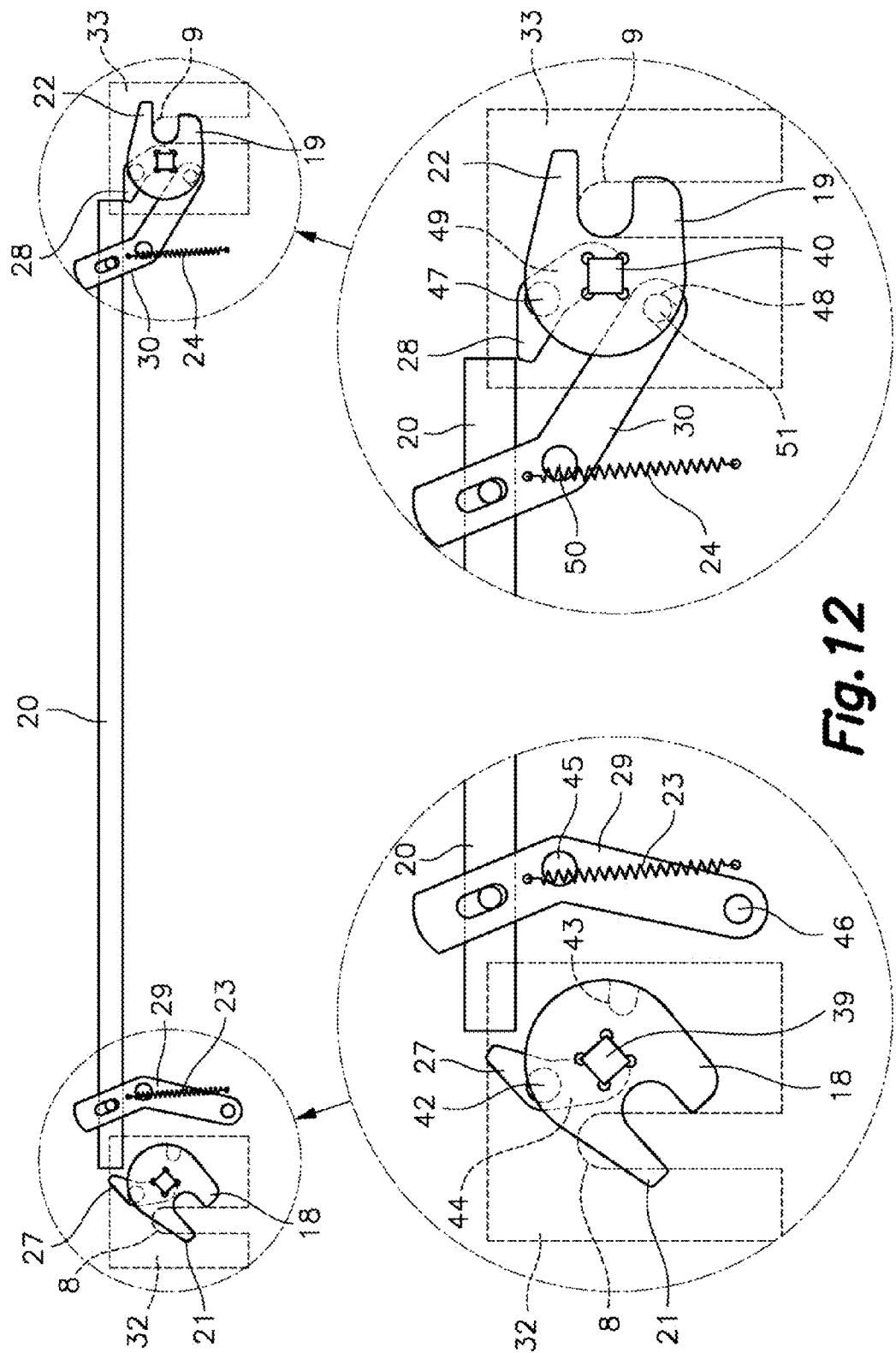


Fig. 12

SOLAR TRACKER

FIELD OF THE ART

[0001] The present invention relates to a simple, compact and economical solar tracker suitable for small-sized solar panels with, for example, a single photovoltaic panel. The solar tracker of the present invention includes a single rotation shaft for daily tracking in the east-west direction and is provided for being installed with a fixed inclination in the north-south direction considered the most suitable according to the latitude of the geographic site where it is located, although it could also optionally be used for tracking in the north-south direction daily or seasonally. Due to its small size and low weight, the solar tracker of the present invention can also be applied as a portable solar power unit.

BACKGROUND OF THE INVENTION

[0002] For better efficiency of solar panels, for example photovoltaic panels, the sun rays should strike them in the most perpendicular direction possible. To that end, solar trackers are usually provided with a first tracking mechanism for orienting the solar panels in the east-west direction and a second tracking mechanism for orienting the solar panels in the north-south direction for the purpose of tracking the relative movements of the sun during the day, including the yearly cycle variations occurring during the seasons. East-west direction tracking is the most important because it involves a movement covering a very broad arc, whereas north-south direction tracking involves a movement covering a considerably smaller arc.

[0003] The implementation of the two aforementioned tracking mechanisms in a two-shaft solar tracker entails a complex construction and increase manufacturing cost.

[0004] Accordingly, the present invention proposes a light-weight and economical solar tracker provided with a single tracking mechanism for orienting at least one solar panel in the east-west direction, taking into account that the solar panel and the tracking mechanism are supported in a base which can be installed in a stationary manner at a mid-point inclination in the north-south direction according to the latitude of the site where it is installed. The slight loss of efficiency due to tracking in a single shaft is offset with the low cost, light weight, ease of transport and ease of installation of the solar tracker of the present invention.

[0005] Document US 2011/0061644 A1 discloses a low-profile solar energy collection system comprising a base for assembling the system on a suitable substrate and a plurality of solar panels arranged next to one another on the base. A first set of solar panels are movable relative to a second set of solar panels for tracking the relative movements of the sun during the day. The solar panels of the first set are arranged in an alternating manner with the solar panels of the second set. In one embodiment, the solar panels of the second set are arranged in a stationary manner and in another embodiment they are movable relative to the solar panels of the first set. A drawback of this system is that in at all times only one set of solar panels, i.e., only half of the solar panels, receives the rays of the sun in suitable conditions.

[0006] Document CN 101098113 A describes a solar tracker comprising a horizontal rotating support on which a solar panel is installed having a first lower end connected in a pivoting manner to the horizontal support by a horizontal shaft. A first actuator drives rotational movements of the

horizontal rotating support around a vertical shaft for orienting the solar panel in the east-west direction and a second actuator drives a lifting mechanism pivoting the solar panel with respect to the horizontal rotating support around the aforementioned horizontal shaft for orienting the solar panel in the north-south direction according to the relative movements of the sun. A drawback of this solar tracker is that it needs two tracking mechanisms in two orthogonal shafts, making it more expensive and complex.

[0007] If for simplicity's sake a person skilled in the art decided to use only the main tracking mechanism in the east-west direction in the solar tracker of the mentioned document CN 101098113 A, it would correspond to the rotational movement of the horizontal support around the vertical shaft, which entails greater constructive complexity in comparison with the pivoting movement mechanism. If the person skilled in the art decided to use the pivoting movement mechanism of the solar panel around the horizontal shaft for tracking in the east-west direction, the angle covered by this mechanism would be insufficient.

DISCLOSURE OF THE INVENTION

[0008] The present invention contributes to solving the foregoing and other drawbacks by providing a solar tracker comprising a base on which a solar panel is installed having first and second opposite ends. The aforementioned first and second ends of the solar panel can be connected to said base by respective first and second mutually parallel shafts by means of an automatic connection/disconnection device connecting the second end of the solar panel to the base while at the same time disconnecting the first end of the solar panel from the base, and vice versa, every time the solar panel reaches a position parallel to the base, such that the solar panel can pivot with respect to the base around said first shaft when the first end is connected to the base and the second end is disconnected from the base, and the solar panel can pivot with respect to the base around said second shaft when the second end is connected to the base and the first end is disconnected from the base.

[0009] The solar tracker further comprises a lifting mechanism connected to the solar panel in an intermediate region between said first and second ends and an actuator operatively connected for moving said lifting mechanism and thereby pivoting said solar panel alternately around the first shaft and around the second shaft passing through said position parallel to the base according to the relative movements of the sun. Therefore, the actuator and the lifting mechanism are configured for pivoting the solar panel between a raised position and a position parallel to the base and the automatic connection/disconnection device is configured for inverting the inclination of the solar panel with respect to the base every time the solar panel reaches the position parallel to the base and the lifting mechanism is driven again for moving the solar panel from the position parallel to the base towards the raised position.

[0010] In one embodiment, the first shaft is defined by at least a first journal fixed to the base and at least a corresponding first half-bearing fixed to the solar panel, or vice versa, and the second shaft is defined by at least a second journal fixed to the base and at least a corresponding second half-bearing fixed to the solar panel, or vice versa. The first and second half-bearings are formed, for example, by closed and rounded ends of notches, and are configured and arranged for receiving

ing the corresponding first and second journals in a radial direction when the solar panel reaches the position parallel to the base.

[0011] The aforementioned automatic connection/disconnection device comprises at least a first closing element associated with the first half-bearing and a second closing element associated with the second half-bearing. Said first closing element is movable between a closed position, in which the first closing element retains the first journal coupled to the first half-bearing, and an open position, in which the first closing element allows the first journal to move along the corresponding notch and to be coupled and decoupled to/from the first half-bearing. Similarly, said second closing element is movable between a closed position, in which the second closing element retains the second journal coupled to the second half-bearing, and an open position, in which the second closing element allows the second journal to move along the corresponding notch and to be coupled and decoupled to/from the second half-bearing.

[0012] In one embodiment, the automatic connection/disconnection device includes at least one linking member kinematically linking said first and second closing elements to one another such that when the first closing element is moved to said open position the second closing element is moved to said closed position, and vice versa. At least one elastic element is installed in a flip-flop arrangement whereby said elastic element pushes one of the first and second closing elements towards the closed position and towards the open position from an intermediate neutral position, and the other closing element follows the opposite movements in accordance with the link kinematically provided by the linking member, although alternatively the automatic connection/disconnection device can include a first elastic element installed in a flip-flop arrangement associated with the first closing element and a second elastic element installed in a flip-flop arrangement associated with the second closing element.

[0013] In this embodiment, the automatic connection/disconnection device further comprises a first activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the second shaft reaches said position parallel to the base. This first activation lever is kinematically linked to a first pusher arranged for moving said first closing element from the open position to beyond said intermediate neutral position when the first activation lever is pushed to said activation position, such that the closing element suddenly moves from the intermediate neutral position to the closed position pushed by the elastic element.

[0014] Similarly, a second activation lever is positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the first shaft reaches said position parallel to the base, said second activation lever being kinematically linked to a second pusher arranged for moving said second closing element from the open position to beyond said intermediate neutral position when the second activation lever is pushed to said activation position.

[0015] Preferably, the first and second activation levers are associated with the first and second half-bearings such that they interfere in the passage along the corresponding notches when they are located in the stand-by position and are pushed

by the respective first and second journals when they are received in the corresponding first and second half-bearings.

[0016] According to another alternative embodiment, the automatic connection/disconnection device comprises a first locking member movable between a locked position, in which the first locking member locks the first closing element in said closed position, and an unlocked position, in which the first locking member allows the first closing element to move between said closed and open positions, and a second locking member movable between a locked position, in which the second locking member locks the second closing element in said closed position, and an unlocked position, in which the second locking member allows the second closing element to move between said closed and open positions. In this embodiment, the linking member kinematically links said first and second locking elements to one another such that when the first locking element is moved to said locked position the second locking element is moved to said unlocked position, and vice versa.

[0017] In this embodiment, the automatic connection/disconnection device further comprises at least one elastic element installed in a flip-flop arrangement whereby said elastic element pushes one of the first and second locking elements towards the locked position and towards the unlocked position from an intermediate neutral position. A single elastic element is sufficient in accordance with the kinematic link provided by the linking member, although alternatively the automatic connection/disconnection device can include a first elastic element installed in a flip-flop arrangement and associated with the first locking element and a second elastic element installed in a flip-flop arrangement and associated with the second locking element for pushing them towards the locked position and towards the unlocked position from an intermediate neutral position.

[0018] In this embodiment, the automatic connection/disconnection device further comprises a first activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the second shaft reaches said position parallel to the base. This first activation lever is kinematically linked to a first pusher arranged for moving said first locking element from the unlocked position to beyond said intermediate neutral position when the first activation lever is pushed to said activation position. Therefore, the first locking element is suddenly moved to the locked position by the elastic element.

[0019] Similarly, a second activation lever is positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the first shaft reaches said position parallel to the base, said second activation lever being kinematically linked to a second pusher arranged for moving said second locking element from the unlocked position to beyond said intermediate neutral position when the second activation lever is pushed to said activation position.

[0020] When the first closing element is unlocked, the first journal interferes with the closing element and returns it to the open position during an initial phase of the pivoting movement of the solar panel around the second shaft from the position parallel to the base, and when the second closing element is unlocked, the second journal interferes with the closing element and returns it to the open position during an

initial phase of the pivoting movement of the solar panel around the first shaft from the position parallel to the base.

[0021] Preferably, in this embodiment the first and second activation levers are positioned at the entrance of the corresponding first and second half-bearings such that they are pushed from the stand-by position to the activation position by the respective first and second journals when they are received in the corresponding half-bearings. Also preferably, the first activation lever and the first closing element are formed in a single part and the second activation lever and the second closing element are formed in a single part.

[0022] In a preferred embodiment, the solar panel comprises a support structure supporting at least one photovoltaic panel, and the aforementioned first and second half-bearings together with the automatic connection/disconnection device are fixed to said support structure of the solar panel, whereas said first and second journals are fixed to the base.

[0023] In one embodiment, the lifting mechanism comprises at least first and second movable arms having upper ends connected to the solar panel by a first articulation. The first movable arm has a lower end connected by a second articulation to a nut coupled to a first threaded region of a screw supported in the base and the second movable arm has a lower end connected by a third articulation to a second nut coupled to a second threaded region of the screw. Said first and second threaded portions of the screw have opposite thread directions, and the screw is rotatably driven by the aforementioned actuator, which can be, for example, an electronically controlled electric motor.

[0024] Preferably, the rotation axis of the screw is arranged in a direction perpendicular to the first and second shafts, and the screw, said first and second nuts and the actuator are installed such that the assembly moves freely with respect to the base along a guide oriented in a direction parallel to said rotation axis of the screw.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The foregoing and other features and advantages will be better understood from the following detailed description of several embodiments with reference to the attached drawings, in which:

[0026] FIG. 1 is a perspective view of a solar tracker according to a first embodiment of the present invention, with two enlarged details;

[0027] FIG. 2 is a side elevational view of the solar tracker in an eastern-oriented position corresponding to the morning;

[0028] FIG. 3 is a side elevational view of the solar tracker in a horizontal position corresponding to mid-day;

[0029] FIG. 4 is a side elevational view of the solar tracker in a western-oriented position corresponding to the evening;

[0030] FIG. 5 is a perspective view of a lifting mechanism of the solar tracker of FIG. 1;

[0031] FIG. 6 is a side elevational view with two enlarged details of an automatic connection/disconnection device of the solar tracker of FIG. 1 when the solar tracker is located in the eastern-oriented position shown in FIG. 2;

[0032] FIG. 7 is a side elevational view with two enlarged details of the automatic connection/disconnection device of FIG. 6 when the solar tracker is located in the western-oriented position shown in FIG. 4;

[0033] FIG. 8 is a schematic partial perspective view of an automatic connection/disconnection device of a solar tracker according to a second embodiment of the present invention;

[0034] FIG. 9 is a partial perspective view illustrating a locking member of the automatic connection/disconnection device of FIG. 8;

[0035] FIGS. 10 and 11 are partial perspective views illustrating a pusher of the automatic connection/disconnection device of FIG. 8; and

[0036] FIG. 12 is a side elevational view with two enlarged details of the automatic connection/disconnection device of FIG. 8 when the solar tracker is located in the western-oriented position shown in FIG. 4.

DETAILED DESCRIPTION OF SEVERAL EMBODIMENTS

[0037] First in reference to FIGS. 1 to 4, such figures show a solar tracker according to a first embodiment of the present invention, comprising a base 1 formed by connected metal sections forming an "H" shape and a solar panel 2 made up of a support structure 25 formed by connected metal sections forming an "H" shape supporting a photovoltaic panel 26. The photovoltaic panel 26 is secured to the support structure 25 by clamps 31 best shown in the enlarged details of FIGS. 6 and 7. The solar panel 2 has first and second opposite ends 2a, 2b. The first end 2a can be connected to the base 1 by a first shaft E1 and the second end 2b can be connected to the base 1 by a second shaft E2, such that the solar panel 2 can pivot with respect to the base 1 around said first shaft E1 when the first end 2a is connected to the base 1 and the second end 2b is disconnected from the base 1 (FIG. 2) and the solar panel 2 can pivot with respect to the base 1 around said second shaft E2 when the second end 2b is connected to the base 1 and the first end 2a is disconnected from the base 1 (FIG. 4).

[0038] The solar tracker includes a lifting mechanism installed in the base 1 and connected to the solar panel 2 in an intermediate region between said first and second ends 2a, 2b. This lifting mechanism is driven by an actuator 10 for pivoting the solar panel 2 between a raised position (FIGS. 2 and 4) and a position parallel to the base 1 (FIG. 3) according to the relative movements of the sun.

[0039] There is installed in the solar panel 2 an automatic connection/disconnection device connecting the second end 2b of the solar panel 2 to the base 1 while at the same time disconnecting the first end 2a of the solar panel 2 from the base 1, and vice versa, every time the solar panel 2 reaches said position parallel to the base 1 for inverting the inclination of the solar panel 2 with respect to the base 1 when the lifting mechanism is driven for again moving the solar panel 2 from the position parallel to the base 1 towards said raised position.

[0040] The first shaft E1 is defined by a pair of first coaxial journals 4 fixed to two corners of a first end of the base 1 and a pair of corresponding first coaxial half-bearings 8 fixed to two corners of the first end 2a of the solar panel 2, and the second shaft E2 is defined by a pair of second coaxial journals 5 fixed to two corners of a second end of the base 1 and a pair of corresponding second coaxial half-bearings 9 fixed to two corners of the second end 2b of the solar panel 2. The first and second half-bearings 8, 9 are formed by the rounded ends of notches formed in corresponding first and second casings 32, 33 of the automatic connection/disconnection device fixed to the solar panel 2, and are configured and arranged for receiving the respective first and second journals 4, 5 inserted in a radial direction in said notches when the solar panel 2 reaches said position parallel to the base 1.

[0041] A person skilled in the art will understand that although in the embodiments shown and described the first

and second journals 4, 5 are fixed to the base 1 and the first and second half-bearings 8, 9 together with the automatic connection/disconnection device are fixed to the solar panel 2, a reverse construction (not shown) in which the first and second journals 4, 5 are fixed to the solar panel 2 and the first and second half-bearings 8, 9 together with the automatic connection/disconnection device are fixed to the base 1 is within the scope of the present invention. An embodiment with only a first journal, a first half-bearing, a second journal and a second half-bearing is also within the scope of the present invention. First and second embodiments of the connection/disconnection device in relation to FIGS. 6-7 and 8-12, respectively, will be described below in detail.

[0042] FIG. 5 shows the aforementioned lifting mechanism used for varying the inclination of the solar panel 2 with respect to the base 1. The lifting mechanism comprises first and second movable arms 6, 7 having an upper end connected to a middle region of the support structure 25 of the solar panel 2 by a first articulation 3 (see also FIGS. 1 to 4). The first arm 6 has a lower end connected by a second articulation 11 to a first movable support 16a in which a first nut 12 is fixed and the second movable arm 7 has a lower end connected by a third articulation 13 to a second movable support 16b in which a second nut 14 is fixed.

[0043] These first and second nuts 12, 14 are coupled respectively to first and second threaded regions 15a, 15b of a screw 15 supported in the base 1 and rotatably driven by the aforementioned actuator 10. Said first and second threaded portions 15a, 15b of the screw 15 have opposite thread directions, such that when the screw is turned in one direction the first and second nuts 12, 14 move closer to one another and the first articulation 3 is raised for moving the solar panel 2 towards the raised position, and when it is turned in the direction opposite the first and second nuts 12, 14 move away from one another and the first articulation 3 moves downwards for moving the solar panel 2 towards the position parallel to the base.

[0044] The actuator 10, which in the example shown is an electronically controlled electric motor, is installed on a movable support 16 provided with an opening through which the screw 15 is inserted and operatively connected for driving the screw by means of a gear transmission 34. In the embodiment shown, the first articulation 3 is parallel to the first and second shafts E1, E2, the screw 15 has a rotation axis arranged in a direction perpendicular to the first and second shafts E1, E2, and the movable supports 16, 16a, 16b supporting the screw 15, the first and second nuts 14 and the actuator 10 are installed such that they can move freely with respect to the base 1 along a guide 17 (FIGS. 1 to 4) oriented in a direction parallel to said rotation axis of the screw 15.

[0045] Nevertheless, an alternative embodiment (not shown) in which the rotation axis of the screw 15 is arranged in a direction parallel to the first and second shafts E1, E2 is within the scope of the present invention, and even an alternative embodiment (not shown) provided with a single movable arm with an upper end connected to the solar panel and a lower end connected to a single nut coupled to a screw provided with a single threaded portion can be conceived. Any lifting mechanism based on a mechanical arrangement different from that shown and described in relation to FIG. 5 is also within the scope of the present invention provided that it is capable of pivoting the solar panel 2 around the first and second shafts E1, E2 between the raised position and the position parallel to the base under the drive of an actuator 10.

[0046] FIGS. 6 and 7 show a first embodiment of the automatic connection/disconnection device, comprising first and second closing elements 18, 19 associated with the first and second first half-bearings 8, 9, respectively. Each of the aforementioned first closing elements 18 is installed in one of the first casings 32 such that it can move relative to the corresponding first half-bearing 8 between a closed position (shown on the left in FIG. 7), in which said first closing element 18 closes the passage through the corresponding notch for retaining the first journal 4 coupled to the first half-bearing 8, and an open position (shown on the left in FIG. 6), in which the first closing element 18 allows the first journal 4 to slide along the notch for being coupled and decoupled to/from the first half-bearing 8. Similarly, each of the second closing elements 19 is installed in one of the second casings 33 such that it can move relative to the corresponding second half-bearing 9 between a closed position (shown on the right in FIG. 6), in which the second closing element 19 closes the passage through the corresponding notch for retaining the second journal 5 coupled to the second half-bearing 9, and an open position (shown on the right in FIG. 7), in which the second closing element 19 allows the second journal 5 to slide along the notch for being coupled and decoupled to/from the second half-bearing 9.

[0047] The first and second closing elements 18, 19 are kinematically linked to one another by a linking member 20 such that when the first closing element 18 is moved to said open position the second closing element 19 is moved to said closed position, and vice versa. For that purpose, the aforementioned linking member 20 extends between the first and second casings 32, 33 and is assembled such that it can slide axially with respect thereto. The first closing element 18 is connected in an articulated manner to a first end of a first rocker 35 the second end of which is connected in an articulated manner to the linking member 20, and a first elastic element 23 connected to the first rocker 35 is installed in a flip-flop arrangement whereby said first elastic element 23 pushes the first closing element 18 towards the closed position and towards the open position from an intermediate neutral position.

[0048] Similarly, the second closing element 19 is connected in an articulated manner to a first end of a second rocker 36 the second end of which is connected in an articulated manner to the linking member 20, and a second elastic element 24 connected to the second rocker 36 is installed in a flip-flop arrangement whereby said second elastic element 24 pushes the second closing element 19 towards the closed position and towards the open position from an intermediate neutral position. It will be understood that in accordance with the kinematic link between the first and second closing elements 18, 19 provided by the linking member 20 and the first and second rockers 35, 36, a single elastic element connected to any element of the kinematic chain and installed in a flip-flop arrangement would be sufficient.

[0049] The automatic connection/disconnection device further comprises a first activation lever 21 positioned in the first casing 32 at the entrance of the notch defining the first half-bearing 8 such that it is movable between a stand-by position (shown on the left in FIG. 6), in which the first activation lever 21 interferes with the passage along the corresponding notch, and an activation position (shown on the left in FIG. 7), in which the first activation lever 21 is withdrawn from the notch. This first activation lever 21 is pushed from the stand-by position to the activation position by the

first journal 4 when the solar panel 2, after a downward pivoting movement around the second shaft E2, reaches said position parallel to the base 1 and the first journal 4 is inserted in the corresponding notch for being coupled with the first half-bearing 8.

[0050] Similarly, a second activation lever 22 is positioned in the second casing 33 at the entrance of the notch defining the second half-bearing 9 such that it is movable between a stand-by position (shown on the right in FIG. 7), in which the second activation lever 22 interferes with the passage along the corresponding notch, and an activation position (shown on the right in FIG. 6), in which the second activation lever 22 is withdrawn from the notch. This second activation lever 22 is pushed from the stand-by position to the activation position by the second journal 5 when the solar panel 2, after a downward pivoting movement around the first shaft E1, reaches the position parallel to the base 1 and the second journal 5 is inserted in the corresponding notch for being coupled with the second half-bearing 9.

[0051] The first activation lever 21 is kinematically linked by a first connecting rod 37 to a first pusher 27 arranged relative to one end of the linking member 20 such that when the first activation lever 21 is moved by the first journal 4 from its stand-by position to its activation position the first pusher 27 pushes the linking member 20 and the latter in turn by means of the first rocker 35 moves the first closing element 18 from the open position to beyond said intermediate neutral position, from which the first elastic element 23 ends up suddenly moving the first closing element 18 to the closed position, whereby the first closing element 18 traps the first journal 4 in coupling with the first half-bearing 8 for defining the first shaft E1. At the same time, and in accordance with the kinematic link provided by the linking member 20 and the first and second rockers 35, 36, the second closing element 19 is moved to its open position, whereby the second closing element 19 releases the second journal 5 so that it can be decoupled from the second half-bearing 9.

[0052] Similarly, the second activation lever 22 is kinematically linked by a second connecting rod 38 to a second pusher 28 arranged relative to the other end of the linking member 20 such that when the second activation lever 22 is moved by the second journal 5 from its stand-by position to its activation position the second pusher 28 pushes the linking member 20 and the latter in turn by means of the second rocker 36 moves the second closing element 19 from the open position to beyond said intermediate neutral position, from which the second elastic element 24 ends up suddenly moving the second closing element 19 to the closed position, whereby the second closing element 19 traps the second journal 5 in coupling with the second half-bearing 9 for defining the second shaft E2. At the same time, and in accordance with the kinematic link provided by the linking member 20 and the first and second rockers 35, 36, the first closing element 18 is moved to its open position, whereby the first closing element 18 releases the first journal 4 so that it can be decoupled from the first half-bearing 8.

[0053] FIGS. 8 to 12 show a second alternative embodiment of the automatic connection/disconnection device. Similarly to the first embodiment, the solar tracker comprises a base 1 and a solar panel 2 comprising, for example, a support structure supporting at least one photovoltaic panel. The first shaft E1 is defined by the coupling of a pair of first coaxial journals 4 fixed to the base 1 with a pair of corresponding first coaxial half-bearings 8 formed by notches of first casings 32

fixed to the solar panel 2, and a second shaft E2 is defined by the coupling of a pair of second coaxial journals 5 fixed to the base 1 with a pair of corresponding second half-coaxial bearings 9 formed in the ends of notches formed in second casings 33 fixed to the solar panel 2.

[0054] In each of the first casings 32 there is a first closing element 18 and a first activation lever 21 positioned relative to the notch defining the first half-bearing 8. The first closing element 18 and the first activation lever 21 are formed in a single part which is movable between a first position (shown on the left in FIG. 12), in which the first closing element 18 is in the open position and the first activation lever 21 is in the stand-by position, and a second position (not shown), in which the first closing element 18 is in the closed position and the first activation lever 21 is in the activation position. The first activation lever 21 is pushed by the first journal 4 from the stand-by position to the activation position when the first journal 4 is inserted in the corresponding notch, whereby the first closing element 18 retains the first journal 4 coupled to the first half-bearing 8, and the first closing element 18 is pushed from the closed position to the open position by the first journal 4 when the latter comes out of the corresponding notch and is decoupled from the first half-bearing 8.

[0055] Similarly, in each of the second casings 32 there is a second closing element 19 and a second activation lever 22 positioned relative to the notch defining the second half-bearing 9. The second closing element 19 and the second activation lever 22 are formed in a single part which is movable between a first position (not shown), in which the first closing element 18 is in the open position and the first activation lever 21 is in the stand-by position, and a second position (shown on the right in FIG. 12), in which the first closing element 18 is in the closed position and the first activation lever 21 is in the activation position. The second activation lever 22 is pushed by the second journal 5 from the stand-by position to the activation position when the second journal 5 is inserted in the corresponding notch, whereby the second closing element 19 retains the second journal 5 coupled to the second half-bearing 9, and the second closing element 19 is pushed from the closed position to the open position by the second journal 5 when the latter comes out of the corresponding notch and is decoupled from the second half-bearing 9.

[0056] The automatic connection/disconnection device of this second embodiment further comprises a locking device configured for alternately locking the first and second closing elements 18, 19 in their respective closed positions, and for alternately unlocking the first and second closing elements 18, 19 and thereby allowing their movements between their respective closed and open positions.

[0057] As shown in FIG. 8, the two parts defining the first closing element 18 and the first activation lever 21 in each of the two first casings 32 are connected to one another by a first square cross-section connecting rod 39. A first closing support 41 is fixed in a middle region of this first connecting rod 39, assembled such that it can pivot around a first closing shaft 42 supported in the solar panel 2. This first closing support 41 has a first locking notch 43 (best shown in FIG. 10). A first pusher 27 is associated with the first closing support 41, assembled such that it can pivot independently around said first closing shaft 42. This first pusher 27 has an appendage 44 configured for acting as a stop for the first connecting rod 39.

[0058] The first pusher 27 is positioned relative to an end of a single linking member 20 extending between first and sec-

ond ends **2a**, **2b** of the solar panel **2** and assembled such that it can slide axially with respect thereto. In accordance with the stop between the appendage **44** and the first connecting rod **39**, the first pusher **27** can be turned in a first direction by the first activation levers **21** for pushing the linking member **20**, and it is turned in a second opposite direction by an elastic element (not shown) for recovering its initial position.

[0059] A first locking member **29**, which is assembled such that it can pivot around a first locking shaft **45** supported in the solar panel **2**, has an upper end connected in an articulated manner to a first end of the linking member **20** and a lower end provided with a first locking element **46**. This first locking member **29** can pivot between a locked position (FIGS. **8** and **9**), in which the first locking element **46** is inserted in the first locking notch **43** of the first closing support **41** for locking the first closing elements **18** in their closed positions, and an unlocked position (shown on the left in FIG. **12**), in which it allows the first closing elements **18** to move between said closed and open positions.

[0060] A first elastic element **23** connected to the first locking member **29** is installed in a flip-flop arrangement, such that this first elastic element **23** pushes the first locking element **29** towards the locked position and towards the unlocked position from an intermediate neutral position.

[0061] Similarly, the two parts defining the second closing element **19** and the second activation lever **22** in each of the two second casings **33** are connected to one another by a second square cross-section connecting rod **40**. A second closing support (not shown) is fixed in a middle region of this second connecting rod **40** assembled such that it can pivot around a second closing shaft **47** supported in the solar panel **2**. This second closing support has a second locking notch **48** (shown by means of dotted lines in FIG. **12**). A second pusher **28** is associated with the second closing support, assembled such that it can pivot independently around said second closing shaft **47**. This second pusher **28** has an appendage **49** configured for acting as a stop for the second connecting rod **40**.

[0062] The second pusher **28** is positioned relative to another opposite end of the linking member **20**. In accordance with the stop between the appendage **49** and the second connecting rod **40**, the second pusher **28** can be turned in a first direction by the second activation levers **22** for pushing the linking member **20**, and it is turned in a second opposite direction by an elastic element (not shown) for recovering its initial position.

[0063] A first second locking member **30**, which is assembled such that it can pivot around a second locking shaft **50** supported in the solar panel **2**, has an upper end connected in an articulated manner to a second end of the linking member **20** and a lower end provided with a second locking element **51** (shown by means of dotted lines in FIG. **12**). This second locking member **30** can pivot between a locked position (shown on the right in FIG. **12**), in which the second locking element **51** is inserted in the second locking notch **48** of the second closing support for locking the second closing elements **19** in their closed positions, and an unlocked position (not shown), in which it allows the second closing elements **18** to move between said closed and open positions.

[0064] A second elastic element **24** connected to the second locking member **30** is installed in a flip-flop arrangement, such that this second elastic element **24** pushes the second locking element **30** towards the locked position and towards the unlocked position from an intermediate neutral position.

[0065] It will be observed in this second embodiment of the automatic connection/disconnection device that the linking member **20** kinematically links the first and second locking elements **29**, to one another such that when the first locking element **29** is moved to its locked position the second locking element **30** is moved to its unlocked position, and vice versa. In accordance with this kinematic link, an alternative embodiment in which there is a single elastic element installed in a flip-flop arrangement and connected to any of the first and second locking elements **29**, **30** or even to the linking member **20** for pushing the first and second locking elements **29**, **30** towards their locked and unlocked positions from an intermediate neutral position is considered within the scope of the present invention.

[0066] A reverse construction of this second embodiment, where the first and second journals **4**, **5** are fixed to the solar panel **2** and the first and second half-bearings **8**, **9** together with the automatic connection/disconnection device are installed in the base **1**, is also within the scope of present invention. A variant of this second embodiment where the first and second activation levers **21**, **22** are not formed in the same part as their respective first and second closing elements **18**, **19**, but are separate parts kinematically linked to the respective first and second closing elements **18**, **19** by one or more connecting elements is also within the scope of present invention. Likewise, in any of the first and second embodiments, the first and second activation levers **21**, **22** can be positioned alternatively such that they are pushed from their stand-by positions to their activation positions by any element attached to the base **1** different from the first and second journals **4**, **5** (or any element attached to the solar panel **2** different from the first and second journals **4**, **5** in the case of the aforementioned reverse construction) when the solar panel **2** pivoting around the first or second shaft **E1**, **E2** reaches said position parallel to the base **1**.

1. A solar tracker of the type comprising:

- a base;
- a solar panel having first and second opposite ends, wherein said first end is connected to said base by a first shaft such that said solar panel can pivot with respect to the base around said first shaft;
- a lifting mechanism connected to the solar panel in an intermediate region between said first and second ends; and
- an actuator operatively connected for moving said lifting mechanism and thereby pivoting said solar panel around the first shaft according to the relative movements of the sun;

characterized in that:
 said actuator and the lifting mechanism are configured for pivoting the solar panel between a raised position and a position parallel to the base;
 the first end of the solar panel can be disconnected from the base;
 the second end of the solar panel can be connected to the base by a second shaft parallel to the first shaft such that the solar panel can pivot with respect to the base around said second shaft when the second end is connected to the base and the first end is disconnected from the base; and

the solar tracker further comprises an automatic connection/disconnection device connecting the second end of the solar panel to the base while at the same time disconnecting the first end of the solar panel from the base,

and vice versa, every time the solar panel reaches said position parallel to the base for inverting the inclination of the solar panel with respect to the base when the lifting mechanism is driven for moving the solar panel from the position parallel to the base towards said raised position.

2. The solar tracker according to claim 1, characterized in that said first shaft is defined by at least a first journal fixed to the base and at least a corresponding first half-bearing fixed to the solar panel, or vice versa, said first half-bearing being configured and arranged for receiving said first journal in a radial direction when the solar panel reaches said position parallel to the base, and said second shaft is defined by at least a second journal fixed to the base and at least a corresponding second half-bearing fixed to the solar panel, or vice versa, said second half-bearing being configured and arranged for receiving said second journal in a radial direction when the solar panel reaches said position parallel to the base.

3. The solar tracker according to claim 2, characterized in that said automatic connection/disconnection device comprises at least a first closing element movable relative to said first half-bearing between a closed position, in which said first closing element retains the first journal coupled to the first half-bearing, and an open position, in which the first closing element allows the first journal to be coupled and decoupled to/from the first half-bearing, and at least a second closing element movable relative to said second half-bearing between a closed position, in which the second closing element retains the second journal coupled to the second half-bearing, and an open position, in which the second closing element allows the second journal to be coupled and decoupled to/from the second half-bearing.

4. The solar tracker according to claim 3, characterized in that said automatic connection/disconnection device further comprises at least one linking member kinematically linking said first and second closing elements to one another such that when the first closing element is moved to said open position the second closing element is moved to said closed position, and vice versa.

5. The solar tracker according to claim 4, characterized in that the automatic connection/disconnection device further comprises at least one elastic element installed in a flip-flop arrangement whereby said elastic element pushes said first and second closing elements towards their closed and open positions from an intermediate neutral position.

6. The solar tracker according to claim 5, characterized in that the automatic connection/disconnection device further comprises a first activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the second shaft reaches said position parallel to the base, said first activation lever being kinematically linked to a first pusher arranged for moving said first closing element from the open position to beyond said intermediate neutral position when the first activation lever is pushed to said activation position, and a second activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the first shaft reaches said position parallel to the base, said second activation lever being kinematically linked to a second pusher arranged for moving said second closing element from

the open position to beyond said intermediate neutral position when the second activation lever is pushed to said activation position.

7. The solar tracker according to claim 3, characterized in that said automatic connection/disconnection device further comprises a first locking member movable between a locked position, in which said first locking member locks the first closing element in said closed position, and an unlocked position, in which the first locking member allows the first closing element to move between said closed and open positions, a second locking member movable between a locked position, in which said second locking member locks the second closing element in said closed position, and an unlocked position, in which the second locking member allows the second closing element to move between said closed and open positions, and a linking member kinematically linking said first and second locking elements to one another such that when the first locking element is moved to said locked position the second locking element is moved to said unlocked position, and vice versa.

8. The solar tracker according to claim 7, characterized in that the automatic connection/disconnection device further comprises at least one elastic element installed in a flip-flop arrangement whereby said elastic element pushes said first and second locking elements towards their locked and unlocked positions from an intermediate neutral position.

9. The solar tracker according to claim 8, characterized in that the automatic connection/disconnection device further comprises a first activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the second shaft reaches said position parallel to the base, said first activation lever being kinematically linked to a first pusher arranged for moving said first locking element from the unlocked position to beyond said intermediate neutral position when the first activation lever is pushed to said activation position, and a second activation lever positioned such that it is pushed from a stand-by position to an activation position by an element attached to the base or to the solar panel when the solar panel pivoting around the first shaft reaches said position parallel to the base, said second activation lever being kinematically linked to a second pusher arranged for moving said second locking element from the unlocked position to beyond said intermediate neutral position when the second activation lever is pushed to said activation position.

10. The solar tracker according to claim 6, characterized in that the first activation lever is positioned at the entrance of said first half-bearing such that it is pushed from the stand-by position to the activation position by the first journal when it is received in the first half-bearing and the second activation lever is positioned at the entrance of said second half-bearing such that it is pushed from the stand-by position to the activation position by the second journal when the second journal is received in the second half-bearing.

11. The solar tracker according to claim 2, characterized in that said solar panel comprises a support structure supporting at least one photovoltaic panel and in that said first and second half-bearings together with the automatic connection/disconnection device are fixed to said support structure of the solar panel and said first and second journals are fixed to the base.

12. The solar tracker according to claim 1, characterized in that said lifting mechanism comprises at least a first movable arm having an upper end connected to the solar panel by a first

articulation and a lower end connected by a second articulation to a first nut coupled to a first threaded region of a screw supported in the base and rotatably driven by said actuator.

13. The solar tracker according to claim **12**, characterized in that the lifting mechanism further comprises at least a second movable arm having an upper end connected to the solar panel by the first articulation and a lower end connected by a third articulation to a second nut coupled to a second threaded region of said screw, said first and second threaded portions of the screw having opposite thread directions.

14. The solar tracker according to claim **13**, characterized in that the screw has a rotation axis arranged in a direction perpendicular to the first and second shafts.

15. The solar tracker according to claim **14**, characterized in that the screw, said first and second nuts and the actuator are

installed such that they move freely with respect to the base along a guide oriented in a direction parallel to said rotation axis of the screw.

16. The solar tracker according to claim **9**, characterized in that the first activation lever is positioned at the entrance of said first half-bearing such that it is pushed from the stand-by position to the activation position by the first journal when it is received in the first half-bearing and the second activation lever is positioned at the entrance of said second half-bearing such that it is pushed from the stand-by position to the activation position by the second journal when the second journal is received in the second half-bearing.

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