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(54) **SOLAR CONCENTRATORS, METHOD OF MANUFACTURING AND USES THEREOF**

Publication Classification

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USPC **126/600**

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(57) **ABSTRACT**

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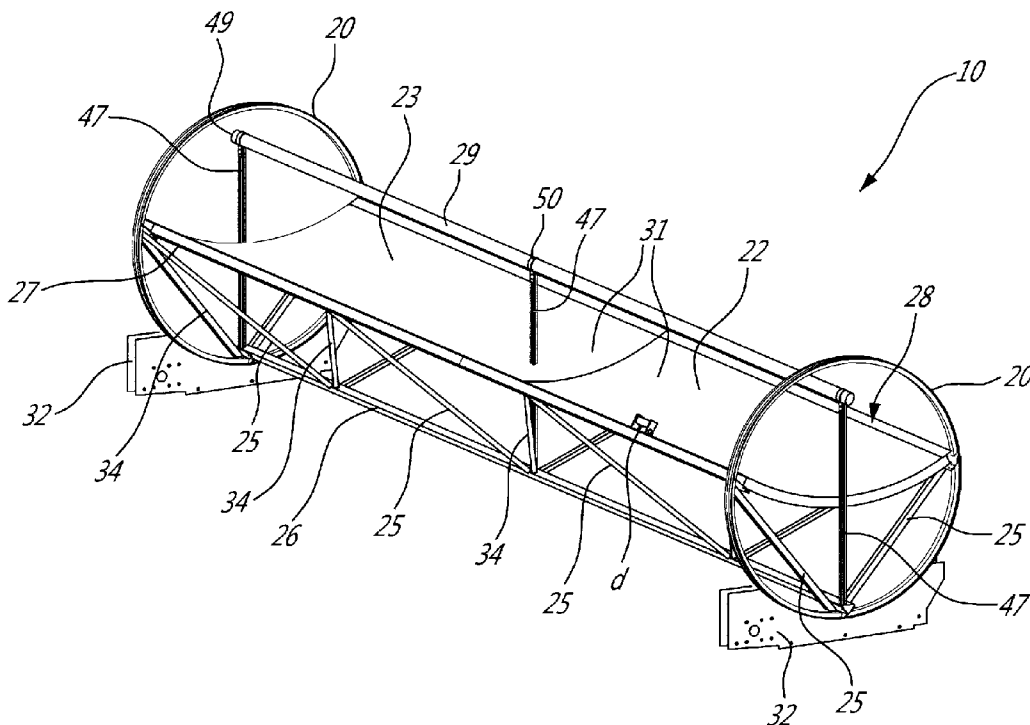
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Aug. 4, 2011 (CA) 2748632
Aug. 4, 2011 (CA) 2748635

A solar concentrator comprising at least one rigid parabolic self-supporting solar collector comprising at least one parabolic reflector and at least one heat collector rigidly supported above a reflective surface of the parabolic reflector; and a positioning unit configured for positioning the solar collector into an operation position for reception of solar beams by the parabolic reflector, and into a rest position in which the reflective surface of said parabolic reflector and the heat collector are at least partly under cover of a back surface of the parabolic reflector.



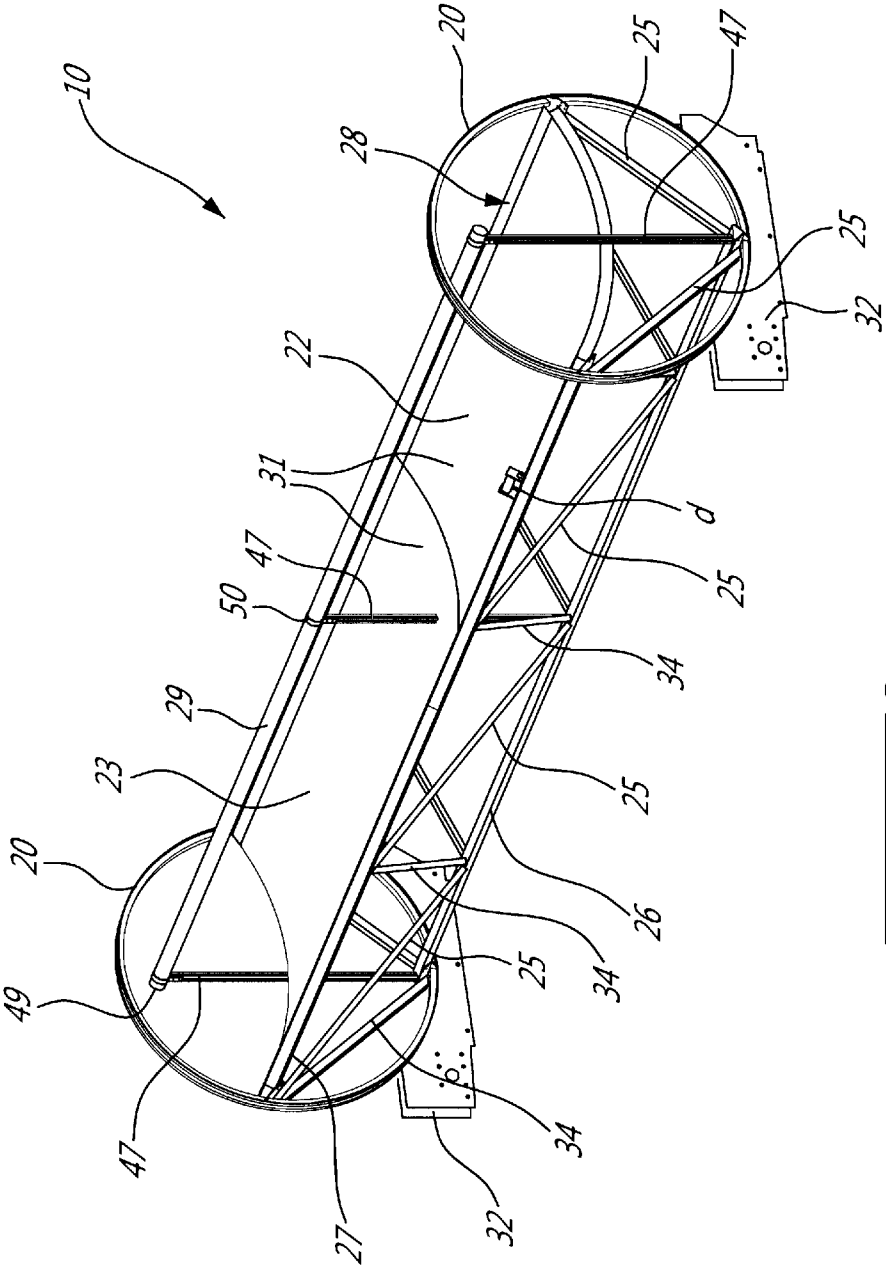


FIG. 1

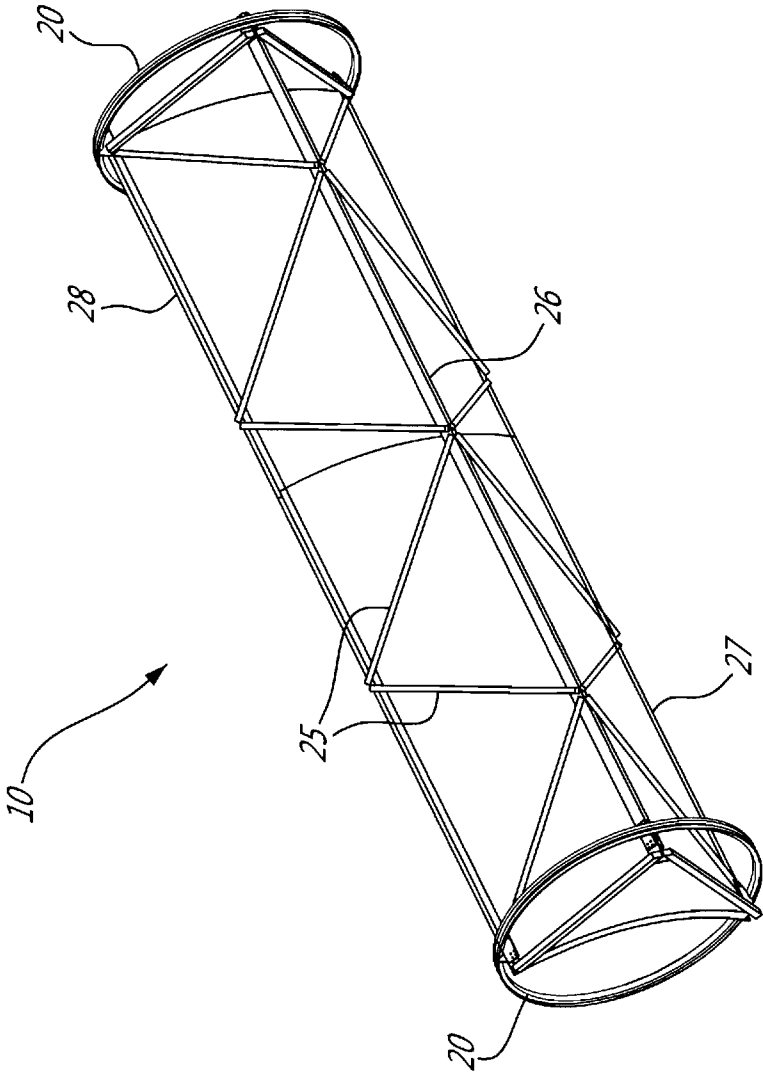


FIG. 2

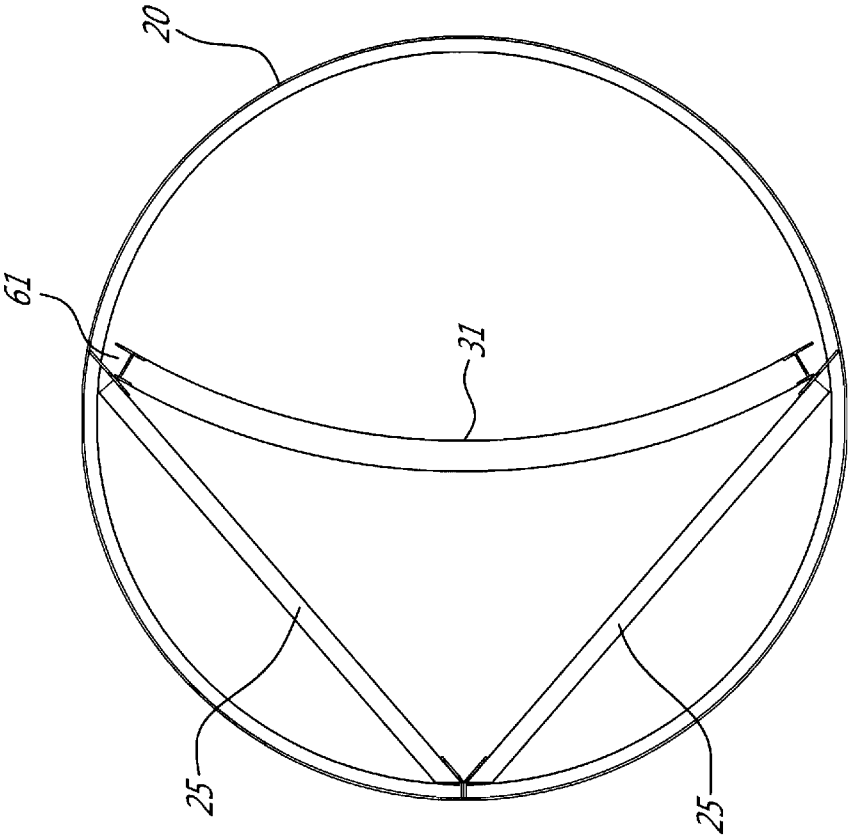


FIG. 3

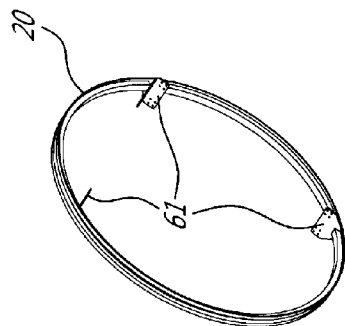


FIG. 4c

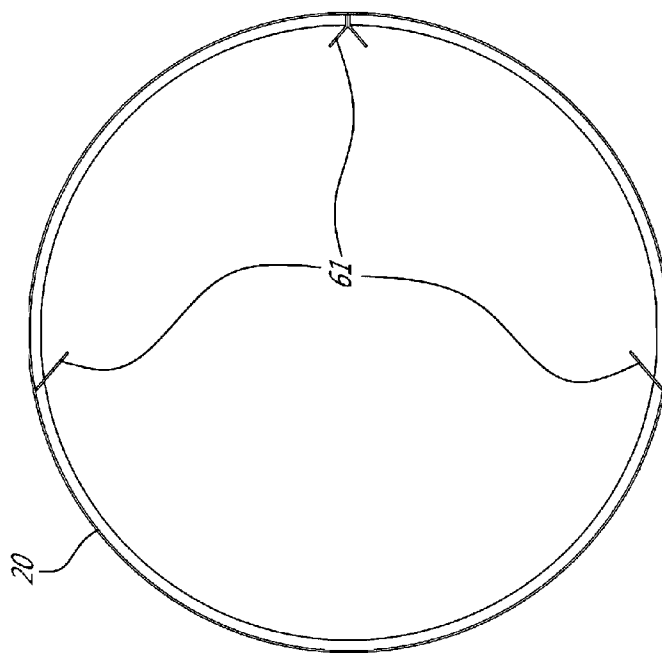


FIG. 4b

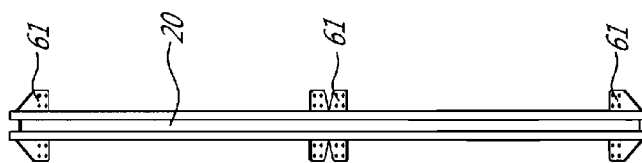


FIG. 4a

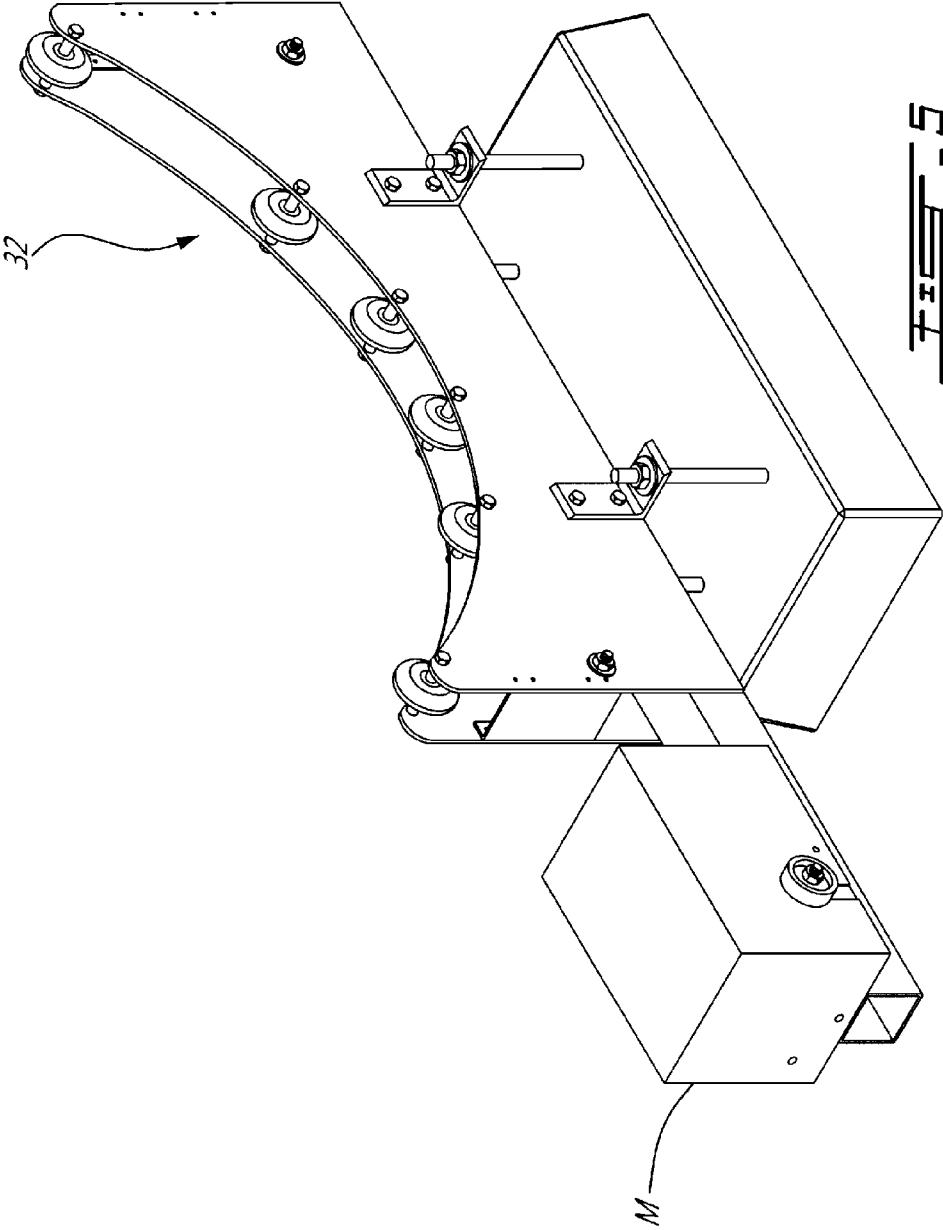


FIG. 5

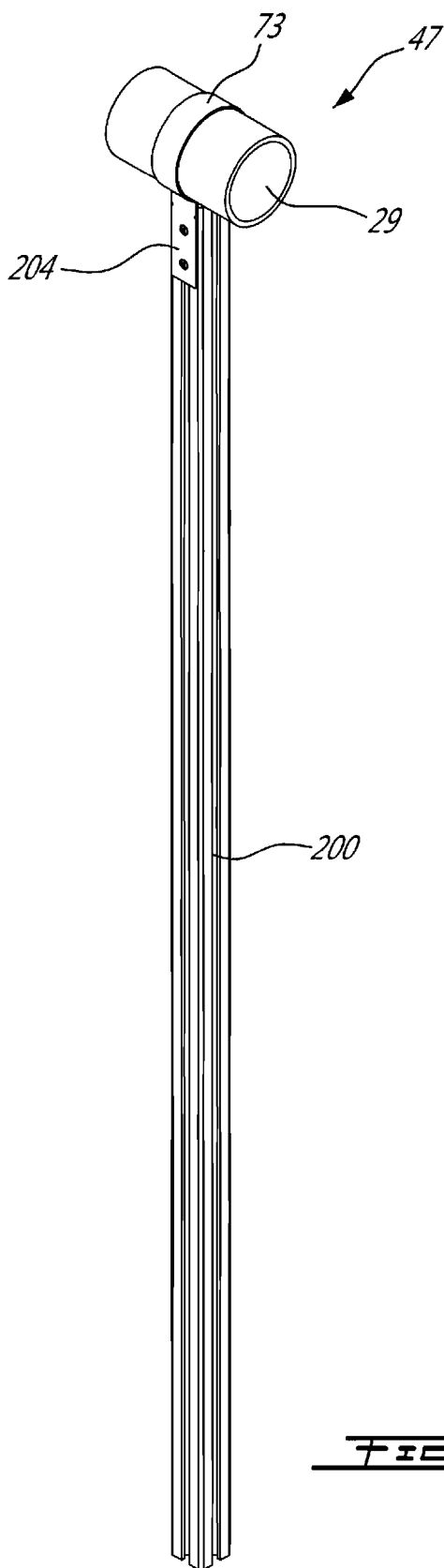


FIG. 6

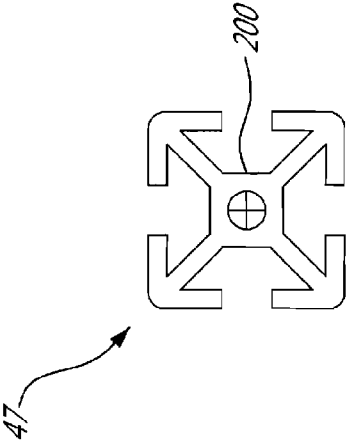


FIG. 7a

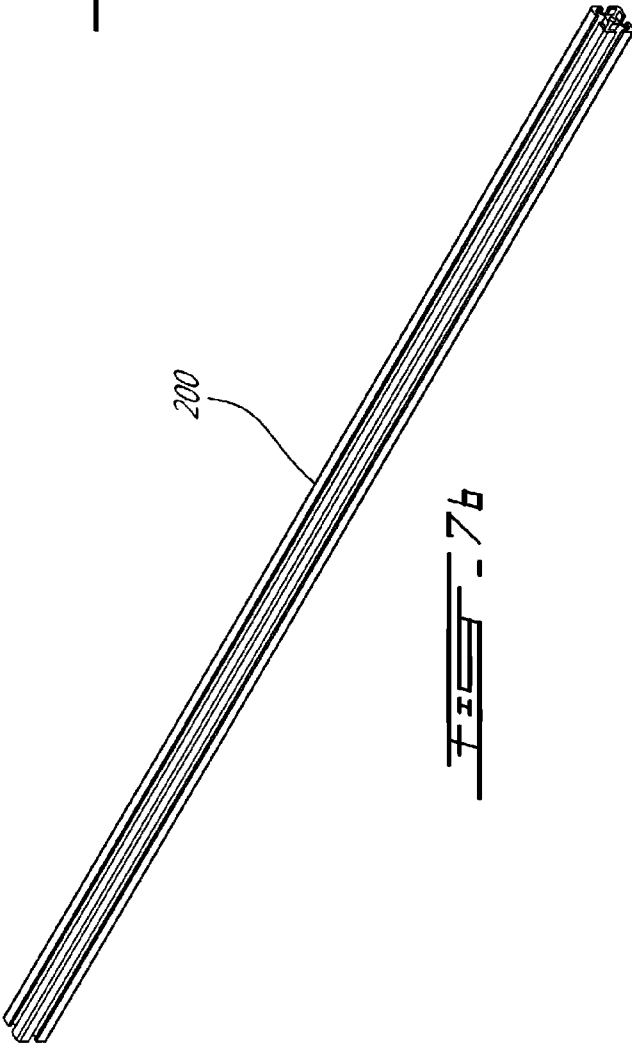
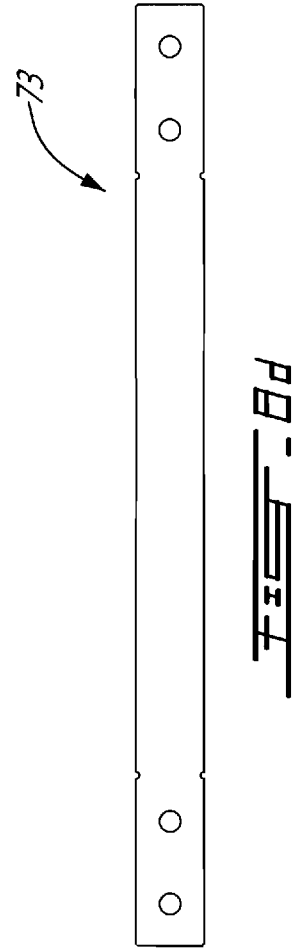
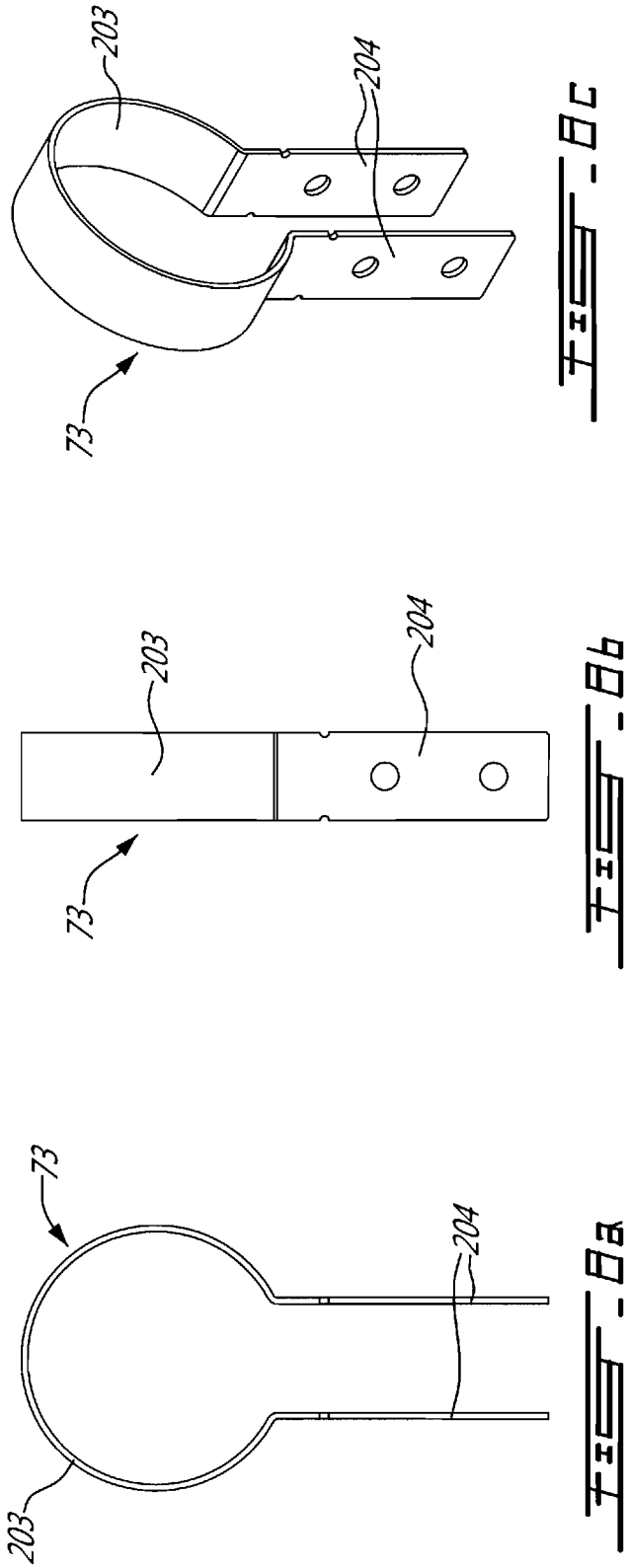


FIG. 7b



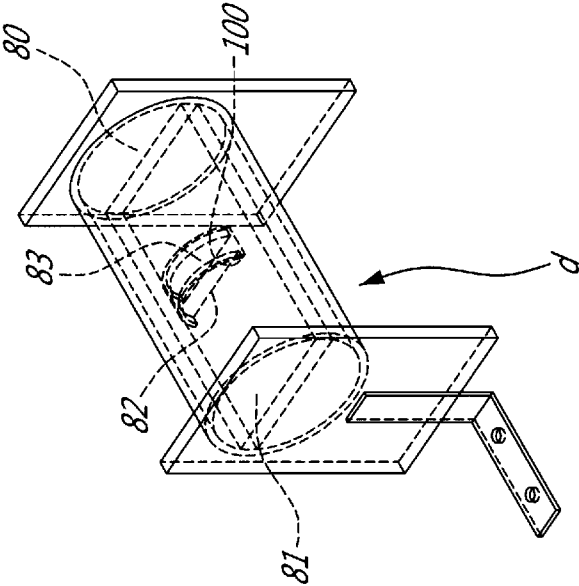


FIG. 9

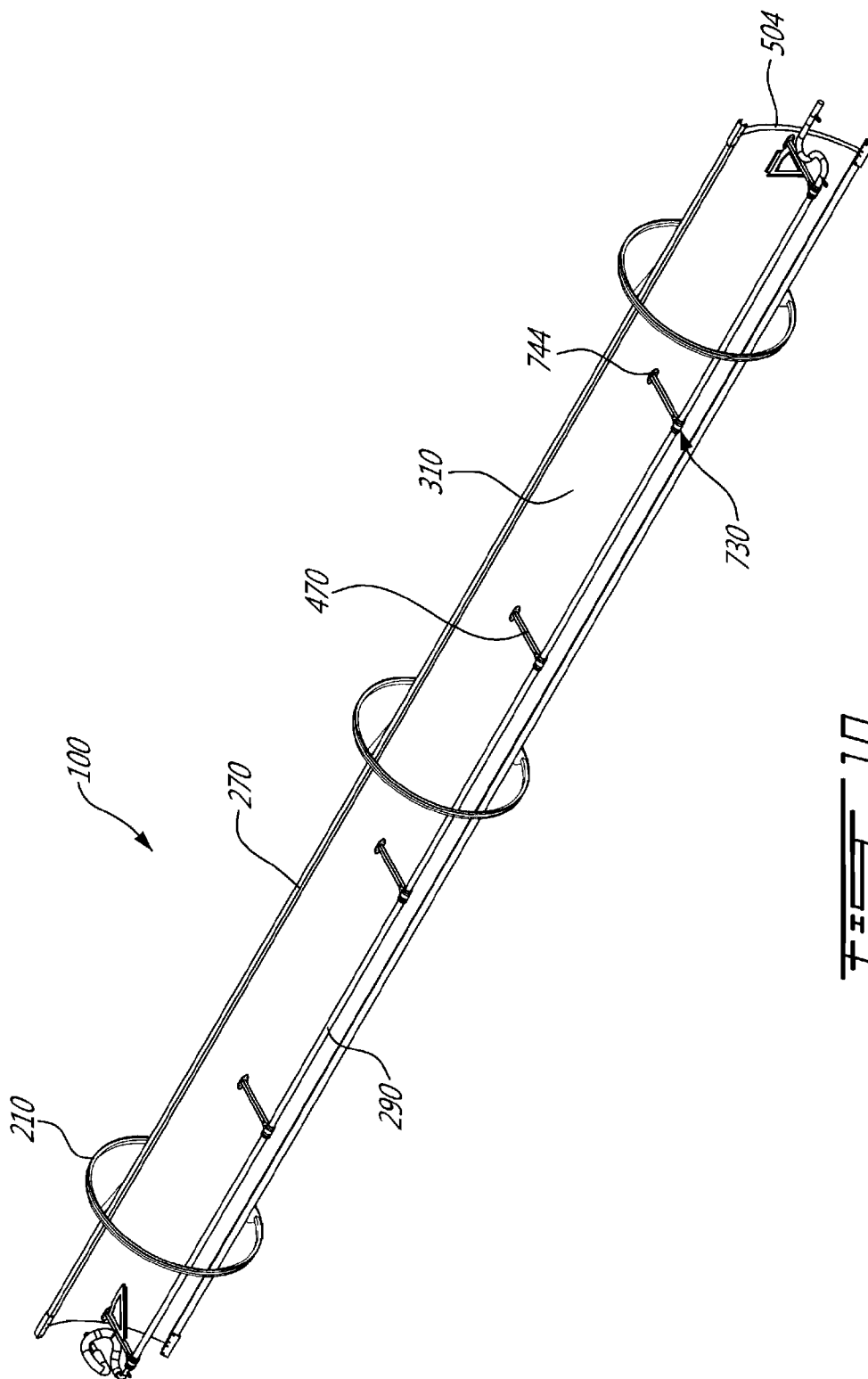


FIG. 10

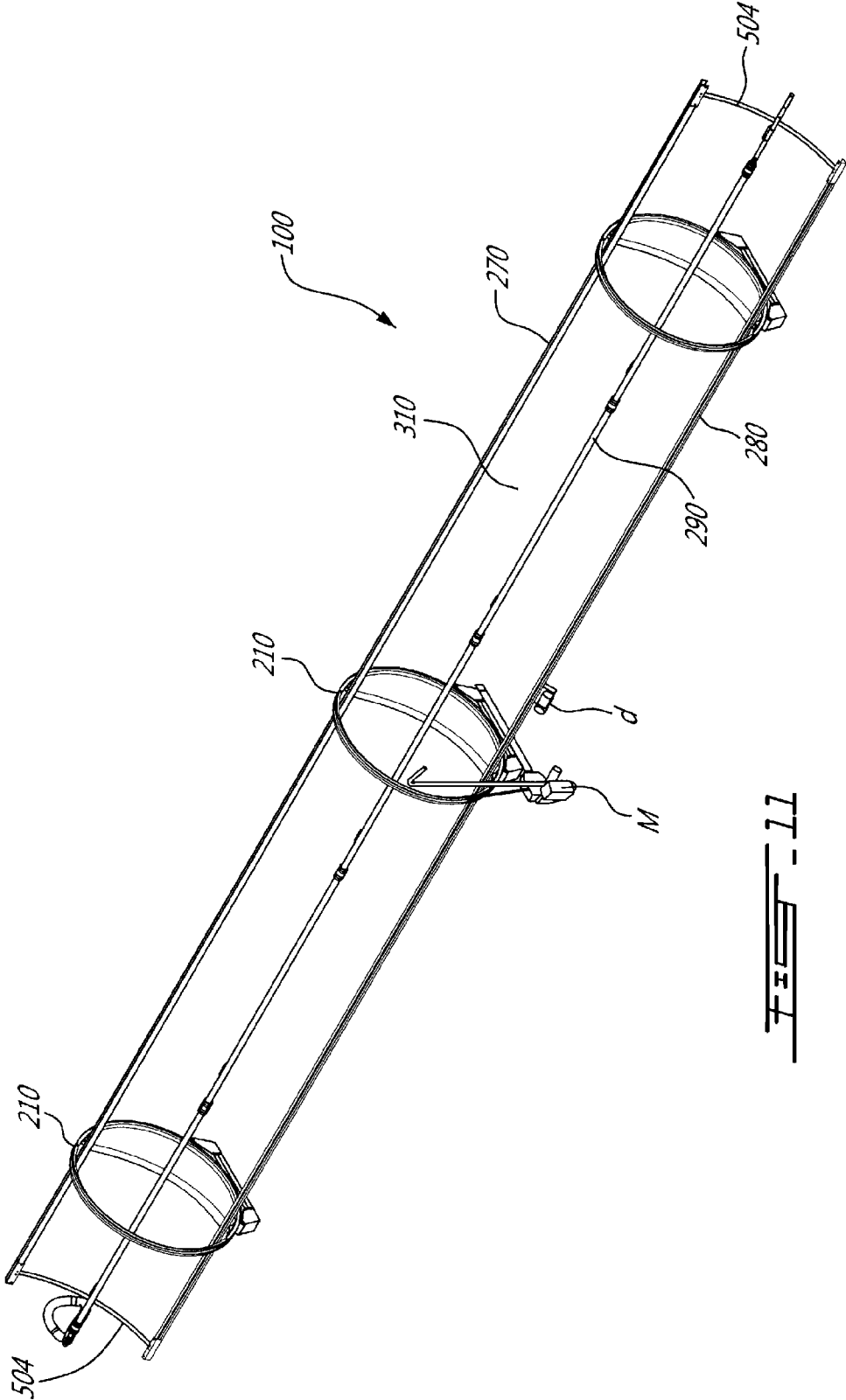


FIG. 11

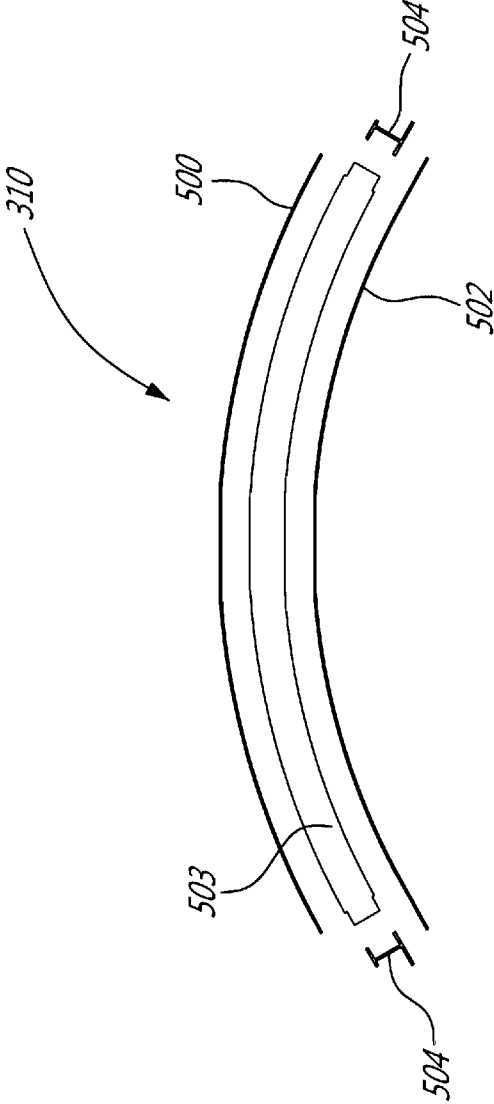


FIG. 12

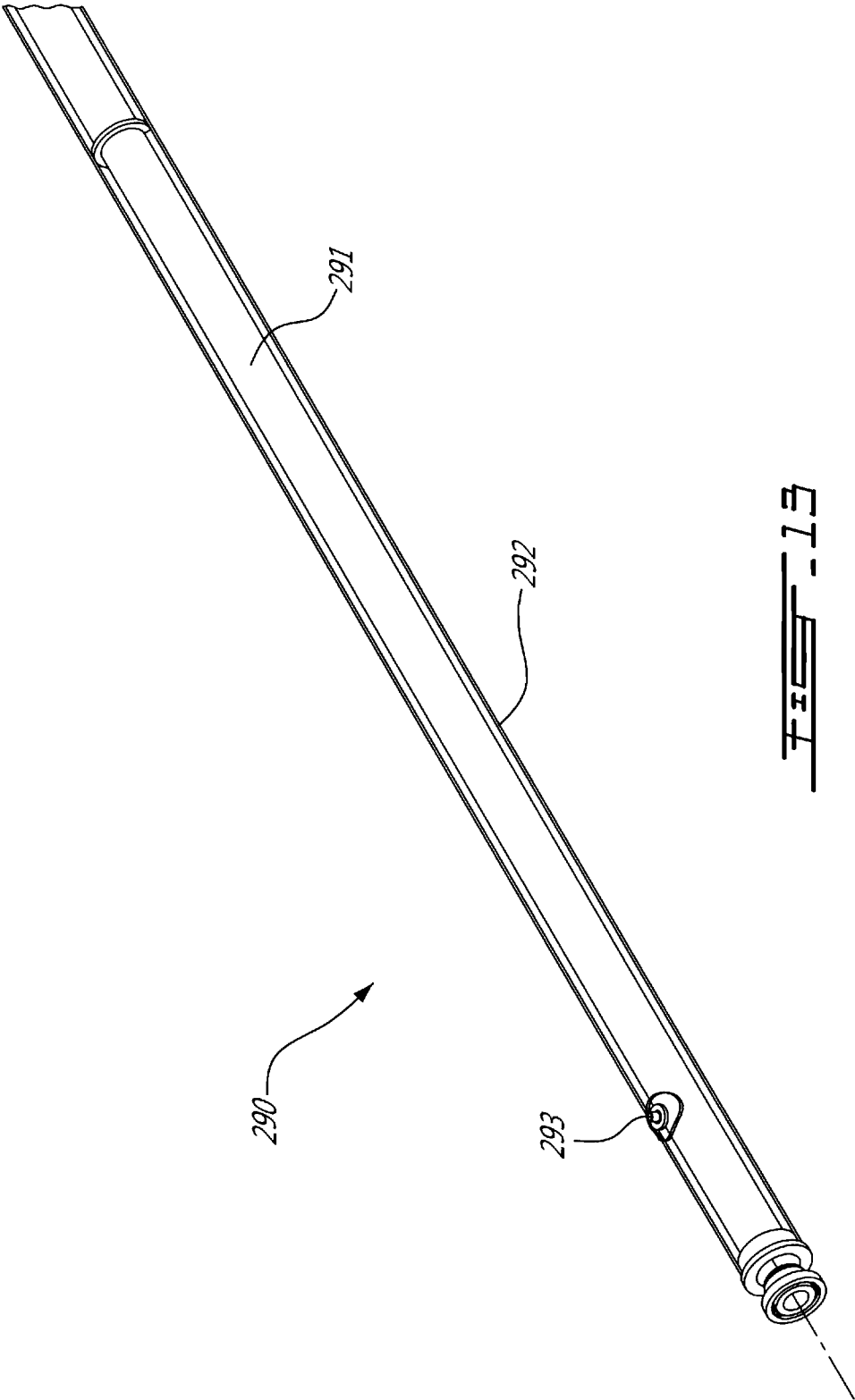
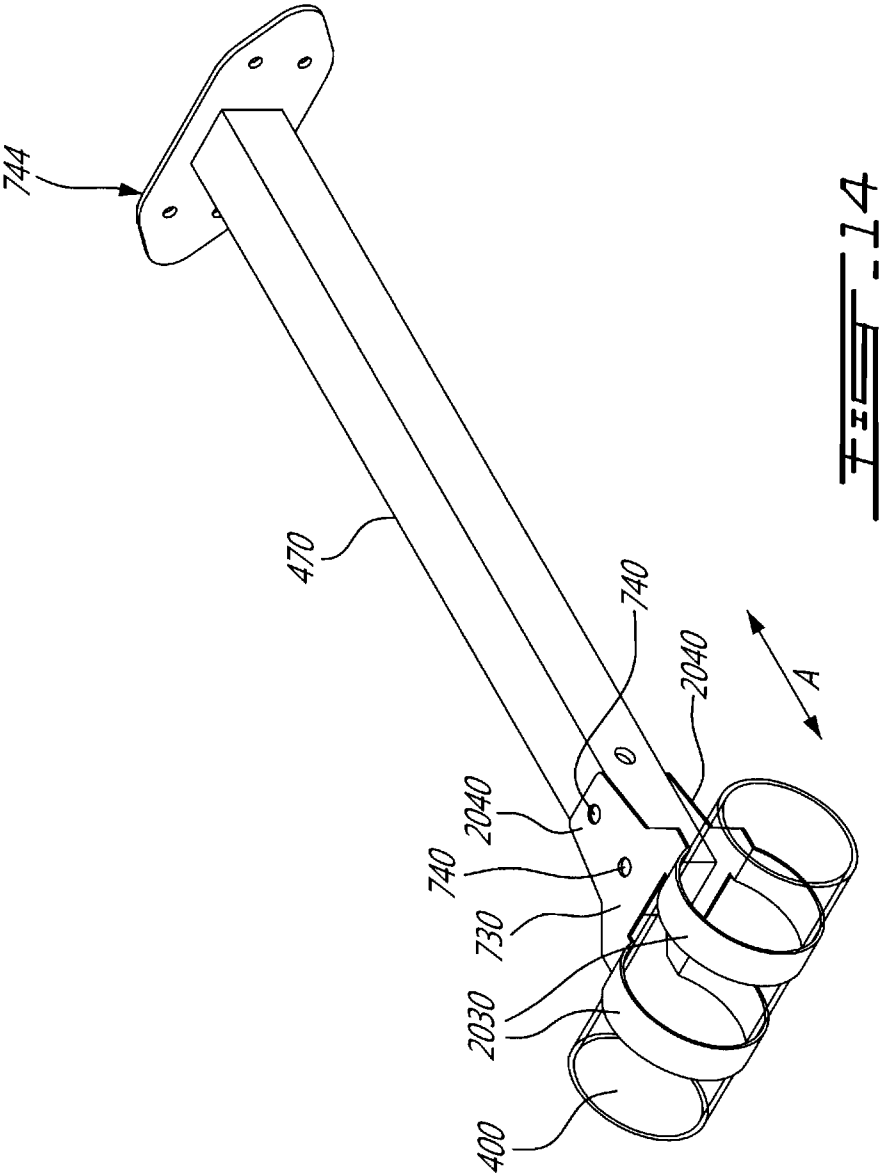


FIG. 13



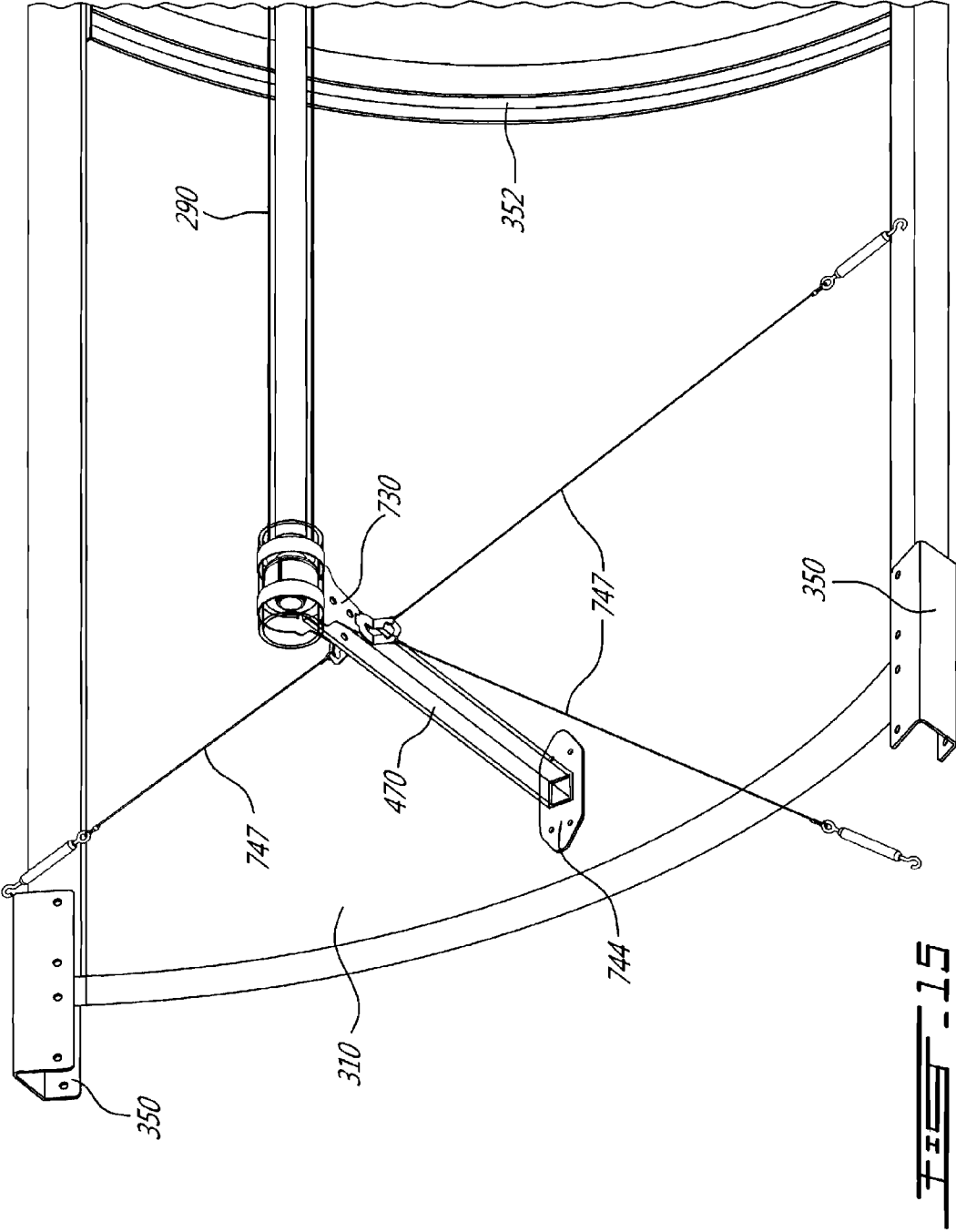


FIG. 15

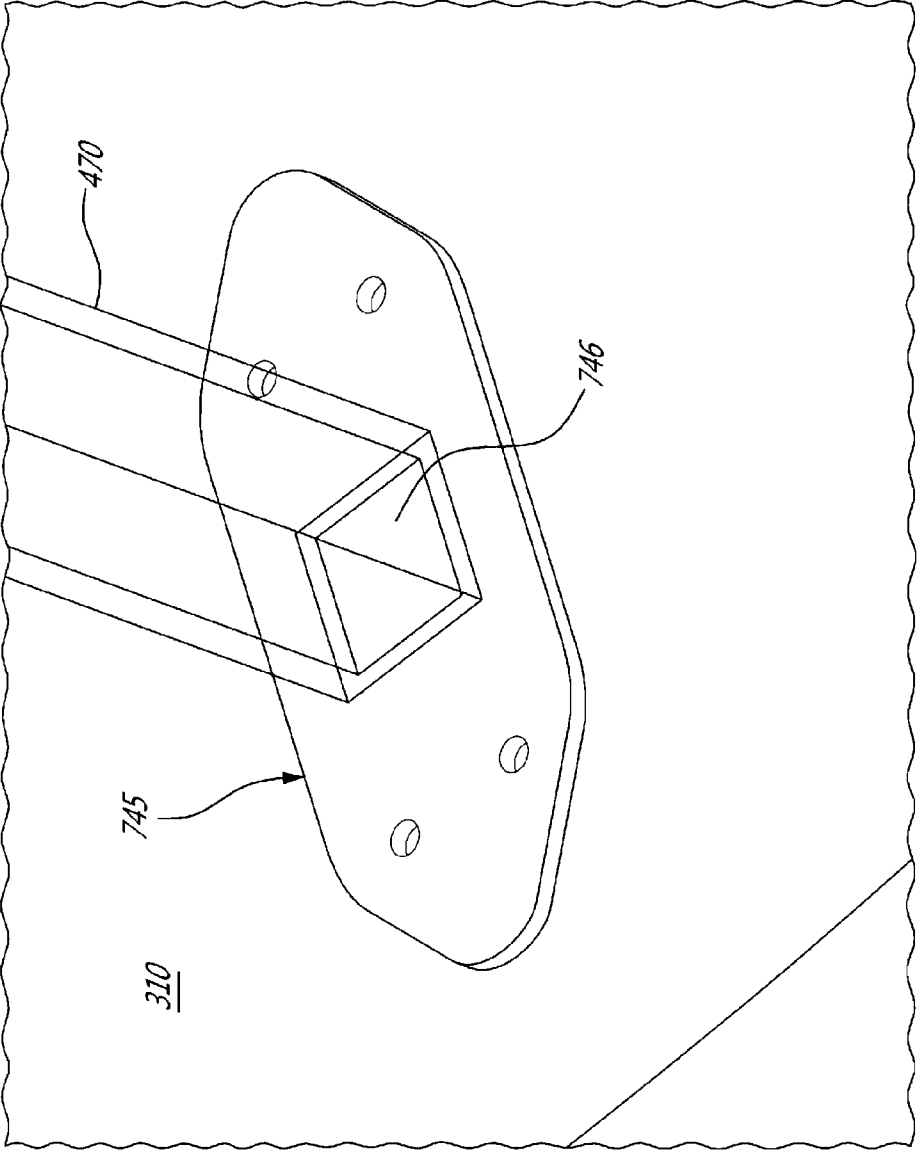
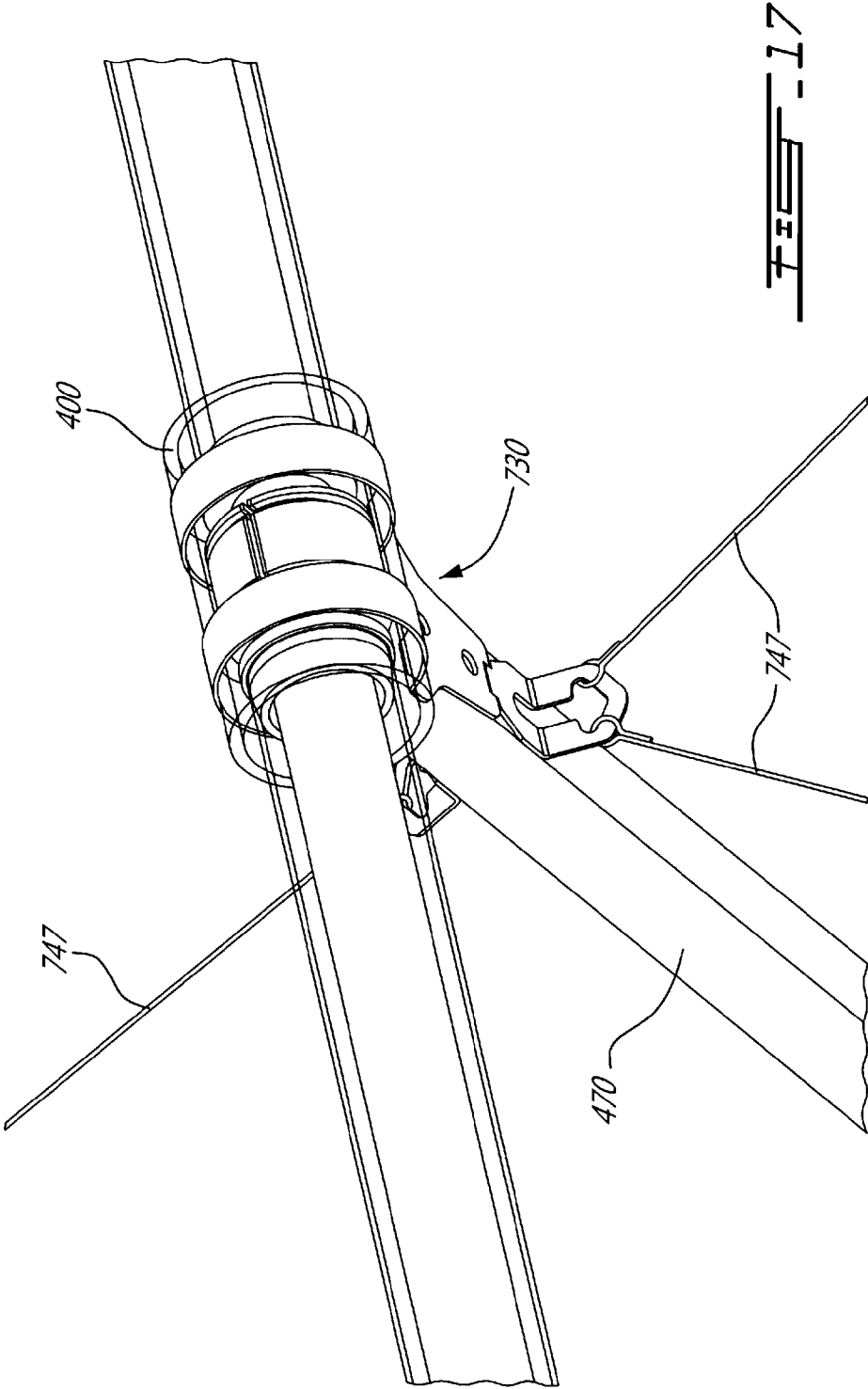


FIG. 16



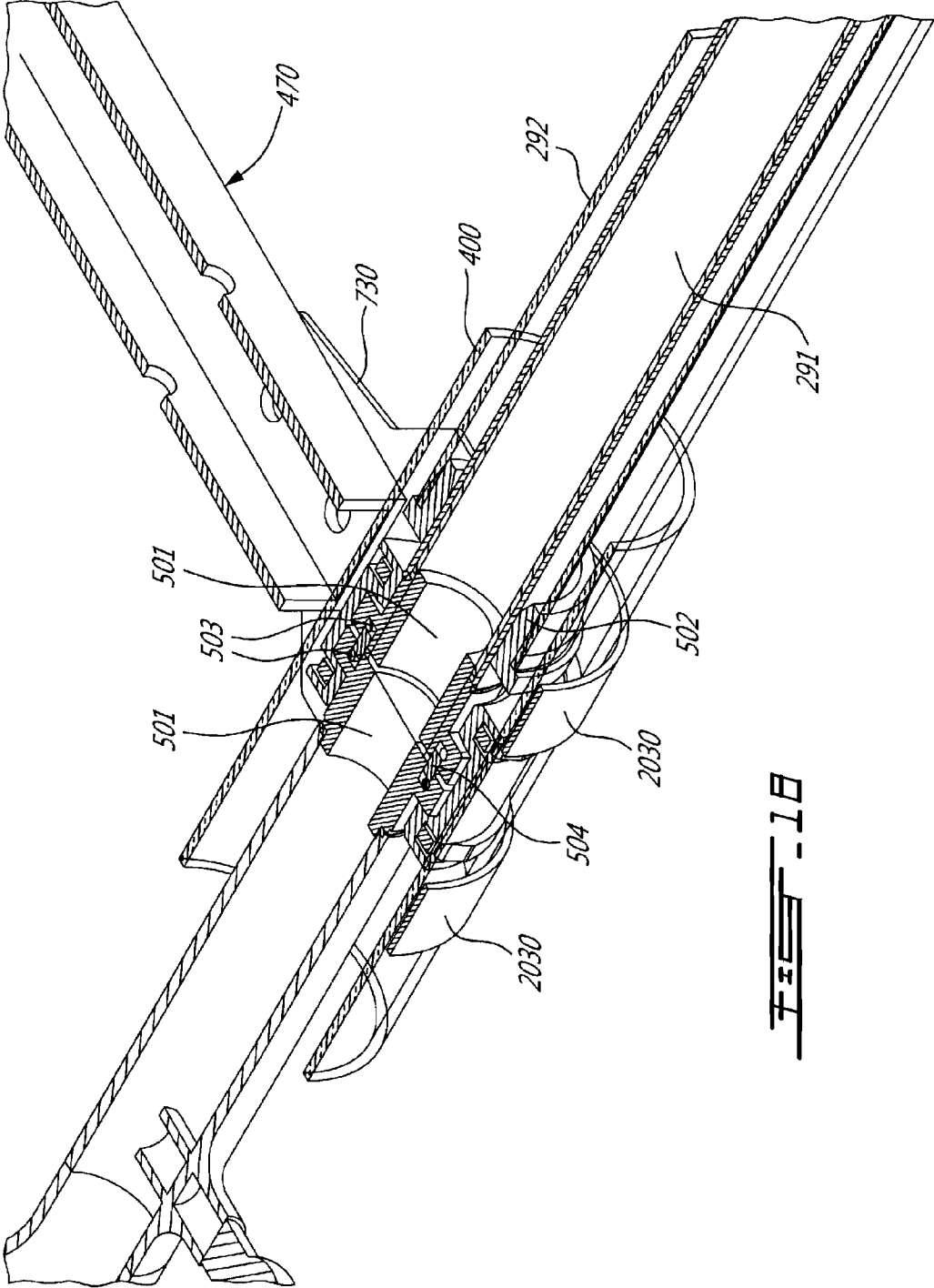


FIG. 10

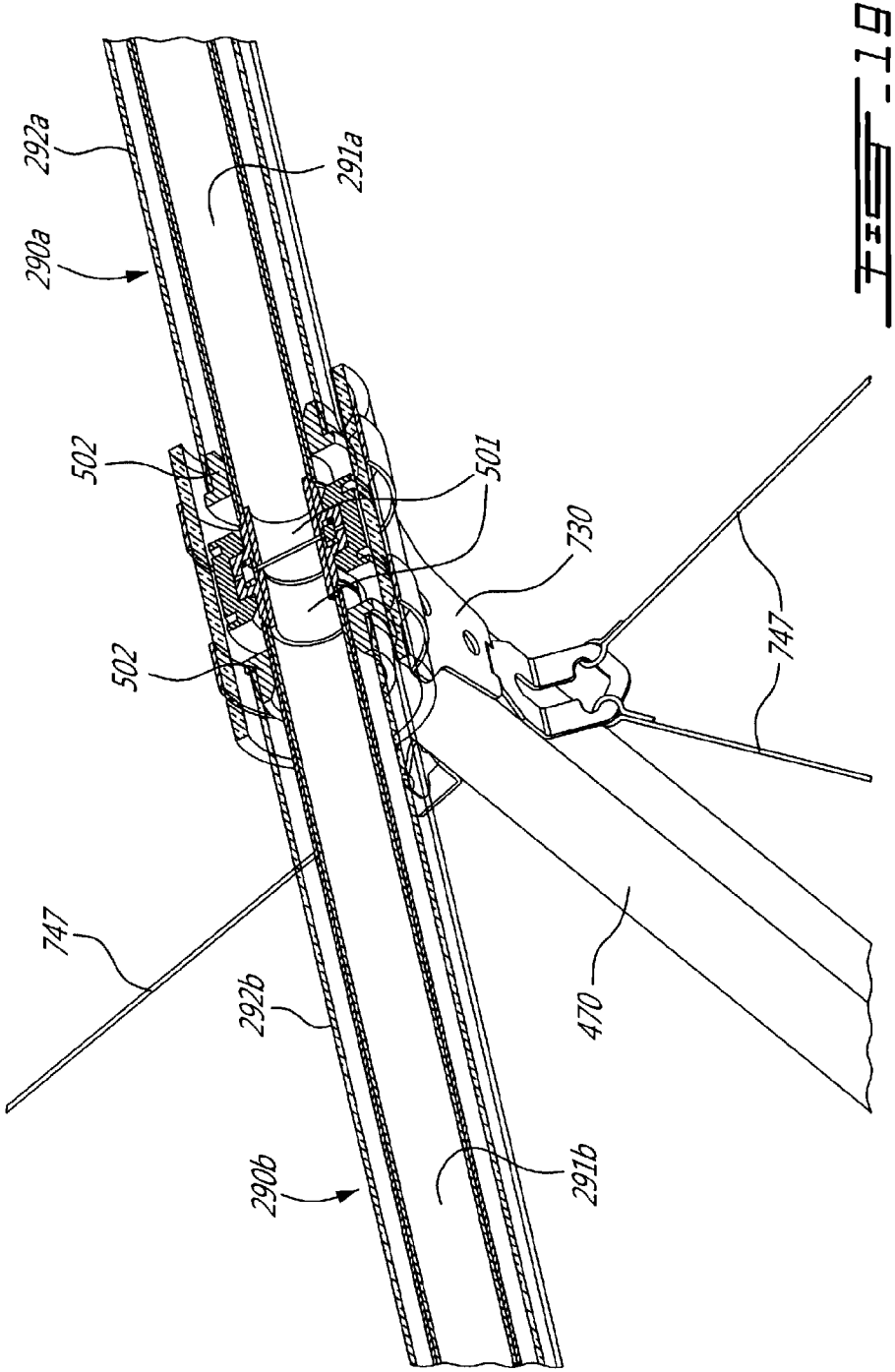


FIG. 19

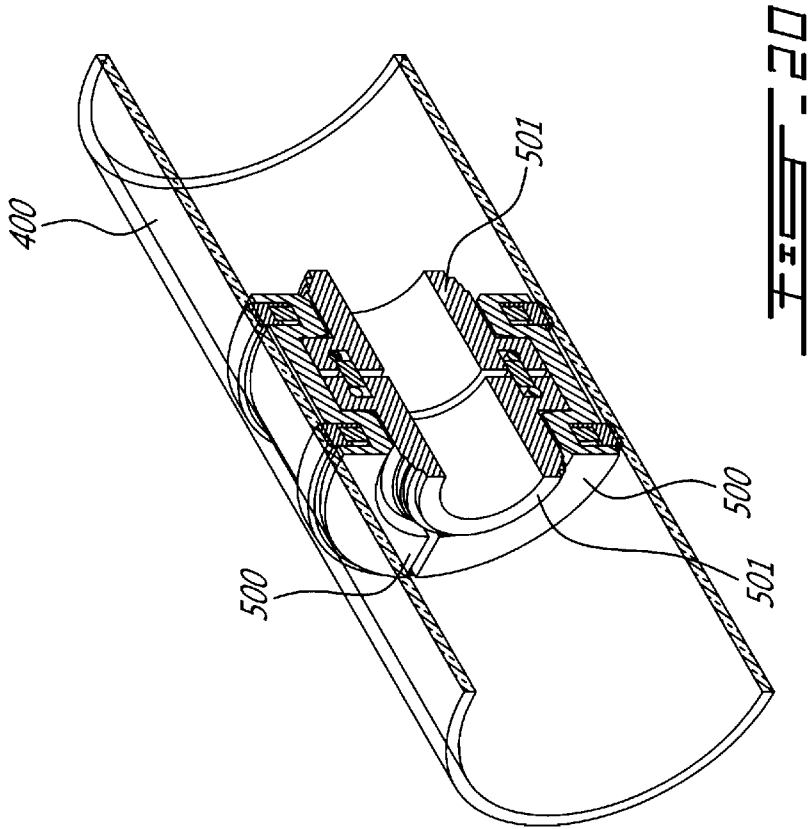


FIG. 20

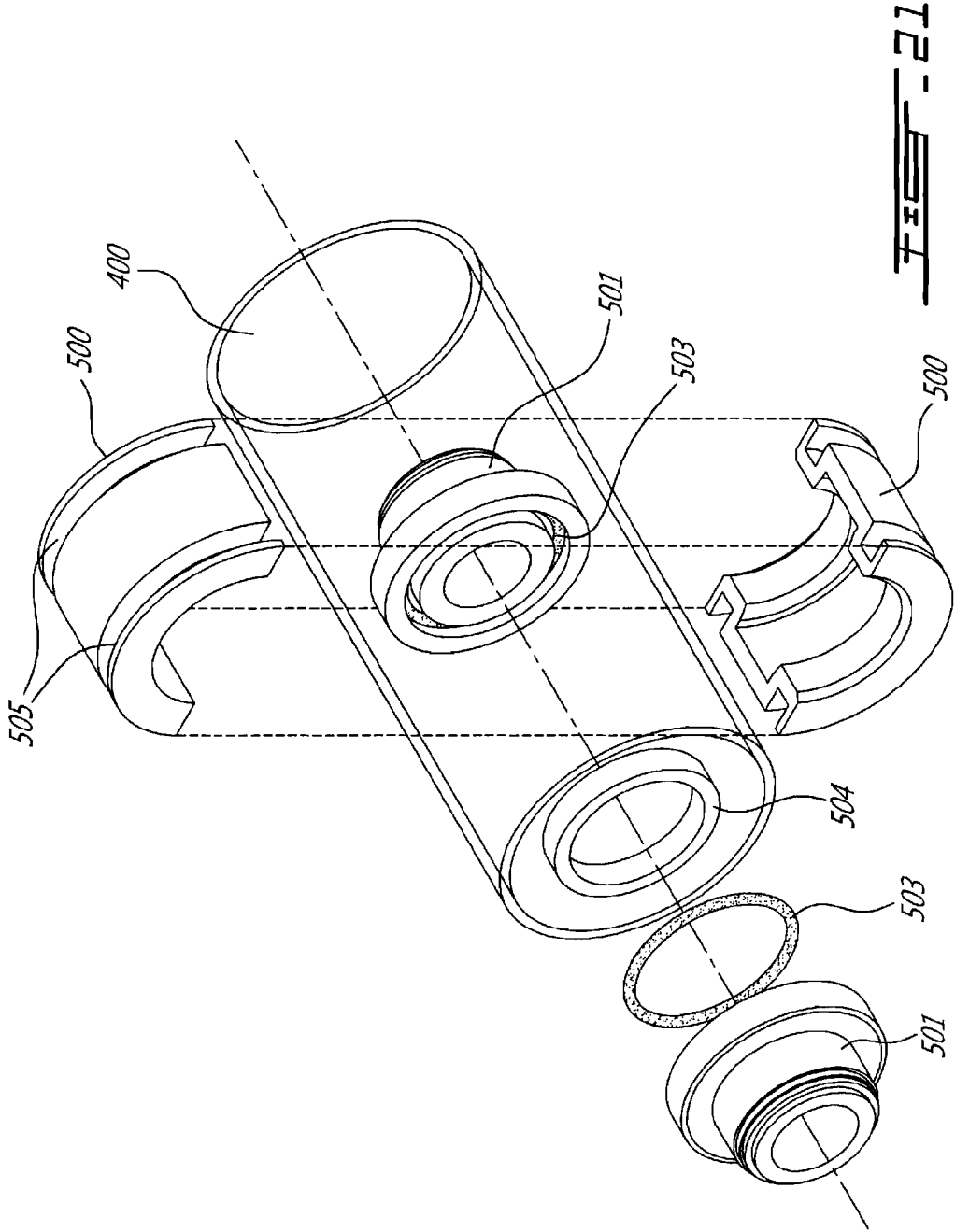


FIG. 21

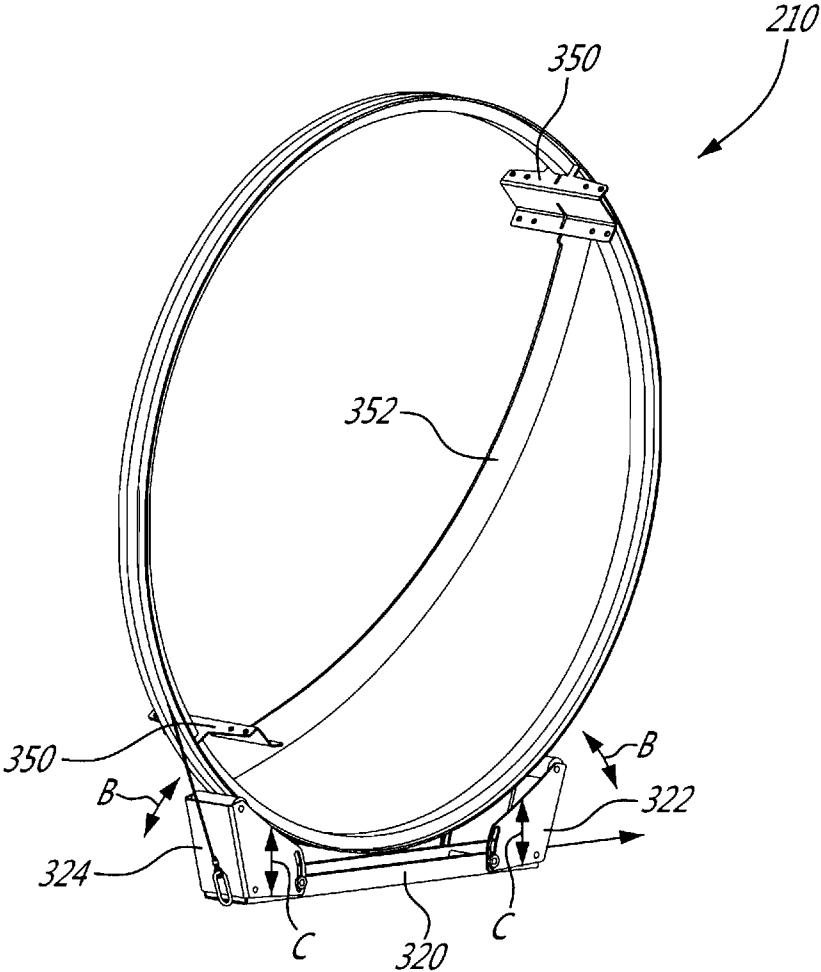


FIG. 22

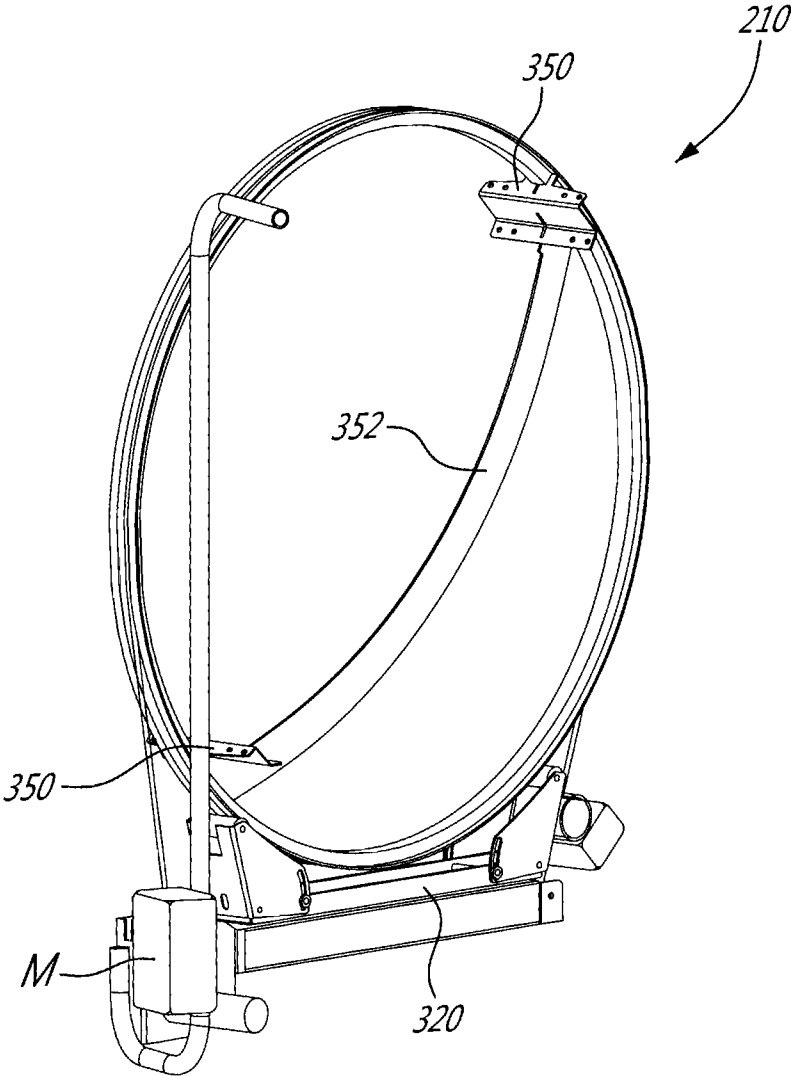
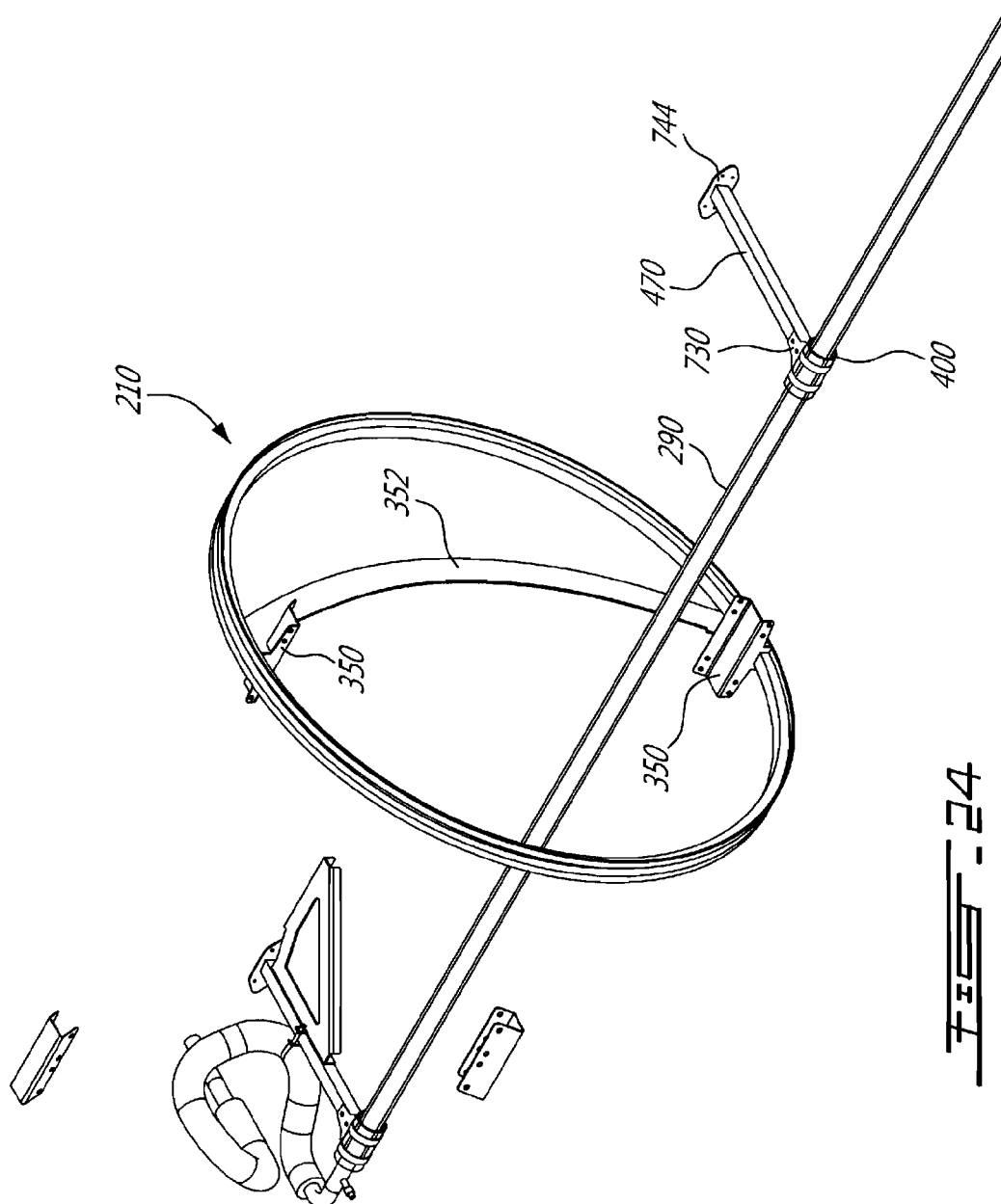


FIG. 23



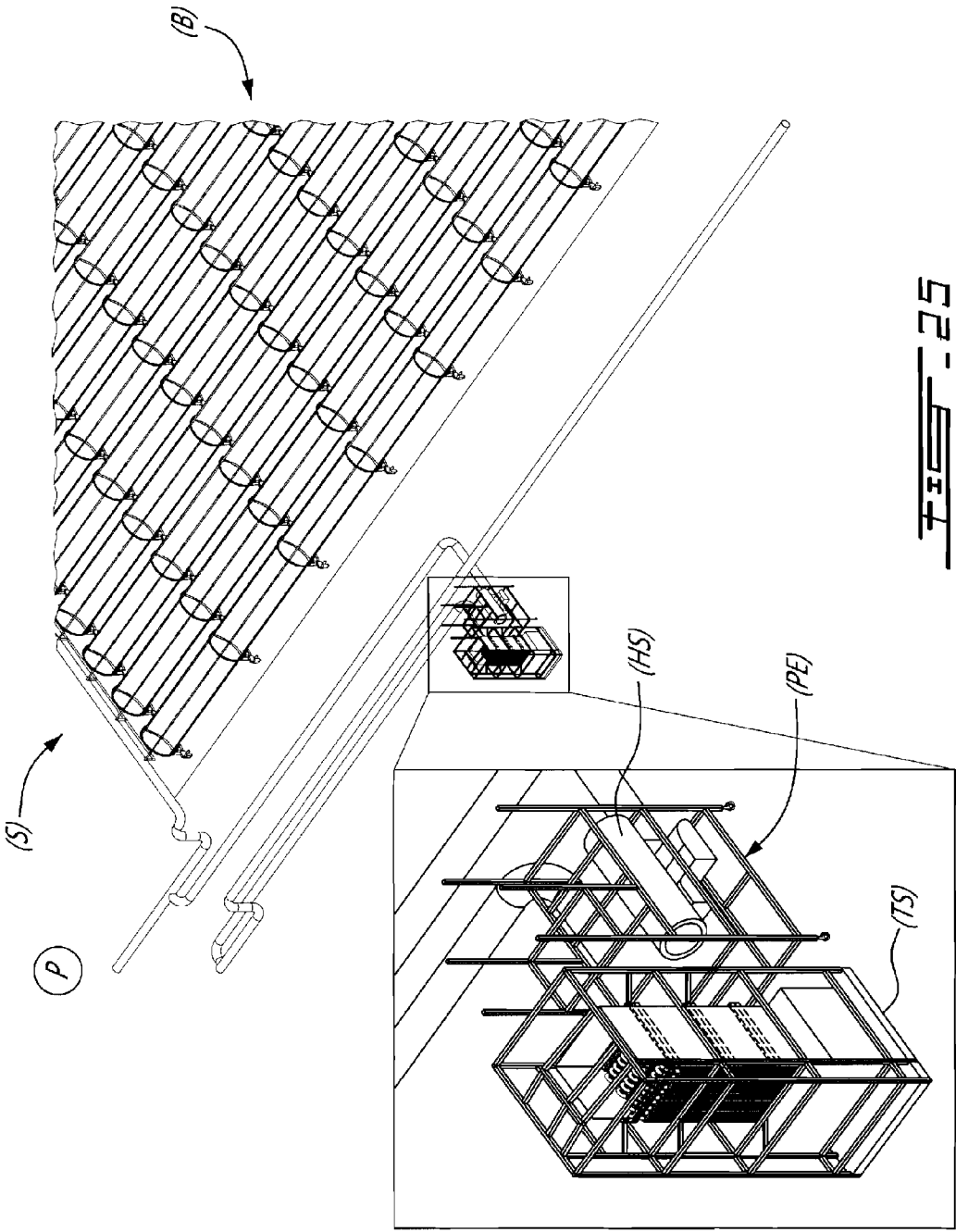


FIG. 25

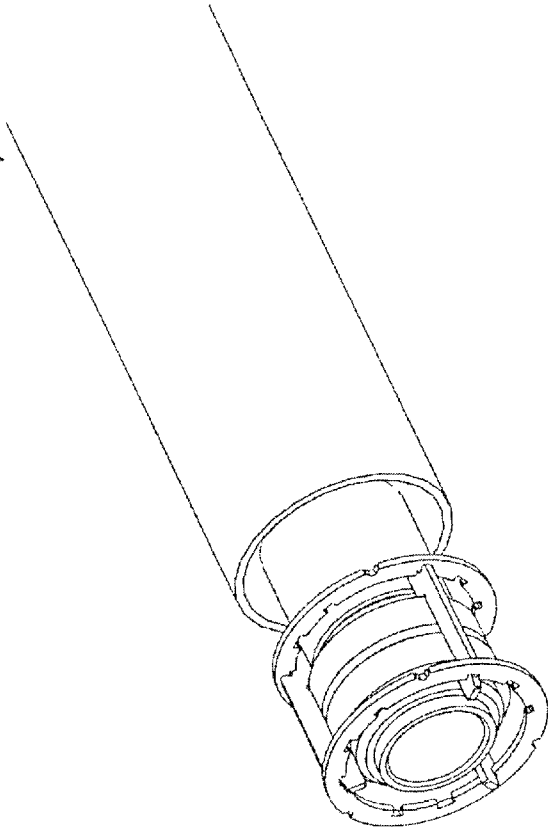


FIGURE 26

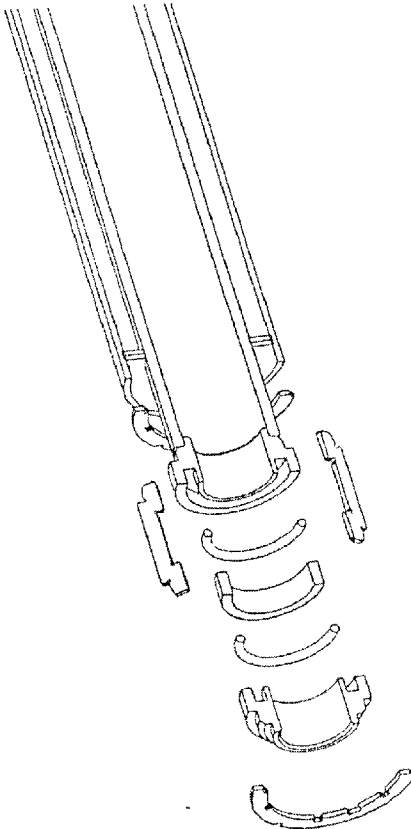


FIGURE 27

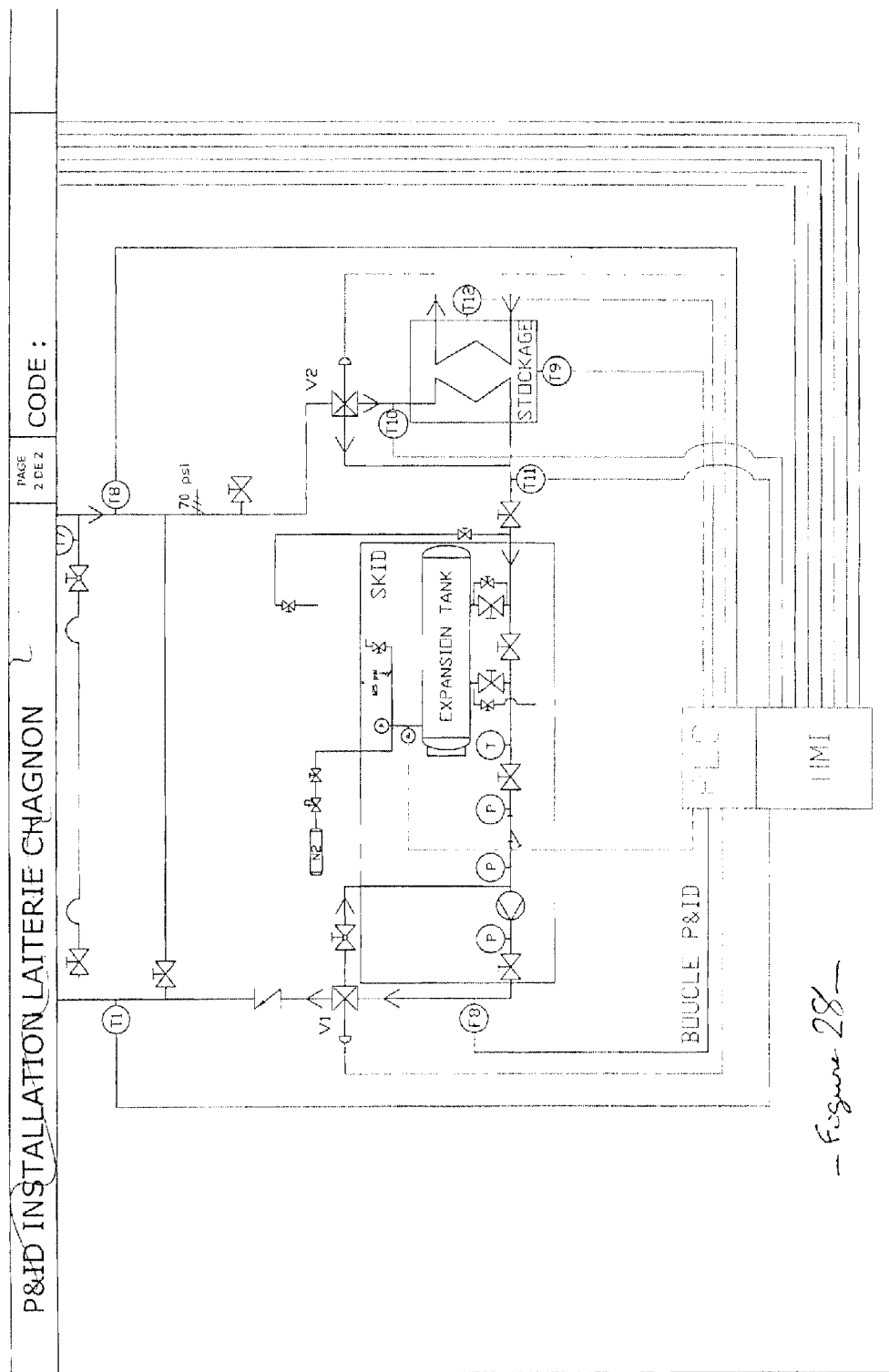


Figure 28

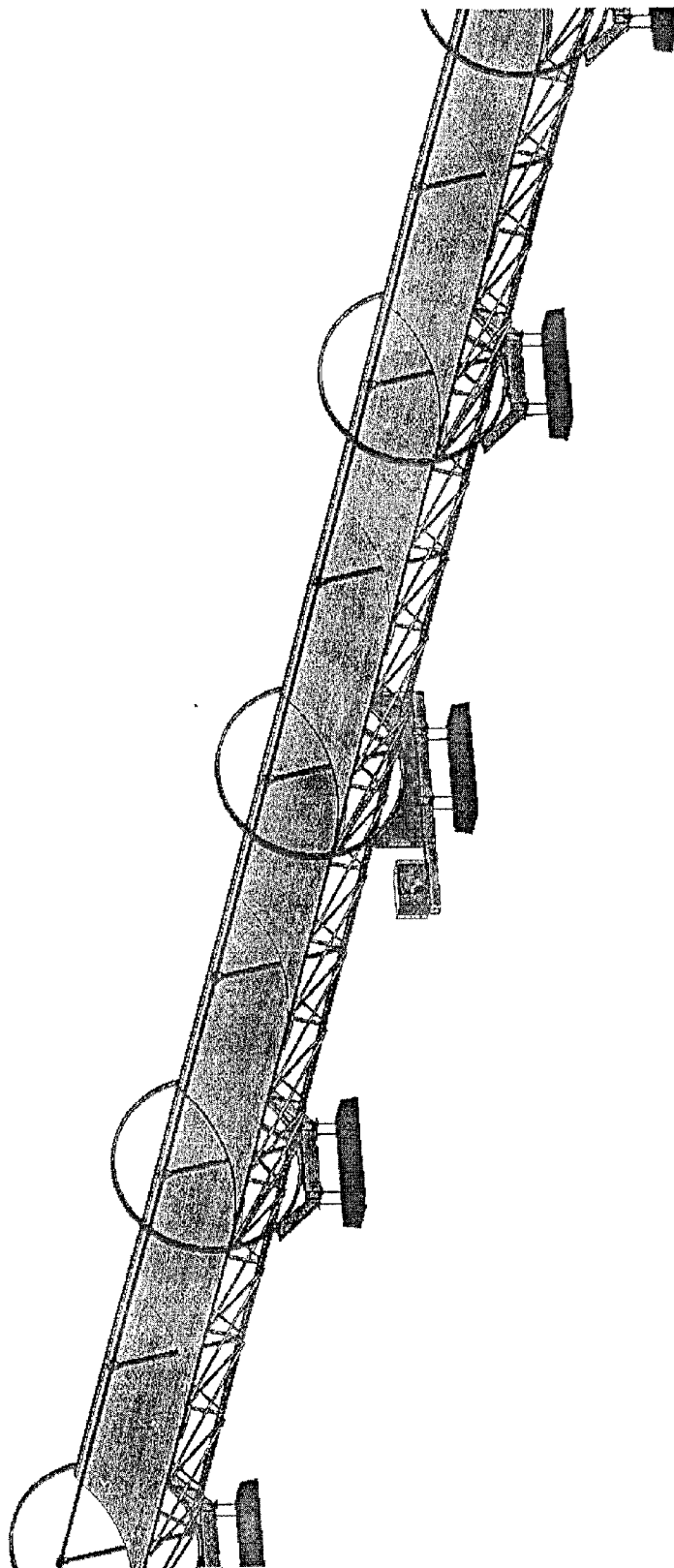


Figure 29

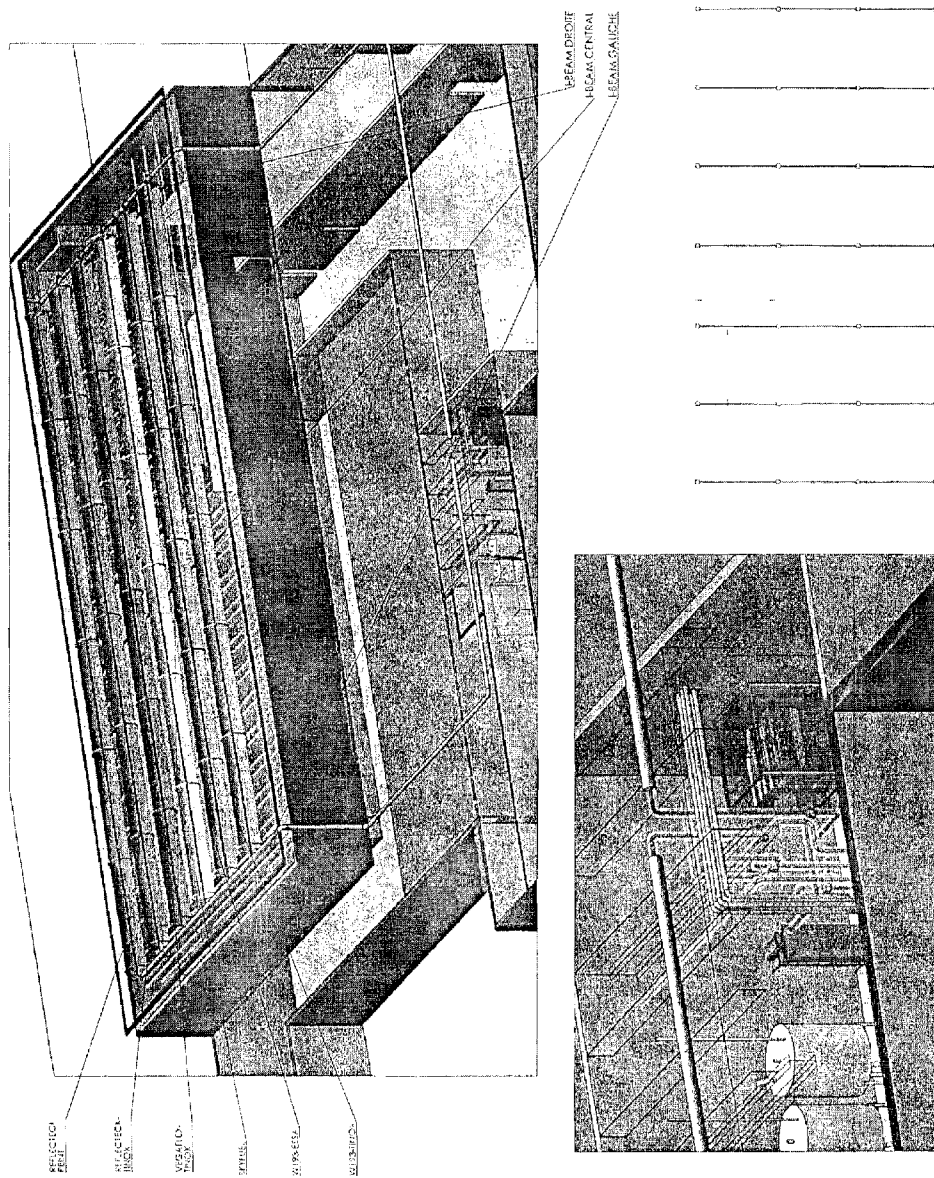


FIG. 30 is a perspective view of a roof structure. The structure consists of a series of parallel beams supported by a central beam. The beams are labeled as REFLECTOR, BEAM DROITE, BEAM CENTRAL, and BEAM GAUCHE. The structure is supported by a roof. A perspective view of the structure is shown below the main drawing.

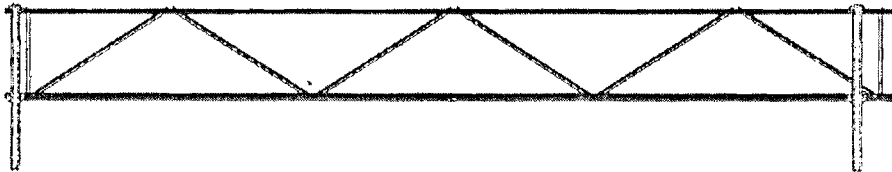


FIGURE 31

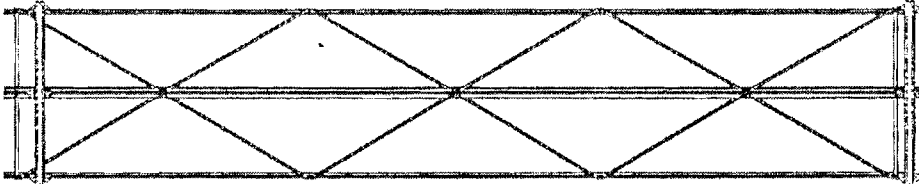
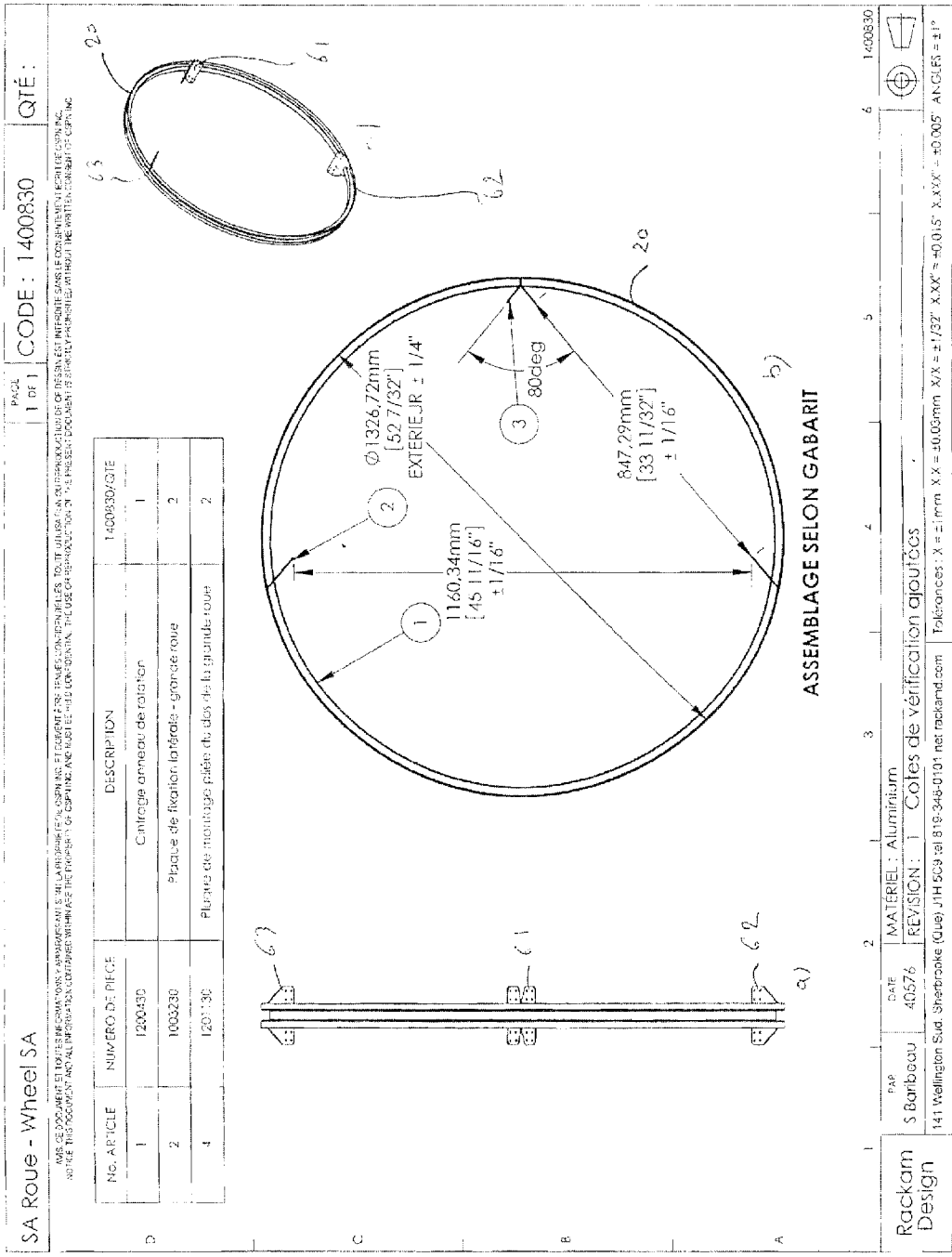


FIGURE 32



SOLAR CONCENTRATORS, METHOD OF MANUFACTURING AND USES THEREOF

FIELD OF THE INVENTION

[0001] The present invention relates to solar energy. More specifically, the present invention is concerned with parabolic solar concentrators, method of manufacturing and uses thereof.

BACKGROUND OF THE INVENTION

[0002] Solar energy is a renewable energy source, clean and available anywhere in the world, which does not require direct extraction of fossil fuels and contributes less to global warming and environmental problems. In addition, solar energy is an energy source that can be used locally, thereby limiting the transport and hence the losses.

[0003] In the field of concentrated solar power (CSP), mirrors or lenses are used to concentrate sunlight or solar thermal energy, onto a small area which absorbs this energy. The collected heat can then be transported and used for a multitude of applications.

[0004] US Patent Application number 2008 0078380 A1 describes a concentrating solar energy collector comprising a) a heat collector; b) first and second identical or substantially identical panels forming at least a portion of a housing; and a first reflector positioned within said housing to receive solar radiation and concentrate at least portion of said solar radiation on said heat collector.

[0005] US Patent Application number 2008 0083405 A1 describes a concentrating solar energy collector comprising a) a frame or housing; b) a heat collector; and c) a first electrically deformable reflector; said first elastically deformable reflector being at least substantially flat absent deforming force; d) wherein said frame or housing is configured to receive said first elastically deformable reflector in a shape that concentrates at least a portion of said solar radiation on said at least heat collector.

[0006] US Patent Application number 2011 0067692 A1 describes a foam backed solid support structure and trough solar energy collector. A support structure has foam or other polymeric material, a plurality of end arms, and a plurality of end caps secured to the formed foam material. The foam material is cut into a parabolic or semi-parabolic shape, and a reflective element may be placed onto the formed foam material and secured mechanically, with adhesion, and/or integrated with the surface. A solar energy collector formed using a polymeric core may have longitudinally-extending cowlings, end caps, and end arms as described.

[0007] US Patent Application number 2010 0236600 A1 describes a solar energy collector array comprising a plurality of rows of solar energy collectors having a first deflector adjacent to a first row of the solar energy collectors and second deflector adjacent to a second row of the solar energy collectors.

[0008] US Patent Application number 2011 0067692 describes a trough solar energy collector having a rotational axis comprising a collector tube, a first reflective panel and a second reflective panel, (i) each of said first and second reflective panels comprising a honeycomb or polymeric core having an arc-shaped surface a reflector on the arc-shaped surface of the polymeric core cowlings along a longitudinal edge extending along the polymeric core and extending parallel to the rotational axis of the solar collector (ii) the first reflective

panel being positioned to illuminate a first side of the collector tube, (iii) the second reflective panel being positioned to illuminate a second side of the collector tube.

[0009] US Patent Application 2011 0073104 describes examples and variations of apparatus and methods for concentrating solar radiations with trough solar energy collectors are disclosed. A support assembly for a trough solar energy collector has a plurality of transverse ribs attached to longitudinal rails and end assemblies secured to the rails. End assemblies may attach to longitudinal rails through transverse ribs, and guy wires may span from one of the end sections to the other. Transverse ribs may be formed of two rib sections with semi-parabolic shape. Solar energy collecting panels may be placed on the ribs and secured with cowlings and transverse panel-retaining strips, for instance.

[0010] In one variation, a trough solar energy collector, comprising: a support assembly for supporting one or more solar energy collecting panels, said support assembly further comprising: (a) a plurality of longitudinal rails; (b) a first transverse rib and a second transverse rib both secured to said plurality of longitudinal rails, wherein each of said ribs has a shape approximating an arc of a cylindrical or parabolic surface; and (c) a first end assembly and a second end assembly both secured to said plurality of longitudinal rails; wherein each of said first and second transverse ribs is formed from at least two rib pieces; said rib pieces forming part of said cylindrical or parabolic surface, said first and second rib pieces having portions overlapping one another at an apex, minimum, or vertex of said cylindrical or parabolic surface; at least one solar energy collecting panel; and a collector tube positioned to receive light reflected by said collecting panel.

[0011] U.S. Pat. No. 4,515,148 relates to a collector comprising a reflector (1) formed by a plurality of reflecting elements (6) engaged between consecutive frames (2). Each of the frames is formed by two members (7) moulded from Zanak and fixed to an aluminium beam (11) having a triangular cross-sectional shape. Each pair of members (7) defines arms (17) whereby the reflector is rotatively mounted on a fixed absorber tube (3). The latter is protected by a transparent hood (28) fixed on supports (4) disposed on each side of the reflector. A device (34, 35, 37) for adjusting the angular position of the reflector is provided at at least one end of the collector.

[0012] U.S. Pat. No. 4,372,027 relates to an improved monocoque parabolic solar collector which can be machine welded or fastened with rivets, bolts or other mechanical fasteners without the need for any blind fastening systems.

[0013] U.S. Pat. No. 4,423,719 also relates to an improved monocoque parabolic solar collector which can be machine welded or fastened with rivets, bolts or other mechanical fasteners without the need for any blind fastening systems. U.S. Pat. No. 4,296,737 relates to a concentrating solar collector includes a radiation reflective surface having the configuration of a paraboloid of translation, the axial extent of the paraboloid being the portion between the apex and the plane perpendicular to the axis and passing through the focus. A receiver of reflected radiant energy is located along the focal line of the paraboloid, and includes a receiver entrance aperture whose plane is oriented at an angle to the axis, preferably at an angle of 29 DEG+/-10 DEG. The width of the entrance aperture is a function of the distance between the lip and axis of the parabola and the angular radius of the sun.

[0014] U.S. Pat. No. 4,493,313 relates to a parabolic trough solar collector using reflective flexible materials is disclosed.

A parabolic cylinder mirror is formed by stretching a flexible reflecting material between two parabolic end formers. The formers are held in place by a spreader bar. The resulting mirror is made to track the sun, focusing the sun's rays on a receiver tube. The ends of the reflective material are attached by glue or other suitable means to attachment straps. The flexible mirror is then attached to the formers. The attachment straps are mounted in brackets and tensioned by tightening associated nuts on the ends of the attachment straps. This serves both to stretch the flexible material orthogonal to the receiver tube and to hold the flexible material on the formers. The flexible mirror is stretched in the direction of the receiver tube by adjusting tensioning nuts. If materials with matching coefficients of expansion for temperature and humidity have been chosen, for example, aluminum foil for the flexible mirror and aluminum for the spreader bar, the mirror will stay in adjustment through temperature and humidity excursions. With dissimilar materials, e.g., aluminized mylar or other polymeric material and steel, spacers can be replaced with springs to maintain proper adjustment. The spreader bar cross section is chosen to be in the optic shadow of the receiver tube when tracking and not to intercept rays of the sun that would otherwise reach the receiver tube. This invention can also be used to make non-parabolic mirrors for other apparatus and applications.

[0015] U.S. Pat. No. 4,454,371 relates to a solar energy concentrator system having a plurality of concentrator arrays with each of the arrays being made up of a plurality of adjacent longitudinally extending concentrator modules. Each of the concentrator modules has a semi-cylindrically-shaped housing and a semi-cylindrically-shaped cover in order to form an overall cylindrically-shaped structure which provides protection from adverse environmental conditions and withstands high wind loads. Situated within the cover and connected to the housing is a parabolically-shaped concentrator. The concentrator is made up of a plurality of parallelogram-shaped reflector panels mounted adjacent one another on a bias. This arrangement permits the ends of the panels to overlap adjacent modules so as to provide a substantially continuous reflector surface. The reflector surface redirects solar energy onto a plurality of solar cells located within the cover and as a result of the physical makeup of the concentrator components substantially eliminates the problem of cell shadowing.

[0016] US2006157050 relates to a reflector element carrier structure is disclosed for use in a solar energy reflector system. The structure comprises a reflector element (11), a corrugated platform (12) which carries the reflector element and a skeletal frame structure (13) which supports the platform. The frame structure comprises hoop-like end members (14) that are supported by rollers (18) and the rollers accommodate turning of the carrier structure about an axis of rotation that lies substantially coincident with a longitudinal axis of the reflector element (11). The combination of the corrugated platform (12), the frame structure (13) and the hoop-like end members (14) of the frame structure provide the carrier structure with a torsional stability that permits the application of turning drive from one end of the structure.

[0017] U.S. Pat. No. 4,820,033 relates to a solar mirror apparatus that has an elongate support frame on which resiliently flexible sheet metal mirrors (15) are secured in a parabolically curved arrangement, with an elongate solar radiation receiver (28) being mounted at the focal line of the sheet metal mirrors (15). The support frame is swivellable about an

axis which extends parallel to the focal line of the parabola. The carrying frame has two spaced apart clamping section supports (11) disposed opposite and parallel to one another. The mirror plates are carried by parabolic webs (13) with the mirror plates being fitted shapewise on the parabolic edges (17) of the parabolic webs (12). The ends of the parabolic webs (12) which extend between the clamping section supports (11) are swivellably supported at the confronting sides of the clamping section supports (11) about swivel axes (14) which extend parallel to the longitudinal axes (13) of the clamping section supports (11). The clamping section supports (11) have an elongate abutment (16) which extends parallel to the swivel axis (14) at the side of the swivel axis facing the parabolic edges (17). The end edges of the mirror plates (15) contacting the abutment (16), whereby the mirror plates (15) are held in compression and their shape is determined by the parabolic webs (13).

[0018] US2011073104 relates to examples and variations of apparatus and methods for concentrating solar radiations with trough solar energy collectors are disclosed. A support assembly for a trough solar energy collector has a plurality of transverse ribs attached to longitudinal rails and end assemblies secured to the rails. End assemblies may attach to longitudinal rails through transverse ribs, and guy wires may span from one of the end sections to the other. Transverse ribs may be formed of two rib sections with semi-parabolic shape. Solar energy collecting panels may be placed on the ribs and secured with cowlings and transverse panel-retaining strips, for instance.

[0019] CH637202 relates to a particularly straightforward mode of construction of the device is achieved by virtue of the fact that a curved sheet-metal strip as reflection element (5) is held in the desired shape by means of two thin end-plates (3', 4'). An edge area of the end-plates (3', 4') has the shape of a parabola. Tabs (28) extend outwards from this edge area and through slots (29) in the edge area of the sheet-metal strip (5). As a result of deformation of the tab parts projecting beyond the outer side of the sheet-metal strip (5), the said edge area of the sheet-metal strip (5) lies on the edge area of the end-plates (3', 4') so that the reflecting inner surface of the sheet-metal strip (5) forms at least approximately a cylindrical-parabolic mirror. A tube (2) for conducting a heat carrier extends through the end-plates (3', 4') and along the focal line of the said mirror. Secured on the outer side of the two end-plates (3', 4') is in each case a strut (3'', 4''), which struts project above the outer side of the sheet-metal strip (5). These projecting parts of the struts are connected to one another in a rotationally fixed manner via a tubular stabiliser support (6), so that the end-plates (3', 4'), the struts (3'', 4'') and the stabiliser support (6) form a rigid unit. Projecting outwards from each strut (3'', 4'') is a shaft end (8), about which the whole device can be swivelled. The mode of construction of the device described above is very simple and, on account of the stabiliser support (6), secure against torsion, so that, in order to swivel the device, it suffices to act on it from one side. With devices of this type, the costs for an installation for collecting solar energy can be substantially reduced.

[0020] US2009056704 relates to a reflecting parabolic construction for solar heating systems comprises at least a reflecting parabola for concentrating solar beams on a thermal carrier containing receiver tube, wherein the parabola comprises an aluminum fretted central layer, on the faces thereof two opposite aluminum layers are applied. According to a first embodiment, in the concave part of the reflecting

parabolic construction a crystal mirror of minimum thickness is applied. According to a further aspect of the invention, one of the layers is a reflecting aluminum layer made by depositing vapors, and protected by a sol-gel protective layer having a thickness corresponding to few microns.

[0021] US2009056704 relates to a solar energy collector includes a lens **11** and a parabolic reflector **12** receiving sunlight **1**, **1'** refracted through the lens and focussing the light onto a receiver target **13** such as a photocell. So as to efficiently collect the sunlight irrespective of the position of the sun **Z** in the sky, the lens and reflector are rotated with respect to each other about an axis **11'** that is perpendicular to the plane of the lens by motors **16a**, **16b** driving support rollers **15a** and **15b**. The motor drive control signals are derived by a controller **14** in dependence of the position of the sun and the orientation and geographic position of the collector.

[0022] U.S. Pat. No. 5,058,565 relates to a solar concentrator device is disclosed. The device includes a solar concentrating panel having a longitudinal axis and defining a parabolic surface having a focal line substantially parallel to its longitudinal axis. The parabolic surface terminates in opposed longitudinal side edges. A mechanism is provided for rotating the panel about its longitudinal axis. Finally, an arrangement provides torsional support for the panel and includes a frame structure aligned obliquely to the longitudinal axis and extending between the opposed longitudinal side edges of the parabolic surface.

[0023] WO2010016934 relates to a solar energy reflector, collector, array, and other equipment for converting solar energy to e.g. thermal energy. A reflector or collector may, for instance, comprise a plurality of longitudinal rails; a rib engaging and spanning the plurality of longitudinal rails; and a first mirror panel. The rib of the reflector or collector may have a slot that is parabolic or in the shape of a section of a parabola. A portion of the mirror panel such as an end portion or a portion located away from the ends may be positioned within the rib's slot.

[0024] AU2011100679 relates to a parabolic trough solar collector system has a parabolic reflector used with an independently supported collector tube. The parabolic reflector has a reflective surface formed on a reflective surface support structure, supported by a circular support beam. This assembly rests on a plurality of support and drive rollers supported by a roller support arm, supported by a roller support column. The parabolic reflector assembly rotates against the rollers along a single axis to maintain a focus line of the parabolic reflector surface at the same location as the center of the circle described by the outer edge of the circular support beam. Located at this same focus line is the independently supported collector tube not attached to the parabolic trough reflector. The collector tube is supported on pipe roller hangers, which in turn are supported by a wire catenary system connected to support towers which straddle the parabolic reflector.

[0025] CA2612029 relates to a solar collector has operably connected reflective panels that can be positioned to substantially form a parabolic trough that concentrates solar radiation onto a tube running along the focal line of the trough. A folding mechanism can be manually or automatically operated to selectively fold and unfold the panels into open and closed positions and in to any number of intermediate positions, including the position characterized by formation of a parabolic trough. A rotating mechanism can be manually or automatically operated to selectively rotate the solar collector about an axis parallel to the focus line of the parabolic trough.

The folding mechanism and the rotating mechanism can be operated so as to track the sun, facilitate cleaning or storage, and avoid structural damage during inclement environmental conditions.

[0026] WO2010118885 relates to a support system for a parabolic trough collector (**1**) for generating solar thermal energy. The parabolic trough collector (**1**) is mounted on the support system in such a way as to be rotatable about the focal line of the collector and be able to track the course of the sun. In order to stably suspend the parabolic trough collectors (**1**), taking into consideration the necessary rotary mobility thereof, the support system on which the parabolic trough collector is mounted is designed such that the support system can roll on a flat surface, perpendicular to the direction of the focal line of the parabolic trough collector (**1**). The parabolic trough collector (**1**) is mounted on the support system such that the focal line thereof and the rotational axis of the support system coincide. The support system preferably comprises a wheel segment (**2**) that can roll on a flat path, wherein the wheel axis thereof coincides with the focal line. When the wheel segment (**2**) is rotated about the axis thereof, the parabolic trough collector (**1**) thus moves in the same manner, wherein the position of the focal line remains unchanged relative to the parabolic collectors (**1**). The wheel segment (**2**) is rotatably mounted about an absorber tube (**3**) of the parabolic trough collector (**1**), said absorber tube (**3**) running coaxially to the focal line.

[0027] U.S. Pat. No. 4,421,104 relates to a concentrating/tracking solar energy collector comprised of a rotatable reflective trough assembly having a heat absorber assembly integrally therein. A heat exchange tube supports the absorber assembly in the trough and also serves as an axis point about which the collector rotates.

[0028] WO2011114861 relates to a solar concentrating mirror that has excellent antifouling properties, facilitates partial replacement, and can maintain high reflectivity at a low cost. Also disclosed are a trough solar thermal power generation device and a trough solar power generation device that are equipped with said solar concentrating mirror. The solar concentrating mirror has an elongated shape in which a cross section parallel to the lengthwise direction has a linear shape and a cross section perpendicular to the lengthwise direction has a macroscopically curved shape, and is characterized by being formed from a plurality of discrete elongated film mirrors divided in a direction perpendicular to the lengthwise direction of said solar concentrating mirror.

[0029] US2010172043 relates to a mirror for concentrating solar power devices, associable with a curved supporting panel, which comprises a flat and thin mirror-finished plate which is flexible, as a consequence of a tempering treatment, for complementary shaping, by inflection, with respect to the panel, which is adapted to support and keep the plate inflexed.

[0030] WO2012025849 relates to a supporting structure (**10**) for a parabolic-linear solar plant (**14**) of the concentrating type, suitable to supporting mirrors (**12**) with a curved surface, which intercept the sun's rays and directing them towards a receiver member to produce energy, such as a receiver tube (**16**) in which a heat exchange fluid flows and/or concentration-type photovoltaic cells, the receiver member is disposed along a first axis (X) of substantial alignment of the focuses of said mirrors (**12**). The supporting structure (**10**) comprises a supporting shaft (**18**) that develops parallel to a second rotation axis (Y) parallel to said first axis (X), supporting centrings (**22**) of mirrors (**12**) are mounted along said

supporting shaft (18), placed transversal from opposite sides with respect to said supporting shaft (18) in a manner coordinated with the position of said mirrors (12). Each of the supporting centrings (22) has pivoting ends (26) coupled with the supporting shaft (18). The supporting structure (10) further comprises first positioning blocks (34) disposed along the supporting shaft (18) in a manner coordinated to the disposition of the centrings (22), which have, on opposite sides with respect to the supporting shaft (18), first supporting faces (36) turning, during the use, towards the centrings (22). Said pivoting ends (26) of the centrings (22) carry second positioning blocks (38) having second supporting faces (40) turning, during the use, towards the supporting shaft (18) and apt to cooperate in beating with the first supporting faces (36). The first supporting faces (36) and second supporting faces (40) have surfaces processed together to define reciprocally coordinated shapes, so as to ensure the precise positioning of centrings (22) with respect to the supporting shaft (18), so that the mirrors (12) supported by centrings (22) are correctly oriented with their focuses properly aligned along the first axis (X).

[0031] RU2300058: FIELD: solar power engineering, possible use in broad range depending on working area of concentrator, namely: ranging from production of hot water for home needs to production of high potential energy of overheated steam. ^ SUBSTANCE: solar energy concentrator is made in such a way that absorber located in its focus does not create a shadow in working mirror zone and allows positioning of concentrator rotation axis in gravity center of whole system. Absorber is represented by parabolic cylindrical concentrator with low focus distance, and focuses of concentrator and absorber do not coincide, between them, receiver with heat carrier is positioned, and system for tracking sun by azimuth and its elevation, based on calculated and constant characteristics, corresponding to geographical location where concentrator is mounted and provide required speed of rotation around polar axis and change of height during the day with consideration of time of the year. Device is a reverse mechanical drive, rotating a screw pair, to nut of which a toothed bar is rigidly fastened, during movement of which toothed sector turns and, simultaneously, turning the bar with the follower, which monitors daily sun height change. EFFECT: production of maximal quantity of light stream energy, increased precision and reliability of device.

[0032] CN2809506 relates to an automatic sun tracing device. It comprises a support, a direct-current motor, a transmission device, a heat collector reflective plate, a heat collecting tube which is provided above the heat collecting reflective plate, a solar energy battery, a shade plate and a baffle plate. The two plates are orthogonal to each other in a T shape structure. The back surface of the shade plate and two surfaces of the baffle plate are reflective mirror surfaces. There are two solar-energy batteries which are parallel at the right back of shade plate. The baffle plate is arranged between the shade plate and the solar-energy batteries and it separates the two solar-energy batteries. The direct-current motor is installed on the support. One electrode of the direct-current motor is respectively connected with the anode of the first solar-energy battery and the cathode of second solar-energy battery, and the other electrode is respectively connected with the other poles of two solar-energy batteries. The solar-energy batteries are fixed on the rotation axle of battery plate. The heat collector reflective plate is fixed on the rotation axle of the reflective plate. Two rotation axles are rotationally

installed on the support and are connected with the direct-current motor to be synchronously driven via a transmission device. The utility model can automatically track the height angle of sun or/and the height angle. The reflective plate can automatically reset without an external power source.

[0033] AU2010282524 relates to a trough solar energy collector having a rotational axis comprising a collector tube (2801), a first reflective panel and a second reflective panel, each of said first and second reflective panels comprising a honeycomb or polymeric core (201) having an arc-shaped surface (602), a reflector (601) on the arc-shape surface (602) of the polymeric core (201), cowling (702) along a longitudinal edge extending along the polymeric core and extending parallel to the rotational axis of the solar collector, the first reflective panel being positioned to illuminate a first side of the collector tube (2801), the second reflective panel being positioned to illuminate a second side of the collector tube (2801).

[0034] CN20092111391U provides a solar high-temperature heat collector which comprises a parabolic mirror reflecting plate. The solar high-temperature heat collector is characterized in that a heat absorber filled with heating medium is arranged in the focal position of the parabolic mirror reflecting plate and is connected with a heat exchanger filled with heating medium through a heat transfer pipe filled with heating medium, so that the solar energy can be focused on the heat absorber in the focal position through the parabolic mirror reflecting plate. Firstly, the heating medium in the heat absorber is heated, the heat is transmitted to the heating medium in the heat transfer pipe and the heating medium in the heat exchanger in sequence mainly through a heat conduction method, then the heat absorption and the energy storage are further carried out, and finally the hot water is provided for the users after the heat exchanger performs quick heating and temperature increasing to the water-flowing through the heat exchanger. The utility model has the advantages of quick heat absorption, high heat collection efficiency, convenient heat and energy storage, long holding time and high heating speed, is free from the limitation of sunshine time, and can meet the demands of instant use for the users.

[0035] GB987521 relates to a system for the collection, storage and release of solar energy comprises a heat collector such as a parabolic mirror 2 which radiates the heat on to a boiler portion 4 of a fluid circuit 6, a heat storage device 8, and a heat exchanger 16 from which the cooled fluid is returned to the boiler portion through pump 18. In the system shown, steam generated in a coil 37 of the heat exchanger 16 supplies a turbine 39 driving generator 40 and is then condensed in condenser 44, heated in heat exchanger 48, most of the liquid returning to the exchanger 37 and the remainder passing through conduit 52 to ejector 54. A by-pass 20 by-passes the heat storage unit and is controlled by thermostatic valve 22 to keep the temperature of the input fluid to coil 14 constant. A radiator 24 in by-pass 26 which is controlled by thermostatic valve 28, disposes of excess heat. Flow through a further by-pass 30 is controlled by thermostatic valve 32. The heat storing unit 10 contains a heat absorbing liquid.

[0036] CN101825072 discloses a trough-dish combined solar thermal power generation system with a fixed focus and relates to a solar thermal power generation technology. The system comprises a trough type heat-collecting and heat-storing subsystem, a dish type heat-collecting and heat-storing subsystem and a power generation subsystem, wherein

the trough type heat-collecting and heat-storing subsystem and the dish type heat-collecting and heat-storing subsystem are separately connected with the power generation subsystem; and the low temperature heat exchanger of the trough type heat-collecting and heat-storing subsystem is connected with the high temperature heat exchanger of the dish type heat-collecting and heat-storing subsystem. A parabolic dish reflecting mirror contains one dish or two dishes which can perform single-spindle automatic tracking and the focus, namely the receiver is fixed, thus facilitating the heating and heat insulation of large flow high temperature fluid. The invention adopts a trough type solar field with low investment cost to heat the low temperature section of the working medium and a dish type solar field to heat the high temperature section of the working medium, thus reducing the investment of the electric power plant under the premise of ensuring high generating efficiency.

[0037] US2011277471 relates to a method for storing heat from a solar collector CSTC in Concentrating Solar Power plants and delivering the heat to the power plant PP when needed. The method uses a compressed gas such as carbon dioxide or air as a heat transfer medium in the collectors CSTC and transferring the heat by depositing it on a bed of heat-resistant solids and later, recovering the heat by a second circuit of the same compressed gas. The storage system HSS is designed to allow the heat to be recovered at a high efficiency with practically no reduction in temperature. Unlike liquid heat transfer media, our storage method itself can operate at very high temperatures, up to 3000 DEG F., a capability which can lead to greater efficiency.

[0038] ES2193000 relates to a parabolic solar collector. The solar collector includes a parabolic reflector (1) from which the solar rays are reflected, a primary heat exchanger (8) mounted at the focal point of the parabolic reflector (5), a secondary heat exchanger (4) inside a tank of domestic hot water (9) that is to be heated and a circuit (6) connected between the said heat exchangers (8, 4) and characterised by the fact that the said parabolic reflector (1) is mounted on a rotating mounting (3) fitted with a pair of motors (2) connected to a supply and control unit (11) so that the said parabolic reflector (1) can rotate vertically and horizontally according to the position of the solar rays by means of the said supply and control panel (11). The collector makes the maximum use of the sun's light, producing optimum efficiency of the solar collector.

[0039] U.S. Pat. No. 4,362,149 relates to a thermal energy storage system and method for storing substantial quantities of heat for extended periods of time. The system includes a heat collecting fluid which is in a heat-exchange relationship with a source of heat or thermal energy, a housing containing a large volume of particulate material such as rocks for the storage of thermal energy, a heat transfer gas in a heat-exchange relationship with the rocks and means for causing the heat collecting fluid and the heat transfer gas to flow in counter-current, indirect heat-exchange relationship with one another, the means further includes provisions for reversing the direction of flow of the heat collecting fluid and gas for the introduction and removal of heat from a portion of the body of rock. There further is provided a working fluid and means for passing the working fluid and heat collecting fluid in indirect, heat-exchange relationship with one another for the transfer of heat to the working fluid, and a means operatively associated with the working fluid to extract energy therefrom. In a particularly preferred embodiment, the source of heat com-

prises a solar heat collector which uses a liquid alkali metal as the heat collecting fluid and the preferred heat transfer gas comprises air.

[0040] U.S. Pat. No. 7,441,558 relates to an active thermal energy storage system is disclosed which uses an energy storage material that is stable at atmospheric pressure and temperature and has a melting point higher than 32 degrees F. This energy storage material is held within a storage tank and used as an energy storage source, from which a heat transfer system (e.g., a heat pump) can draw to provide heating of residential or commercial buildings and associated hot water. The energy storage material may also accept waste heat from a conventional air conditioning loop, and may store such heat until needed. The system may be supplemented by a solar panel system that can be used to collect energy during daylight hours, storing the collected energy in the energy storage material. The stored energy may then be used during the evening hours to heat recirculation air for a building in which the system is installed.

[0041] There is still a need in the art for solar concentrators.

SUMMARY OF THE INVENTION

[0042] More specifically, there is provided a rigid self-supporting solar collector comprising at least one parabolic reflector and at least one heat collector rigidly supported above a reflective surface of said parabolic reflector; wherein said parabolic reflector comprises a first outer metallic sheet coated with a reflective layer on an outer surface thereof, an inner layer, and a second outer metallic sheet, said outer metallic sheets and said inner layer being assembled together and shaped into a unitary parabolic shape and reinforced with longitudinal and lateral rails.

[0043] There is further provided a rigid self-supporting solar collector comprising at least one parabolic reflector and at least one heat collector rigidly supported above a reflective surface of said parabolic reflector; wherein said parabolic reflector comprises a first outer metallic sheet coated with a reflective layer on an outer surface thereof, an inner layer of a honey comb structure, and a second outer metallic sheet, said outer metallic sheets and said inner layer of a honey comb structure being assembled together and shaped into a unitary parabolic shape and reinforced with longitudinal and lateral rails.

[0044] There is further provided a rigid self-supporting solar collector comprising at least one parabolic reflector and at least one heat collector rigidly supported above a reflective surface of said parabolic reflector by at least one supporting arm, wherein said supporting arm is connected to the heat collector at a first end thereof and to the parabolic reflector at a second end thereof, and further held into position by cables tensioned between its first end and edges of the parabolic reflector.

[0045] There is further provided a solar concentrator, comprising at least one rigid self-supporting solar collector comprising at least one parabolic reflector and at least one heat collector rigidly supported above a reflective surface of said parabolic reflector; and a positioning unit configured for positioning said solar collector into an operational position for reception of solar beams by said parabolic reflector, said parabolic reflector focusing the solar beams onto the heat collector, and into a rest position in which said reflective surface of said parabolic reflector and said heat collector are at least partly under cover of a back surface of said parabolic reflector.

[0046] There is further provided a self-supporting reflector, comprising a first outer metallic sheet coated with a reflective layer on an outer surface thereof, an inner layer, and a second outer metallic sheet, said outer metallic sheets and said inner layer being assembled together and shaped into a unitary parabolic shape and reinforced with longitudinal and lateral rails.

[0047] There is further provided a heat collector, comprising an inner tube for circulation of a fluid, and an outer tube generally coaxial with the inner tube, the inner tube being made in a thermally conductive material and the outer tube being in a material transparent to sun beams, vacuum being maintained in an interspace between the inner tube and the outer tube.

[0048] There is further provided a joint for tubular members of a heat collector, comprising a first tubular fitting receiving an extremity of a first tubular member and a second tubular fitting receiving an extremity of a second tubular member, the first and said second tubular fittings coming into abutment; two half rings clipping around the abutting first and second tubular fittings; and a sleeve maintaining a clipping engagement of the half rings about the abutting first and second tubular fittings and members; wherein the joint allows a coaxial movement of a resulting tubular member within the sleeve.

[0049] Other objects, advantages and features of the present invention will become more apparent upon reading of the following non-restrictive description of specific embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] In the appended drawings:

[0051] FIG. 1 is a perspective side view of a solar concentrator unit according to a first embodiment of an aspect of the present invention;

[0052] FIG. 2 is a perspective back view of the solar concentrator unit of FIG. 1;

[0053] FIG. 3 is a vertical cross view of the solar concentrator unit of FIG. 1;

[0054] FIG. 4 is a) a front view, b) a side view and c) a perspective view of a wheel in the solar concentrator unit of FIG. 1;

[0055] FIG. 5 shows a perspective view of a support for a wheel of a solar concentrator unit according to an embodiment of an aspect of the present invention;

[0056] FIG. 6 is a perspective side view of an arm supporting a heat collector in the solar concentrator unit of FIG. 1;

[0057] FIG. 7 shows a) a horizontal cross view and b) a horizontal perspective side view, of the supporting arm of FIG. 6;

[0058] FIG. 8 shows a) a front view, b) a side view, c) a perspective view and d) a linear view, of a connection element between a supporting arm and a heat collector in a solar concentrator according to an embodiment of an aspect of the present invention;

[0059] FIG. 9 is a perspective view of a solar tracker in a solar concentrator according to an embodiment of an aspect of the present invention;

[0060] FIG. 10 is a first perspective side view of a series of solar concentrator units according to a second embodiment of an aspect of the present invention;

[0061] FIG. 11 is a second perspective side view of a series of solar concentrator units according to the second embodiment of an aspect of the present invention;

[0062] FIG. 12 is a cross section of a parabolic mirror according to an embodiment of an aspect of the present invention;

[0063] FIG. 13 is a partial perspective view of a heat collector according to an embodiment of an aspect of the present invention;

[0064] FIG. 14 is a perspective view of an arm supporting a heat collector in a solar concentrator unit of FIGS. 10 and 11;

[0065] FIG. 15 shows attachment of the supporting arm of FIG. 14 to a mirror of a solar concentrator unit according to an embodiment of an aspect of the present invention;

[0066] FIG. 16 is a detail of FIG. 15;

[0067] FIG. 17 is a detail of a connecting member between a supporting arm and the heat collector of the solar concentrator unit of FIG. 10 or 11;

[0068] FIG. 18 is a first sectional view of FIG. 17;

[0069] FIG. 19 is a second sectional view of FIG. 17;

[0070] FIG. 20 shows a detail of FIGS. 17-19;

[0071] FIG. 21 is an exploded view of FIG. 20;

[0072] FIG. 22 is a perspective view of a wheel of a solar concentrator unit according to an embodiment of an aspect of the present invention;

[0073] FIG. 23 is a view of a motorized wheel of a solar concentrator unit according to an embodiment of an aspect of the present invention;

[0074] FIG. 24 shows a wheel and heat collector of a solar concentrator unit according to an embodiment of an aspect of the present invention; and

[0075] FIG. 25 is a schematic view of a system for recovering solar energy by solar energy concentration, using a battery of parabolic solar concentrators according to an embodiment of an aspect of the present invention.

[0076] FIG. 26: represents a perspective view one joint between heat transfer tubes at focal point.

[0077] FIG. 27: represents the exploded view and split view of joints between 2 heat transfer tube as use in the a cross section.

[0078] FIG. 28 represents the general diagram of the highly efficient system (S)

[0079] FIG. 29: is a perspective view of a line of solar dish unit, with supporting means apparent.

[0080] FIG. 30: is a perspective view of the system S mounted on the flat roof of a dairy plant.

[0081] FIG. 31: represents a side view of the streamlined isometric structure of the solar dish unit assembly according to the preferred embodiment of the parabolic solar collectors represented in FIGS. 1 to 3.

[0082] FIG. 32: represents an aerial view of the streamlined structure of a solar dish unit assembly according to the preferred embodiment of the invention as represented in FIG. 2.

[0083] FIG. 33: represents a front view a), a side view b) and a perspective view of the structural wheel of the solar dish unit assembly represented in FIG. 2.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0084] The present invention is illustrated in further details by the following non-limiting examples.

[0085] A solar concentrator of the invention generally comprises a self-supporting reflector, a heat collector and a positioning unit.

[0086] In a solar concentrator **10** according to an embodiment illustrated for example in FIGS. **1-9**, the self-supporting reflector comprises a parabolic trough **31**, made in this example of two adjacent parabolic mirrors **22, 23** of laminated aluminum coated with a reflective film. The mirrors have a thickness less than about 1 inch, for example about ½ inches.

[0087] The longitudinal edges of the parabolic trough **31** are reinforced by longitudinal rails **27, 28**. The longitudinal rails **27, 28** are connected at the back of the trough **31** to a spinal rail **26** by vertical members **34**, two consecutive vertical members being connected together by diagonal members **25**.

[0088] The positioning unit comprises side wheels **20**, connected together by the rails **26, 27** and **28** by brackets at three contact points **61** as shown in FIG. **4** for example.

[0089] The rails **26, 27, 28**, and vertical and diagonal members **34** and **24** may be of extrusions of aluminum or other extrudable material for example, or molded members. Connection between rails and members may be done by riveting or welding or screwing for example.

[0090] The side wheels **20** are mounted on supports **32**, such as roller supports best seen in FIG. **5**, for rotation about a longitudinal axis of the unit (**10**) on at least 180°, for example at least 210°, to allow optimization of the capture of solar light beams by the parabolic trough **31** in an operational mode and rotation into a rest mode as will be described hereinbelow.

[0091] In the example of FIG. **1**, the side wheels **20** have a diameter of 1.20 meter, for a solar concentrator unit **10** of 4.84 meter broad between the two wheels **20**.

[0092] Such reflector is resistant to torsion without the need for any additional torsion rigidifying member.

[0093] The trough **31** may be dismounted from the rails **26, 27** and **28** and members **25** and **34**, for maintenance or replacement for example, without having to dismantle the positioning unit.

[0094] The heat collector **29** is shown as a tubular member. It is made in a thermally conductive structural material, resistant to pressures of at least 80 bars, with a high absorbency/low emissivity surface. For example, it may be a stainless steel tube with a metallic coating of absorbance a of 0.95 and emissivity e of 0.15.

[0095] The heat collector **29** is maintained in a predetermined fixed position above the concave surface of the trough **31** and relative to the focus of the trough **31**, by means of supporting arms **47** attached to the heat collector **29** (for example at an end **49** and at the center **50** of heat collector **29** as shown in FIG. **1**) and to the spinal rail **26** (for example at to left end and to its center as shown in FIG. **1**) respectively.

[0096] In FIGS. **6** to **8**, the supporting arm **47** is shown as a corrugated shaft **200**, made by extrusion. A connecting member **73** for connection of the supporting arm **47** to the heat collector **29** is shown in FIG. **8**. The connecting member **73** comprises a ring part **203** engaging the section of the heat collector **29** and tabs **204** secured to sides of the supporting arm **47**.

[0097] The solar concentrator unit **10** may be manually operated or operated through a control unit (d).

[0098] A control unit (d) may comprise a solar tracker as shown in FIG. **9** for example, tracking the position of the sun to drive the solar concentrator unit, or a series thereof, and a processor configured to send positioning instructions to a motor (M) powering the positioning unit (see FIG. **5**). The

solar tracker may be positioned on a longitudinal edge of the trough **31**, or on the heat collector **29**. In the example illustrated in FIG. **9**, an optical solar tracker is shown, comprising photo cells **82** and **83** for tracking the position of the sun by means of two reference angles, supported by a plate **81** mounted on a cylinder **80**, and a half disc **100**, for example, providing a shaded zone for the photo cells **82** and **83**.

[0099] Alternatively, the control unit (d) may receive data on the sun position from a remote database and use these data to send instructions to the motor (M) powering the positioning unit.

[0100] When high positioning precision is requested, both a solar tracker positioned on the solar concentrator unit and databases data may be combined by the control unit (d) to compensate for mechanical or optical errors or environmental interferences.

[0101] When solar concentrator units are assembled in series, one control unit (d) may be used for a row for example. The control unit (d) thus precisely controls movement of the positioning unit, by rotation of the wheels for example, for an optimal orientation of the trough **31** relative to the solar beams, the trough **31** then focusing the sun's rays onto the heat collector **29**, for a maximum efficiency during operation of the solar concentrator unit.

[0102] During the night, or when the intensity of solar beams is too weak, the unit may be rotated into a rest position, the concave part of the trough **31** facing generally downwards, the heat collector **29** thus under cover of the concave part of the trough **31** from rain, hail, ice or any other environmental aggressive natural elements.

[0103] The unit is rotated back into an operational position when operational conditions are present. In the operational position, the control unit (d) controls an optimized positioning of the trough **31** for receiving the solar beams. Heat from the solar beams focused onto the heat collector **29** is transferred through the walls of the heat collector **29** to a heat transfer fluid for example, such as XCEL THERM® Grade 500 for example, which may then be pumped by means of a pump system through a thermal storage system for example as will be discussed in relation to FIG. **25** hereinbelow.

[0104] In another embodiment illustrated for example in FIGS. **10-24**, the self-supporting reflector is a parabolic mirror **310** of a sandwich structure, comprising outer metallic sheets **500, 502** sandwiching inner layer **503**, assembled together by gluing and shaped into a parabolic curve (see FIG. **14**). The thickness of the parabolic mirror **310** is about 2 inches. The longitudinal edges of the mirror are reinforced with rails **270** and **280** (see FIGS. **10** and **11**). The assembly is further locked into shape by lateral rails **504**.

[0105] The reflective surface of the parabolic mirror **310** is made for example with a laminated aluminum sheet **502** coated with a reflexive layer. The sheet **500** for the back surface may be of aluminum or steel for example. The inner layer **503** may have a honeycomb structure for example, such as aluminum honeycomb, for rigidity and lightness, or a polymer, resistant to humidity and to thermal expansion, flexible while dense enough, such as polystyrene, polypropylene or polyurethane for example, for a more precise and smooth finish surface, once curved, of the reflective surface **502**.

[0106] Ateral extrusions **504** and longitudinal rails **279, 280**, the parabolic mirror **310** is resistant to loads in torsion. Interestingly, ateral extrusions **504** also allow connecting together lengths of parabolic mirrors, for example when assembling solar concentrator units **100** in series (see FIGS.

10 and 11 for example). The mirror 310 is supported at lateral edges by bow arms 352 extending across the wheels 210 and secured at lateral edges thereof by clips 350, as shown in FIGS. 10, 11 and 22 to 24 for example.

[0107] The wheels 210 are allowed to rotate on supports 320, on at least 180°, for example at least 210°. The supports 320 comprises side arms 322, 324, which may be adjustable (see arrows B and C in FIG. 22) to modify orientation and height of the wheel 210.

[0108] As best seen in FIG. 13, the heat collector 290 comprises an inner tube 291 for circulation of a fluid, within an outer tube 292 generally coaxial with the inner tube. The inner tube is made in a thermally conductive material, the outer tube being in a material transparent to sun rays, such as glass for example. Vacuum is achieved between the inner tube 291 and the outer tube 292, to minimise thermal loss while letting the sun beams go through. Vacuum may be maintained by a vacuum pump (see connection at 293), which allows overcoming any permeability of the glass tube, and also allows adjusting to pressure variations caused by temperature variations for example. The heat collector 290 is maintained on the focal line of the parabolic mirror 310 by supporting arms 470, shown in FIGS. 14 to 21.

[0109] Each supporting arm 470 is connected to the heat collector 290 at a first end thereof by a connecting member 730. The connecting member 730 comprises a ring part 2030 adapted to be positioned about the heat collector 290 over a sleeve 400 and tabs 2040 adapted to be secured on sides of supporting arm 470. The tabs 2040 may be provided with openings 740 at different positions for adjusting the positioning of the supporting arm 470 relative to the heat collector 290 (see arrow A in FIG. 14).

[0110] The heat collector 290 may be made of a number of heat collectors members 290a (inner tube 291a and outer tube 292a) and 290b (inner tube 291b and outer tube 292b) joined in series for example (see FIG. 19), using a dismountable joint, best seen in FIGS. 18-21.

[0111] The joint is shown as comprising two half rings 505, maintaining in a clipping engagement around abutting tubular fittings 501 by the sleeve 400, each fitting 501 receiving an extremity of a section of heat collector member (see FIG. 19), or a an extremity of a section of heat collector member and an extremity of another tubular element respectively (see FIG. 18. In FIG. 21 the half rings 500 of the joint are shown exterior to the sleeve 400 for clarity only). In case of an extremity of a heat collector member, a sealing ring 502 is also provided between the inner tube and the outer tube of the heat collector member. Coaxial movement of the connected tube members is allowed within the sleeve 400. The outer surface of the half rings 500 may be provided with grooves 505 for accommodating a layer of material having a low coefficient of friction against solid, such as Teflon™ for example.

[0112] Upon internal pressure applied by the fluid within the heat collector members thus joined in series into a resulting heat collector, or upon expansion of the resulting heat collector, the half rings 505, and O-rings 503, 504, are compressed, thereby ensuring fluid tightness of the joint.

[0113] Such joint and sleeve between tubular members as described hereinabove may be used as locations for connecting the supporting arms 470 to the heat collector 290 at a first end of the supporting arm 470, as shown for example in FIG. 17.

[0114] At an opposite end 744 thereof, the supporting arm 470 is secured to the back of the parabolic mirror 310. As

shown in FIGS. 15 and 16, a plate 745, riveted to the mirror and supporting a positioning plate 476, engaging the open end 744 of the supporting arm 470 for example, may be used. The supporting arm 470, with its end 744 thus secured at a desired position on the mirror 310, and connected to the heat collector as described hereinabove, is further held into position by cables 747 tensioned between the connecting member 730 and the lateral extrusions 504 of the mirror 310. The supporting arms 470 are rigid and light, such as aluminum extrusions for example, and may be secured at any location at the back of the parabolic mirror 310 (see FIG. 10). The present reflector is thus a structural modular element, which length may be varied according to specific needs and constraints. Operation of the unit 100 is similar to that described in relation to the embodiment described hereinabove in relations to FIGS. 1-9. In the operational mode, the control unit (d), from the position of the solar beams relative to the reflector, controls an optimized orientation of the reflector as described hereinabove for receiving the solar beams. Heat from the solar beams focused by the reflector onto the heat collector may then be transferred through the walls of the heat collector to a fluid.

[0115] an installation comprising a system (S) for recovering solar energy by solar energy concentration, with a battery of parabolic solar concentrators (B), as a complementary energy system for an industrial dairy plant (P) for example, and installed on the roof of the dairy plant. With an efficiency of about 70% on an average sunny day, the battery (B) of parabolic solar concentrators can absorb 700 Watts of 1 000 watts received per square meters. The solar energy thereby captured is then converted to thermal energy as a heat transfer fluid is circulated at the apex of the parabolic solar concentrators in a heat collector.

[0116] The battery of parabolic solar concentrators (B) is made of six lines of 120 feet of parabolic solar concentrators according of the present invention, covering 252 square meters, the parabolic solar concentrators being connected in series, in six parallel lines, of solar concentrators units. The battery (B) of parabolic solar concentrators on the roof is connected to a heat storage system (HS) by means of tubular connections (see insert FIG. 25). A tubular connection feeds the battery (B) of parabolic solar concentrators with cold fluid coming, in this example, from the dairy plant (P). A tubular connection connects the heat storage system HS with the plant (P) and feeds the plant (P) with heated fluid. A pump and expansion tank system ensures the circulation of the fluids in the tubular connections and absorbs volumes expansion according to the temperature of the fluids circulating in tubular connections.

[0117] There is thus provided a concentrating solar dish unit assembly having a rotational axis, which solar dish unit assembly comprises at least one rigid parabolic self-supporting solar collector system comprising at least one solar mirror, at least one heat transfer collector positioned above the concave part of the self-supporting solar collector and to receive light reflected from the parabolic solar collector, the heat transfer collector being connected, in a rigid way, to the parabolic self-supporting solar collector; one structural rotational system configured for positioning, by rotation around the rotational axis, the rigid parabolic self-supporting solar collector system in an optimised positioning relative to the positioning of the solar beam at the place; and one solar beam detection system configured to analyse the specification, such as the positioning and such as the intensity, of the solar beam at the place and to send optimised positioning parameters to

the structural rotational system, the solar beam detection system being preferably positioned on a edge of the lateral side solar mirror.

[0118] The rigid parabolic self-supporting solar collector system comprises a reinforced structure. The rigid parabolic self-supporting mirror system can be made of various elementary mirrors having preferably the same features, particularly the same curves, to receive solar radiation and to concentrate at least portion of the solar radiation on the heat transfer collector. The heat transfer collector, such as a heat transfer tube, is positioned to receive light reflected from the parabolic solar collector, the heat transfer tube being positioned at a position that is about parallel to the axle of the parabolic mirror and that is sensibly constant relative to the spatial positioning of the parabolic self-supporting mirror. A heat transfer tube support is positioned under the heat transfer tube for assuring support and rigidity of the heat transfer tube. The positioning unit can be a structural rotational system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of the solar dish unit and a mechanical system connected to the wheels for positioning the dish unit according to the position of the solar beam comprising a motor that may be positioned in the supporting arm. A beam detection system and a conversion unit may be provided for providing the mechanical system with instructions for positioning the wheels.

[0119] The parabolic self-supporting mirror may be attached directly or indirectly to the positioning unit, its reinforced structure comprising at least 3 rails, a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to the internal part of the two external wheels, each of the 2 lateral sides of the parabolic self-supporting mirror being attached and/or supported to/by one of the at least 2 edge rails; the spinal rail being connected to the edge rails by the reinforcing elements; the heat transfer tube being inside the cylinder defined by the 2 external parallel wheels, and positioned at the focal of the beam; and the heat transfer tube support being attached to the spinal tube and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube.

[0120] The structural rotational system is configured to be able to position the system from 0 to 360 degrees, in a non-use position wherein the rotational angle of the wheel system may vary from 0 to 180 degrees relative to the use position—preferably the non-use rotational angle is about 200 degrees.

[0121] The structural circular wheel, which is fixed, on the structure, allows rotation of the assembly in order to pursue the sun's orientation.

[0122] The heat collector has a low to very low emissivity, the emissivity being measure according to ASTM E408-71 is preferably between 3 and 10%, and more preferably is about 5%.

[0123] The combination of the parabolic solar collector system and its reinforced structure allows the entire system to make up the forces applied (especially shear and torsion) without adding special piece. The reinforced structure is composed of three reinforced rails positioned in a triangle. The reinforced structure comprises 2 identical edge rails or tubes and the third rail named spinal rail may be a tube. The reinforcing elements are diagonal reinforcement bars. The three rails may be designed, with tracks for example, to make possible riveting with diagonal reinforcement bars (without

adding extra room). The positioning of the three rails in a triangle made by the diagonal reinforcement bars can give shape to the structure to accommodate the solar collectors or dishes. The two side rails allow radial positioning of parabolic solar collector and its holding it in the predetermined position, this result may be achieved, for example, by riveting.

[0124] The parabolic mirror may be made of a sandwich structure such as a honeycomb type structure. The structural strength and sustainability of the curvature of the mirror is achieved through the sandwich structure which provides the necessary rigidity with low weight, in addition to ensuring high precision optics. A sandwich structure auto carrier can be disassembled from the front of the solar unit assembly and regardless of the complete structure.

[0125] The structural strength and sustainability of the curvature of the mirror is achieved without mechanical maintenance or additional torque.

[0126] At least the concave surface of the self-supporting parabolic solar collective system is reflective.

[0127] The heat transfer collector, such as a heat transfer tube, is supported at the focal line of the parabolic solar collector by a supporting arm allowing optimal and permanent positioning of the heat transfer collector, while thermal fluid circulating inside the heat transfer collector, absorbs and transports the thereby collected energy.

[0128] The heat transfer collector can consist of a highly thermally conductive structural material, which material is preferably coated with a high absorbcency surface material such as electrodeposited chrome material.

[0129] The mechanical system allows the rigid parabolic self-supporting mirror that may be an assembly of mirrors, to rotate on an axis to allow optimization of the capture of light beams.

[0130] The solar beam sensing system detects solar potential evaluates its intensity and steer precisely the structure (via the mechanical system) towards optimal solar collection and if appropriate steers the structure to a non-use (sleep) position.

[0131] A solar assembly series comprising at least two solar unit assemblies connected together, in series for example, can be assembled.

[0132] A solar assembly or a solar assembly series can be used for heating a heat transfer fluid, for producing industrial steam.

[0133] The solar dish unit assembly or the solar assembly series can be manufactures by using assembling methods such as welding, moulding, riveting, coating, bending, laminating, extruding, screwing and combination of at least 2 of the latter technologies.

[0134] There is provided an easily transportable kit constituted by:

[0135] a rigid parabolic self-supporting solar collector system comprising at least one solar mirror, at least one heat transfer element being positioned above the concave part of the supporting solar collector and to receive light reflected from the parabolic solar collector, the heat transfer element being connected in a solider way to the parabolic self-supporting solar collector;

[0136] a structural rotational system configured for positioning the rigid parabolic self-supporting solar collector system in an optimised positioning relative to the positioning of the solar beam at the place; and

[0137] a beam detection system configured to analyse the specification, such as the positioning, of the solar at

the place and to send optimised positioning parameters to structural rotational system.

[0138] This kit can be used for easy installing, preferably on the roof, of a concentrating solar dish unit assembly in private house, building, manufactory or industry.

[0139] This kit can be used in a remote place.

[0140] This kit can be used for producing industrial steam.

[0141] There is provided a concentrating solar dish unit assembly, which comprises at least:

[0142] a rigid parabolic self-supporting mirror system, which mirror system can be made of various elementary mirrors having preferably the same features, particularly the same curves, to receive solar radiation and to concentrate at least portion of the solar radiation on the heat transfer collector;

[0143] a reinforced structure for supporting the parabolic mirror, which reinforcing structure being positioned under the parabolic mirror and supporting part of the back of the rigid parabolic self-supporting mirror system, preferably the reinforced structure is a circular tube or a circular tube longitudinally cut in order to have 2 contact surfaces between the cut tube and the back of the parabolic mirror, having an axis about parallel to the mirror axis;

[0144] a heat transfer collector, preferably a heat transfer tube, positioned to receive light reflected from the parabolic solar collector, the heat transfer tube being positioned at a position that is about parallel to the axle of the parabolic mirror and that is sensibly constant relative to the spatial positioning of the parabolic self-supporting mirror;

[0145] a heat transfer tube support positioned under the heat transfer tube for assuring support and rigidity of the heat transfer tube, preferably the heat transfer tube support is connected to the reinforced supporting structure;

[0146] a structural rotational system that is a wheel system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of the solar dish unit;

[0147] a mechanical system connected to the structural wheel system for positioning the dish unit according to the position of the solar beam comprising a motor that may be positioned in the supporting arm; and

[0148] a beam detection system and a conversion unit for providing the mechanical system with instructions for positioning the structural wheel system.

[0149] As people in the art will now be in a position to appreciate, the present solar concentrator units are simple, modular, scalable and robust. They may be used in adverse environments, including in arid or Nordic climates. They may be combined in series and assemblies in a modular way to meet target performances and space constraints. Such flexibility allows tailoring assemblies according to energy needs of businesses in industrial sectors, such as food processing, paper pulp, hospitality, health and any businesses that require heat in their processes for example, commercial and even residential, as well as applications of power generation such as organic Rankine cycles or steam generation. The streamlined structure of the present units and assemblies thereof allows a reduced footprint and minimizes shadows on the solar collection surfaces, thus optimizing the performance of sun concentration. Moreover, the streamlined structure allows a reduced weight and limits the aerodynamic drag force from the winds, which allows installation of such units

on roofs for example. The simple structure allows easy and rapid assembly. Easily transportable, the units may be used in remote locations. Only common tools and equipment are required for installation and no special training is needed. A large majority of the member of the units can be extruded thereby reducing manufacturing costs. The invention relates to:

[0150] 1. A concentrating solar dish unit assembly having a rotational axis, which solar dish unit assembly comprises at least:

[0151] one rigid parabolic self-supporting solar collector system comprising at least one solar mirror, at least one heat transfer collector positioned above the concave part of said self-supporting solar collector and to receive light reflected from said parabolic solar collector, said heat transfer collector being connected, preferably in a rigid way, to the said parabolic self-supporting solar collector;

[0152] one structural rotational system configured for positioning, by rotation around said rotational axis, the rigid parabolic self-supporting solar collector system in an optimised positioning relative to the positioning of the solar beam at the place; and

[0153] preferably one solar beam detection system configured to analyse the specification, such as the positioning and such as the intensity, of the solar beam at the place and to send optimised positioning parameters to said structural rotational system, said solar beam detection system being preferably positioned on a edge of the lateral side solar mirror.

[0154] 2. A concentrating solar dish unit assembly according to claim 1, wherein said rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror.

[0155] 3. A concentrating solar dish unit assembly having according to claim 1 or 2, which comprises at least:

[0156] a rigid parabolic self-supporting mirror system, which mirror system can be made of various elementary mirrors having preferably the same features, particularly the same curves, to receive solar radiation and to concentrate at least portion of said solar radiation on said heat transfer collector;

[0157] a reinforced structure for supporting said parabolic mirror, which reinforcing structure being positioned under said parabolic mirror;

[0158] a heat transfer collector, preferably a heat transfer tube, positioned to receive light reflected from said parabolic solar collector, said heat transfer tube being positioned at a position that is about parallel to the axle of said parabolic mirror and that is sensibly constant relative to the spatial positioning of the parabolic self-supporting mirror;

[0159] a heat transfer tube support positioned under said heat transfer tube for assuring support and rigidity of said heat transfer tube;

[0160] a structural rotational system that is a wheel system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of said solar dish unit;

[0161] a mechanical system connected to the said structural wheel system for positioning said dish unit according to the position of the solar beam comprising a motor that may be positioned in the calo-arm; and

- [0162] a beam detection system and a conversion unit for providing said mechanical system with instructions for positioning said structural wheel system.
- [0163] 4. A concentrating solar dish unit assembly, having according to anyone of claims 1 to 3, presenting at least one of the following specifications:
- [0164] said parabolic self-supporting mirror being attached directly or indirectly to the structural wheel system,
- [0165] said reinforced structure comprising at least 3 rails, a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to the internal part of the two external wheels,
- [0166] each of the 2 lateral sides of said parabolic self-supporting mirror being attached and/or supported to/by one of the at least 2 edge rails;
- [0167] the spinal rail being connected to the edge rails by the said reinforcing elements;
- [0168] said heat transfer tube being inside the cylinder defined by the 2 external parallel wheels, and positioned at the focal of the beam; and
- [0169] the heat transfer tube support being attached to the spinal tube and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube.
- [0170] 5. A solar dish unit assembly according to anyone of claims 1 to 4, wherein the structural rotational system is configured to be able to position the system from 0 to 360 degrees, an in a non use position wherein the rotational angle of the wheel system may vary from 0 to 180 degrees relative to the use position—preferably the non-use rotational angle is about 200 degrees.
- [0171] 6. A solar dish unit assembly according to anyone of claims 1 to 5, wherein the heat collector has a low to very low emissivity, the emissivity being measure according to ASTM E408-71 is preferably between 3 and 10%, and more preferably is about 5%.
- [0172] 7. A solar unit assembly according to anyone of claims 1 to 6, wherein the combination of the parabolic solar collector system and of the self-supporting reinforced structure allows the entire system to make up the forces applied (especially shear and torsion) without adding special piece.
- [0173] 8. A solar unit assembly according to anyone of claims 3 to 7, wherein the freestanding said parabolic mirror is made of a sandwich structure preferably of a “honeycomb” type structure.
- [0174] 9. A solar unit assembly according to anyone of claims 1 to 8, wherein at least the concave surface of the self-supporting parabolic solar collective system is reflective.
- [0175] 10. A solar unit assembly according to claims 8 and 9, wherein structural strength and sustainability of the curvature of the mirror is achieved through the sandwich structure which provides the necessary rigidity with low weight, in addition to ensuring high precision optics.
- [0176] 11. A solar unit assembly according to anyone of claims 1 to 10, wherein structural strength and sustainability of the curvature of the mirror is achieved without mechanical maintenance or additional torque.
- [0177] 12. A solar unit assembly according to anyone of claims 9 to 11, wherein the sandwich structure auto carrier can be disassembled from the front of said solar unit assembly and regardless of the complete structure.
- [0178] 13. A solar unit assembly according to anyone of claims 1 to 13, wherein said reinforced structure is composed of three reinforced rails positioned in a triangle.
- [0179] 14. A solar unit assembly according to anyone of claim 12, wherein in said reinforced structure the 2 edge rails are identical and are preferably tubes and the third rail named spinal rail is preferably a tube.
- [0180] 15. A solar unit assembly according to claim 13 or 14, wherein the reinforcing elements are diagonal reinforcement bars.
- [0181] 16. A solar unit assembly according to anyone of claims 13 to 15, wherein the three rails are designed, preferably with tracks, to make possible riveting with diagonal reinforcement bars (without adding extra room).
- [0182] 17. A solar unit assembly according to anyone of claims 13 to 16, wherein the positioning of the three rails in a triangle made by the diagonal reinforcement bars can give shape to the structure to accommodate the solar collectors or dishes.
- [0183] 18. A solar unit assembly according to anyone of claims 1 to 17, wherein the two side rails allow radial positioning of parabolic solar collector and its holding it in the predetermined position, this result may be achieved, for example, by riveting.
- [0184] 19. A solar unit assembly according to anyone of claims 3 to 18, wherein said structural circular wheel, which is fixed, on the structure, allow rotation of the assembly in order to pursue the sun’s orientation.
- [0185] 20. A solar unit assembly according to anyone of claims 16 to 19, wherein the heat transfer collector, preferably the heat transfer tube, is supported at the focal line of the parabolic solar collector by a calo-arm allowing optimal and permanent positioning of the heat transfer collector, while thermal fluid circulating inside said heat transfer collector, absorbs and transports the thereby collected energy.
- [0186] 21. A solar unit assembly according to anyone of claims 1 to 20, wherein said heat transfer collector consists of a highly thermally conductive structural material, which material is preferably coated with a high absorbency surface material such as electrodeposited chrome material.
- [0187] 22. A solar unit assembly according to anyone of claims 1 to 21, wherein the mechanical system allows the rigid parabolic self-supporting mirror that may be an assembly of mirrors, to rotate on an axis to allow optimization of the capture of light beams.
- [0188] 23. A solar unit assembly according to anyone of claims 1 to 22, wherein the solar beam sensing system detects solar potential evaluates its intensity and steer precisely the structure (via the mechanical system) towards optimal solar collection and if appropriate steers the structure to a non-use (sleep) position.
- [0189] 24. A solar assembly series comprising at least two solar unit assemblies, as defined in anyone of claims 1 to 23, connected together.
- [0190] 25. A solar assembly series according to claim 24, wherein the solar unit assemblies are connected, two by two, in series mode.
- [0191] 26. Use of a solar assembly as defined in anyone of claims 1 to 25 or of a solar assembly series that is defined in claim 23 or 24, for heating a heat transfer fluid.
- [0192] 27. Use of a solar assembly as defined in anyone of claims 1 to 25 or of a solar assembly series that is defined in claim 23 or 24, for producing industrial steam.

- [0193] 28. Process for manufacturing a solar dish unit assembly according to anyone of claims 1 to 23 or for manufacturing a solar assembly series as defined in claim 24 or 25, by using assembling methods such as welding, moulding, riveting, coating, bending, laminating, extruding, screwing and combination of at least 2 of the latter technologies.
- [0194] 29. Easily transportable kit constituted by:
- [0195] a rigid parabolic self-supporting solar collector system comprising at least one solar mirror, at least one heat transfer element being positioned above the concave part of said supporting solar collector and to receive light reflected from said parabolic solar collector, said heat transfer element being connected in a solid way to the said parabolic self-supporting solar collector;
- [0196] a structural rotational system configured for positioning the rigid parabolic self supporting solar collector system in an optimised positioning relative to the positioning of the solar beam at the place; and
- [0197] a beam detection system configured to analyse the specification, such as the positioning, of the solar at the place and to send optimised positioning parameters to said structural rotational system.
- [0198] 30. Use of a kit according to claim 29 for easy installing, preferably on the roof, of a concentrating solar dish unit assembly in private house, building, manufactory or industry.
- [0199] 31. Use of a kit according to claim 30 in a remote place.
- [0200] 32. Use of a kit according to claim 30 or 31 for producing industrial steam.
- [0201] 33. A concentrating solar dish unit assembly having according to claim 1 or 2, which comprises at least:
- [0202] a rigid parabolic self-supporting mirror system, which mirror system can be made of various elementary mirrors having preferably the same features, particularly the same curves, to receive solar radiation and to concentrate at least portion of said solar radiation on said heat transfer collector;
- [0203] a reinforced structure for supporting said parabolic mirror, which reinforcing structure being positioned under said parabolic mirror and supporting part of the back of said rigid parabolic self-supporting mirror system, preferably said reinforced structure is a circular tube or a circular tube longitudinally cut in order to have 2 contact surfaces between said cut tube and the back of the said parabolic mirror, having an axis about parallel to the mirror axis;
- [0204] a heat transfer collector, preferably a heat transfer tube, positioned to receive light reflected from said parabolic solar collector, said heat transfer tube being positioned at a position that is about parallel to the axle of said parabolic mirror and that is sensibly constant relative to the spatial positioning of the parabolic self-supporting mirror;
- [0205] a heat transfer tube support positioned under said heat transfer tube for assuring support and rigidity of said heat transfer tube, preferably the heat transfer tube support is connected to said reinforced supporting structure;
- [0206] a structural rotational system that is a wheel system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of said solar dish unit;
- [0207] a mechanical system connected to the said structural wheel system for positioning said dish unit according to the position of the solar beam comprising a motor that may be positioned in the calo-arm; and
- [0208] a beam detection system and a conversion unit for providing said mechanical system with instructions for positioning said structural wheel system.
- [0209] The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.
1. A concentrating solar dish unit assembly having a rotational axis, said solar dish unit assembly comprising at least:
 - one unitary rigid parabolic self-supporting solar collector system comprising at least one solar mirror;
 - at least one heat transfer collector positioned above a concave surface of said unitary self-supporting solar collector and adapted to receive light reflected from said parabolic solar collector, said heat transfer collector being connected, preferably in a rigid way, to said unitary parabolic self-supporting solar collector,
 - a structural rotational system configured for positioning, by rotation around said rotational axis, the unitary parabolic self-supporting solar collector system in an optimised positioning relative to the positioning of incident solar beam; and
 - preferably one solar beam detection system configured to analyse parameters of the incident solar beam and to send optimised positioning parameters to said structural rotational system, said solar beam detection system being preferably positioned on an edge of the lateral side solar mirror.
 2. The concentrating solar dish unit assembly according to claim 1, wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror.
 3. (canceled)
 4. The concentrating solar dish unit assembly according to claim 1, wherein:
 - said unitary solar collector system comprises at least one elementary parabolic mirror to receive the solar beam and to concentrate at least portion of said solar beam on said heat transfer collector;
 - said heat transfer collector being a heat transfer tube positioned to receive light reflected from said parabolic solar collector, said heat transfer tube being positioned at a position that is about parallel to the axis of said parabolic mirror and that is sensibly constant relative to a spatial positioning of the unitary parabolic self-supporting mirror;
 - said assembly further comprising a heat transfer tube support positioned under said heat transfer tube for assuring support and rigidity of said heat transfer tube;
 - said assembly further comprising a structural rotational system that is a wheel system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of said solar dish unit assembly;

said assembly further comprising a mechanical system connected to said structural rotational system for positioning said dish unit according to the position of the solar beam; and

said assembly further comprising a beam detection system and a conversion unit for providing said mechanical system with instructions for positioning said structural rotational system.

5. The concentrating solar dish unit assembly according to claim 1,

wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror, and

wherein:

said unitary parabolic self-supporting mirror is attached directly or indirectly to the structural wheel system, said reinforced structure comprises at least three rails including a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to an internal part of the two external wheels; each of the two lateral sides of said unitary parabolic self-supporting mirror being attached and/or supported to/by one of the at least two edge rails; the spinal rail being connected to the edge rails by said reinforcing elements;

said heat transfer tube is positioned inside a cylinder defined by the two external parallel wheels, and positioned at the focal of the solar beam; and

the heat transfer tube support is attached to the spinal rail and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube.

6. The concentrating solar dish unit assembly according to claim 1, wherein the structural rotational system is configured to be able to position the system from 0 to 360 degrees, in a non-use position wherein the rotational angle of the wheel system may vary from 0 to 180 degrees relative to a use position.

7. (canceled)

8. (canceled)

9. (canceled)

10. The concentrating solar dish unit assembly according to claim 1, wherein the solar mirror has one of a sandwich structure and a honeycomb structure.

11. (canceled)

12. The concentrating solar dish unit assembly according to claim 1, wherein at least the concave surface of the unitary self-supporting parabolic solar collective system is reflective.

13. The concentrating solar dish unit assembly according to claim 1, wherein the mirror can be independently disassembled from the front of said solar dish unit assembly.

14. The concentrating solar dish unit assembly according to claim 1, wherein said reinforced structure is composed of three reinforced rails positioned in a triangle.

15. The concentrating solar dish unit assembly according to claim 1,

wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror,

wherein:

said unitary parabolic self-supporting mirror is attached directly or indirectly to the structural wheel system, said reinforced structure comprises at least three rails including a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to an internal part of the two external wheels; each of the two lateral sides of said unitary parabolic self-supporting mirror being attached and/or supported to/by one of the at least two edge rails; the spinal rail being connected to the edge rails by said reinforcing elements;

said heat transfer tube is positioned inside a cylinder defined by the two external parallel wheels, and positioned at the focal of the solar beam; and

the heat transfer tube support is attached to the spinal rail and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube, and

wherein in said reinforced structure the two edge rails are identical.

16. The concentrating solar dish unit assembly according to claim 1,

wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror,

wherein:

said unitary parabolic self-supporting mirror is attached directly or indirectly to the structural wheel system, said reinforced structure comprises at least three rails including a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to an internal part of the two external wheels; each of the two lateral sides of said unitary parabolic self-supporting mirror being attached and/or supported to/by one of the at least two edge rails; the spinal rail being connected to the edge rails by said reinforcing elements;

said heat transfer tube is positioned inside a cylinder defined by the two external parallel wheels, and positioned at the focal of the solar beam; and

the heat transfer tube support is attached to the spinal rail and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube, and

wherein in said reinforced structure the two edge rails are identical tubes and the spinal rail is a tube.

17. The concentrating solar dish unit assembly according to claim 1,

wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror,

wherein:

said unitary parabolic self-supporting mirror is attached directly or indirectly to the structural wheel system, said reinforced structure comprises at least three rails including a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to an internal part of the two external wheels; each of the two lateral sides of said

unitary parabolic self-supporting mirror being attached and/or supported to/by one of the at least two edge rails; the spinal rail being connected to the edge rails by said reinforcing elements;

said heat transfer tube is positioned inside a cylinder defined by the two external parallel wheels, and positioned at the focal of the solar beam; and

the heat transfer tube support is attached to the spinal rail and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube, and

wherein the reinforcing elements are diagonal reinforcement bars.

18. The concentrating solar dish unit assembly according to claim 1,

wherein said unitary rigid parabolic self-supporting solar collector system comprises a reinforced structure supporting the at least one solar mirror, said reinforced structure comprising brackets securing said solar mirror to said structural rotational system and lateral rails on said unitary solar mirror,

wherein:

said unitary parabolic self-supporting mirror is attached directly or indirectly to the structural wheel system, said reinforced structure comprises at least three rails including a spinal rail and two edge rails connected together by reinforcing elements which are attached directly and/or indirectly to an internal part of the two external wheels; each of the two lateral sides of said unitary parabolic self-supporting mirror being attached and/or supported to/by one of the at least two edge rails; the spinal rail being connected to the edge rails by said reinforcing elements;

said heat transfer tube is positioned inside a cylinder defined by the two external parallel wheels, and positioned at the focal of the solar beam; and

the heat transfer tube support is attached to the spinal rail and to the heat transfer tube and being perpendicular to the spinal rail to the heat transfer tube, wherein the reinforcing elements are diagonal reinforcement bars; and

wherein the three rails are tracks adapted for riveting with said diagonal reinforcement bars.

19-31. (canceled)

32. Easily transportable kit constituted by:

a unitary rigid parabolic self-supporting solar collector system comprising at least one solar mirror, at least one heat transfer element being positioned above a concave part of said unitary self-supporting solar collector and to

receive light reflected from said unitary self-supporting solar collector, said heat transfer element being connected in a solid way to the said unitary self-supporting solar collector;

a structural rotational system configured for positioning the unitary self-supporting solar collector system in an optimised positioning relative to the positioning of solar beams; and

a beam detection system configured to analyse the specifications of the solar beams, such as the positioning, of the solar beams and to send optimised positioning parameters to said structural rotational system.

33-35. (canceled)

36. A concentrating solar dish unit assembly, comprising: at least one heat transfer collector;

a unitary rigid parabolic self-supporting mirror system, which mirror system comprising at least one elementary mirror, to receive solar radiation and to concentrate at least portion of said solar radiation on said heat transfer collector;

a reinforced structure for supporting said parabolic mirror, which reinforcing structure being positioned under said parabolic mirror and supporting part of the back of said unitary rigid parabolic self-supporting mirror system, preferably said reinforced structure is a circular tube or a circular tube longitudinally cut in order to have 2 contact surfaces between said cut tube and the back of the said parabolic mirror, having an axis about parallel to the mirror axis;

wherein said heat transfer collector is positioned to receive light reflected from said unitary mirror system at a position that is about parallel to the axis of said mirror system and that is sensibly constant relative to the spatial positioning of mirror system;

a heat transfer collector support positioned under said heat transfer collector for assuring support and rigidity of said heat transfer collector;

a structural rotational system that is a wheel system comprising at least two parallel external wheels having sensibly the same diameter and positioned at opposite extremities of said solar dish unit;

a mechanical system connected to the said structural wheel system for positioning said dish unit according to the position of the solar beam; and

a beam detection system and a conversion unit for providing said mechanical system with instructions for positioning said structural wheel system.

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