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(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0199561 A1**
(43) **Pub. Date:** **Aug. 30, 2007**(54) **FLASHABLE ROOFTOP SOLAR
COLLECTOR ENCLOSURE****Publication Classification**(51) **Int. Cl.**
F24J 2/46 (2006.01)
(52) **U.S. Cl.** **126/623**(57) **ABSTRACT**

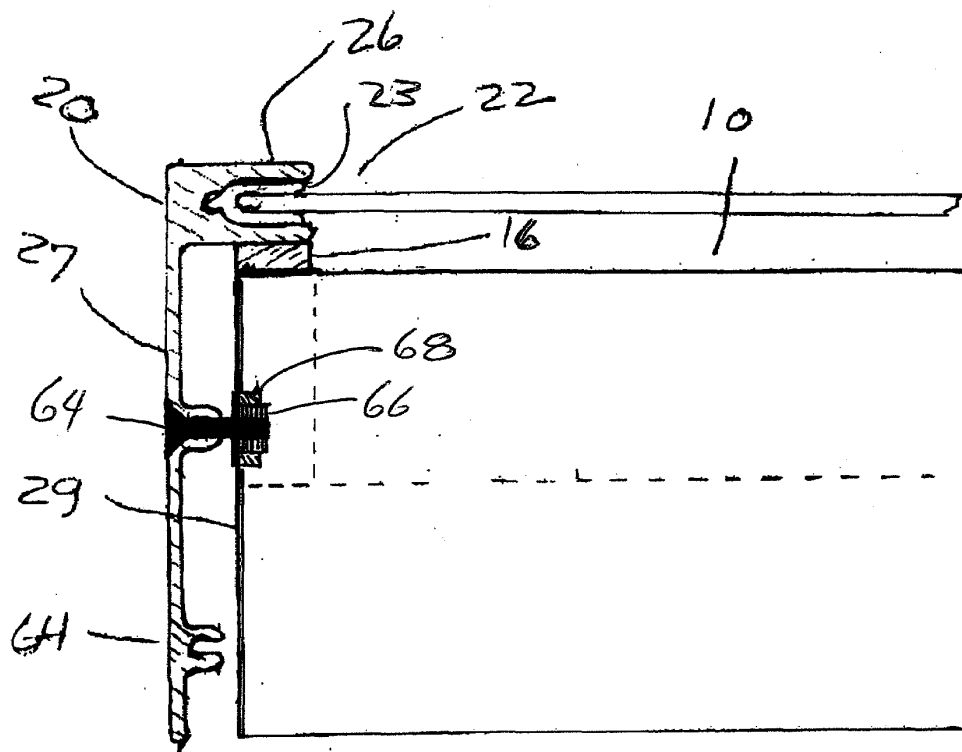
A flashable, rooftop enclosure with a solar radiation transmissive glazing suitable for holding solar energy collector of a solar power system includes an insulated base section with sidewalls which is secured to the roof sheathing and flashed all around, and a removably attachable glazed top section with full skirt, that is secured to and over the base unit after the interior components and connections are made, so as to seal the enclosure, overlap the flashing, and admit solar radiation. The internal components may include any or all of photovoltaic and thermal converters, with electrical and thermal fluid means of removing energy from the enclosure to respective energy distribution systems.

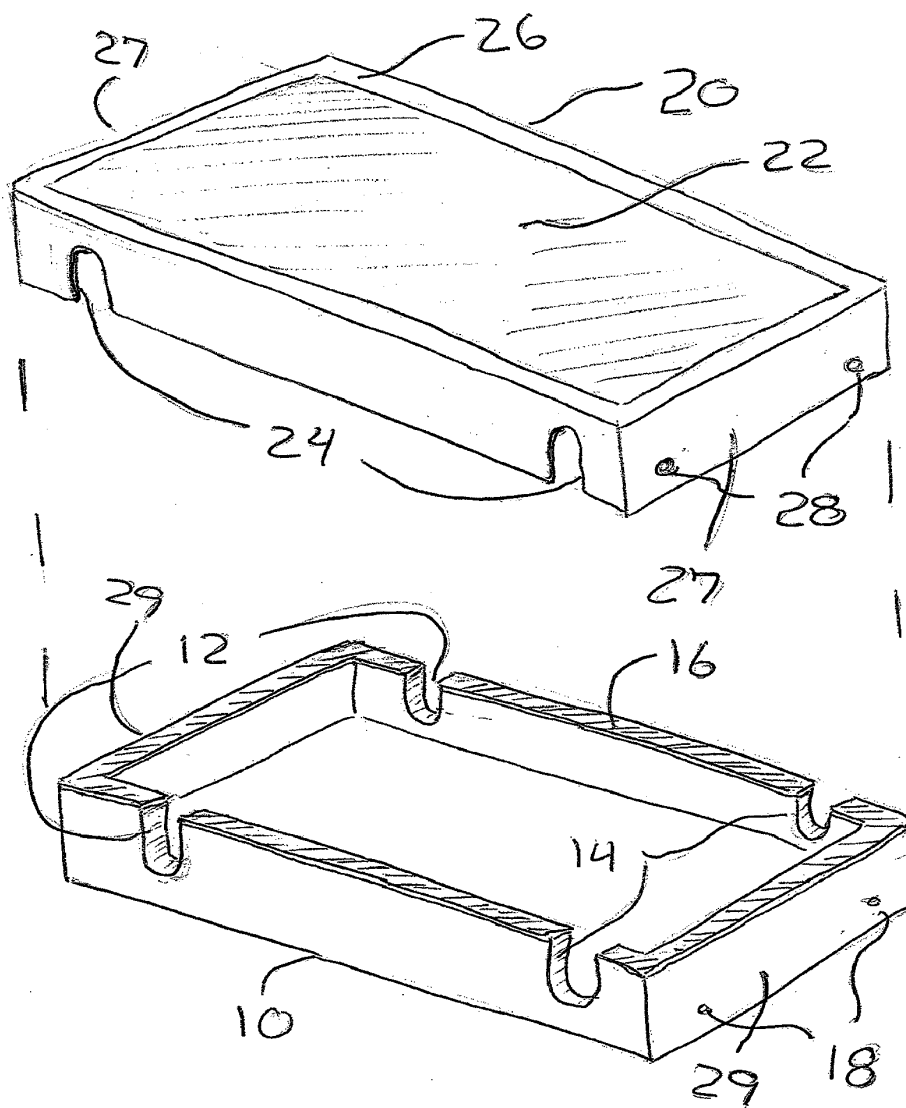
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NASHUA, NH 03061-3445**(21) Appl. No.: **11/677,590**(22) Filed: **Feb. 22, 2007****Related U.S. Application Data**

(60) Provisional application No. 60/776,519, filed on Feb. 24, 2006.





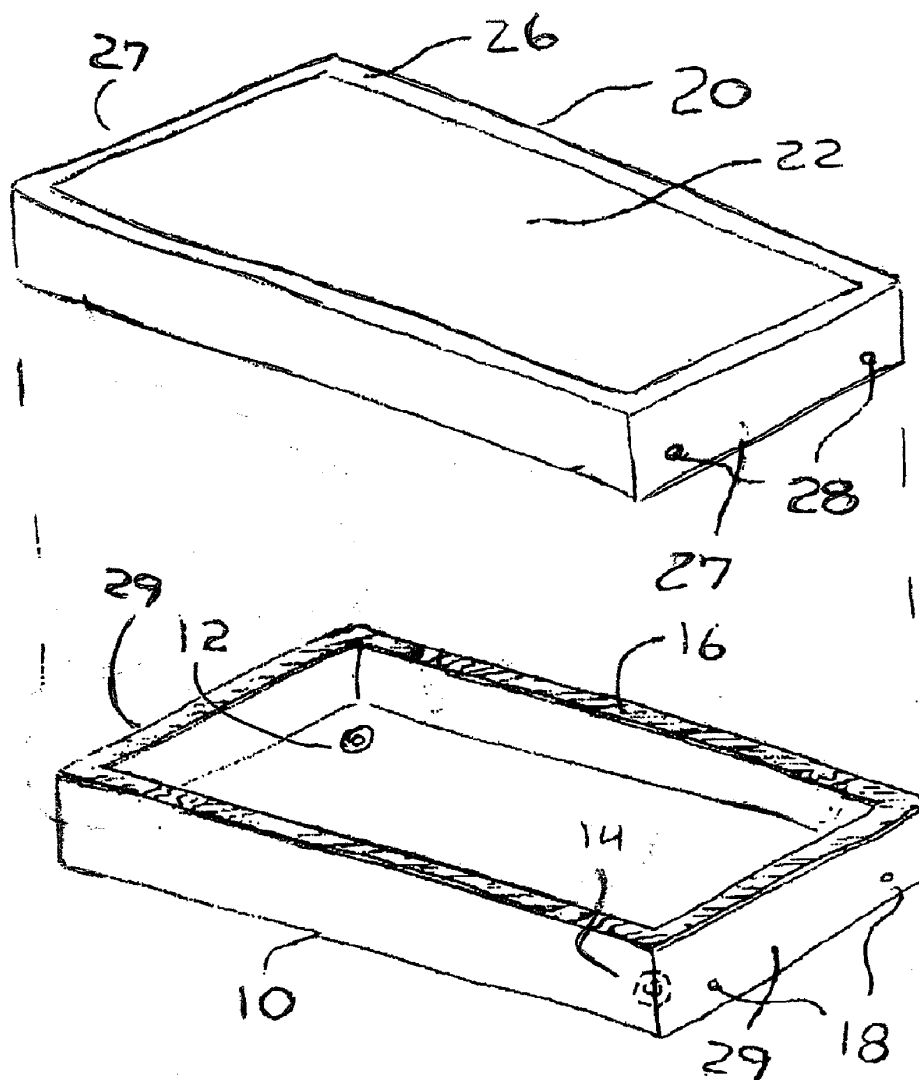
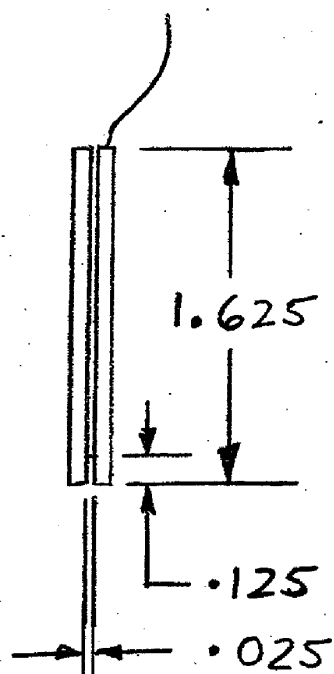
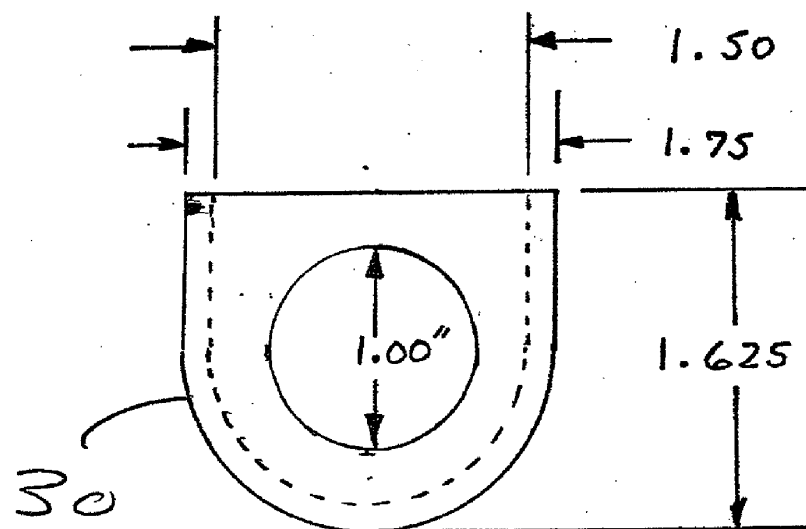


FIG. 1A



MATERIAL: SILICONE
DUROMETER: 80

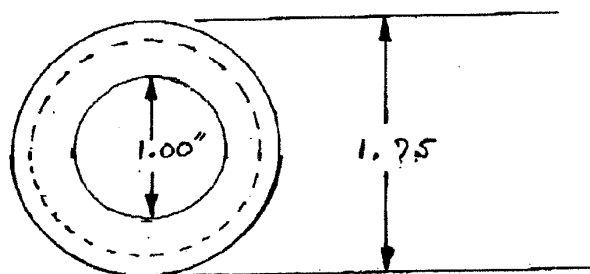


FIG 2C

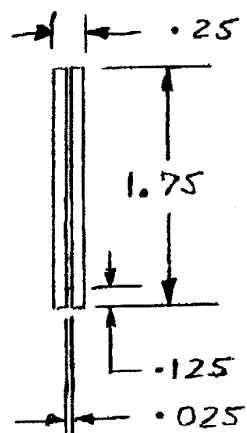
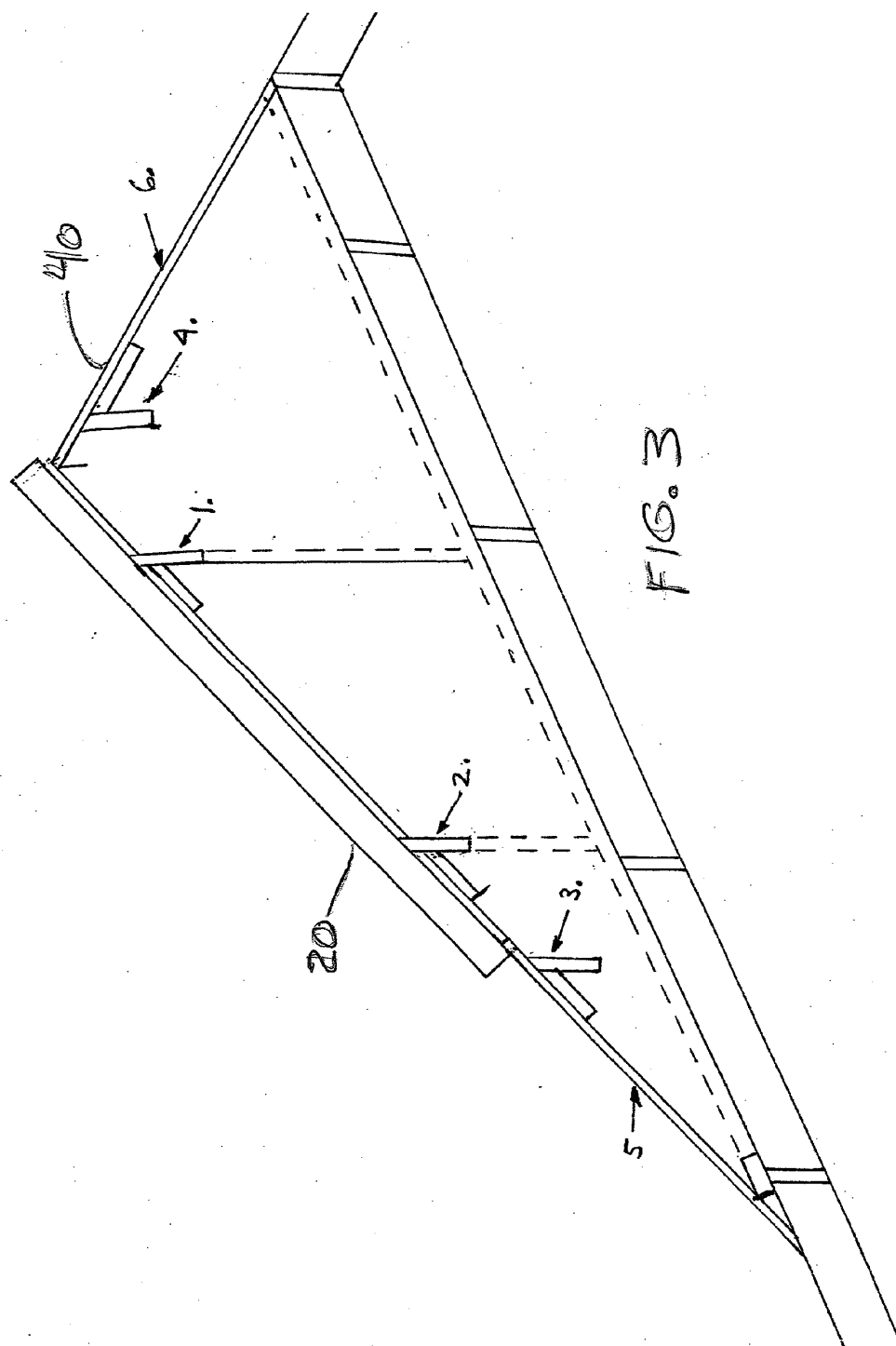


FIG 2D



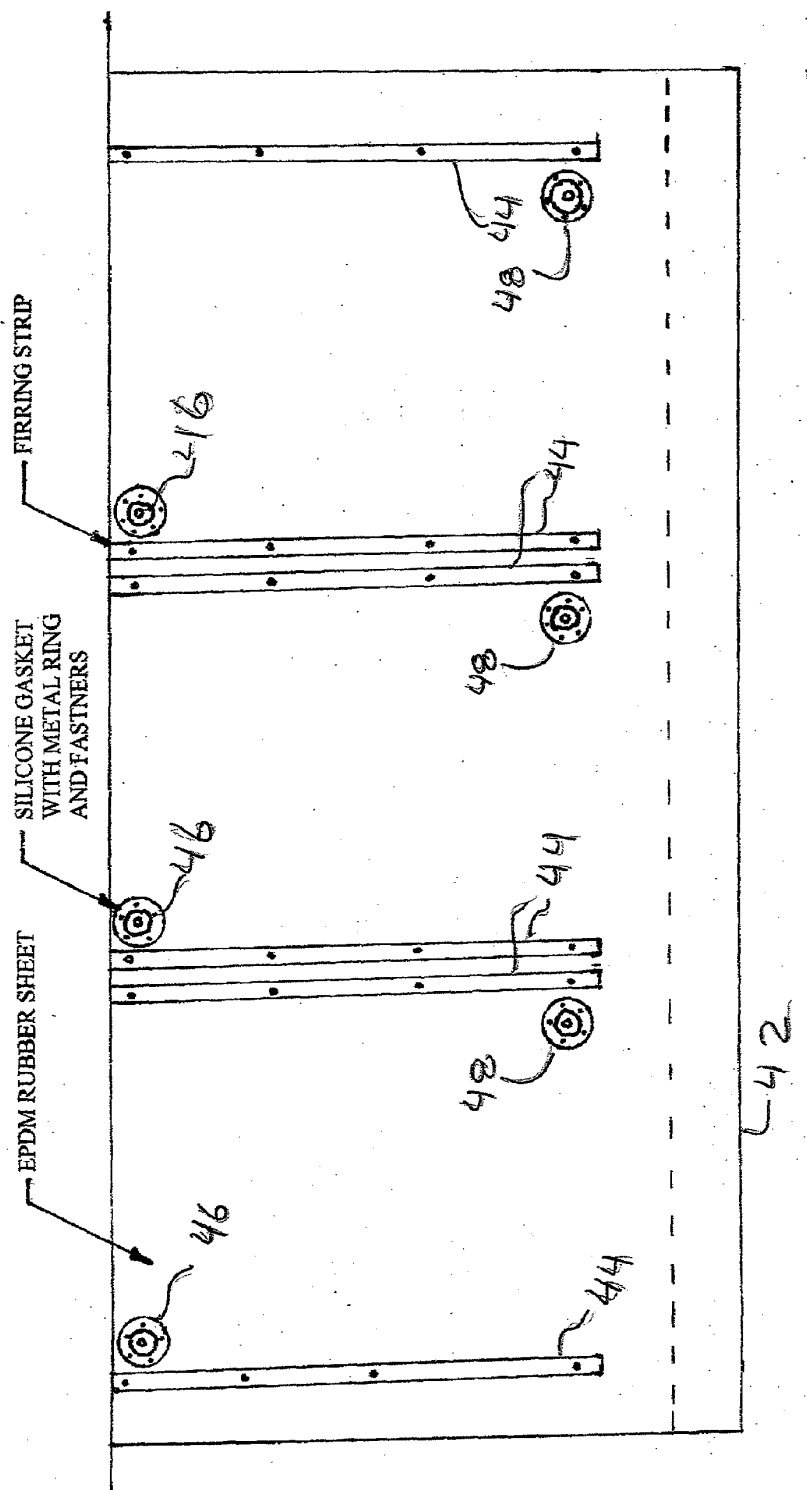
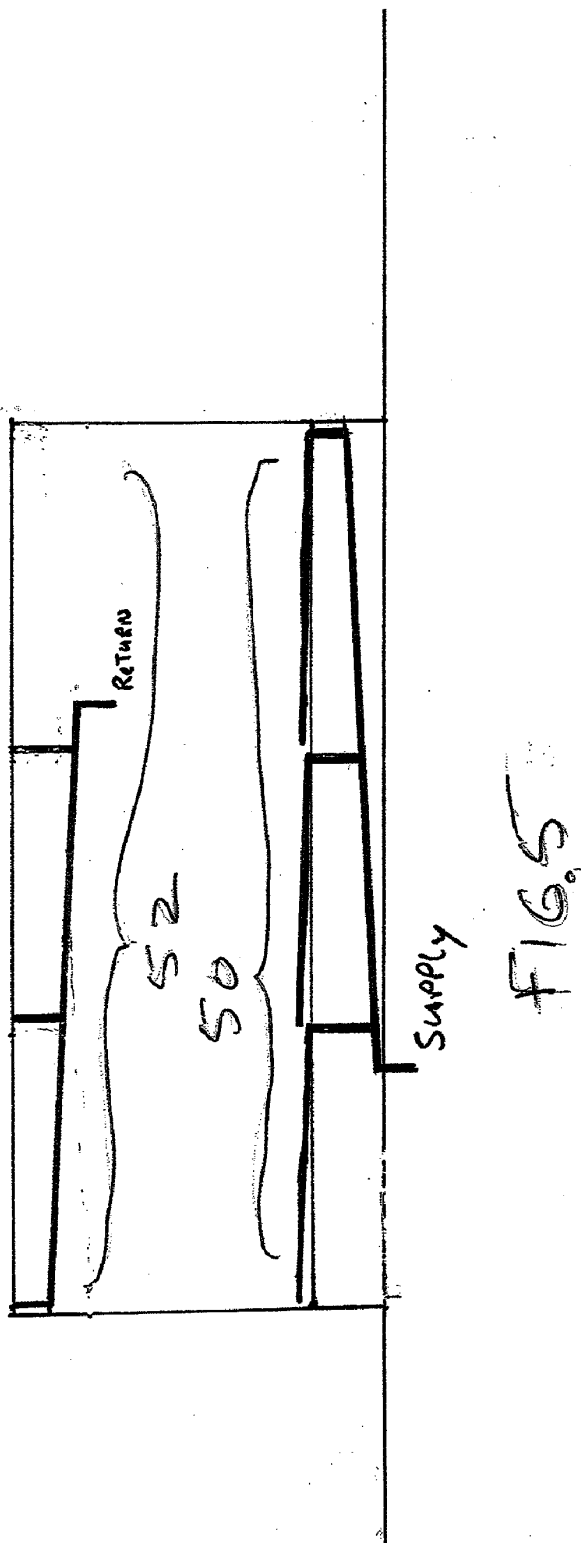
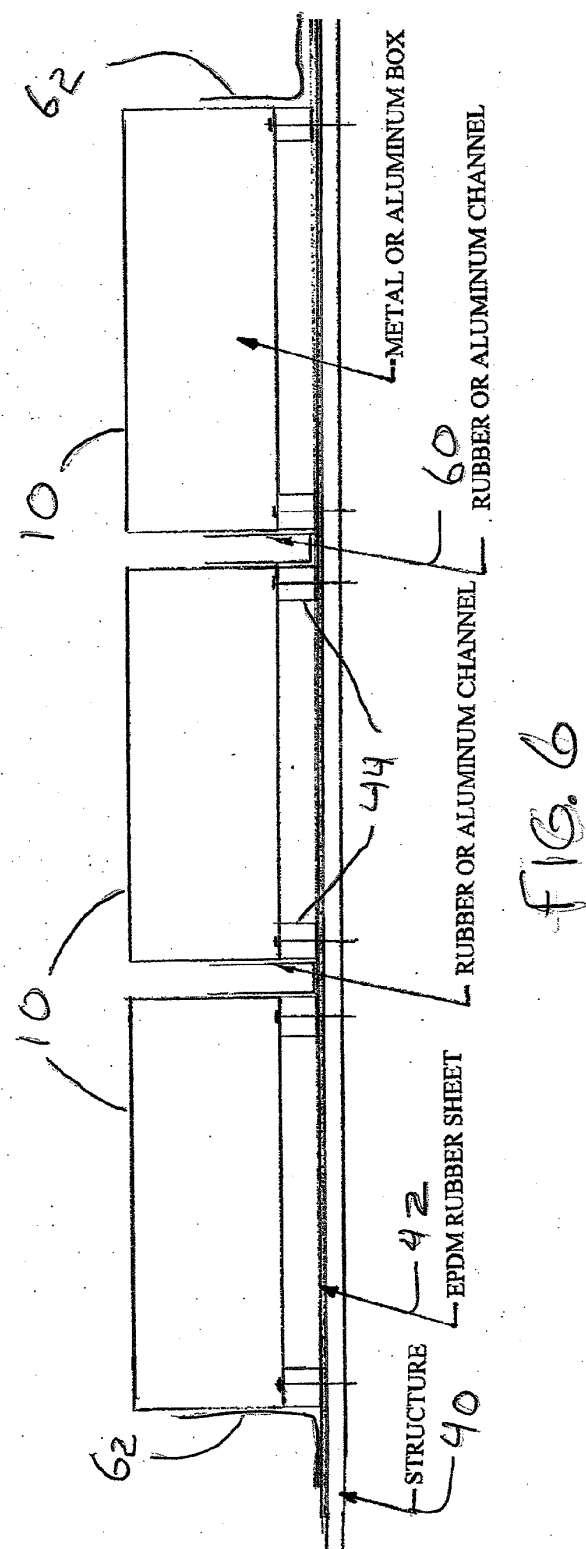


FIG. 4





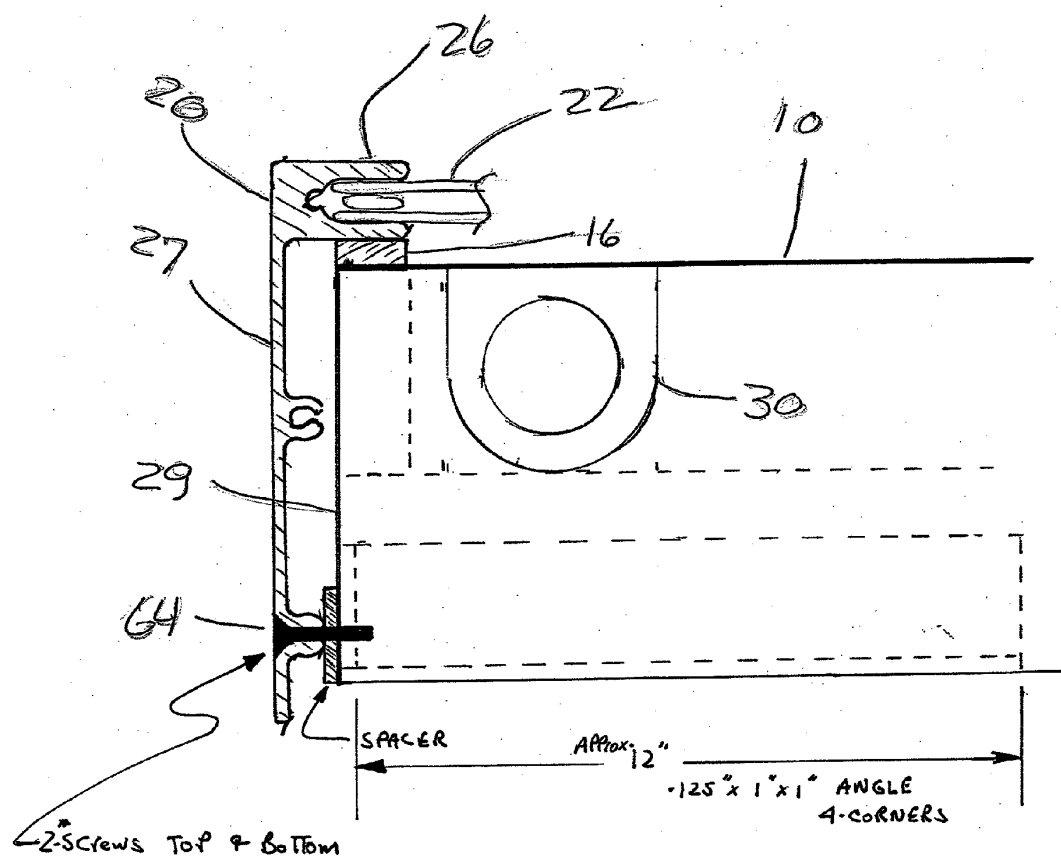


FIG. 7

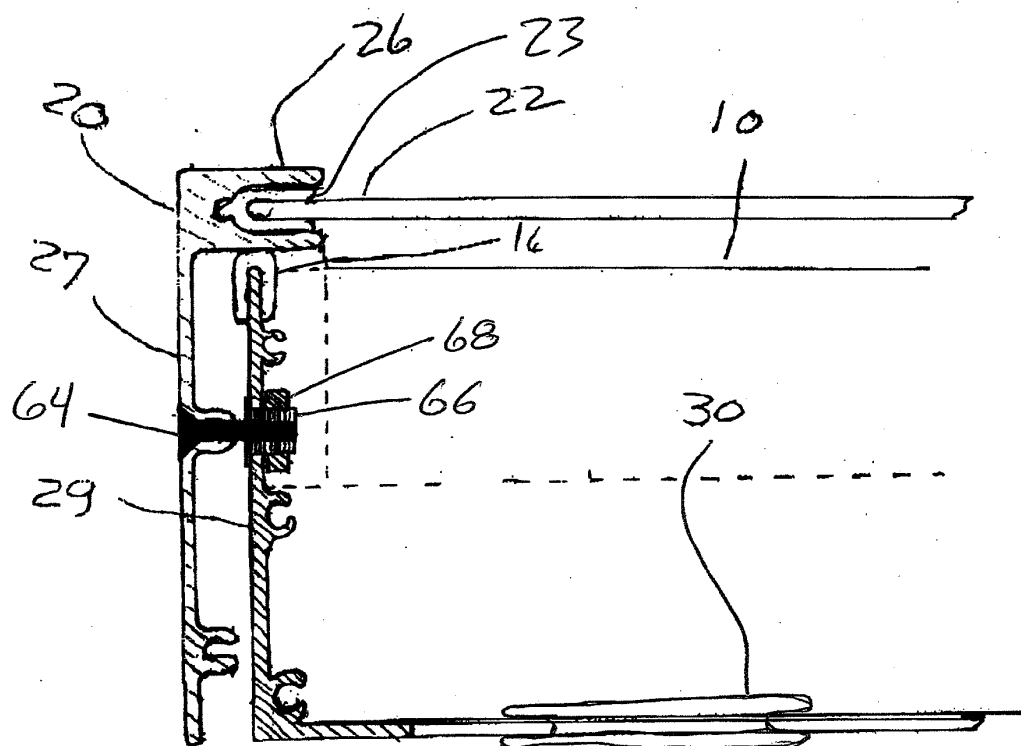
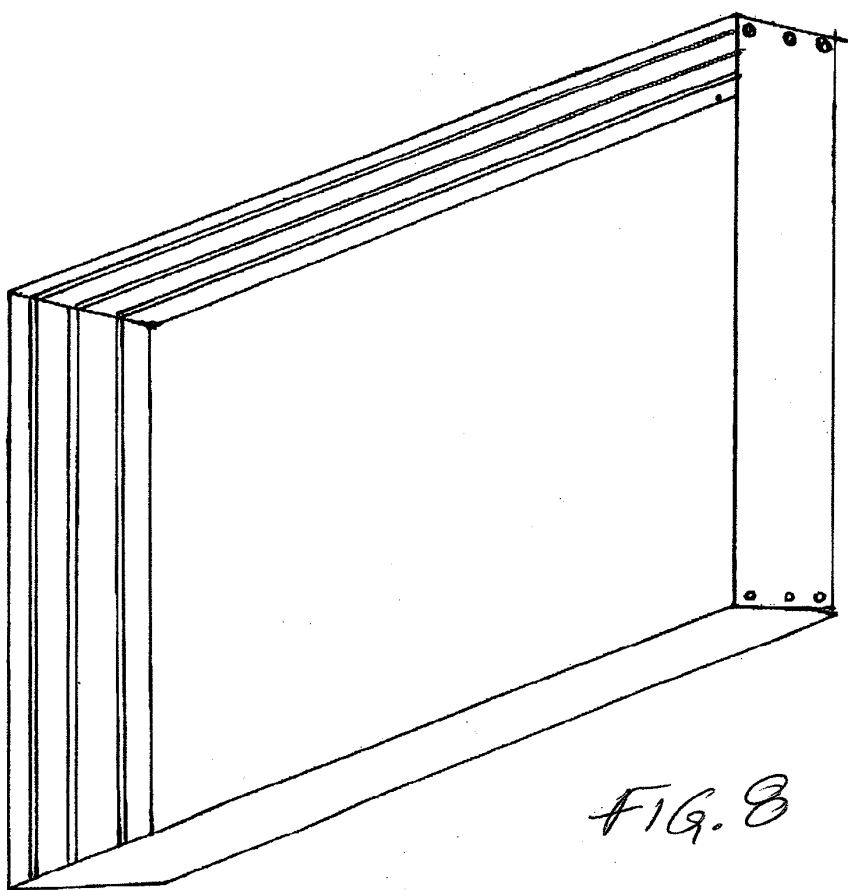


FIG. 7A



EPDM OR
SILICONE - BROWN
60-80 DUROMETER

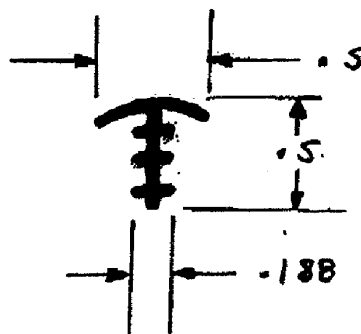
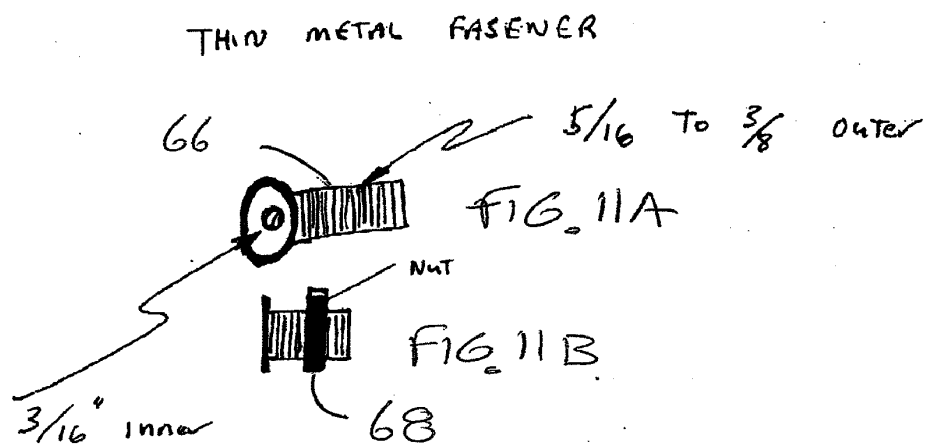
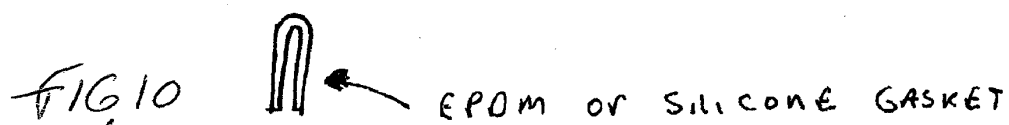


FIG. 9



**FLASHABLE ROOFTOP SOLAR
COLLECTOR ENCLOSURE****PRIORITY CLAIM**

[0001] This application claims priority to pending U.S. application Ser. No. 60/776,519 filed Feb. 24, 2006.

FIELD OF THE INVENTION

[0002] The invention relates to solar collector enclosures, and more particularly, to a flush mounted and flashable, two part, solar collector enclosure system that facilitates installation, maintenance and repair of solar passive, photovoltaic, and hybrid solar power systems.

BACKGROUND OF THE INVENTION

[0003] Solar energy is universally available. Sunshine striking the earth on a typical day is estimated to be sufficient to heat millions of homes, potentially conserving substantial fossil fuel and corresponding costs.

[0004] In the context of the exploding technology of home and building construction materials, designs and building techniques, there has not been much recent development in residential solar collector design. Although solar energy is abundant, harnessing it for residential and commercial use is limited by available, cost effective technology. Numerous active and passive solar collector systems for residential, commercial and industrial applications have been designed, installed and otherwise proposed; however, widespread acceptance of past solar collector systems is restricted by high initial cost, installation and weather related performance deficiencies, sometimes complicated operating nuances, unexpected maintenance issues, and high repair costs. Costly suitable solar collection materials and fabrication techniques, unattractive installations, and questionable reliability/repair capability make their purchase unattractive to many potential users.

[0005] Other problems associated with current solar energy collectors include their being difficult, expensive or impractical for fitting or retrofitting to existing structures; bulkiness, weight, size and unaesthetic appearance; unsuitability for on-site assembly and installation by building contractors and the do-it-yourself handyperson; the requirement of a thermal mass, complicated circulation equipment and other accessories for operation; compromising of conventional roof structures and coverings; inflexibility for heating selected spaces; requirements for a single or possibly multiple glazings, thick insulating materials, rubber gaskets and other heat loss reduction materials. The typical collector is large, bulky, difficult to manufacture, unsuitable for site assembly, difficult to install and thereby increases overall system cost.

[0006] The difficulties of installation, maintenance and repair is a subject not much discussed in the prior art. Many years of experience have indicated that these problems are a significant contributor to the relatively low level of acceptance. Unitary collector modules with their single or double glazed panes and insulated bodies are heavy, difficult or not suitable or intended to flash to a roof top or other support surface, as well as time consuming and difficult to access for repairs. Applicant's own issued patent U.S. Pat. No. 5,596, 981, particularly FIGS. 1 and 3, incorporated herein by reference, illustrates a contemporary design of a heavy glazing, modular collector that is both heavy and awkward to install, and time consuming to access for any necessary

repairs. Placing collector modules in banks or arrays in close proximity adds complexity to the installation and in particular to access for repairs.

[0007] These problems can lead to a breach of system or roof top integrity, or damage to the internal components, or abandonment and replacement of otherwise functional collectors when simple repairs are needed or attempted. Completed repairs where complex disassembly and reassembly is required, may result in a failure to fully restore the solar energy collection system to its original capability. Clearly a need exists for an improved solar collector system and installation methodology that overcomes the problems and limitations associated with the current solar collector modules and systems.

SUMMARY OF THE INVENTION

[0008] In one aspect, the invention is an improved solar power collector enclosure for enclosing the collector sub-assembly of an air or fluid circulation heating system or photovoltaic or hybrid solar power system. The enclosure offers significant benefits relating to system design, installation, and subsequent maintenance and operations. The basic enclosure unit, which may be ganged together with like units in various ways as is later described, is a two part system. The first part is a walled base component which may be installed on the sheathing of a roof or other mounting surface and may be flashed or sealingly joined about its perimeter to the roof shingles or other roof covering system.

[0009] The second part is a glazed and fully skirted top component sized for easy placement on and over the base component with a significant overlap of its skirting down over the wall of the base component and flashing. The top is then secured to the base unit so as to hold the top in a sealing manner to the base component, forming a secure, effective and weather-proof enclosure, flush mounted and flashed to the roof system. The enclosure is easily opened for and during installation, and later for maintenance and repairs, for placement and access to collector components and associated wiring and/or plumbing. The glazing is transparent to a high degree to solar radiation over a wide spectrum, for optimal performance of the enclosed collector.

[0010] As is well known, a photovoltaic cell array, or a solar collector array for a water or air circulated heating system, is generally mounted in so far as is practical with a direction and angle of elevation that will optimize the array's exposure to sunlight. Other variables, including complexity and cost of the installation and connections to the space being served, as well as esthetics, are also important considerations, making every installation design a compromise. Fluid and air circulation type solar collector modules are typically rectangular with two opposing edges longer than their adjoining edges, specifically configured in some cases as for flow of the gas or fluid medium, to have the long sides running with the pitch angle of the roof or mounting structure, and the short sides installed as the upper and lower ends. In some cases and for some installations it may be preferable to orient rectangular modules with the short sides as the sloping sides. These and other types and shapes of collectors and photovoltaic cell arrays, where rectangular includes square, and other shapes including round and other than rectangular or round, are candidates for incorporation with and/or enclosed within an enclosure of the invention.

[0011] In many cases, for practical reasons including cost and ease of installation, the mounting of an enclosure of the invention is stationary such as on a rooftop or other fixed structure. In this respect, the mounting options of the base

component of the invention are flexible. In one aspect it may be mounted directly on a roof surface as by fasteners through the bottom surface of the base component into the roof sheathing or by angle brackets joining the sides of the base component to the sheathing. It may alternatively be similarly mounted on an elevated surface of conforming size or a rack assembly or open framework configured with an appropriate fixed or variable direction and/or slope. For example the base may be mounted on a pipe rack by attachment of the underside of the base component to horizontal support pipes arranged at different heights so as to place the collector at the desired angle of elevation, or on a raised roof section or false roof built on an existing roof to provide the correct angle of elevation for the collectors. The supporting structure may include a manual or automatic single or multi axis motion system with appropriate sensors or angular pre-calibration to keep the plane of the enclosure and the collectors within directed towards the sun during daylight hours, as is well known in the art.

[0012] The base component has an insulated, substantially planar bottom side to for heat retention and protection of the surface upon which it is mounted, and an upwardly extending side wall around its entire perimeter, that terminates in a generally upwardly exposed sealing surface. The sidewall may be insulated as well. The sidewall is at least of sufficient height to accept conventional step flashing with roofing shingles that expose about 5 inches to the weather, nominally 5 inches or more high. At the top and bottom and in some installations along the sides there may be a continuous strip of flashing or waterproof membrane. The flashing or membrane may or may not be attached or adhered to the sidewall of the enclosure base so long as it retains its position and alignment during placement of the enclosure top.

[0013] The interior surfaces of the base component and/or the absorber plates of the solar collector installed therein, whatever the type may be, are generally coated, lined, or layered with solar radiation absorbent material. The base component of the enclosure may be configured with openings in the bottom, and/or U-shaped notches in the side walls, within which duct work, tubing or pipes carrying thermal energy transfer gas or fluid, or control rods, or wires carrying electrical control signals or power, enter or exit the base component. Such duct work, tubing, pipes or wires extending into the enclosure may be configured with unions, joints, or connectors accessible within the enclosure when opened, for ease of installation, updating and repair of the solar power collector subsystem. The top component of the enclosure may be configured with matching U-shaped notches in its skirt, by which the duct work, pipes or wires contained at their point of entry or exit from the enclosure, when it is assembled and sealed.

[0014] The solar collector enclosure of the invention is in some aspects separable from the solar collector subassembly within, but not necessarily in all respects. Components of the solar collector may be incorporated into the base component, and/or the top component of the enclosure. For example, the glazing of the enclosure top may also be considered a component of the solar collector, retaining the heat generated within. Likewise base component of the enclosure may be integrated in its assembly or fabrication with the solar power collector, for example as a plenum or reflector or both, or otherwise configured with fluid carrying pipes, ducts or passageways where the fluid is directly or indirectly heated during normal operation of the solar collector. The base component may be integrated with photovoltaic components, wiring, and means for cooling or temperature controlling the active photovoltaic elements, such

as metallic, air or fluid channels configured for conducting high heat away from the photovoltaic devices. It may also carry reflective elements that focus light on photovoltaic elements to match the full size of the glazing window to the functional area of the photovoltaic cells. Likewise, some of the structure by which these functionalities are accomplished may be fabricated or assembled as internal or underside attachments to the enclosure top or its glazing.

[0015] When the base component is installed directly on a roof top or other support surface which is normally required to be sealed or shingled to shed rain and snow, flashing or other sealing means may be extended from the roof surface or roof covering material up onto the sides, particularly the sloped sides, of the base component sufficiently far to insure that when the enclosure top is in place, rain water will normally be diverted away from or around the enclosure.

[0016] The enclosure top or cover component is configured as an inverted tray or cover, sized to cover and fully enclose the base component, including any flashing or sealing means that have been extended or bent and lapped up onto the side of the base component. The topside of the cover component is glazed with a transparent or translucent solar energy admittance material. The frame of the top within which the glazing is secured, consisting in one aspect of the rim and the sides, may be fabricated of stock or extruded metal such as aluminum, such as power-coated, painted or anodized aluminum, or other material suitable to extended outside exposure and temperature extremes. The enclosure top is sized to be placed over and enclose the base component and flashing or sealing materials fully, with the top sides extending down over the upward extending sides of the base sides so as to fully envelop the base component. The interior topside of the top component is brought into sealing contact with the sealing surface of the base component, thereby closing the collector enclosure to unwanted air infiltration. The top is then secured to the base with a minimal number of fasteners, preferably one at or about each corner, although more or less may be used. The term fasteners is intended to be construed broadly, as sufficient to retain the top to the base in a weatherproof and relatively airtight manner, excepting intentional or tolerable amounts of air leakage or water drainage.

[0017] Solar collectors may be installed side by side with little room in between for sidewall access to fasteners. For this reason, cover components may be secured to base components by side accessible latches or fasteners applied only to or through the exposed top and bottom sides, the upper and lower ends of the top section; two fasteners at the top and two at the bottom being one example. Other examples and embodiments may employ fasteners applied from the top, where side access is irrelevant.

[0018] The box-like structure of the cover component or enclosure is fabricated with sufficient rigidity to assure that the sealing contact is maintained around the full perimeter of the collector, and the fasteners may in some cases function like hinges at least to a limited extent. For example, in some embodiments, one side or end may be opened for limited access by unlatching or removing fasteners from all but the opposing side, and elevating the first side of the enclosure top for access to the interior of the enclosure. Alternatively, the top can be completely removed for access to the interior or repair of the top, or replacement of the top with a new top if necessary or useful as in the case of the glazing being broken.

[0019] The features and advantages described herein are not all-inclusive and, in particular, many additional features and advantages will be apparent to one of ordinary skill in

the art in view of the drawings, specification, and claims. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and not to limit the scope of the inventive subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is an exploded, perspective view of the top and base or bottom sections of one embodiment of a solar collector enclosure.

[0021] FIG. 1A is a variant of FIG. 1, with side notches replaced by through-bottom holes.

[0022] FIGS. 2A and 2B are face and side elevations of a grommet used for sealing pipe connections passing through the side walls of the top and bottom sections of FIG. 1.

[0023] FIGS. 2C and 2D are face and side elevations of a grommet used for sealing pipe connection passing through the bottom side of the bottom section of FIG. 1A.

[0024] FIG. 3 is a simplified construction schematic end view of a false roof section for providing a higher angle of presentation of an array of solar collectors.

[0025] FIG. 4 is a top view of the surface of a false roof or support surface as in FIG. 3, prepared for installation of solar collectors.

[0026] FIG. 5 is a simplified plumbing schematic of the return and supply lines for the installation of FIG. 4.

[0027] FIG. 6 is an end view of the installation of FIGS. 3, 4 and 5 with the base sections installed.

[0028] FIG. 7 is a partial cross section view of one end of a solar collector enclosure of one embodiment of the invention, showing a double glazing and details of the sealing contact area, end wall fastener, and side wall pipe grommet.

[0029] FIG. 7A is a partial cross section view of one end of a solar collector enclosure of one embodiment of the invention, showing single glazing and details of the sealing contact area, end wall fastener using a flanged thin wall insert and backing nut, and bottom side pipe grommet.

[0030] FIG. 7B is a partial cross section view of one end of a solar collector enclosure of one embodiment of the invention, showing details of the sealing contact area and end wall fastener.

[0031] FIG. 8 is a perspective view of a frame for a bottom section assembled from extruded material having rib or channel-like features similar to the extrusions of FIG. 7.

[0032] FIG. 9 is a cross section view of a sealing gasket intended to seal two suitably-spaced adjacent solar collector modules.

[0033] FIG. 10 is a cross section view of a sealing gasket as illustrated in FIG. 7A.

[0034] FIGS. 11A and 11B are perspective and side views of a flanged and threaded thin wall insert and retaining nut for use with the fasteners of FIGS. 7, 7A and 7B.

DETAILED DESCRIPTION

[0035] Solar collectors for heating systems typically use an energy transfer medium of gas, fluid or electricity, and may use a combination of mediums. The embodiments described below are generally presented in the context of fluid medium solar collectors but are applicable to collectors using other energy transfer mediums as well to solar power system employing photovoltaic cells and arrays. Please note, for purposes of the description that follows, the term "solar collector" extends, where the context admits, to some embodiments of the solar collector "enclosure" of the invention, particularly in solar heating applications where the

primary energy capture mechanism is the circulating of air through the enclosure as a plenum, or of air or liquid through an energy absorbing conduit within the enclosure, for solar warming of the air or liquid as part of a heating circuit extending to a heat exchanger or space intended to be heated.

[0036] Solar collection systems require means for routing the energy transfer medium into, through, and out of the collection system and routed for delivery to the subject facility or device for dispersion of the collected energy. Multiple collector modules, of a size that is suited to system design flexibility, ease and cost of manufacture, and relative ease of installation, are frequently installed in banks or arrays of side by side collectors as a system. The array is arranged with a fixed or adjustable direction and elevation such that the collectors get maximum solar exposure. The array is sized to meet the overall installation requirement for peak and average thermal collection capacity.

[0037] An interconnect path between modules is required to provide an efficient routing of the energy transfer medium. The modules are typically connected in a parallel arrangement, although series and series/parallel combinations of module interconnections, as are well understood in the art, may be used. For air and fluid medium collectors, this interconnect path is typically configured as inlet and outlet manifolds of some sort; one running along the top end of an array of side by side modules, and the other running along the bottom or lower end.

[0038] Referring to FIG. 1, a simplified illustration of a two part enclosure for a solar collector module discloses one aspect of the invention. This embodiment is of a fluid medium collector module enclosure. Base section 10 is an insulated base component, in the form of a box or tray with an open top. Top section 20 has a glazed top side pane enclosed by flange 26 which is further configured with downward extending sidewalls which are configured with U-shaped notches 24. The base section 10 is installed to a roof or rack or other suitable support, with short ends 29 oriented as the upper and lower ends; the interior components of the module such as piping and/or ducting are installed, connected and checked; and the top section then fitted over and attached to the base section in a fully enclosing manner to complete the enclosure. Other embodiments may employ grommets in the sidewall of the base section rather than U-shapes notches, where during installation the necessary fittings are run through the grommets holes. The top section necessarily retains corresponding notches for removable attachment to the base section with clearance for the one or more sidewall connections after all plumbing and wiring is completed.

[0039] The division of the collector module enclosure into separate, standard size top and base sections facilitates the installation greatly. Base section 10 is relatively light and easily handled. Glazed top sections 20 are more easily handled with less risk of damage after all base sections are installed, and all the associated interior components of the collector are installed, connections made, fluid added, and leak checks performed. Subsequent repairs or alterations are also greatly facilitated by this arrangement.

[0040] The sides and bottom of base section 10 are made or include layers of thermal insulating materials. The interior surfaces or absorber plates placed therein are coated or lined with light energy absorbent materials such as a black coating, and the exterior is weatherproof. Various means may be

used for attachment of the base section to a pipe rack, roof top, raised platform or other mounting structure, as is well understood in the art. Notches 12 and 14 at opposite ends of base section 10 are provided for fluid piping interconnections between adjacent modules.

[0041] It should be noted that in some embodiments, fluid piping and/or air or gas ductwork may be routed through the bottom of base section 10 or the short end walls 29 rather than the long sidewalls. For example, FIG. 1A illustrates a variation of the embodiment of FIG. 1, in which side notches are replaced with through-holes 12 and 14 in the bottom side of base section 10, thus eliminating the need for pipe openings in the top section.

[0042] Referring to FIGS. 1, 2A and 2B, rubber grommets 30 as illustrated in FIGS. 2A and 2B are used to close notches 12 and 14 around fluid pipes running out of and between adjacent base sections 10. Notches may be oversized to accommodate a range of pipe diameters. Grommet size can be selected to fit the pipe size. The grommets may be slipped over the ends of pipe lengths during assembly; or slit so that they can be slipped around a pipe and manipulated into place within the notch. Two such grommets 30 may be used in each notch 12 and 14, providing an air gap in between for further insulative value. Variants of grommets 30 may be fully as thick as the wall of base component 10. Another variant of grommet 30 may be a circular grommet as in FIGS. 2C and 2D for use in the embodiment of FIG. 1A; or a two piece grommet in the form of a semi-circular lower half grommet or gasket to which is mated a top half grommet or gasket that fills the remainder of the notch.

[0043] Referring again to FIG. 1, base section 10 is further configured with a top edge seal 16 that is substantially continuous around the perimeter, except for notches 12 and 14 for which grommets 30 form an equivalent sealing structure and function.

[0044] Top section 20 is of a size calculated to be placed over and enclose base section 10, with the underside of flange 26 resting on top edge seal 16 so as to seal the enclosure against infiltration of outside air that might reduce the efficiency of the collector. Notches 24 align with notches 12 and 14 to accommodate piping or other pass-through conduits. Grommets 30 or a variant thereof may be used to seal notches 24 around the piping or otherwise close the notch. It should be noted that there is sufficient spacing between the respective sidewalls of base section 10 and top section 20 to accommodate and cover flashing or other roofing material or other sealant that may have been applied to the sidewalls of base section 10 in order to seal or make a rainproof joint with respect to the rooftop or other support platform to which the base section 10 may be attached.

[0045] An array of base sections 10 may be installed in a variety of configurations; side by side installations being most common. Referring to FIG. 3, a simple pipe rack, raised surface section, or fully enclosed false roof may be constructed to provide a structure with a suitable direction and angle of elevation for installation of the collector array. FIG. 3 illustrates in simplified form a fully framed false roof section 40 configured for attachment of collector module base section 10 (not shown) such that the top end of the collector enclosure top section 20, when complete, overhangs the peak, facilitating the flashing requirement on this side of the collector.

[0046] FIG. 4 illustrates preparation of the surface of the false roof 40 of FIG. 3, with an EPDM rubber sheet 42

applied first, firing strips 44 applied to support base sections 10, and fluid line openings 46 (top end) and 48 (lower end) prepared with silicone gaskets for sealing the fluid pipes that will pass through the false roof surface connecting to a suitable line or manifold in the false attic below.

[0047] FIG. 5 illustrates the plumbing associated with FIG. 4, configured underneath false roof 40. Return line system 52 ties fluid line openings 46 together, and supply line system 50 ties fluid line openings 48 together. It should be noted that everywhere fluid carrying pipes are shown in FIGS. 4 and 5, they may in other embodiments be air ducts and/or wiring conduits, with energy transfer or collector sensor or control functions, depending on the type and complexity of the solar power system and in particular the type and design of the collectors.

[0048] FIG. 6 is an end view of base sections 10 installed on firing strips 44, on EPDM rubber sheet 42 on false roof 40. Base sections 10 in this embodiment have openings in their underside, rather than notches in the sidewalls, aligned with fluid line openings 46 and 48 through which fluid lines of the core components (not shown) will be connected to supply line system 50 and return line system 52. Rubber or aluminum U-channels 60, spanning the distance between the sidewalls and extending substantially up the sidewalls, are installed between adjacent base sections 60 so as to provide a drainage channel between base sections. Flashing or sealant 62 is applied to the outer sides of the outer base sections 10 in conjunction with the roofing of false roof 40 so as to provide a rain proof joint.

[0049] While this embodiment contemplates attachment to firings and fluid connections being made through the bottom of the base sections; other embodiments may use other attachment means and utilize the notches of the FIG. 1 embodiment for interconnections of fluid lines, or wire or air conduits between modules. In those cases, channels 60 and flashing or sealant 62 is modified accordingly to assure the modules will be sealable when tops are applied.

[0050] Referring again to FIG. 1, and to partial cross section FIG. 7, a top section 20 (without notches) is placed over each base section 10 such that each module is sealed by contact of flanges 26 on respective top side seals 16, and such that the sidewalls of top section 20 enclose the vertical portions of channels 60 and flashing or sealant 62. Fasteners 64 are then applied at points 28 in the upper and lower endwalls 27 of top sections 20, penetrating into base sections 10 at points 18 on end walls 29 so as to secure the top sections to the base sections. There is sufficient rigidity in both sections to insure that the upper and lower end attachments maintain the top and base sections in sealing contact with each other without the need for an extensive line of fasteners along the sides of each collector. There may in some embodiments be a further top side bead of sealant or sealing strip applied between adjacent top sections 20 so as to prevent rain water from penetrating the space between collector modules.

[0051] FIG. 7A illustrates another variation of the embodiment of FIG. 7, where a single pane 22 of tempered glass is fitted to flange 26 with a U-shaped seal 23, and a sealing gasket 16 is also a U-shaped seal on the top edge of the frame of bottom section 10. There may be a bead of RTV or equivalent sealing material applied to seal the exposed edges of seal 23, top and bottom, thereby further assuring that the glazing to frame junction will remain water tight for an extended period. Connector 64 uses a flanged, threaded, thin

wall insert **66** and retaining nut **68** to secure top section **20** to base section **10**. Connector **64** may be positioned higher or lower in endwall **27**, or alternatively or in addition in the sidewalls of base section **10**. Grommet **30** is installed in the bottom or underside of base section **10**.

[0052] FIG. 7B illustrates another variation of the embodiment of FIGS. 7 and 7A, using the same reference numbers. Other variations and combinations of these features are within the scope of the invention. It should be noted that speed nuts and other forms of reinforcement for using fasteners in thin wall applications may be employed for fastening the top to the base section. Reinforcing ribs, mounting extensions, and/or hinged latching mechanisms and the like may also be integrated, attached or configured for attaching the top to the base section for easy full or partial disassembly so that the top can be swung upward in a hinged-like manner from one or either end of the base section, or removed altogether, for access to the interior components.

[0053] It will be appreciated that other means and types of fasteners or latching systems may be employed to fasten or latch the top sections to their respective base sections. But, consistent with one goal of the invention, the location of required fasteners in one embodiment of the invention should be restricted to the upper and lower ends of each module, providing one fastener proximate each corner for good sealing, and assuring that the proximity of adjacent modules does not interfere with sidewall fastener access. The number of fasteners should be minimal, as few as one fastener in each end being within the scope of these embodiments, so as to provide quick access for removal of the top section for maintenance and repair.

[0054] Other embodiments may have a minimal number of side or top accessible fasteners or latches, either tool-operated or manually actuated, as few as one on each end or one on each of four sides of the top section, for quick removal of the top section from the base section.

[0055] The top may comprise one or more glazings, which may be tempered glass or plastic of suitable composition. The glazing may or may not be planar; For example, there may be a dome shaped glazing providing greater volume and/or clearance for the collection elements within the enclosure.

[0056] The enclosure may contain active elements such as air dampers, fluid valves, electrical switches, motorized or manually movable reflectors, process sensors, and/or micro-processors or computers. The internal elements of each enclosure or collector may contain or be configured for wired or wireless communication and remote control. There may be lights or light emitting elements within or mounted on the enclosures that provide functional or decorative illumination of internal components or indicate process conditions, or simply highlight the enclosures through their glazings from a distance during periods of darkness.

[0057] Among the many further examples of the invention is a flashable, rooftop enclosure for containing solar energy collector and converter components of a solar power system. The enclosure consists of a rectangular base section having an insulated bottom, and an upward extending sidewall terminating in a sealing top edge. There are a variety of common means for attachment of the base section to an exterior supporting surface such as a roof, as described elsewhere in this disclosure, whereby weatherproof flashing

or sealing may extend from a protective layer of shingles or other roof covering to the sidewall.

[0058] There is also a top section having a sealing rim structure with a full skirt extending downward. The rim structure sealingly encloses a solar energy transmissive glazing. The top section is sized to fit over the base section so as to make sealing contact between the sealing rim structure and the sealing top edge, with the skirt overlapping the sidewall and the flashing or sealing, thereby forming a sealed enclosure capped by the glazing and flashed or sealed to the protective layer. There may be any of many common means or unique means for removably securing or attaching the top section to the base section, some of which have been described herein. The rooftop enclosure will have one or a combination of common or unique means for transferring collected energy out of the enclosure to one or more energy distribution systems, such as has been further described herein.

[0059] The rooftop enclosure may contain an array or module of interconnected photovoltaic cells, or at least one photovoltaic cell, and may have associated circuitry by which the electrical output is managed and delivered to an electrical energy distribution system. There may be a reflector or reflector array associated with the photovoltaic array or module, not shown here but all as is well understood in the art. The reflector and/or the reflector and photo array may be adjustable such as rotatable about at least one axis, for optimizing the solar efficiency of the cell, not shown here but well understood in the art, and contained within an enclosure of the invention.

[0060] There may be a cooling or temperature control subsystem in the enclosure, associated with the photovoltaic cell, module or array, whereby the efficiency of the photovoltaic elements is optimized. The subsystem may include fluid ducts connected to a thermal fluid flow circuit. The fluid may be air or liquid such as glycol or water or other fluids commonly used for such purposes. The heat energy absorbed by the subsystem may be conducted out of the enclosure and to a heat energy distribution system.

[0061] The foregoing description of embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of this disclosure. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

What is claimed is:

1. A flashable, rooftop enclosure for containing solar energy collector and converter components of a solar power system, comprising:

- a rectangular base section having an insulated bottom, an upward extending sidewall terminating in a sealing top edge, and means for attachment to an exterior supporting surface whereby a weatherproof flashing or sealing means may extend from a protective layer on said supporting surface onto said sidewall;
- a top section having a sealing rim structure with a full skirt extending downward therefrom, said rim structure sealingly enclosing a solar energy transmissive glazing, said top section sized to fit over said base section so as to make sealing contact between said sealing rim structure and said sealing top edge, with said skirt overlapping said sidewall and flashing or sealing

means, thereby forming a sealed enclosure capped by said glazing and flashed or sealed to said protective layer;
 means for removably attaching said top section to said base section; and
 means for transferring collected energy out of said rooftop enclosure to an energy distribution system;

2. The rooftop enclosure of claim 1, said means for transferring collected energy out of said rooftop enclosure comprising openings in said bottom of said base section.

3. The rooftop enclosure of claim 1, said means for transferring collected energy out of said rooftop enclosure comprising openings in said sidewall of said base section and corresponding notches in said skirt of said top section.

4. The rooftop enclosure of claim 1, further comprising a fluid conduit configured for converting solar radiation to heat and transferring the heat to a fluid flow therein.

5. The rooftop enclosure of claim 1, further comprising an air duct configured for converting solar radiation to heat and transferring the heat to an airflow therein.

6. The rooftop enclosure of claim 1, further comprising at least one photovoltaic cell.

7. The rooftop enclosure of claim 1, further comprising a reflector associated with a said solar energy collector and converter component.

8. The rooftop enclosure of claim 7, said reflector being rotatable on at least one axis.

9. The rooftop enclosure of claim 6, further comprising a cooling subsystem for said photovoltaic cell.

10. The rooftop enclosure of claim 1, said supporting surface comprising roof sheathing, said protective layer comprising roof shingles.

11. The rooftop enclosure of claim 1, said glazing comprising tempered glass.

12. The rooftop enclosure of claim 1, said sealing top edge comprising a seal applied to a top edge of said sidewall.

13. The rooftop enclosure of claim 1, said means for removably attaching said top section to said base section comprising fasteners.

14. The rooftop enclosure of claim 13, said fasteners being applied through said skirt into said sidewall.

15. The rooftop enclosure of claim 14, arranged immediately adjacent another said rooftop enclosure on a said support surface, said fasteners being applied only to the upper and lower ends of said top section.

16. A flashable, rooftop enclosure for containing solar energy collector and converter components of a solar power system, comprising:

a rectangular base section having an insulated bottom, an upward extending sidewall terminating in a top edge configured with a seal, means for attachment to the sheathing layer of a shingled roof whereby flashing may be extended from the roof shingles onto said sidewall, and openings in the insulated bottom for circulating a thermal fluid in and out of said base section to and from an energy distribution system;

a top section having a sealing rim structure with a full skirt extending downward therefrom, said rim structure

sealingly enclosing a panel of tempered glass, said top section sized to fit over said base section so as to make sealing contact between said sealing rim structure and said sealing top edge, with said skirt overlapping said sidewall and flashing, thereby forming a sealed enclosure capped by said tempered glass and flashed to said roof shingles; and

means for removably attaching said top section to said base section.

17. A flashable, rooftop enclosure and solar energy collector, comprising:

a rectangular base section having an insulated bottom, an upward extending sidewall terminating in a sealing top edge, means for attachment to an exterior supporting surface whereby a weatherproof flashing or sealing means may extend from a protective layer on said supporting surface onto said sidewall,

a top section having a sealing rim structure with a full skirt extending downward therefrom, said rim structure sealingly enclosing a solar energy transmissive glazing, said top section sized to fit over said base section so as to make sealing contact between said sealing rim structure and said sealing top edge, with said skirt overlapping said sidewall and flashing or sealing means, thereby forming a sealed enclosure capped by said glazing and flashed or sealed to said protective layer;

means for removably securing said top section to said base section;

electrical wires extending from said rooftop enclosure for connection to an electrical energy distribution system;

means for transferring heat energy out of said rooftop enclosure to a heat energy distribution system;

at least one photovoltaic cell within said sealed enclosure connectible to said electrical wires; and

a temperature control subsystem configured for maintaining said at least one photovoltaic cell within a normal operating temperature and connected to said means for transferring heat energy to a heat distribution system.

18. The rooftop enclosure of claim 17, said temperature control subsystem comprising a fluid conduit proximate said at least one photovoltaic cell and configured for transferring heat from said photovoltaic cell to a fluid flow within said fluid conduit, said means for transferring heat energy out of said rooftop enclosure to a heat energy distribution system comprising a fluid flow circuit.

19. The rooftop enclosure of claim 17, further comprising at least one reflector associated with said at least one photovoltaic cell.

20. The rooftop enclosure of claim 19, said at least one reflector being rotatable on at least one axis, said enclosure comprising means for rotating said at least one reflector thereby affecting the amount of solar radiation received by said at least one photovoltaic cell.

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