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The present invention provides a system for solar and/or rainwater harvesting to be installed in open spaces to store the rainwater or charge ground water level and/or to harvest solar energy. The system for rainwater harvesting comprises at least one canopy to be installed for capturing rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; a storage unit for storing the captured water; a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and at least two filtration means adapted between the canopy and the storage unit for filtering the captured water.

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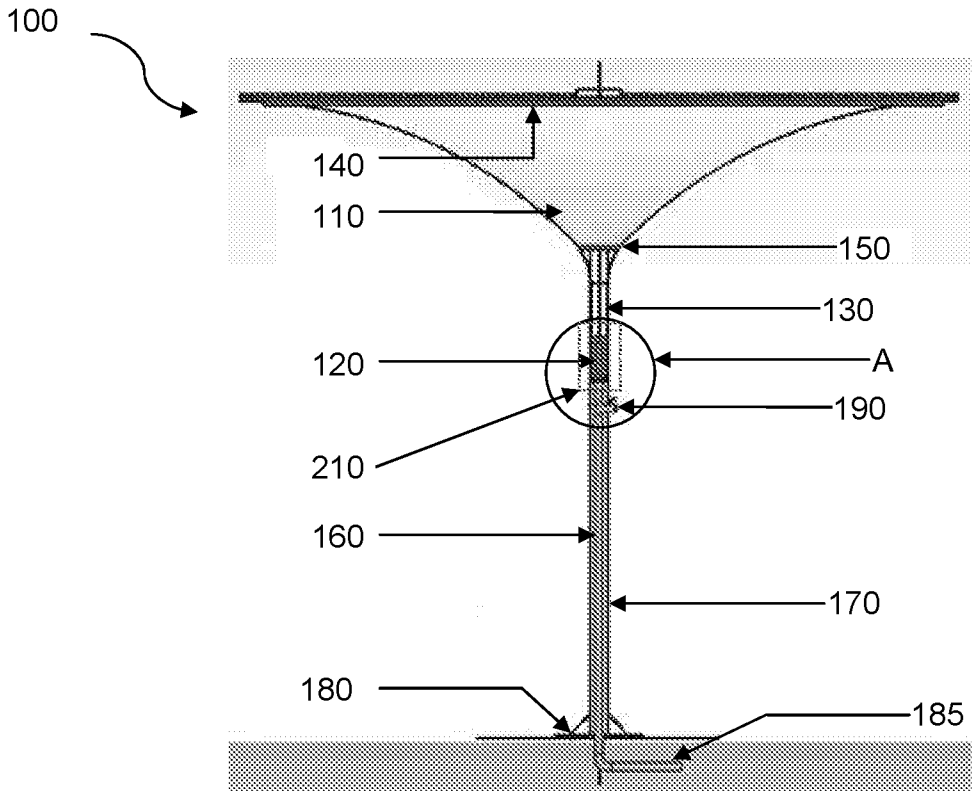

Figure 1

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SYSTEM FOR SOLAR AND RAINWATER HARVESTING IN OPEN SPACES

FIELD OF THE INVENTION

The present invention relates to a solar and/or rainwater harvesting system to be installed in open spaces.

BACKGROUND OF THE INVENTION

Precipitation is one of the crucial aspect in maintaining growth and ecological balance on the earth. However, rapid development and concretization of open spaces such as roads, grounds, public plazas, and parking areas have resulted in the large storm water run-offs that is wasted in urban drainage systems. This has led to major issues concerning usage and preservation of rain water. In addition, water scarcity is also increasing due to lack of sufficient available water resources to meet the demands of water usage.

Further, primarily electricity is generated using fossil fuel and hydrocarbon based power plants. Burning fossil fuels produces energy necessary to run homes, offices, and automobiles. In the process, they release pollutants and contribute to global warming. Two of those pollutants sulphur dioxide and nitrogen oxide react with water or moisture in the air to form nitric and sulphuric acids. These chemicals fall to the earth in the form of acid rain,

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damaging trees, soil, and waterways. Unfortunately, the process that provides electricity to so many homes is also a major contributor to global climate change.

Moreover, mercury that escapes coal-burning power plants through smoke stacks may wind up settling on rivers, lakes, estuaries, and bays. Fish absorb the mercury and then pass it along to humans who eat the fish and are especially harmful to the nervous systems of unborn fetuses, babies, and young children.

For these and other reasons, people have started to look at alternatives when it comes to providing electricity as well as saving rain water. However, there is no efficient mechanism to harvest solar as well as rainwater from open spaces such as roads, grounds, public plazas, parking areas.

Hence, the object of the present invention is to develop and design an efficient and cost effective system to resolve one or more aforementioned issue.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides a system for solar and/or rainwater harvesting to be installed in open spaces.

In one embodiment, the system for rainwater harvesting to be installed in open spaces is provided, the system comprising at least one canopy to be

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installed for capturing the rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; a storage unit for storing the captured water; a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and at least two filtration means adapted between the canopy and the storage unit for filtering the captured water.

According to the present invention, the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening.

According to the present invention, the connecting means and filtration means are designed to maintain a required flow rate of the captured water from the canopy to the storage unit.

In another embodiment, the present invention provides a system for solar and rainwater harvesting to be installed in open spaces, the system comprising at least one canopy to be installed for capturing the rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; at least one collapsible solar module for harvesting solar energy, removably or fixedly attached to the canopy; a storage unit for storing the captured

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water; a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and at least two filtration means adapted between the canopy and the storage unit for filtering the captured water.

According to the present invention, the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening.

According to the present invention, the connecting means and filtration means are designed to maintain a required flow rate of the captured water from the canopy to the storage unit.

In yet another embodiment, the present invention provides a system for rainwater harvesting to be installed in open spaces for charging the ground water level, where the water flows over the spaces such as roads, parking areas, public plazas, etc., the system comprising at least one canopy to be installed for capturing rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; and a connecting means extending from the discharge opening of the canopy to a level below a ground or a percolated tank for allowing flow of the captured water from the canopy to charge the ground water level.

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According to the present invention, the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening.

BRIEF DESCRIPTION OF DRAWINGS

Reference will be made to embodiments of the invention, an example of which may be illustrated in the accompanying figures. These figures are intended to be illustrative, not limiting. Although, the invention is generally described in the context of these embodiments, it should be understood that it is not intended to limit the scope of the invention to these particular embodiments.

Figure 1 shows a system for rainwater harvesting to be installed in open spaces according to an embodiment of the present invention.

Figure 2 shows a sectional view of A marked in Figure 1 according to an embodiment of the present invention; and

Figure 3 shows a system for solar and rainwater harvesting to be installed in open spaces according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a system for solar and/or rainwater harvesting to be installed in open spaces to store the rainwater or charge ground water level and/or to harvest solar energy.

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The present invention in first embodiment provides a system for rainwater harvesting to be installed in open spaces, the system comprising at least one canopy to be installed for capturing rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; a storage unit for storing the captured water; a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and at least two filtration means adapted between the canopy and the storage unit for filtering the captured water.

According to the present invention, the canopy has inverted cone-like structure for capturing the rainwater in the open space and at least one discharge opening for outflow of the captured water. The surface of the canopy is similar to that of the shape a funnel thereby facilitating easy flow of the captured water through the discharge opening of the canopy. The structure of the canopy has the added advantage as it avoids any build of solids on the canopy which may block the path of captured water to outflow through the discharge opening of the canopy. Further, the canopy can be covered with a filtration mesh of at least 2000 microns to avoid collection of leaves, larger dust and solid particles, etc. Advantageously, the canopy structure uses lesser material as compared to a traditional conical structure thereby reducing the weight of the system. The canopy is

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made of waterproof material including PVC, fabric and the like. Alternatively, the canopy can be made of metals which are anti-rust or rust proof as a result of special paint and coating and may have cleaning means depending upon the material of the canopy.

According to the present invention, a solar module for harvesting solar energy can be removably or fixedly attached to the canopy or to a support mast. The solar module comprises at least one solar panel and a solar tracking device for orienting the solar panels based on the solar light. The solar panel is a wedge shaped, light weight polymer solar leaf like structures. The solar cells are made according to specification and laminated between clear polymer sheets making it extremely light weight compared to the conventional solar panels which have a glass casing thereby utilizing the canopy area of the system to build a 365 day solution for clean water and clean energy generation. The angle of the solar panels can be adjusted to optimize solar generation such that they are all oriented to the south at an angle which is equal to the latitude of the location on which it is to be installed.

Further, the solar tracking device of the solar module can be used to further optimize the solar power generation. Solar radiation that reaches the surface of the solar panel is greater when the surface of the solar module is perpendicular to the direction of the sun's rays, which can

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happen through the use of a tracking system or radiation prediction. Various methods may be used to optimize the solar zenith angle, solar azimuth angle, sun-earth distance such as a geometrical method. Advantageously, the solar tracking device can be automatic or manually controlled. The automatic method is preferred as it will take into account accurate light readings factoring in the global cloud cover index and orient the solar module based on the light. The actual rotation mechanism will work on a dual axis zenith and azimuth angle. The rotators will be centrally connected through the centre of the canopy or the support mast. As all solar panels will face in a single direction a single rotator would be optimum. The rotating mechanics can use micro motors as the module is light weight and would not require much torque to rotate.

In addition, the individual wedge shaped solar panels rest between the spokes, so as to avoid any shadow to be cast by the structural cables. The individual solar panel is detached from each other to facilitate easier installation and maintenance. It also provides flexibility to reduce or increase the solar power generation, based on the number of solar panels installed. The same wedges would also prove to be the optimum arrangement because the gaps in between each solar panel allow water to pass through during the monsoon. The independent arrangement of the solar panel also provides enough aerodynamics and flexibility for the structure to withstand high winds. As opposed to a single solar panel which would create uplift and have a lower wind tolerance factor due to the

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large connected surface area, the independent solar panels prove to be more flexible. Advantageously, the solar panel is sized to adequately fit within the edges of the canopy such that none of the rainwater that falls on the panels flows out of the canopy.

Moreover, when the canopy is of larger dimension multiple solar modules can be installed for effective and efficient harvesting of the solar energy. Advantageously, the solar module is collapsible that allows multiple solar panels to collapse when solar harvesting is not required.

According to an embodiment of the present invention, the solar panel can be a photovoltaic panel or of nano solar technology which is fabric integrated solar cells that can bend around the fabric structure. Advantageously, the canopy can be made of fabric integrated solar cells.

According to the present invention, the solar power generated from the solar module can be stored in a battery or can be connected to the grid via an inverter for immediate use. The inverter is used for converting the Direct Current (DC) output of the solar module to Alternating Current (AC). The inverter and battery can be mounted at the base of the system or mounted at the top of the support mast. Alternatively, both these units can be installed separately detached from the support mast. Further, the wiring connecting the solar module to the inverter and the battery is water proof,

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passes through the discharge opening of the canopy and inside of the connecting means. Customized waterproof cut-outs are made in the connecting means for allowing the wiring to pass through the filtration means and passes down to the base where it can be connected to the inverter and the battery. Advantageously, use of connectors allows the inverter and the battery to work like a plug-and-play system.

According to the present invention, the storage unit is used for storing the captured water from the canopy. Further, the storage unit may be connected to other centralized storage unit for storing the captured water. Advantageously, the storage unit can be installed above or below ground, and can be used for sitting or other purpose when installed above the ground.

According to the present invention, the connecting means extends from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit. The connecting means is designed in such a way that it maintains the required flow rate of the captured water from the canopy to the storage unit. Advantageously, the filtration device is removably adapted in the connecting means for filtering the captured water to make it partially ready for potable use. Moreover, the connecting means may have at least one diverter for allowing flow of the water at the higher level above the ground for other

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purpose. Such as, the first diverter is below the filtration device allowing collection of water above ground level. This allows the rainwater harvesting system easy to install in areas where storage of water under the ground may be difficult. The first diverter also provides means to divert the captured water which may be acidic in nature and/or first monsoon rain of the season from being stored in the storage unit. The second diverter is located at the end of the discharge opening to allow flow of the captured water to the storage unit or to charge the ground water level.

According to the present invention, one of the filtration means is a filtration screen in the form of the cuts adapted at the discharge opening of the canopy and other is a filtration device removably adapted in the connecting means. The filtration screen is at least 10,000 microns to filter the captured water. The filtration device comprises a housing; a vertical filtration screen of at least 20 microns for removing fine dust and dirt particles in the rainwater; and a mesh of at least 1 micron adapted below the vertical filtration screen for removing substantially all smallest dirt particles. The vertical design of the vertical filtration screen increases the surface area available for filtration wherein the captured water enters from outside to inside through the vertical filtration screen, thereby providing to be more effective than a horizontal mesh or membrane and improving the flow rate of the water passing through it. The vertical filtration has an added advantage as it uses gravity instead of passing water through filter

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via forced method (e.g. pump), there by using no excess energy in the filtration process.

According to the present invention, an UV (Ultraviolet), Reverse Osmosis (RO) or any microbial filtration system can be connected to the filtration device removably or fixedly to obtain potable drinking water.

The present invention in second embodiment provides a system for solar and rainwater harvesting to be installed in open spaces, the system comprising at least one canopy to be installed for capturing rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; at least one collapsible solar module for harvesting solar energy, removably or fixedly attached to the canopy; a storage unit for storing the captured water; a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and at least two filtration means adapted between the canopy and the storage unit for filtering the captured water.

According to the present invention, the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening.

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According to the present invention, the connecting means and filtration means are designed to maintain a required flow rate of the captured water from the canopy to the storage unit.

The present invention in third embodiment provides a system for rainwater harvesting to be installed in open spaces for charging the ground water level, where the water flows over the spaces such as roads, parking areas, public plazas, etc., the system comprising at least one canopy to be fixed in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water; and a connecting means extending from the discharge opening of the canopy to a level below a ground or a percolated tank for allowing flow of the captured water from the canopy to charge the ground water level.

According to the present invention, the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening.

The subject matter is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the claimed subject matter. It may be evident, however,

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that such matter can be practiced with these specific details. In other instances, well-known structures as shown in diagram form in order to facilitate describing the invention.

Referring Figure 1 shows a system (100) for rainwater harvesting installed in open space according to an embodiment of the present invention. As shown in Figure 1, the system (100) comprises a canopy (110) and a connecting means (130,160) extending from a discharge opening of the canopy towards a ground having a filtration device (120).

As shown in the Figure 1, the canopy (110) has inverted cone-like structure to capture water and a discharge opening for outflow of the captured water. The canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening. The capturing surface of the canopy (110) is covered by a filtration mesh (140). Advantageously, the filtration mesh (140) prevents larger impurities such as leaves and other dust particles from entering into the canopy (110). The filtration mesh (140) can be made of materials like fabric, metal, etc.

As shown in the Figure 1, the filtration screen (150) in form of cuts is adapted at the discharge opening of the canopy (110) to further filter out the impurities from the captured water. The filtration screen (150) can be made of metal, plastic and the like etc.

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As shown in Figures 1 and 2, the connecting means (130) comprises a funnel-like structure (250) below the discharge opening of the canopy for maintaining a required flow rate of the captured water from the canopy (110) to the discharge point (185). As shown, the filtration device (120) connected to the connecting means (130, 160), the filtration device (120) comprises a housing (240); a vertical filtration screen (220) preferably of at least 20 microns for removing fine dust and dirt particles in the rainwater; and a mesh (230) preferably of at least 1 micron adapted below the vertical filtration screen (220) for removing substantially all smallest dirt particles. The vertical design of the vertical filtration screen (220) increases the surface area available for filtration wherein the captured water enters from outside to inside through the vertical filtration screen (220), thereby providing to be more effective than a horizontal mesh or membrane and improving the flow rate of the water passing through it. The vertical filtration has an added advantage as it uses gravity instead of passing water through filter via forced method (e.g. pump), there by using no excess energy in the filtration process.The connecting means (160) is connecting below the housing of the filtration device (120).

As shown in Figures 1 and 2, the diverter (190) is connected to the connecting means (160) between the filtration device (120) and discharge

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point (185) to discharge the filtered captured water or allow it to flow to the discharge point (185).

As shown in the Figures 1 and 2, the connecting means (130, 160) and the filtration device (120) are adapted inside a support mast (170) of the canopy. The support mast (170) comprises a window (210) for easy removal, installation and maintenance of the filtration device (120) through a window (not shown) provided in the housing (240) of the filtration device (120). The horizontal means (180) is provided to allows the system (100) for rainwater harvesting to get easly installed.

As shown in Figure 1, the lower discharge point (185) can be connected to piping systems to allow connection to other systems or an existing storage unit.

Referring Figure 3 shows a system (300) for solar and rainwater harvesting installed in open space according to another embodiment of the present invention. As shown in Figure 3, the system (300) comprises a canopy (310) for capturing rainwater, a support mast (330) connected to the canopy (310), a solar module (320) for harvesting solar energy connected to the support mast (330), and a horizontal means (360) connected to the support mast (330) for allowing easy installation of the system (300).

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As shown in the Figure 3, the solar module (320) can be removably or fixedly attached to the support mast (330). The solar module (320) comprises a solar panel (380) and a solar tracking device (370) for orienting the solar panels (380) based on the solar light. Further, the solar tracking device (370) can be automatically controlled based on the light or manually controlled through a remote controlled device over GPS or through wireless communication means.

As shown in Figure 3, inverter and battery (350) is installed at the base of and is connected to the solar module (320) through an internal wiring (not shown) inside the support mast (330) for harvesting the solar power generated from the solar module (320).

As shown in Figure 3, the support mast (330) comprises a window (340) for easy maintenance of the filtration device (not shown) connected to connecting means (not shown) connecting the discharge opening of the canopy (310) and the storing unit (not shown) for flow of the captured water from the canopy (310) to the storage unit (not shown).

As shown in Figure 1 and 3, single canopy (110, 310) is connected to a single support mast (170, 330). However, it is to be understood that multiple canopies with the single support mast and a single canopy with

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multiple support mast can be installed for solar and/or rainwater harvesting for open spaces.

Advantage of the present system is that the entire system can be made of anti rust or rust proof materials. Further the present invention converts open spaces into solar and/or rainwater harvesting places and can also provides aesthetic looks by providing various designs. Moreover, the present systems can be made portable and/or foldable to collect/capture water during monsoon seasons.

While the present invention has been described herein with respect to the various exemplary embodiments, it will be apparent to one of the ordinary skill in the art that many modifications, improvements and sub combinations of the various embodiments, adaptations and variations can be made to the invention without departing from the scope thereof as claimed in the following claims.

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CLAIMS

1. A system for rainwater harvesting to be installed in open spaces, the system comprising:

at least one canopy to be installed for capturing the rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water, wherein the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening;

a storage unit for storing the captured water;

a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and

at least two filtration means adapted between the canopy and the storage unit for filtering the captured water, wherein the filtration means and the connecting means are designed to maintain the required flow rate of the captured water from the canopy to the storage unit.

2. The system as claimed in claim 1, wherein the canopy can be covered with a filtration mesh of at least 2000 microns.

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3. The system as claimed in claim 1, wherein the canopy comprises at least one collapsible solar module for harvesting solar energy.

4. The system as claimed in claim 3, wherein the solar module comprises at least one solar panel and a solar tracking device for orienting the solar panels based on the solar light.

5. The system as claimed in claim 1, wherein the connecting means comprises a funnel-like structure below the discharge opening of the canopy for maintaining the required flow rate of the captured water from the canopy to the storage unit.

6. The system as claimed in claim 1, wherein the connecting means also acts as a holding means for holding the canopy in the open space.

7. The system as claimed in claim 1, wherein one of the filtration means is a filtration screen adapted at the discharge opening of the canopy and other is a filtration device removably adapted in the connecting means.

8. The system as claimed in claim 7, wherein the filtration screen is at least 10,000 microns and is in the form of cuts.

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9. The system as claimed in claim 7, wherein the filtration device comprises:

a housing;

a vertical filtration screen; and

a mesh adapted below the vertical filtration screen, wherein the water enters from outside to inside through the vertical filtration screen.

10. The system as claimed in claim 9, wherein the vertical filtration screen is at least 20 microns and the mesh is at least 1 micron to provide potable water.

11. The system as claimed in claim 1, wherein the storage unit can be above or below a ground.

12. The system as claimed in claim 1 or 11, wherein the storage unit can be used for sitting or other purpose when installed above the ground.

13. A system for solar and rainwater harvesting to be installed in open spaces, the system comprising:

at least one canopy to be installed for capturing the rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the

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captured water, wherein the canopy is designed in such a way that the captured water within the canopy flows towards the discharge opening;

at least one collapsible solar module for harvesting solar energy, removably or fixedly attached to the canopy;

a storage unit for storing the captured water;

a connecting means extending from the discharge opening of the canopy to the storage unit for allowing flow of the captured water from the canopy to the storage unit; and

at least two filtration means adapted between the canopy and the storage unit for filtering the captured water, wherein the filtration means and connecting means are designed to maintain the required flow rate of the captured water from the canopy to the storage unit.

14. A system for rainwater harvesting to be installed in open spaces for charging the ground water level, where the water flows over the spaces such as roads, parking areas, public plazas, etc., the system comprising:

at least one canopy to be installed for capturing the rainwater in the open space, having inverted cone-like structure to capture water and at least one discharge opening for outflow of the captured water, wherein the canopy is designed in such a way that

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the captured water within the canopy flows towards the discharge opening; and

a connecting means extending from the discharge opening of the canopy to a level below a ground or a percolated tank for allowing flow of the captured water from the canopy to charge the ground water level.

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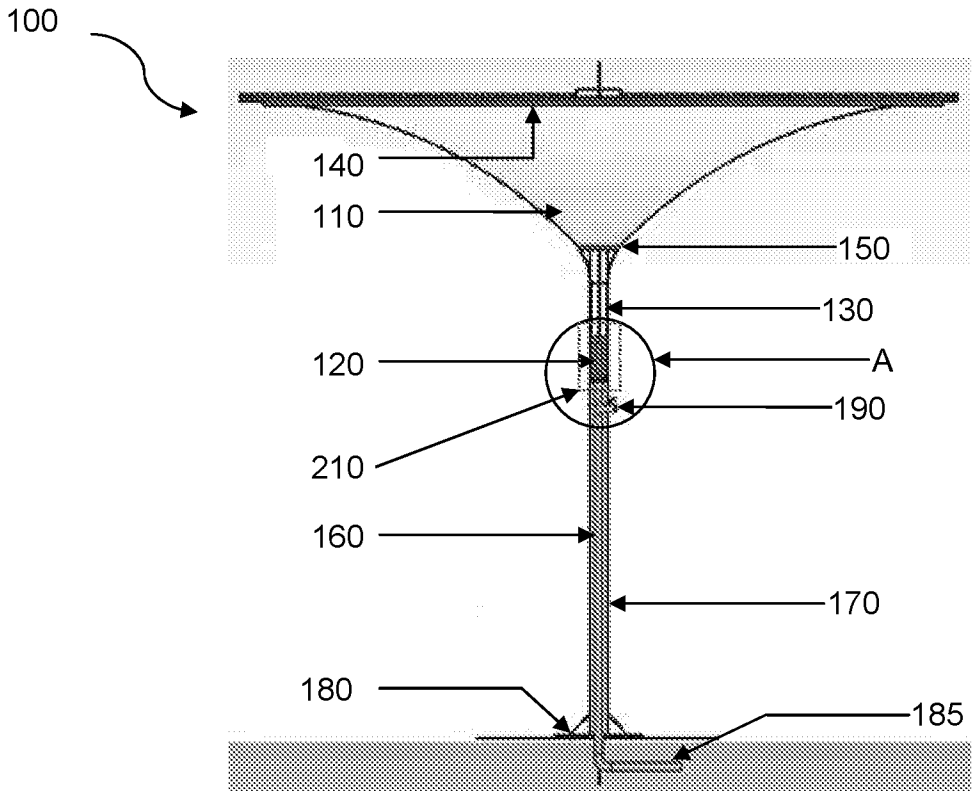

Figure 1

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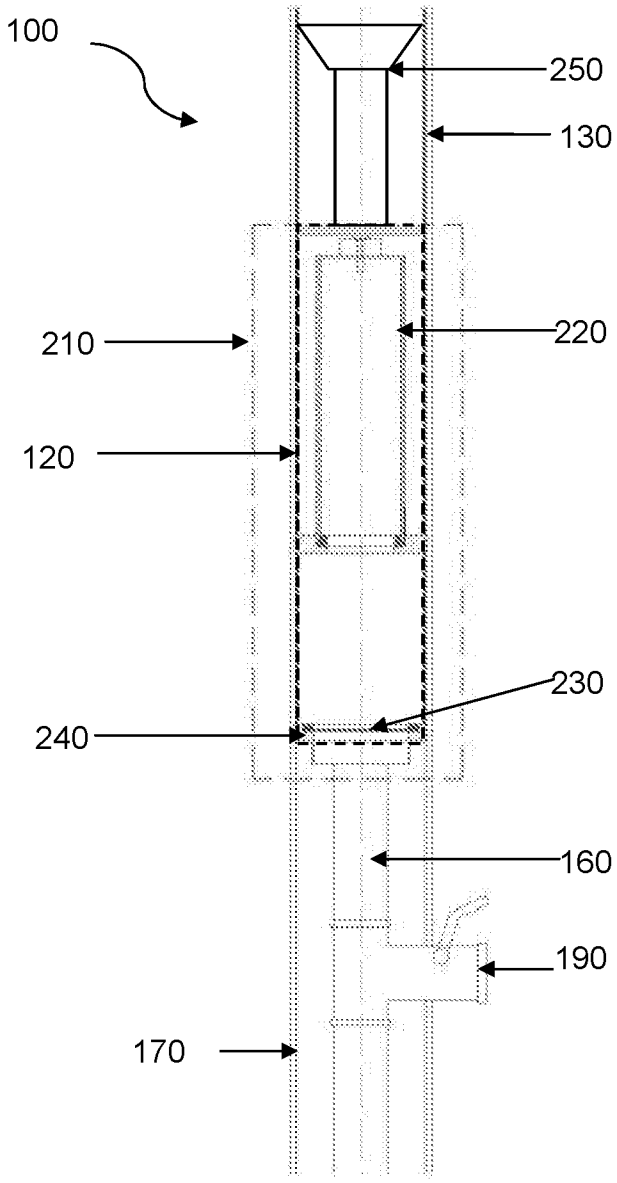

Figure 2

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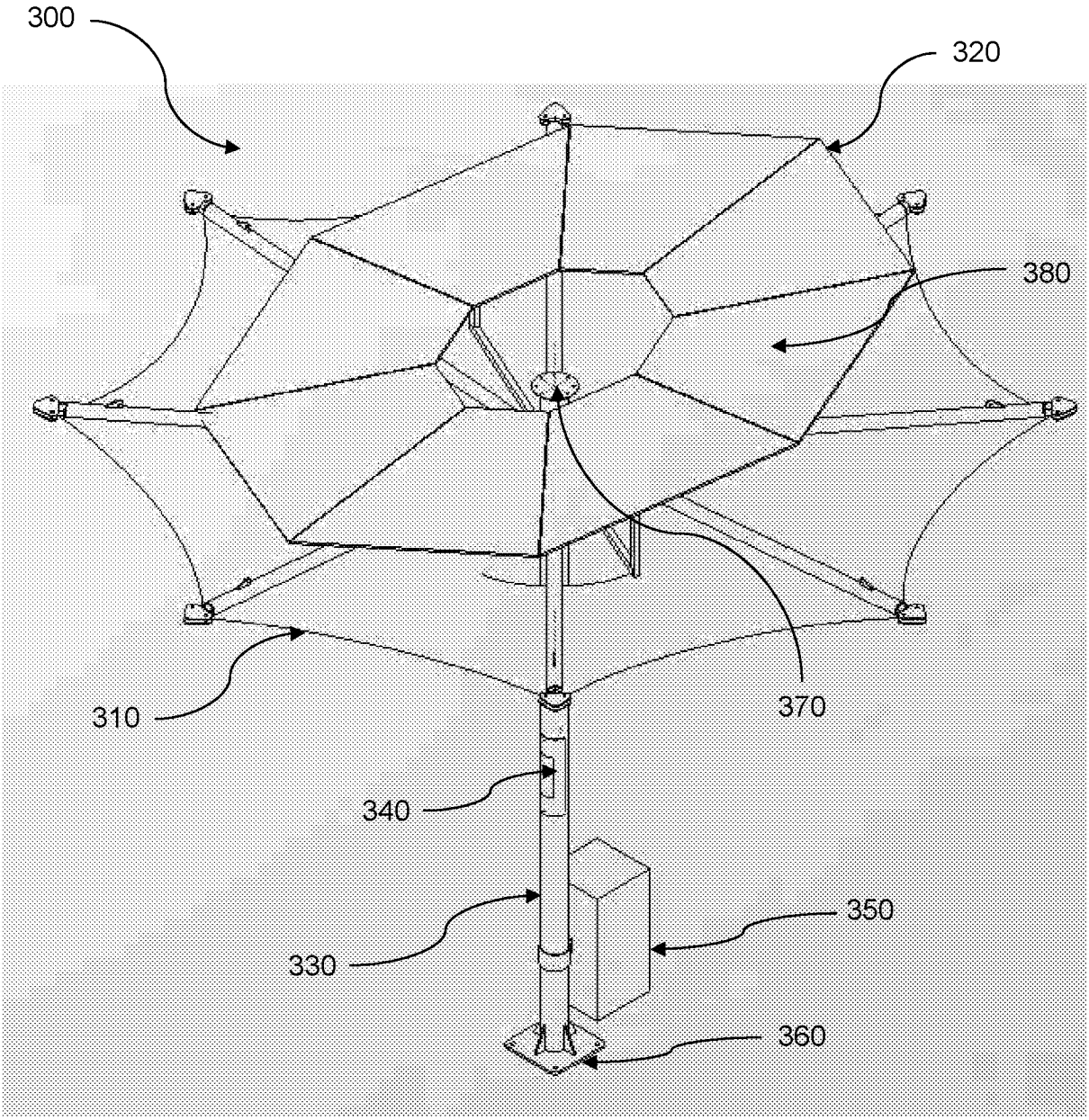

Figure 3