AEROPONIC SYSTEM AND METHOD FOR WATERING PLANTS

CROSS-REFERNCE TO RELTED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 63/605881 filed December 4, 2023, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The disclosed exemplary embodiments relate to methods and systems for crop cultivation, and more particularly to aeroponic crop cultivation.

BACKGROUND

[0003] Traditional crop cultivation systems include greenhouses and irrigation booms that water plants from above, while the crops being cultivated grow in soil. Aeroponic systems supply crops with water and nutrients by spraying roots suspended below a plant support with water, or a nutrient rich solution. The leaves of the plants extend above the plant support, with the roots extending below. Both the roots and the leaves are exposed to the air. Aeroponic systems provide improved aeration of the roots over hydroponic systems.

[0004] The plants are supported by, and their leaves and crowns extend above, the plant support. Aeroponic systems allow air to contact both the canopy and the roots of the crop plants so the crops grow with a plentiful supply of oxygen, carbon dioxide, water, and nutrients. Improved aeration of the roots is one of the advantages of aeroponics over hydroponics.

[0005] U.S. patent publication no. 2017/0202163 relates to an aeroponic culture line comprising a surface for separating the follicular space and radicular space, provided with openings for receiving porous culture supports and spray means arranged on the radicular side of the surface. The spray means are designed to produce a spray area that is smaller than 10% of the total area of the separation surface, the spray means being mounted on a carriage that can move in parallel to the separation surface, on the radicular side, in order to periodically cover all of the area of the surface provided with culture supports.

[0006] U.S. patent no. 11,457,574 relates to a device for moistening and/or fertilizing plants, comprising a movable spray lance with at least one spray nozzle arranged on the spray lance, wherein a preferably linear guide rail is provided, wherein the spray lance is movably guided in the guide rail in a trajectory extending parallel to the guide rail and extends substantially normal to this trajectory, and wherein a drive, preferably a linear drive, is arranged for moving the spray lance in the area of the guide rail. The invention further relates to a system for cultivating plants without a substrate, comprising the device according to the invention. U.S. patent no. 4,965,962 relates to a hydroponic culture system comprising an angle panel having a plurality of holes for supporting plants with roots projecting through the holes, and a hydroponic solution feeding means comprising a hydroponic solution spraying means for supplying a hydroponic solution onto the roots of the plants and a hydroponic solution pumping means for supplying the hydroponic solution to the hydroponic solution spraying means, in which the hydroponic solution spraying mechanism is movable along the longitudinal direction of the angle panel, or the angle panel is disposed in a plant cultivation structure which is supplied with carbon dioxide through a duct for controlling the environment within the structure, or a plurality of angle panels are disposed in a plurality of rows and top edges of the adjacent angle panel rows are connected with canopies to form substantially triangular-sectioned spaces between the adjacent angle panel rows for enhanced lighting efficiency, thereby cultivating the plants systematically and almost uniformly with improved cultivation efficiency and economy.

SUMMARY

[0007] The following summary is intended to introduce the reader to various aspects of the detailed description, but not to define or delimit any invention.

[0008] In at least one broad aspect there is provided a system for growing plants, the system comprising: at least one growing segment comprising: a plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the plant support configured to shield roots from light; a flexible liquid capture sheet underlying the plant support layer whereby the liquid capture sheet and the lower surface cooperate to at least partially bound a root chamber extending longitudinally between a first chamber end and a second chamber end, the root chamber configured to

receive the roots of the plants in the plant support layer so that the roots are suspended within the root chamber are exposed and to shield the roots from light; a runway extending longitudinally within the root chamber between a first terminus proximate the first chamber end and a second terminus proximate the second chamber end; a watering pod supported by and movable along the runway within the root chamber between the first terminus and the second terminus, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

[0009] In some cases, the runway comprises at least one cable and wherein the watering pod comprises one or more engagement member configured to engage the at least one cable for moving the watering pod along the at least one cable, and wherein the drive system comprises an elongate drive connector extending between the watering pod and a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

[0010] In some cases, the drive system may include a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

[0011] In some cases, the system may include at least a second growing segment, the at least a second growing segment comprising: a second plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the second plant configured to shield roots from light; a second flexible liquid capture sheet underlying the second plant support layer whereby the second liquid capture sheet and the lower surface cooperate to at least partially bound a second root chamber extending longitudinally between a first chamber end and a second chamber end and that is disposed longitudinally between the first end of the second root chamber and the first root chamber, the second root chamber configured to receive the roots of the plants in the second plant support layer so that the roots are suspended within the second root

chamber and exposed and to shield the roots from light; a second runway extending longitudinally within the second root chamber between a third terminus proximate the first end of the second root chamber and a fourth terminus proximate the second end of the second root chamber; and a second watering pod supported by and movable along the second runway within the second root chamber between the third terminus and the fourth terminus, the second watering pod comprising a watering mechanism fluidly connectable to the water supply and configured to emit water within the root chamber while the second watering pod is moving between the third terminus and the fourth terminus.

[0012] In some cases, the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the second runway at least towards the third terminus.

[0013] In some cases, the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus and the fourth terminus respectively, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus and the third terminus respectively.

[0014] In some cases, the runway comprises a rail.

[0015] In some cases, the watering pod comprises one or more engagement member configured to engage the rail for moving the watering pod along the rail, and wherein the drive system comprises an onboard motor configured to the drive the one or more engagement member.

[0016] In some cases, the water supply comprises a water chamber housed within and movable with the watering pod.

[0017] In some cases, the system may include a refilling station configured to refill the water chamber of the watering pod.

[0018] In some cases, the system may include a second refilling station configured to refill a water chamber of the second watering pod.

[0019] In some cases, the watering pod may include a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

[0020] In some cases, the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0021] In some cases, the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0022] In some cases, the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

[0023] In some cases, the watering mechanism comprises an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0024] In some cases, the system may include a housing overlying the plant support layer whereby a longitudinally extending plant chamber is at least partially bound by the housing and the upper surface of the plant support layer.

[0025] In some cases, the liquid capture sheet comprises a drain configured to direct run-off water to the water supply.

[0026] In some cases, the at least one growing segment may include: a first base support, having a body extending between a lower end and an upper end, and a second base support spaced longitudinally from the first base support, each base support having a body extending between a lower end and an upper end; a first crossmember coupled to and supported by the first base support, the first crossmember extending in a lateral direction, and a second crossmember coupled to and supported by the second base support, the second crossmember extending in the lateral direction; a first mounting cable extending between the first crossmember and the second crossmember, and a second mounting cable laterally spaced from the first mounting cable and extending between the first crossmember and the second crossmember; and the plant support layer formed from a sheet of flexible material supported by the first mounting cable and the second mounting cable, the sheet of flexible material extending between a first end connectable to the first crossmember and a second end connectable to the second crossmember and

comprising: a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving the first mounting cable thereby attaching the first edge to the first mounting cable; and a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving the second mounting cable thereby attaching the second edge to the second mounting cable.

[0027] In some cases, the plant support layer is slidable along the first mounting cable and second mounting cable to secure the first end to the first crossmember and the second end to the second crossmember and wherein the first mounting cable and second mounting cable resist lateral sagging of the plant support layer when tensioned.

[0028] In some cases, each base support having a pair of supporting arms extending outwardly from the body, each supporting arm extending from opposing sides of the base support upwardly and outwardly.

[0029] In some cases, the first mounting cable and the second mounting cable are connectable to the first crossmember and the second crossmember at each end whereby the first mounting cable and the second mounting cable are tensioned to support the plant support layer.

[0030] In some cases, the first mounting support and the second mounting support comprise feedthroughs configured to receive a respective one of the first mounting cable and the second mounting cable, the first mounting cable and the second mounting cable attachable to a first ground anchor proximate the first mounting support and a second ground anchor proximate the second mounting support.

[0031] In some cases, the first and second crossmembers comprise rigid beams.

[0032] In some cases, the crossmembers are one of cables, wires, and ropes.

[0033] In some cases, the one of cables, wires, and ropes have a thermal expansion coefficient that is less than about 0.0017 m/m-°C.

[0034] In some cases, the first edge and second edge of the sheet of flexible material are arcuate such that the sheet of flexible material has a width at a location between the first end and second end of the sheet of flexible material that is less than a width at the first end of the sheet of flexible material.

[0035] In some cases, the plant support sheet is attachable to the crossmembers by a plurality of fasteners.

[0036] In some cases, the system may include at least one intermediate crossmember positioned longitudinally between the first cross member and the second cross member and slidably engaging the first mounting cable and the second mounting cable and supporting the plant support layer, the at least one intermediate crossmember supported by an intermediate base support.

[0037] In some cases, the at least one intermediate crossmember is cable, the at least one intermediate crossmember receivable through an opening at each of the mounting supports and configured to support the plant support sheet.

[0038] In some cases, the plant support sheet comprises a selectably openable access point extending through the sheet of flexible materials and securable using a releasable fastener, whereby when the fastener is disengaged the access point is open and provides communication between a lower side of the plant support layer and an upper side of the plant support layer and when the fastener is engaged the access point is closed and isolates the upper side from the lower side.

[0039] In some cases, the releasable fastener comprises a hook and loop fastener.

[0040] In some cases, the releasable fastener comprises a zipper.

[0041] In some cases, the plant support layer comprises at least two plant support subpanels, joined together by an intermediate connecting panel, each of the at least two plant support subpanels comprising the plurality of apertures configured to receive and support plants and formed from a sheet of flexible material.

[0042] In some cases, each subpanel extends between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising: a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving one of the first mounting cable and the second mounting cable thereby attaching the first edge to the one of first mounting cable and the second mounting cable; and a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving one of a first intermediate mounting cable and a second intermediate

mounting cable, thereby attaching the second edge to the one of the first intermediate mounting cable and the second intermediate mounting cable.

[0043] In some cases, the selectable closable access point is disposed in the intermediate connecting panel.

[0044] In some cases, the plant growing system spans a length of approximately 50 feet.

[0045] In another broad aspect there is provided an apparatus for watering plants, the apparatus comprising: a watering pod supported by and movable along a runway within a root chamber between a first terminus and a second terminus of the runway, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

[0046] In some cases, the water supply comprises a water chamber housed within and movable with the watering pod.

[0047] In some cases, the apparatus may include a complementary refilling station configured to refill the water chamber of the watering pod.

[0048] In some cases, the watering pod may include a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

[0049] In some cases, the drive system comprises an elongate drive connector extending between the watering pod and a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

[0050] In some cases, the drive system comprises may include a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

[0051] In some cases, the apparatus may include a second watering pod and wherein the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

[0052] In some cases, the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus.

[0053] In some cases, the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0054] In some cases, the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0055] In some cases, the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

[0056] In some cases, the apparatus may include an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0057] In another broad aspect there is provided a system for growing plants, the system comprising: at least one growing segment comprising: a first base support, having a body extending between a lower end and an upper end, and a second base support spaced longitudinally from the first base support, each base support having a body extending between a lower end and an upper end; a first crossmember coupled to and supported by the first base support, the first crossmember extending in a lateral direction, and a second crossmember coupled to and supported by the second base support, the second crossmember extending in the lateral direction; a first mounting cable extending between the first crossmember and the second crossmember, and a second mounting cable laterally spaced from the first mounting cable and extending between the first crossmember and the second crossmember; a plant support layer comprising a plurality of apertures configured to receive and support plants and formed from a sheet of flexible material supported by the first mounting cable and the second mounting cable, the sheet

of flexible material extending between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising: a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving the first mounting cable thereby attaching the first edge to the first mounting cable; and a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving the second mounting cable thereby attaching the second edge to the second mounting cable; and a flexible, liquid capture sheet underlying the plant support layer whereby the liquid capture sheet and a lower surface of the plant support layer cooperate to at least partially bound a root chamber extending longitudinally between a first chamber end and a second chamber end, the root chamber configured to receive roots of the plants in the plant support layer so that the roots are suspended within the root chamber and exposed and to shield the roots from light.

[0058] In some cases, the plant support layer is slidable along the first mounting cable and second mounting cable to secure the first end to the first crossmember and the second end to the second crossmember and wherein the first mounting cable and second mounting cable resist lateral sagging of the plant support layer when tensioned.

[0059] In some cases, each base support having a pair of supporting arms extending outwardly from the body, each supporting arm extending from opposing sides of the base support upwardly and outwardly.

[0060] In some cases, the first mounting cable and the second mounting cable are connectable to the first crossmember and the second crossmember at each end whereby the first mounting cable and the second mounting cable are tensioned to support the plant support layer.

[0061] In some cases, the first mounting support and the second mounting support comprise feedthroughs configured to receive a respective one of the first mounting cable and the second mounting cable, the first mounting cable and the second mounting cable attachable to a first ground anchor proximate the first mounting support and a second ground anchor proximate the second mounting support.

[0062] In some cases, the first and second crossmembers comprise rigid beams.

[0063] In some cases, the crossmembers are one of cables, wires, and ropes.

[0064] In some cases, the one of cables, wires, and ropes have a thermal expansion coefficient that is less than about 0.0017 m/m-°C.

[0065] In some cases, the first edge and second edge of the sheet of flexible material are arcuate such that the sheet of flexible material has a width at a location between the first end and second end of the sheet of flexible material that is less than a width at the first end of the sheet of flexible material.

[0066] In some cases, the plant support sheet is attachable to the crossmembers by a plurality of fasteners.

[0067] In some cases, the system may include at least one intermediate crossmember positioned longitudinally between the first cross member and the second cross member and slidably engaging the first mounting cable and the second mounting cable and supporting the plant support layer, the at least one intermediate crossmember supported by an intermediate base support.

[0068] In some cases, the at least one intermediate crossmember is cable, the at least one intermediate crossmember receivable through an opening at each of the mounting supports and configured to support the plant support sheet.

[0069] In some cases, the plant support sheet comprises a selectably openable access point extending through the sheet of flexible materials and securable using a releasable fastener, whereby when the fastener is disengaged the access point is open and provides communication between a lower side of the plant support layer and an upper side of the plant support layer and when the fastener is engaged the access point is closed and isolates the upper side from the lower side.

[0070] In some cases, the releasable fastener comprises a hook and loop fastener.

[0071] In some cases, the releasable fastener comprises a zipper.

[0072] In some cases, the plant support layer comprises at least two plant support subpanels, joined together by an intermediate connecting panel, each of the at least two plant support subpanels comprising the plurality of apertures configured to receive and support plants and formed from a sheet of flexible material.

[0073] In some cases, each subpanel extends between a first end connectable to the first crossmember and a second end connectable to the second crossmember and

comprising: a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving one of the first mounting cable and the second mounting cable thereby attaching the first edge to the one of first mounting cable and the second mounting cable; and a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving one of a first intermediate mounting cable and a second intermediate mounting cable, thereby attaching the second edge to the one of the first intermediate mounting cable and the second intermediate mounting cable.

[0074] In some cases, the selectable closable access point is disposed in the intermediate connecting panel.

[0075] In some cases, the plant growing system spans a length of approximately 50 feet.

[0076] In some cases, the system may include a housing overlying the plant support layer whereby a longitudinally extending plant chamber is at least partially bound by the housing and the upper surface of the plant support layer.

[0077] In some cases, the system may include a runway disposed below the plant support layer and extending between the first crossmember and the second crossmember in the root chamber, and having a first terminus proximate the first crossmember and a second terminus proximate the second crossmember, the runway attachable to and supported by the first crossmember and the second crossmember; a watering pod supported by and movable along the runway within the root chamber between the first terminus and the second terminus, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

[0078] In some cases, the runway underlies the at least one intermediate crossmember.

[0079] In some cases, the runway comprises at least one cable and wherein the watering pod comprises one or more engagement member configured to engage the at least one cable for moving the watering pod along the at least one cable, and wherein the drive system comprises an elongate drive connector extending between the watering pod and

a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

[0080] In some cases, the drive system may include a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

[0081] In some cases, the system may include at least a second growing segment, the at least a second growing segment comprising: a second plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the second plant support layer comprising a light-impermeable material; a second flexible liquid capture sheet underlying the second plant support layer whereby the second liquid capture sheet and the lower surface cooperate to at least partially bound a second root chamber extending longitudinally between a first chamber end and a second chamber end and that is disposed longitudinally between the first end of the second root chamber and the first root chamber, the second root chamber configured to receive roots of the plants in the second plant support layer so that the roots are suspended within the second root chamber and exposed and to shield the roots from light; a second runway extending longitudinally within the second root chamber between a third terminus proximate the first end of the second root chamber and a fourth terminus proximate the second end of the second root chamber; and a second watering pod supported by and movable along the second runway within the second root chamber between the third terminus and the fourth terminus, the second watering pod comprising a watering mechanism fluidly connectable to the water supply and configured to emit water within the root chamber while the second watering pod is moving between the third terminus and the fourth terminus.

[0082] In some cases, the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the second runway at least towards the third terminus.

[0083] In some cases, the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus

and the fourth terminus respectively, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus and the third terminus respectively.

[0084] In some cases, the runway comprises a rail.

[0085] In some cases, the watering pod comprises one or more engagement member configured to engage the rail for moving the watering pod along the rail, and wherein the drive system comprises an onboard motor configured to the drive the one or more engagement member.

[0086] In some cases, the water supply comprises a water chamber housed within and movable with the watering pod.

[0087] In some cases, the system may include a refilling station configured to refill the water chamber of the watering pod.

[0088] In some cases, the system may include a second refilling station configured to refill a water chamber of the second watering pod.

[0089] In some cases, the watering pod may include a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

[0090] In some cases, the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0091] In some cases, the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0092] In some cases, the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

[0093] In some cases, the watering mechanism may include an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

[0094] In some cases, the liquid capture sheet comprises a drain configured to direct run-off water to the water supply.

BRIEF DESCRIPTION OF THE DRAWINGS

[0095] The drawings included herewith are for illustrating various examples of articles, methods, and systems of the present specification and are not intended to limit the scope of what is taught in any way. In the drawings:

[0096] [INVENTORS – To be updated on receipt of final drawings from artist.]

FIG. 1 is a cross-sectional perspective view of one example of a system for watering plants.

FIG. 2 is an enlarged view of a plant support portion of the system for watering plants of FIG 1.

FIG. 3A is a perspective view of one example of a watering pod that can be used in combination with the system for watering plants of Fig. 1.

FIG. 3B is an enlarged view of a portion of the watering pod of FIG. 3A.

FIG. 3C is an enlarged view of a portion of the watering pod of FIG. 3A.

FIG. 4 is a schematic, block diagram representation of the components the watering pod of FIG. 3A.

FIG. 5 is a perspective view of another example of a watering pod that can be used in combination with the system for watering plants of FIG. 1.

FIG. 6 is a schematic, block diagram representation of the components the watering pod of FIG. 5.

FIG. 7 is a perspective view of another example of a watering pod that can be used in combination with the system for watering plants of FIG. 1.

FIG. 8 is a schematic, block diagram representation of the components the watering pod of FIG. 7.

FIG. 9 is a perspective view of another example of a watering pod that can be used in combination with the system for watering plants of FIG. 1.

FIG. 10 is a schematic, block diagram representation of the components the watering pod of FIG. 9.

FIG. 11 is a diagram of an exemplary water capture structure that can be used in combination with the system for watering plants.

FIG. 12 is a block diagram of an exemplary method of watering plant roots.

FIG. 13 is a perspective view of another example of a system for watering plants;

FIG. 14 is an exploded perspective view of the system of FIG. 13.

FIG. 15 is a top plan view of the system of FIG. 13.

FIG. 16 is a side elevation view of the system of FIG. 13.

FIG. 17 is an end elevation view of the system of FIG. 13.

FIG. 18 is a cross-sectional view of the system of FIG. 13.

FIG. 19 is a perspective view of an alternate arrangement of the system of FIG. 13.

FIG. 20 is an exploded perspective view the alternate arrangement of the system of FIG. 13.

FIG. 21 is another exploded perspective view of the arrangement of the system of the alternate arrangement of the system of FIG. 13.

FIG. 22 is an exploded perspective view of another alternate arrangement of the system of FIG. 13.

DETAILED DESCRIPTION

[0097] Various apparatuses or processes will be described below to provide an example of an embodiment of each claimed invention. No embodiment described below limits any claimed invention and any claimed invention may cover processes or apparatuses that differ from those described below. The claimed inventions are not limited to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses described below. It is possible that an apparatus or process described below is not an embodiment of any claimed

invention. Any invention disclosed in an apparatus or process described below that is not claimed in this document may be the subject matter of another protective instrument, for example, a continuing patent application, and the applicants, inventors or owners do not intend to abandon, disclaim or dedicate to the public any such invention by its disclosure in this document.

[0098] The teachings herein relate to systems for growing plants, and preferably systems for growing plants using aeroponic cultivation techniques, in which the roots of the plants are suspended in the air, as compared to be buried in soil or submerged in liquid water or growing solutions. The roots can then be supplied with water and nutrients via misting or spraying of liquid onto the exposed roots. Plants grow using aeroponic techniques can tend to produce higher yields than comparable plants grown in soil.

[0099] While known aeroponic systems may be considered a better method of growing plants, the are not as widely adopted as conventional soil growing systems, which may be to aeroponic systems having relatively operating and initial setup costs. As the roots are suspended, and exposed to the air, there is a requirement for them to watered, or misted, at set intervals to prevent them from drying out and to provide nutrients. For example, depending on the size of the aeroponic system and the type of crop being cultivated, the intervals between misting/watering operations may be from about 30 seconds up to a few minutes.

[00100] Some conventional aeroponic systems are configured to incorporate a long pipe with several nozzles that is facing the roots of the plants. The pipe is filled with water at a relatively high pressure and the roots are misted by the water leaving the nozzles at the set intervals. A large pump is required to create the necessary pressure in the pipe to provide the mist through the nozzles, however the larger the system, the greater the number of nozzles in the pipe, the larger and more powerful the pump needs to be. Valves can be introduced to the system to provide valve-based flow redirection, however the valves are limited in the pressure they can handle and introduce failure points to the system. Such systems can tend to be relatively complicated and expensive to build, operate and maintain.

[00101] Despite the existence of some known aeroponic systems there remains a requirement for an aeroponic system that can overcome at least some of the shortfalls of convention systems, and that may optionally be less expensive to build and maintain that conventional systems, and/or that may optionally be less complicated and optionally simpler to operate than some existing aeroponic systems. The systems and methods/techniques described herein include an aeroponic system having a moving watering component, a novel plant holding structure and water collection structure, and a novel supporting system having support members, crossmembers and supporting cables to help support the plant growing layer. The plant growing systems described herein may include one or more growing segment (have respective plant supporting layers, supports and movable watering pods) and may include two or more segments arranged to provide a larger system.

[00102] Referring now to FIG. 1, there is illustrated a diagram of an exemplary a system for growing plants in the form of an aeroponic system in accordance with at least some embodiments.

[00103] In this example, the system for growing plants is described as an aeroponic system 100 that includes an outer shell 110 which is generally elongate and extends in a longitudinal direction. The outer shell 110 serves to bound a generally hollow interior of the aeroponic system 100 which, in this example is divided by the plant support layer 130 into a plant chamber 120 and a root chamber 122. In this example, the plant chamber 120 contains the above ground portions of the plants being grown (the leaves and flowers/fruit), whereas the roots and underground portions of the plants being grown are located on the opposed side of the plant support layer 130 in the root chamber 122. The conditions to which the above ground portions of the plants are exposed (e.g., within the plant chamber 120 in this example) and the conditions to which the roots the plants are exposed (e.g., within the root chamber 122 in this example) can be different. For example, the plant chamber 120 may be exposed to light to help the plants grow, while the root chamber 122 is kept relatively darker so that the roots are not exposed to too much light. In this example the plant support layer 130 extends generally horizontally such that the plant chamber 120 is arranged as an upper chamber that is above an upper side of the plant support layer 130 and the root chamber 122 is a lower chamber disposed on an

underside of the plant support layer 130. In other examples the plant support layer 130 need not be generally horizontal, and may be arranged on an incline or in a generally vertical or upright orientation.

[00104] In this example, the aeroponic system 100 includes a runway 124 that extends generally longitudinally within the outer shell 110 and that is positioned on the lower side of the plant support layer 130, within the root chamber 120. A watering pod 150 is suspended from and supported by the runway 124 and is configured so that it can translate along the runway 124 when the system is in use to help provide water to plants 140 at different locations along the plant support layer. To help support the outer shell 110 and plant support layer 130 above the underlying ground or floor surface the system 100 includes supporting legs 126 which connect to and help support the outer shell 110.

[00105] The plant support layer 130 is arranged, in this example, to house and support plants 140 (and any associated pots/containers, etc.) and divides the interior of the outer shell 110 into the plant chamber 120 and the root chamber 122. The plant support layer 130 may be made from any suitable material that can support the weight of the plants 140 and that can help sub-divide the interior to define the root chamber 120. This can include materials that are generally flexible but have sufficient strength to hold the plants 140, such as woven or non-woven fabrics, plastic sheets or films and the like. Flexible materials of this nature may be relatively lighter weight than rigid materials. In other examples at least some portions of the plant support layer 130 may be formed from rigid materials like plastic or metal sheets. Optionally, the plant support layer 130 may be formed from material that can block at least some of the light from outside the root chamber 120 from reaching the interior of the root chamber 120, and may be at least partially opaque.

[00106] Optionally, the outer shell 110 may be configured as a relatively aerodynamic structure having a curved design promoting the flow of air over and under the outer shell 110. This may help reduce wind resistance/ wind loading on the outer shell 110 when the system 100 is in use. The outer shell 110 includes an upper arcuate portion 112 and a lower arcuate portion 114, that together create a generally curved, and optionally oval or ellipse shape in cross-section. The outer shell 110 may have several oval structures or

segments spanning the length of the system 100. Each oval structure is connected by a connecting portion 116 that extends between the oval structures. Sheet of material 118 is attached to the upper arcuate portion 112, the lower arcuate portion 114, and the connecting portions 116 to create the generally hollow interior inside the outer shell 110. The sheet 118 may be of a variety of suitable configurations and materials, and optionally in some examples may be formed from a thermally insulating material to provide an insulated chamber for the plants 140. This may be advantageous if the climate outside the outer shell 110 is too hot, or too cold, for growing the desired plants 140. One example of a suitable sheet is a sheet 118 that includes a plurality of layers of a plastic bubble wrap material (a plastic film with trapped air pockets – optionally 3 to 5 layers) that is coated in an aluminium layer/skin. The layers of such sheets may be joined together for form a laminate, such as be being heat sealed together. The described sheet 118 may help reduce conduction, convection, and radiation heat transfer between the interior of the outer shell 110 and the surrounding environment. For example, the aluminium layer may help reflect sunlight, the pockets within the layers of bubble wrap create layers of resistance for air movement, and the gaps between the pockets and the plastic material help reduce conductive heat transfer.

[00107] The outer shell 110 may be supported by supporting legs 126 spanning the length of the outer shell 110 at intervals. The supporting legs 126 raise the outer shell 110 from the ground and with the curved design of the outer shell 110, air can also flow under the outer shell 110. In temperate climates, this movement of air can have a cooling effect on the interior of the outer shell 110 meaning that additional cooling systems are not required. In hotter climates additional cooling systems may be included in the system 100, for example air duct system 128 can be used to introduce cool air or a cooling spray of water into the interior of the system 100.

[00108] In some examples, the outer shell 110 may have a length 109 in the longitudinal direction of between 10 and 2000 feet, or more, and optionally may be between about 20 and 1500 feet, or between 30 and 1200 feed and between 124 feet and 1000 feet. The outer shell may have a width 111 in a lateral direction (that is generally orthogonal to the longitudinal direction) that is between 2 and 30 feet, and may be between about 5 and 15 feet and optionally may be between 9 feet and 12 feet. In other examples, the system 100

may include two or more segments that each include their own outer shell 110, plant support layer 130 and watering pod 150. Each segment may have a longitudinal length that is between 5 and 200 feet, and optionally may be between 10 and 100 feet, and may be between 20 and 80 feet, and optionally may be between about 30 and 50 feet.

[00109] The supports for the outer shell 110 may be made of any sufficiently strong and formable material that can support the sheet 118 in its desired position and configuration. This can include wood, aluminium, steel, plastic or similar materials. The outer shell 110 may include a reflective insulation layer to help reduce heat loss, and optionally the outer shell 110 may include a layer of UV resistant insulation.

[00110] As shown in this illustrated example, the interior of the outer shell 110 is divided into the plant chamber 120 and the root chamber 122 by the plant support layer 130. The plant support layer 130 is, in this example, formed from a cloth mesh sheet/layer that is suspended from the sides from the outer shell 110. The plant support layer 130 houses plants 140 and the stems and leaves of the plants 140 grow in the plant chamber 120 with the roots grow in the root chamber 122. The plant chamber 120 is configured so that the leaves and stems of the plants 140 are exposed to light and air. The root chamber 122 is configured so that the roots of the plants 140 are exposed to air, but not to too much light and such that they are not submerged in liquid water, soil or other physical growing media/substrates.

[00111] During the growing cycle the roots of the plants 140 are misted/sprayed with water and nutrients. Some of the water/nutrients are absorbed by the roots and/or remain deposited on the surfaces of the roots and plant support layer 130. Excess portions of the water/nutrients may form into droplets and may fall away from the roots due to gravity. In some examples, this extra water may be allowed to drop to the ground and/or may be disposed of as wastewater. Alternatively, it may be preferred for the system 100 to be configured to capture this excess water and more preferably to re-collect this water to be recycled and sprayed onto the roots for a second or subsequent time. The water reclamation and recycling may include suitable cleaning and filtration steps (for example to remove debris or contaminants from the recaptured water) before the water is re-used for spraying the roots.

[00112] To help facilitate water re-capture and collection, the illustrated example of the system 100 includes a water recollection sheet 160 that is suspended below the plant support layer 130 to underlie the plant roots, in the root chamber 122. In this arrangement the water recollection sheet 160 collects excess run-off water falling from the roots or undersurface of the plant support layer 130. Preferably, the water recollection sheet 160 is shaped to help direct the flow of the water it receives, and more preferably can be shaped to help direct the collected water toward a tank 162, which is positioned underneath the water recollection sheet 160. The water collected in the tank 162 may be reused by the system 100. Depending on the length of the system 100, there may be multiple water recollection sheets 160 spanning the length, each being in communication with one or more tanks 162 located to collect the water. A suitable conduit, such as a pipe 164 may connect each of the tanks 162 so that the excess run-off water collected by each water recollection sheet 160 is directed towards one master tank or collection reservoir (not shown) and reused in the system 100.

[00113] In this example, the runway 124 extends generally longitudinally along the length of the outer shell 110, beneath the plant support layer 130, and has a respective terminus at each longitudinal end of the runway 124. Preferably, the runway 124 may be positioned toward the lateral centreline of the plant support layer 130, with a generally equal distribution of plants 140 on either side of the runway 124. This may help provide a relatively even misting of the plants on either side of the runway 124 when the watering pod 150 is in use. Alternatively, the runway 124 may be positioned laterally offset from the middle of the plant support layer 130 (e.g., toward one edge of the plant support layer 130) such that the plants 140 are distributed only on one side of the runway 124.

[00114] Suspended from the runway 124 is the watering pod 150. The watering pod 150 is movable between the two end points/terminus of the runway 124 and is preferably configured to emit a generally laterally extending spray/mist of water to the roots while the watering pod 150 is moving longitudinally along the length of the runway 124 within the root chamber 120. The terminus of the runway 124 can be understood to be the location where the watering pod 150 is intended to stop when it reaches the practical end of its range of travel. Optionally, the water/mist may be emitted continuously as the

watering pod 150 moves or alternatively the water/mist may be emitted at intervals while the watering pod 150 remains in motion.

[00115] The runway 124 is preferably configured to be a structure that can extend through the root chamber 122 to help define the travel path of the watering pod 150, and preferably is configured to support at least most, and optionally the entire weight of the watering pod 150 while it is in use. The runway may include rigid or flexible, tension loaded members. For example, the runway 124 may include one or more supporting cable (where a cable is understood to include a flexible tensile member and could be a rope or wire or the like), with the watering pod 150 suspended in a fixed position on the rope or wire, with the rope or wire being movable longitudinally along the runway path. Cables can include any type of tension member, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. Alternatively, the supporting cable(s) forming the runway may be fixed and the watering pod 150 may travel along and be supported by the cables. In yet another alternative, as shown in Figure 1, the runway 124 may be a generally rigid support such as a rail, with the watering pod 150 being movable along and supported by the rail. Preferably each runway will extend along all, or at least a majority of the longitudinal length of its associated plant support layer 130.

[00116] While the systems disclosed herein are described as being configured to spray/mist water onto the roots of the plants for convenience, it is understood that the systems can also be used to spray/mist water-based liquid solutions that may include nutrients, fertilizers and/or other suitable chemicals to help support plant growth and/or for disease management that can be sprayed/misted using the watering pods described herein. This may include water-based solutions or mixtures having up to approximately 2000 to approximately 10000 ppm . One example of a water-based solution or mixture for supporting plant growth and/or disease management is the Hydroponic Nutrients product offered by We Hydroponics.

[00117] To provide the desired supply of liquid the watering pods described herein may, in some examples, be connected to an external water supply via a hose or other suitable conduit. Alternatively, in other embodiments the watering pods may include an onboard water supply/reservoir. Providing an onboard water reservoir may eliminate the need to

have a water supply hose connected to the water pod as it is moving along the runway 124. In one of the illustrated examples the watering pod includes an internal water reservoir 151, a pump 152, a watering mechanism 153 that is fluidly connected to the water reservoir 151 and is operable to spray/mist the water from the watering pod 150 into the root chamber 122, a motor 154, and a refilling pipe 169. In this example, the watering mechanism 153 includes an optional reciprocating nozzle 158, an actuator for reciprocating the nozzle 157, at least one nozzle 158, and an atomizer 159.

[00118] In embodiments where the watering pod 150 includes an onboard water reservoir, the system can also include a refilling mechanism that can be used to re-fill the onboard water reservoir when it is getting low. Optionally, the refilling mechanism can be provided as part of a docking station or similar type of structure that can be provided along the runway and can receive and support, and optionally re-fill the watering pod. This may allow the use of a relatively smaller water reservoir that can supply the watering pod with enough water for at least one trip along the runway, and preferably at least a few trips along the runway before the watering pod can pause at the refilling mechanism to receive more water. For example, as shown in Figures 3 and 4 the watering pod 150 may dock with a complimentary docking station 190.

[00119] Optionally, some examples of the watering pod 150 may have a length L of between 6 inches and 10 inches, a width W of between 6 inches and 10 inches, and a height H of between 6 inches and 12 inches.

[00120] Referring now to FIG. 2, there is illustrated a diagram of an individual plant in the plant support layer 130.

[00121] In this example the plant support layer 130 includes several apertures 132 that are sized and configured to hold at least one plant 140, and preferably are configured so that there is one plant 140 per aperture 132. Each plant 140 is held within a plant holder 134 which is receivable within one of the apertures 132. Each aperture 132 may have a reinforcing rim 136. A lower portion of the plant holder 134 extends below the plant support layer 130. The lower portion of the plant holder 134 has several slots 138 about its surface through which the roots are exposed to the air, and through which the roots may grow. The plant holder 134 may have a lip that extends outwardly and may contact

the upper surface of the plant support layer 130 so that the plant holder 134 does not fall through the aperture 132. The plant holder 134 may have a tapered shape whereby the bottom is narrower than the top. While one example of an aperture 132 and plant holder 134 are illustrated in this example, other variations of apertures and related plant holders can be used in other examples.

[00122] Referring now to FIG. 3A, FIG. 3B, FIG. 3C and FIG. 4, there is illustrated an exemplary watering pod 150 for use in the aeroponic system 100. The watering pod 150 includes an interface which couples the watering pod 150 to the runway 124, a drive system 310 for motivating/driving the watering pod 150 along the runway, an onboard power source in the form of a battery 320 providing the watering pod 150 with a power supply, an onboard water reservoir in the form of a water tank 151, and the watering mechanism 153.

[00123] The battery 320 provides power to the drive system 310 that drives the wheels 315. The runway 124 is a rail and the interface may be a wheel or wheels 315 configured to engage the runway 124, with the wheel or wheels 315 providing a friction force against the runway 124.

[00124] The drive system 310 may be, for example, an electric motor that drives the wheels 315 forward and backward to cause the watering pod 150 to travel along the runway 124, optionally in response to a signal from an associated system controller that can co-ordinate and control the movement of the watering pod 150, the timing of the water spraying/misting and other analogous system operations.

[00125] Preferably, the watering pods described herein are configured so that they can travel along their respective runways at a rate of speed that allows them to cover the length of their associated plant support layer (or at least a portion thereof) in a predetermined period of time, such as once every 20 sec, 30 sec, 40 sec, 50 sec, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes or more. This can allow the watering pods to travel past the roots of at least a majority of the plants in the plant support layer at a desired frequency to help keep the roots sufficiently moist. Optionally, the watering pod 150 may be capable of moving along the runway at speeds in the range of between a higher speed that preferably less than about 100, 90, 80, 70, 60, 50, 40, 35, 30, 25, 20, 19, 18, 17, 16 or 15

feet per minute to lower speed that is at least about 1, 2, 3, 4, 5, 6, 7 or 8 feet per minute or more to help ensure the humidity of the root chamber 122 is maintained at a desired humidity level by spraying the roots while moving. The desired humidity level may be selected based on a number of parameters, including the type of plants being grown and the surrounding atmospheric conditions, and may be at level of at least 80% humidity. The humidity in the root chamber 122 need not be uniform throughout the entire root chamber interior. Instead, the humidity level may vary in different locations, and may be relatively higher in closer proximity to the watering pod 150. For example, as the watering pod 150 moves the humidity in the vicinity of the watering pod 150 may increase to at least 80%. As an example, the humidity within 1 ft of the watering pod 150 may be at 80%, but beyond the 1ft the humidity may be lower than 80%. As the watering pod 150 moves along the runway 124, the humidity in the vicinity of the watering pod 150 is preferably at about 80%.

[00126] Optionally, when the watering pod 150 reaches the end of the runway 124, it may stop emitting the mist before returning along the runway 124. In such instances the humidity in the vicinity of the watering pod 150 may drop below 80% until the watering pod 150 emits the mist when movement resumes.

[00127] In some cases, the watering pod 150 may preferably move at a speed of about 0.1 feet per second. The drive system 310 may include a single electric motor capable of moving the watering pod 150 in both directions along the runway 124. The drive system 310 may include one electric motor to drive the watering pod 150 in one direction, and another electric motor to drive the watering pod 150 in the other direction along the runway 124.

[00128] The water tank 151 contains water and/or a water-based mixture that can also include nutrients and the like. The water tank 151 has an onboard volume of water that is preferably at least enough to spray the roots while moving from one end of the runway 124 to the other. The water tank 151 is fluidly connected to the watering mechanism 153. The mist emitted by the watering pod 150 in this example is a relatively fine mist with a droplet size that is preferably less than 50 μm per droplet.

[00129] In examples where the watering pod 150 includes an internal water supply it may also optionally include a water pump 152 and an air pump 330 to help with water spraying/distribution. The water pump 152 may be a vacuum pump, for example, and pressurizes the water in the water tank 151 before the water is conveyed to and emitted from the nozzles 158. An optional air pump 330 can be used to mix the water with air from the air pump 330 before being emitted from the atomizer 159. The system may also include an optional pressure sensor that detects the pressure within the water tank 151. If the pressure drops below a set threshold, the system control can activate the water pump 152 to increase the pressure within the water tank 151.

[00130] The watering mechanism 153 in the watering pod 150 may include both the nozzles 158 and the atomizer 159. In some cases, the watering mechanism 153 may include only nozzles 158. In this case, only the water pump 152 is required. The watering mechanism 153 may include only one nozzle 158 per side. The nozzles 158 may be stainless steel or brass or similar. The nozzles 158 and atomizer 159 may be moveable with respect to the watering pod 150 allowing them to move through various degrees of freedom, such as up, down, side to side etc. This results in the watering pod 150 spraying a greater area while the watering pod 150 moves. An actuator mechanism 340, operatively coupled to the nozzles 158 and the atomizer 159, controls the movement.

[00131] The nozzles 158 and the atomizer 159 may be mounted on a common housing that is connected to a reciprocating arm 342 that can move the nozzles 158 and atomizer 159 in a generally up and down motion (as illustrated by arrow 302) in a direction that is orthogonal to the longitudinal direction of the runway 124. That is, the watering pod 150 is configured to move in one direction and the nozzles 158 and atomizer 159 are configured to move in a different direction, relative to the watering pod 150 while it is in motion. The movement of the reciprocating arm 342 may be controlled by a motion hub or actuator 340. The actuator 340 may be operatively coupled to the drive system 310, so that as the watering pod 150 moves along the runway 124, the nozzles 158 and atomizer 159 reciprocate in the direction of the reciprocating arm 342. All the nozzles 158 and the atomizer 159 may be configured so that they all reciprocate. In some cases, only the nozzles 158 or the atomizer 159 may be configured to reciprocate. In some cases, only one of the nozzles 158 may be configured to reciprocate.

[00132] In some cases, the watering mechanism 153 incorporates a centrifugal nozzle (5614, described below) either in addition to, or in place of, the nozzles 158 and the atomizer 159. The centrifugal nozzle 5614 is connected to the reciprocating arm 342 that can move the centrifugal nozzle 5614 in a generally up and down motion in a direction that is orthogonal to the longitudinal direction of the runway 124. That is, the watering pod 150 is configured to move in one direction and the centrifugal nozzle 5614 is configured to move in a different direction, relative to the watering pod 150 while it is in motion. The movement of the reciprocating arm 342 may be controlled by the motion hub or actuator 340. The actuator 340 may be operatively coupled to the drive system 310, so that as the watering pod 150 moves along the runway 124, the centrifugal nozzle 5614 reciprocates in the direction of the reciprocating arm 342.

[00133] The watering pod 150 may also include a controller 350 which controls the mist emitted from the watering mechanism 153. The watering pod 150 may also include a valve or valves 360 to control the mist emitted from the watering mechanism 153. The controller 350 is operatively coupled to the valve or valves 360 to open them and close them as required depending on the misting requirements of the plants being cultivated. The controller 350 is operatively coupled to the drive system 310 to control the movement of the watering pod 150 along the runway 124. The controller 350 may be operatively coupled to the actuator mechanism 340 to control the movement of the watering mechanism 153. The controller 350 may be operatively coupled to the water pump 152 and air pump 330 to control the operation of the water pump 152 and the air pump 330. For example, the pressure sensor may send the detected pressure of the water tank 151 to the controller, which then operates the water pump 152 to increase the pressure within the water tank 151.

[00134] Optionally, the system 100 may include, at both or one of the ends of the runway 124, a docking station 190 that is configured to receive and preferably service/engage with the watering pod 150. For example, in this example the docking station 190 electrically connects to the watering pod 150 to recharge the battery 320. By docking at the docking station 190 at either both ends or one end of the runway 124, the battery 320 may be recharged to ensure continued operation of the watering pod 150. This example of a docking station 190 is also configured to fluidly connect to the watering pod 150 to

help resupply the onboard water reservoir. In this arrangement the water tank 151 can be refilled when needed at either both ends or one end of the runway 124. This ensures that the watering pod 150 has an adequate water reserve for misting the roots while moving. In this example the docking station 190 fluidly connects to the watering pod 150 via complimentary refilling pipe or pipes. Water enters the watering pod 150 at the refilling pipe 155 and flows through a funnel 362. The funnel is fluidly connected to the water tank 151 by water pipes 364. Other connections for the electrical and/or water connections can be used in other examples. Also, in some examples the docking station 190 need not include both electrical and liquid connections, and may include only one of those services.

[00135] Optionally, the docking station can include a sensor or actuator to help determine when the watering pod is present in the docking station 190. This information can be provided to the controller and can help determine when charging or refilling systems should be activated. For example, in this illustrated example the docking station 190 includes a limit switch 370 that protrudes from a bottom surface of the docking station 190. The limit switch 370 operates when the watering pod 150 makes contact with it at the end of the runway 124. When the limit switch 370 operates, the docking station 190 commences with recharging the battery 320 and refilling the water tank 151.

[00136] Referring now to FIG. 5 and FIG 6, there is illustrated another exemplary watering pod 1150 for use in the aeroponic system 100. Watering pod 1150 is analogous to watering pod 150 and like features are identified using like reference characters indexed by 1000. In this example, the watering pod 1150 includes an interface which couples the watering pod 1150 to the runway 124, a drive system 1310, battery 1320 providing a power supply, conduit 1352 connecting the watering pod 1150 to an external water supply 1353, and a watering mechanism 1153. The watering mechanism 1153 includes nozzles 1158 and atomizer 1159.

[00137] The battery 1320 provides power to the drive system 1310 that drives the wheels 315. The runway 124 is a rail and the interface may be a wheel or wheels 315 configured to engage the runway 124, with the wheel or wheels 315 providing a friction force against the runway 124.

[00138] The drive system 1310 may be, for example, an electric motor that drives the wheels 315 forward and backward to cause the watering pod 1150 to travel along the runway 124, optionally in response to a signal from an associated system controller that can co-ordinate and control the movement of the watering pod 1150, the timing of the water spraying/misting and other analogous system operations.

[00139] Preferably, the watering pod 1150 is configured so that it can travel along the runway at a rate of speed that allows it to cover the length of its associated plant support layer (or at least a portion thereof) in a predetermined period of time, such as once every 20 sec, 30 sec, 40 sec, 50 sec, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes or more. This can allow the watering pod 1150 to travel past the roots of at least a majority of the plants in the plant support layer at a desired frequency to help keep the roots sufficiently moist. Optionally, the watering pod 1150 may be capable of moving along the runway at speeds in the range of between a higher speed that preferably less than about 100, 90, 80, 70, 60, 50, 40, 35, 30, 25, 20, 19, 18, 17, 16 or 15 feet per minute to lower speed that is at least about 1, 2, 3, 4, 5, 6, 7 or 8 feet per minute or more to help ensure the humidity of the root chamber 122 is maintained at a desired humidity level by spraying the roots while moving. The desired humidity level may be selected based on a number of parameters, including the type of plants being grown and the surrounding atmospheric conditions, and may be at level of at least 80% humidity. The humidity in the root chamber 122 need not be uniform throughout the entire root chamber interior. Instead, the humidity level may vary in different locations, and may be relatively higher in closer proximity to the watering pod 1150. For example, as the watering pod 1150 moves the humidity in the vicinity of the watering pod 1150 may increase to at least 80%. As an example, the humidity within 1 ft of the watering pod 1150 may be at 80%, but beyond the 1ft the humidity may be lower than 80%. As the watering pod 1150 moves along the runway 124, the humidity in the vicinity of the watering pod 1150 is preferably at about 80%.

[00140] Optionally, when the watering pod 150 reaches the end of the runway 124, it may stop emitting the mist before returning along the runway 124. In such instances the humidity in the vicinity of the watering pod 1150 may drop below 80% until the watering pod 1150 emits the mist when movement resumes.

[00141] In some cases, the watering pod 1150 may preferably move at a speed of about 0.1 feet per second. The drive system 1310 may include a single electric motor capable of moving the watering pod 1150 in both directions along the runway 124. The drive system 1310 may include one electric motor to drive the watering pod 1150 in one direction, and another electric motor to drive the watering pod 1150 in the other direction along the runway 124.

[00142] The water supply 1353 is external to the watering pod 1150 and is connected to the watering pod 1150 by the conduit 1352. The water supply 1353 is fluidly connected to the watering mechanism 1153. The mist emitted by the watering pod 1150 is a fine mist at less than 50 μm per droplet.

[00143] As the water supply 1353 is external to the watering pod 1150, the water is delivered to the watering pod 1150 by the conduit 1352 wherein the water is already pressurized. A pump, external to the watering pod 1150, may pressurize the water before being supplied to the watering pod 1150.

[00144] The use of the external water supply 1353 removes the requirement for an onboard water reservoir. As a result, the watering pod 1150 may be lighter on the rail. It removes the requirement for the docking station or similar type of structure to fluidly connect to the watering pod 1150 for refilling purposes. The use of the external water supply 1353 also removes the requirement for the water pump to aid in spraying/distribution or maintaining a pressure in the onboard water reservoir.

[00145] The watering mechanism 1153 in the watering pod 1150 may include both the nozzles 1158 and the atomizer 1159. In some cases, the watering mechanism 1153 may include only nozzles 1158. The watering mechanism 1153 may include only one nozzle 1158 per side of the watering pod 1150. The nozzles 1158 may be stainless steel or brass or similar. The nozzles 1158 and atomizer 1159 may be moveable with respect to the watering pod 1150 allowing them to move through various degrees of freedom, such as up, down, side to side etc. This results in the watering pod 1150 spraying a greater area while the watering pod 1150 moves. An actuator mechanism 1340, operatively coupled to the nozzles 1158 and the atomizer 1159, controls the movement.

[00146] The watering mechanism 1153 may be mounted on a common housing that is connected to a reciprocating arm 1156 that can move the nozzles 158 and atomizer 159 in a generally up and down motion (as illustrated by arrow 1302) in a direction that is orthogonal to the longitudinal direction of the runway 124. That is, the watering pod 1150 is configured to move in one direction and the nozzles 1158 and atomizer 1159 are configured to move in a different direction, relative to the watering pod 150 while it is in motion. The movement of the reciprocating arm 1156 may be controlled by a motion hub or actuator 1157. The actuator 1157 may be operatively coupled to the drive system 1310, so that as the watering pod 1150 moves along the runway 124, the nozzles 1158 and atomizer 1159 reciprocate in the direction of the reciprocating arm 1156. All the nozzles 1158 and the atomizer 1159 may be configured so that they all reciprocate. In some cases, only the nozzles 1158 or the atomizer 1159 may be configured to reciprocate. In some cases, only one of the nozzles 1158 may be configured to reciprocate.

[00147] The watering pod 1150 may also include a controller 1350 which controls the mist emitted from the watering mechanism 1153. The watering pod 1150 may also include a valve or valves 1360 to control the mist emitted from the watering mechanism 1153. The controller 1350 is operatively coupled to the valve or valves 1360 to open them and close them as required depending on the misting requirements of the plants being cultivated. The controller 1350 is operatively coupled to the drive system 1310 to control the movement of the watering pod 1150 along the runway 124. The controller 1350 may also be operatively coupled to the actuator mechanism 1157 to control the movement of the nozzles 1158 and atomizer 1159.

[00148] Optionally, the system 100 may include, at both or one of the ends of the runway 124, a docking station 190 that is configured to receive and preferable service/engage with the watering pod 1150. For example, in this example the docking station 190 electrically connects to the watering pod 1150 to charge the battery 1320. By docking at the docking station 190 at either both ends or one end of the runway 124, the battery 1320 is charged to ensure continued operation of the watering pod 1150.

[00149] Optionally, the docking station 190 can include a sensor or actuator to help determine when the watering pod 1150 is present in the docking station 190. This

information can be provided to the controller and can help determine when charging or refilling systems should be activated. For example, in this illustrated example the docking station 190 includes a limit switch 370 that protrudes from a bottom surface of the docking station 190. The limit switch 370 operates when the watering pod 1150 makes contact with it at the end of the runway 124. When the limit switch 370 operates, the docking station 190 commences with recharging the battery 1320.

[00150] Referring now to FIG. 7 and FIG.8, there is illustrated another exemplary watering pod 2150 for use in the aeroponic system 100. The watering pod is analogous to watering pods 150, 1150 and like features are identified using like reference characters indexed by 2000. The watering pod 2150 includes an interface which couples the watering pod 2150 to the runway 124, a drive system 2310, an internal combustion engine 2322, a water tank 2151, and a watering mechanism 2153. The watering mechanism 2153 comprises nozzles 2158 and atomizer 2159.

[00151] The engine 2322 provides power to the drive system 2310 that drives the wheels 315. The runway 124 is a rail and the interface may be a wheel or wheels 315 configured to engage the runway 124, with the wheel or wheels 315 providing a friction force against the runway 124. The engine 2322 may be a petrol engine or a diesel engine, or similar.

[00152] The drive system 2310 may be, for example, a drive train that drives wheels 315 forward and backward to cause the watering pod 2150 to travel along the runway 124, optionally in response to a signal from an associated system controller that can co-ordinate and control the movement of the watering pod 2150, the timing of the water spraying/misting and other analogous system operations.

[00153] Preferably, the watering pod 2150 is configured so that it can travel along the runway at a rate of speed that allows it to cover the length of its associated plant support layer (or at least a portion thereof) in a predetermined period of time, such as once every 20 sec, 30 sec, 40 sec, 50 sec, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes or more. This can allow the watering pod 2150 to travel past the roots of at least a majority of the plants in the plant support layer at a desired frequency to help keep the roots sufficiently moist. Optionally, the watering pod 2150 may be capable of moving along the runway at speeds in the range of between a higher speed that preferably less than about 100, 90, 80, 70,

60, 50, 40, 35, 30, 25, 20, 19, 18, 17, 16 or 15 feet per minute to lower speed that is at least about 1, 2, 3, 4, 5, 6, 7 or 8 feet per minute or more to help ensure the humidity of the root chamber 122 is maintained at a desired humidity level by spraying the roots while moving. The desired humidity level may be selected based on a number of parameters, including the type of plants being grown and the surrounding atmospheric conditions, and may be at level of at least 80% humidity. The humidity in the root chamber 122 need not be uniform throughout the entire root chamber interior. Instead, the humidity level may vary in different locations, and may be relatively higher in closer proximity to the watering pod 2150. For example, as the watering pod 2150 moves the humidity in the vicinity of the watering pod 2150 may increase to at least 80%. As an example, the humidity within 1 ft of the watering pod 2150 may be at 80%, but beyond the 1ft the humidity may be lower than 80%. As the watering pod 2150 moves along the runway 124, the humidity in the vicinity of the watering pod 2150 is preferably at about 80%.

[00154] Optionally, when the watering pod 2150 reaches the end of the runway 124, it may stop emitting the mist before returning along the runway 124. In such instances the humidity in the vicinity of the watering pod 2150 may drop below 80% until the watering pod 2150 emits the mist when movement resumes.

[00155] In some cases, the watering pod 2150 may preferably move at a speed of about 0.1 feet per second. The drive system 2310 may include a single drive train capable of moving the watering pod 2150 in both directions along the runway 124.

[00156] The water tank 2151 contains water and/or a water-based mixture that can also include nutrients and the like. The water tank 2151 has an onboard volume of water that is preferably at least enough to spray the roots while moving from one end of the runway 124 to the other. The water tank 2151 is fluidly connected to the watering mechanism 2153. The mist emitted by the watering pod 2150 in this example is a relatively fine mist with a droplet size that is preferably less than 50 μm per droplet.

[00157] In examples where the watering pod 2150 includes an internal water supply it may also optionally include a water pump 2152 and an air pump 2330 to help with water spraying/distribution. The water pump 2152 may be a vacuum pump, for example, and pressurizes the water in the water tank 2151 before the water is conveyed to and emitted

from the nozzles 158. An optional air pump 2330 can be used to mix the water with air from the air pump 2330 before being emitted from the atomizer 2159. The system may also include an optional pressure sensor that detects the pressure within the water tank 2151. If the pressure drops below a set threshold, the system control can activate the water pump 2152 to increase the pressure within the water tank 2151.

[00158] The watering mechanism 2153 in the watering pod 2150 may include both nozzles 158 and the atomizer 159. In some cases, the watering mechanism 2153 in the watering pod 2150 may include only nozzles 2158. In this case, only the water pump 2152 is required. The watering mechanism 2153 may include only one nozzle 2158 per side of the watering pod 2150. The nozzles 2158 may be stainless steel or brass or similar. The nozzles 2158 and atomizer 2159 may be moveable with respect to the watering pod 2150 allowing them to move through various degrees of freedom, such as up, down, side to side etc. This results in the watering pod 2150 spraying a greater area while the watering pod 2150 moves. An actuator mechanism 2157, operatively coupled to the nozzles 2158 and the atomizer 2159, controls the movement.

[00159] The nozzles 2158 and the atomizer 2159 may be mounted on a common housing that is connected to a reciprocating arm 2342 that can move the nozzles 2158 and atomizer 2159 in a generally up and down motion (as illustrated by arrow 2302) in a direction that is orthogonal to the longitudinal direction of the runway 124. That is, the watering pod 2150 is configured to move in one direction and the nozzles 2158 and atomizer 2159 are configured to move in a different direction, relative to the watering pod 2150 while it is in motion. The movement of the reciprocating arm 2342 may be controlled by a motion hub or actuator 2157. The actuator 2157 may be operatively coupled to the drive system 2310, so that as the watering pod 2150 moves along the runway 124, the nozzles 2158 and atomizer 2159 reciprocate in the direction of the reciprocating arm 2342. All the nozzles 2158 and the atomizer 2159 may be configured so that they all reciprocate. In some cases, only the nozzles 2158 or the atomizer 2159 may be configured to reciprocate. In some cases, only one of the nozzles 2158 may be configured to reciprocate.

[00160] The watering pod 2150 may also include a controller 2350 which controls the mist emitted from the watering mechanism 2153. The watering pod 2150 may also include a valve or valves 2360 to control the mist emitted from the watering mechanism 2153. The controller 2350 is operatively coupled to the valve or valves 2360 to open them and close them as required depending on the misting requirements of the plants being cultivated. The controller 2350 is operatively coupled to the drive system 2310 to control the movement of the watering pod 2150 along the runway 124. The controller 2350 may be operatively coupled to the actuator mechanism 2157 to control the movement of the nozzles 2158 and atomizer 2159. The controller 2350 may be operatively coupled to the water pump 2152 and air pump 2330 to control the operation of the water pump 2152 and the air pump 2330. For example, the pressure sensor may send the detected pressure of the water tank 2151 to the controller 2350, which then operates the water pump 2152 to increase the pressure within the water tank 2151.

[00161] Optionally, the system 100 may include, at both or one of the ends of the runway 124, a docking station 190 that is configured to receive and preferably service/engage with the watering pod 2150. For example, in this example the docking station 190 fluidly connects to the watering pod 2150 to help resupply the onboard water reservoir and a fuel tank of the engine. In this arrangement, the water tank 2151 can be refilled when needed at either both ends or one end of the runway 124. This ensures that the watering pod 2150 has an adequate water reserve for misting the roots while moving. In this example the docking station 190 fluidly connects to the watering pod 2150 via complimentary refilling pipe or pipes. Water enters the watering pod 2150 at the refilling pipe and flows through a funnel 362. The funnel 362 is fluidly connected to the water tank 2151 by water pipes 364. The docking station fluidly connects to the fuel tank for the engine in a similar manner.

[00162] Optionally, the docking station 190 can include a sensor or actuator to help determine when the watering pod 2150 is present in the docking station 190. This information can be provided to the controller and can help determine when charging or refilling systems should be activated. For example, in this illustrated example the docking station 190 includes a limit switch 770 that protrudes from a bottom surface of the docking station 190. The limit switch 770 operates when the watering pod 2150 makes contact

with it at the end of the runway 124. When the limit switch 770 operates, the docking station 190 commences with refilling the water tank 2151 and the fuel tank.

[00163] Referring now to FIG. 9 and FIG. 10, there is illustrated another exemplary watering pod 3150 for use in the aeroponic system 100. Watering pod 3150 is analogous to watering pods 150, 1150, 2150 and like features are identified using like reference characters indexed by 3000. The watering pod 3150 includes an interface which couples the watering pod 3150 to the runway 124, a drive system 3310, wires 3323 connecting the watering pod 3150 to an external power supply 3324, a conduit 951 connecting the watering pod 3150 to an external water supply 3353, and a watering mechanism 3153. The watering mechanism 3153 comprises nozzles 3158 and atomizer 3159.

[00164] The wires 3323 connect the watering pod 3150 to the external power supply 3324. This provides power to the drive system 3310 that drives the wheels 315. The runway 124 is a rail and the interface may be a wheel or wheels 315 configured to engage the runway 124, with the wheel or wheels 315 providing a friction force against the runway 124.

[00165] The use of the external power supply 3353 removes the requirement for an onboard power supply or battery. As a result, the watering pod 3150 may be lighter on the rail. It removes the requirement for the docking station or similar type of structure to electrically connect to the watering pod 3150 for recharging purposes.

[00166] The drive system 3310 may be, for example, an electric motor that drives the wheels 315 forward and backward to cause the watering pod 3150 to travel along the runway 124, optionally in response to a signal from an associated system controller that can co-ordinate and control the movement of the watering pod 3150, the timing of the water spraying/misting and other analogous system operations.

[00167] Preferably, the watering pod 3150 is configured so that it can travel along the runway at a rate of speed that allows it to cover the length of its associated plant support layer (or at least a portion thereof) in a predetermined period of time, such as once every 20 sec, 30 sec, 40 sec, 50 sec, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes or more. This can allow the watering pod 3150 to travel past the roots of at least a majority of the plants in the plant support layer at a desired frequency to help keep the roots sufficiently moist.

Optionally, the watering pod 3150 may be capable of moving along the runway at speeds in the range of between a higher speed that preferably less than about 100, 90, 80, 70, 60, 50, 40, 35, 30, 25, 20, 19, 18, 17, 16 or 15 feet per minute to lower speed that is at least about 1, 2, 3, 4, 5, 6, 7 or 8 feet per minute or more to help ensure the humidity of the root chamber 122 is maintained at a desired humidity level by spraying the roots while moving. The desired humidity level may be selected based on a number of parameters, including the type of plants being grown and the surrounding atmospheric conditions, and may be at level of at least 80% humidity. The humidity in the root chamber 122 need not be uniform throughout the entire root chamber interior. Instead, the humidity level may vary in different locations, and may be relatively higher in closer proximity to the watering pod 3150. For example, as the watering pod 3150 moves the humidity in the vicinity of the watering pod 3150 may increase to at least 80%. As an example, the humidity within 1 ft of the watering pod 3150 may be at 80%, but beyond the 1ft the humidity may be lower than 80%. As the watering pod 3150 moves along the runway 124, the humidity in the vicinity of the watering pod 3150 is preferably at about 80%.

[00168] Optionally, when the watering pod 3150 reaches the end of the runway 124, it may stop emitting the mist before returning along the runway 124. In such instances the humidity in the vicinity of the watering pod 3150 may drop below 80% until the watering pod 3150 emits the mist when movement resumes.

[00169] In some cases, the watering pod 3150 may preferably move at a speed of about 0.1 feet per second. The drive system 3310 may include a single electric motor capable of moving the watering pod 3150 in both directions along the runway 124. The drive system 3310 may include one electric motor to drive the watering pod 3150 in one direction, and another electric motor to drive the watering pod 3150 in the other direction along the runway 124.

[00170] The water supply 3353 is external to the watering pod 3150 and is connected to the watering pod 3150 by the conduit 951. The water supply 3353 is fluidly connected to the watering mechanism 3153. The mist emitted by the watering pod 3150 is a fine mist at less than 50 μm per droplet.

[00171] As the water supply 3353 is external to the watering pod 3150, the water is delivered to the watering pod 3150 by the conduit 951 wherein the water is already pressurized. A pump, external to the watering pod 3150, may pressurize the water before being supplied to the watering pod 3150.

[00172] The use of the external water supply 3353 removes the requirement for an onboard water reservoir. As a result, the watering pod 3150 may be lighter on the rail. It removes the requirement for the docking station or similar type of structure to fluidly connect to the watering pod 3150 for refilling purposes. The use of the external water supply 3353 also removes the requirement for the water pump to aid in spraying/distribution or maintaining a pressure in the onboard water reservoir.

[00173] The watering mechanism 3153 in the watering pod 3150 may include both the nozzles 3158 and the atomizer 3159. In some cases, the watering mechanism 3153 may include only nozzles 3158. The watering mechanism 3153 may include only one nozzle 3158 per side of the watering pod 3150. The nozzles 3158 may be stainless steel or brass or similar. The nozzles 3158 and atomizer 3159 may be moveable with respect to the watering pod 3150 allowing them to move through various degrees of freedom, such as up, down, side to side etc. This results in the watering pod 3150 covering a greater area while the watering pod 3150 moves. An actuator mechanism 3157, operatively coupled to the nozzles 3158 and the atomizer 3159, controls the movement.

[00174] The nozzles 3158 and the atomizer 3159 may be mounted on common housing that is connected to a reciprocating arm 3342 that can move the nozzles 3158 and atomizer 3159 in a generally up and down motion (as illustrated by arrow 3302) in a direction that is orthogonal to the longitudinal direction of the runway 124. That is, the watering pod 3150 is configured to move in one direction and the nozzles 3158 and atomizer 3159 are configured to move in a different direction, relative to the watering pod 3150 while it is in motion. The movement of the reciprocating arm 3342 may be controlled by a motion hub or actuator 3157. The actuator 3157 may be operatively coupled to the drive system 3310, so that as the watering pod 3150 moves along the runway 124, the nozzles 3158 and atomizer 3159 reciprocate in the direction of the reciprocating arm 3342. All the nozzles 3158 and the atomizer 3159 may be configured so that they all

reciprocate. In some cases, only the nozzles 3158 or the atomizer 3159 may be configured to reciprocate. In some cases, only one of the nozzles 3158 may be configured to reciprocate.

[00175] The watering pod 3150 may also include a coiling mechanism (not shown) that coils and uncoils the wires 3323 as the watering pod 3150 moves along the runway 124. This prevents the roots in the root chamber 122 entangling with the wires 3323 and damaging them.

[00176] The watering pod 3150 also includes a controller 3350 which controls the mist emitted from the watering mechanism 3153. The watering pod 3150 may also include a valve or valves 3360 to control the mist emitted from the watering mechanism 3153. The controller 3350 is operatively coupled to the valve or valves 3360 to open them and close them as required depending on the misting requirements of the plants being cultivated. The controller 3350 is operatively coupled to the drive system 3310 to control the movement of the watering pod 3150 along the runway 124. The controller 3350 may also be operatively coupled to the actuator mechanism 3157 to control the movement of the nozzles 3158 and atomizer 3159.

[00177] The system 100 includes a water capture structure 160 to help capture and recycle water that was sprayed within the root chamber 122 and that can be collected and, optionally, recycled for subsequent spraying. In its simplest form, the water capture structure includes a sheet positioned to underlie the lower surface of the plant support layer 130 such that it is also underneath the runway 124, the watering pod 150, and the roots of the plants contained in the root chamber 122. In some examples, the water capture structure 160 can cooperate with the plant support layer 130 to bound and define the root chamber 122. Preferably, the water capture structure 160 is shaped so that water collected thereon can be directed toward one or more low points/drains to help assist with water collection and to help reduce the accumulation of standing water within the water capture structure 160. For example, in some embodiments the water capture structure 160 can be configured so that at one end the sheet is lower than the other, providing a gradient to help promote water flow toward the low end. Excess runoff water that has been misted by the watering pod 150 lands on the sheet and flows towards the lower end.

At the lower end is a tank that collects the water. The water may then be reapplied to the roots either by being reintroduced to the external water supply, or being put into the water tank internal to the watering pod 150, 2150. Alternatively, instead of having a low end the water capture structure 160 can be shaped in a generally converging manner such that it has a low point/ drain that is located toward or at the centre of the water capture structure 160.

[00178] Referring now to FIG. 11, a diagram of a water capture structure according to one embodiment is provided. In this example, a sheet or sheets 166 is positioned underneath the root chamber 122 and configured so that a mid point of the sheet or sheets 166 is the lowest point. The excess runoff water lands on the sheet or sheets 166 and flows towards the lower midpoint. At the midpoint the sheet 166 is an aperture or apertures below which is a tank 162. The tank 162 collects the excess runoff water. The water may then be reapplied to the roots either by being reintroduced to the external water supply, or being put into the water tank internal to the watering pod 2150, 3150.

[00179] In larger systems, there may be several of these arrangements, one after the other, spanning the length of the system. At each end of the particular span of the system 100, the sheet 166 may have an opening 168 that is inline with the runway 124. As the watering pod 150 travels from each span of the system 100, the watering pod 150 may travel along the runway 124 without hindrance and without coming into contact with the sheet 166. The excess runoff water is collected by the sheet 166, and passes through the aperture into a secondary tank 162. There may be several secondary tanks 162 situated along the length of the system. The secondary tanks 162 collect the water that passes through the apertures. The secondary tanks 162 are connected by a pipe 164, with a pump, that directs the water towards a primary tank at one end of the system. The water may then be reapplied to the roots either by being reintroduced to the external water supply, or being put into the water tank internal to the watering pod 150.

[00180] Referring now to FIGs. 13 to 18 an alternative configuration of a plant watering system 5100 is provided. The watering system 5100 is generally analogous to the watering system 100 and like features are indicated using like references characters indexed by 5000.

[00181] In some cases, the outer shell 110 shown in system 100 that covers the upper side of the plants is optional and need not be included in all examples of the systems described herein. For example, in climates that are generally suitable for growing the desired plants, e.g., if the climate is not harsh on the plants, the upper cover portion of the outer shell need not be used and the plants can remain exposed to the surrounding atmosphere. In the system 5100, an upper portion of the outer shell 110 is not required. In this example, and in the other examples described herein, the systems 100 and 5100 can be configured to extend over relatively long longitudinal distances, but each overall system may be made up of one, two or more growing segments - each of which may include the features and functions as described herein.

[00182] For example, each growing segment 5502 may have a plant support layer 5130, a generally enclosed root chamber 5122, a runway 5124 extending through the root chamber 5122 and an associated watering pod 5150 that can travel along the runway 5124 beneath the associated plant support layer 5130. The dimensions of each individual growing segment 5502 can be selected based on the mechanical strength and properties of the described components, as described herein. For example, it may not be practical in some instances to construct a single plant support layer 5130 and a single runway 5124 that extend several hundred feet. Instead, it may be preferred to provide multiple growing segments 5502 of approximately 50-100 feet in length (or other suitable lengths, each with a respective plant growing layer 5130, runway 5124 and watering pod 5150) that are arranged in series with each other to form what appears to be a generally continuous, longer plant growing system. That is, the system 5100 may be a segmented system that can include one or more growing segments 5502. Multiple growing segments 5502 can be installed such that their respective plant support layers 5130 are generally parallel and coplanar with each other to provide a larger system, and optionally such that the runways 5124 in the respective segments are also generally, longitudinally aligned with each other. In some examples a given watering pod 5150 could be configured to traverse between two adjacent runways 5124, but preferably each segment 5502 can include its own watering pod 5150 that travels along the length of its runway 5124 but does not need to transfer to the runway 5124 of an adjacent growing segment. As described herein, FIGs. 13 to 18 show an exemplary growing segment 5502 of the system 5100. FIGs. 19 and 21

show the system with multiple growing segments. The growing segment 5502 may have a length between 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 17, 18, 19, 20 ft and 50, 55, 60, 65, 70, 75, 80, 85, 90, 95 and 100 ft. or more depending on the properties of the materials utilized. In some cases, the growing segment 5502 has a length 5503 of approximately 50 ft.

[00183] In the examples described herein, the exemplary growing segments 5502 can be generally understood as including supporting legs in the form of a first base support 5504 and a second base support 5506, a first crossmember 5508 coupled to the first base support 5504, a second crossmember 5510 coupled to the second base support 5506, a first mounting cable 5512 and a second mounting cable 5514 extending between the first crossmember 5508 and the second crossmember 5510, a plant support layer 5130 supported by the first crossmember 5508 and the second crossmember 5510, and a liquid capture sheet 5160 underlying the plant support layer 5130.

[00184] The first base support 5504 has a body 5522 extending between a lower end 5524 and an upper end 5526. The second base support 5506 is generally identical to the first base support 5504. The second base support 5506 has a body 5528 extending between a lower end 5530 and an upper end 5532. The second base support 5506 is spaced apart longitudinally from the first base support 5504 by a segment length 5503. The first base support 5504 and the second base support 5506 are connectable to the ground. In some cases, the first base support 5504 and the second base support 5506 are aluminium. In some cases, the first base support 5504 and the second base support 5506 are made from metal, such as steel, aluminum or other suitable metals, but may be made from plastic, wood, composite materials or combinations thereof in other examples.

[00185] The first base support 5504 and the second base support 5506 provide support for the system 5100. In some cases, where the outer shell 110 is included in the system 5100, the first base support 5504 and the second base support 5506 provide support for the outer shell 110. The first base support 5504 and the second base support 5506 raise the system 5100 from the ground. When the outer shell 110 is in use, the curved design of the outer shell 110 promotes air flow under the outer shell 110. In temperate climates, this movement of air can have a cooling effect on the interior of the outer shell 110 meaning that additional cooling systems are not required.

[00186] The body 5522 of the first base support 5504 and the body 5528 of the second base support 5506 can be installed in the ground either in a hole in the ground, or set in concrete, for example, in the ground for stability. The single body 5522, 5528 requires only a single hole to be created for each of the first base support 5504 and the second base support 5506 resulting in relatively less ground work for installing and supporting the system 5100, as compared to a system with multiple supports that need to be mounted in the ground.

[00187] Raising the system 5100 from the ground helps to reduce impact from collecting ground water which could waterlog and damage plants and crops, and may help reduce interference from animals.

[00188] The first base support 5504 and the second base support 5506 each have a pair of supporting arms 5534 extending outwardly from their respective body 5522, 5528. Each supporting arm 5534 extends from opposing sides of the first base support 5504 and the second base support 5506 upwardly and outwardly. The supporting arms 5534 of the first base support 5504 couple to the first crossmember 5508. The supporting arms 5534 of the second base support 5506 couple to the second crossmember 5510.

[00189] The supporting arms 5534 may be formed from rigid materials like plastic or metal rods with strength parameters that enable them to support the first crossmember 5508 and the second crossmember 5510 and the remainder of the system 5510 when it is supporting plants 140. Preferably, the supporting arms 5534 are formed from aluminum or steel rods that are fastened to, or integral with, the body 5522, 5528.

[00190] The first crossmember 5508 is coupled to the first base support 5504 and the second crossmember 5510 is coupled to the second base support 5506. The first crossmember 5508 and the second crossmember 5510 extend in a lateral direction 5505 generally perpendicular to the first base support 5504 and the second base support 5506 respectively. In some cases, the first crossmember 5508 and the second crossmember 5510 are beams, such as aluminium beams, steel beams, or similar. In some cases, the first crossmember 5508 and the second crossmember 5510 are cables.

[00191] The first crossmember 5508 and the second crossmember 5510 may be formed from rigid materials like plastic or metal beams with strength parameters that enable them

to support the plant support layer 5130 when it is supporting plants 140. Preferably, the first crossmember 5508 and the second crossmember 5510 are formed from aluminum or steel beams that are fastened to, or integral with, the supporting arms 5534. The first crossmember 5508 and the second crossmember 5510 optionally, may be formed from tension members, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. The cables have strength parameters that enable them to support the plant support layer 5130 when it is supporting plants 140.

[00192] The first mounting cable 5512 and the second mounting cable 5514 extend between the first crossmember 5508 and the second crossmember 5510 and are laterally spaced apart from each other. Cables can include any type of tension member, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. As an example, the cables can be made of steel rope with a diameter ranging from about 1mm to 10mm. Preferably, the diameter is about 4mm. The cables have a thermal expansion coefficient that is in the range of approximately 0.0017 m/m-°C to approximately 0.00001728 m/m-°C.

[00193] The first mounting cable 5512 and the second mounting cable 5514 are attachable to the plant support layer 5130, the first crossmember 5508, and the second crossmember 5510 such that the plant support layer 5130 is supported by the first mounting cable 5512 and the second mounting cable 5514 and extends between the first crossmember 5508 and the second crossmember 5510.

[00194] The plant support layer 5130 is arranged, in this example, to house and support plants 140 (and any associated pots/containers, etc.) and, when cooperating with the liquid capture sheet 5160, forms the root chamber 5122. The plant support layer 1530 may be made from any suitable material that can support the weight of the plants 140 and that can cooperate with the liquid capture sheet 5160 to define the root chamber 120. This can include materials that are generally flexible but have sufficient strength to hold the plants 140, such as woven or non-woven fabrics, plastic sheets or films and the like. Flexible materials of this nature may be relatively lighter weight than rigid materials. In other examples at least some portions of the plant support layer 5130 may be formed from rigid materials like plastic or metal sheets. Optionally, the plant support layer 5130

may be formed from material that can block at least some of the light from outside the root chamber 5122 from reaching the interior of the root chamber 5122, and may be at least partially opaque.

[00195] In this example the plant support layer 5130 includes several apertures 5132 that are sized and configured to hold at least one plant 140, and preferably are configured so that there is one plant 140 per aperture 5132. Each plant 140 is held within a plant holder 134 which is receivable within one of the apertures 5132. Each aperture 5132 may have a reinforcing rim 136. A lower portion of the plant holder 134 extends below the plant support layer 5130. The lower portion of the plant holder 134 has several slots 138 about its surface through which the roots are exposed to the air, and through which the roots may grow. The plant holder 134 may have a lip that extends outwardly and may contact the upper surface of the plant support layer 5130 so that the plant holder 134 does not fall through the aperture 5132. The plant holder 134 may have a tapered shape whereby the bottom is narrower than the top. While one example of an aperture 132 and plant holder 134 are illustrated in this example, other variations of apertures and related plant holders can be used in other examples.

[00196] The plant support layer 5130 has a first edge 5540 and an opposing second edge 5542 that are laterally spaced apart from each other and define the outermost edges of the plant support layer 5130. The first edge 5540 and the second edge 5542 extend longitudinally between a first end 5536 and a second end 5538 of the plant support layer 5130 and, in this example, extend between the first crossmember 5508 and the second crossmember 5510. A first plurality of mounting connectors 5546 are provided so that the plant support layer 5130 can be attached to the first mounting cable 5512. The connectors 5546 are preferably configured to attach the plant support layer 5130 such that contracting in the lateral direction is resisted, but so that the first mounting cable 5512 can slide axially/longitudinally relative to the plant support layer 5130. The first plurality of mounting connectors 5546 is configured to slidably receive the first mounting cable 5512 thereby attaching the first edge 5540 to the first mounting cable 5512. A second plurality of mounting connectors 5548 is longitudinally spaced apart along the second edge 5542. The second plurality of mounting connectors 5548 is configured to slidably receive the

second mounting cable 5514 thereby attaching the second edge 5548 to the second mounting cable 5514.

[00197] The first plurality of connectors 5546 and the second plurality of connectors 5548 may be attachment loops formed along the first edge 5540 and the second edge 5542 and configured to slidably receive the first mounting cable 5512 and the second mounting cable 5514 respectively. The attachment loops may be formed for the same material as the plant support layer 5130. In some cases, the attachment loops are integral with the plant support layer 5130. In some cases, the attachment loops are secured to the plat support layer 5130 by stitching or bonding or similar. This use of the first plurality of connectors 5546 and the second plurality of connectors 5548 allows the first mounting cable 5512 and the second mounting cable 5514 to be tensioned while the plant support layer 5130 is in place without bunching the plant support layer 5130 in a longitudinal direction 5507 or damaging the plant support layer 5130. Preferably, to help distribute the support of the plant support layer 5130 the connectors 5546, 5548 can be longitudinally spaced apart from each other along the first edge 5540 and the second edge 5542 of the plant support layer 5130. In some cases, the first plurality of mounting connectors 5546 and the second plurality of mounting connectors 5548 may be tabs of material, loops, eyelets, or similar, configured to slidably receive the first mounting cable and the second mounting cable.

[00198] The plant support layer 5130 is slidable along the first mounting cable 5512 and second mounting cable 5514 to attach to the first crossmember 5508 and to the second crossmember 5510. The first mounting cable 5512 and the second mounting cable 5514 resist lateral sagging of the plant support layer 5130 when tensioned. In some cases, the first mounting cable 5512 and the second mounting cable 5514 are attached to the first crossmember 5508 and the second crossmember 5510 respectively, to support the plant support layer 5130 when the first mounting cable 5512 and the second mounting cable 5514 are tensioned.

[00199] The first edge 5540 and second edge 5542 of the sheet of flexible material in the plant support layer 5130 are arcuate such that the sheet of flexible material has a width 5509 at a location between the first end 5536 and second end 5538 of the sheet of flexible

material that is less than a width 5511 at the first end 5536 or the second end 5538 of the sheet of flexible material. The arcuate shape encourages the first mounting cable 5512 and the second mounting cable 5514 to curve, providing a greater tensioning of the plant support layer 5130.

[00200] The plant support layer 5130 is attachable to the first crossmember 5508 and the second crossmember 5510 at the first end 5536 and the second end 5538 respectively, by a plurality of fasteners (not shown). In some cases, the plurality of fasteners is a series of pop studs, rivets, zip ties, stitching, or similar. The fasteners secure the plant support layer 5130 to the first crossmember 5508 and the second crossmember 5510 such that it is tensioned in the longitudinal direction 5507. This tension is maintained by the fasteners.

[00201] In some cases, the first crossmember 5508 and the second crossmember 5510 include feedthroughs 5516 configured to receive a respective one of the first mounting cable 5512 and the second mounting cable 5514. The first mounting cable 5512 and the second mounting cable 5514 are fed through the feedthroughs 5516 and are securable to a first anchor system 5518 and a second anchor system 5520.

[00202] The feedthroughs 5516 may be apertures formed in each of the first crossmember 5508 and the second crossmember 5510 such that the first mounting cable 5512 and the second mounting cable 5514 pass through the first crossmember 5508 and the second crossmember 5510. In some cases, the feedthroughs may be loops or similar attachment mounted to each of the first crossmember 5508 and the second crossmember 5510 such that the first mounting cable 5512 and the second mounting cable 5514 connected to the first crossmember 5508 and the second crossmember 5510 but are external to the first crossmember 5508 and the second crossmember 5510.

[00203] The first anchor system 5518 and the second anchor system 5520 provide a fastening point for the first mounting cable 5512 and the second mounting cable 5514 such that, when the first mounting cable 5512 and the second mounting cable 5514 are tensioned, they can be secured to the first anchor system 5518 and the second anchor system 5520 to maintain the tension. The first anchor system 5518 may be a pair of anchor posts, connectable to the ground, at which the first mounting cable 5512 and the second mounting cable 5514 are attachable to. The first mounting cable 5512 may

generally extend from the plant support layer 5130 generally level, meet a first anchor post 5519a of the first anchor system 5518, turn through an angle of approximately 90 degrees, extend down the first anchor post 5519a, and secure to a fastener at a first end of the first mounting cable 5512. The second mounting cable 5514 may generally extend from the plant support layer 5130 generally level, meet a second anchor post 5519b of the first anchor system 5518, turn through an angle of approximately 90 degrees, extend down the second anchor post 5519b, and secure to a fastener at a first end of the second mounting cable 5514. The first mounting cable 5512 may generally extend from the plant support layer 5130 generally level, meet a first anchor post 5521a of the second anchor system 5520, turn through an angle of approximately 90 degrees, extend down the first anchor post 5521a, and secure to a fastener at a second end of the first mounting cable 5512. The second mounting cable 5514 may generally extend from the plant support layer 5130 generally level, meet a second anchor post 5521b of the second anchor system 5520, turn through an angle of approximately 90 degrees, extend down the second anchor post 5521b, and secure to a fastener at a first end of the second mounting cable 5514.

[00204] In some cases, the first anchor system 5518 and the second anchor system 5520 may be integral to the first base support 5504 and the second base support 5506 respectively. In some cases, the first anchor system 5518 and the second anchor system 5520 are separate from and proximate the first base support 5504 and the second base support 5506 respectively. The first mounting cable 5512 and the second mounting cable 5514 are tensioned and secured to the first anchor system 5518 and the second anchor system 5520 to maintain the tension.

[00205] Although the first anchor system 5518 and the second anchor system 5520 are described as having a pair of anchor posts each, in some cases the first anchor system 5518 and the second anchor system 5520 may comprise only one anchor post each.

[00206] The liquid capture sheet 5160 is, in this example, a flexible sheet of material that is generally water resistant. The liquid capture sheet 5160 and the lower surface 5552 of the plant support layer 5130 cooperate to at least partially bound the root chamber 5122. The liquid capture sheet 5160 is attachable to the plant support layer 5130 about the

perimeter of the plant support layer 5130, e.g., about the first end 5536, second end 5538, first edge 5540 and second edge 5542 of the plant support layer 5130. The liquid capture sheet 5160 is attachable to the plant support layer 5130 by a zipper, a hook and loop fastener, pop studs, stitching, zip ties, or similar. In some cases, the liquid capture sheet 5160 is attachable to, and supported by, support cables 5561 that are parallel to the first mounting cable 5512 and the second mounting cable 5514. The support cables 5561 provide additional support to the liquid capture sheet 5160 and reduce the weight on the first mounting cable 5512 and the second mounting cable 5514.

[00207] Preferably, the liquid capture sheet 5160 is shaped so that water collected thereon can be directed toward one or more low points/drains to help assist with water collection and to help reduce the accumulation of standing water within the liquid capture sheet 5160. For example, in some embodiments the liquid capture sheet 5160 can be configured so that at one end the sheet is lower than the other, providing a gradient to help promote water flow toward the low end. Excess runoff water that has been misted by the watering pod 5150 lands on the sheet and flows towards the lower end. At the lower end is a tank that collects the water. The water may then be reapplied to the roots either by being reintroduced to the external water supply, or being put into the water tank internal to the watering pod 5150. Alternatively, instead of having a low end the liquid capture sheet 5160 can be shaped in a generally converging manner such that it has a low point 5610 and/or a drain 5614 that is located toward or at a midpoint 5612 of the liquid capture sheet 5160.

[00208] The root chamber 5122 has a first chamber end 5554, proximate the first crossmember 5508, and a second chamber end 5556, proximate the second crossmember 5510. The root chamber 5122 is configured to receive the roots of the plants 140 in the plant support layer 5130. The roots are suspended within the root chamber 5122, exposed to air, and shielded from light. The runway 5124 extends through the root chamber 5122, on which the watering pod 5150 is supported.

[00209] The growing segment 5502 further includes at least one intermediate crossmember 5558 positioned longitudinally between the first crossmember 5508 and the second crossmember 5510. The intermediate crossmember 5558 is configured to slidably

engage the first mounting cable 5512 and the second mounting cable 5514 and support the plant support layer 5130.

[00210] The at least one intermediate crossmember 5558 is coupled to a respective intermediate base support 5560. The intermediate base support 5560 is generally identical to the first base support 5504 and the second base support 5506. The intermediate crossmember 5558 extends in the lateral direction 5505 generally perpendicular to the intermediate base support 5560. In some cases, the intermediate crossmember 5558 is a beam, such as an aluminium beam, steel beam, or similar. Preferable, the intermediate crossmember 5558 is a cable. The intermediate crossmember 5558 provides support to the plant support layer 5130 at an intermediate point between the first crossmember 5508 and the second crossmember 5510.

[00211] The intermediate crossmember 5558 includes openings 5559. The first mounting cable 5512 and the second mounting cable 5514 are slidably receivable through the openings 5559 in the intermediate crossmember 5558. This provides additional structural support and integrity to the first mounting cable 5512 and the second mounting cable 5514 while they support the plant support layer 5130.

[00212] The intermediate crossmember 5558 may be formed from rigid materials with strength parameters that enable it to support the plant support layer 5130 when it is supporting plants 140. Preferably, the intermediate crossmember 5558 is a cable or formed from a tension member, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. The cable has a strength parameter that enable it to support the plant support layer 5130 when it is supporting plants 140.

[00213] Although Figures 13 to 18 show the growing segment 5502 as having three intermediate base supports 5560 with respective intermediate crossmembers 5558, other configurations are possible. In some cases, the growing segment 5502 may have no intermediate base supports 5560 and intermediate crossmembers 5558. In some cases, the growing segment 5502 may have only one intermediate base support 5560 and intermediate crossmember 5558. In some cases, the growing segment 5502 may have more than one intermediate base support 5560 and intermediate crossmember 5558. The

intermediate crossmembers 5558 provide support to the plant support layer 5130 in the lateral direction 5505.

[00214] In some cases, the plant support layer 5130 includes a selectably openable access point 5562 that extends through the sheet of flexible material and is securable using a releasable fastener 5564. When the releasable fastener 5564 is disengaged, the access point 5562 is open and provides communication between the lower surface 5552 of the plant support layer 5130 and the upper surface 5550 of the plant support layer 5130. When the releasable fastener 5564 is engaged, the access point 5562 is closed and isolates the upper surface 5550 from the lower surface 5552. The access point 5562 enables a farmer or operator to position themselves such that they are able to reach the plants 140 in the plant support layer 5130 for inspection, planting, and harvesting. In some cases, the access point 5562 is positioned along a middle of the plant support layer 5130. In some cases, the releasable fastener 5564 is a hook and loop fastener. In some cases, the releasable fastener 5564 is a zipper. The releasable fastener 5564 is configured to prohibit or limit ingress of light to the root chamber 5122 through the releasable fastener 5564.

[00215] In some cases, the plant support layer 5130 comprises at least two plant support subpanels 5568, joined together by an intermediate connecting panel 5570. Each of the at least two plant support subpanels 5568 has a plurality of apertures 5132 configured to receive and support plants 140 and formed from a sheet of flexible material. The intermediate connecting panel 5570 is a sheet of flexible material with similar properties to that of the plant support subpanels 5568. In some cases, the intermediate connecting panel 5130 is made of the same material at the plant support subpanels 5568, with the absence of the apertures 5132. The intermediate connecting panel 5570 prohibits or limits the permeation of light below the plant support layer 5130.

[00216] The at least two plant support subpanels 5568 includes at least a first subpanel 5572 and a second subpanel 5574. The first subpanel 5572 and the second subpanel 5574 are generally identical to the plant support layer 5130 but having a smaller width such that they are joined by the intermediate connecting panel 5570, with an overall width being similar to that of the plant support layer 5130. The first subpanel 5572 extends

between a first end 5580a and a second end 5582a. The first end 5580a is connectable to the first crossmember 5508 and the second end 5582a is connectable to the second crossmember 5510. The first subpanel 5572 comprises a first edge 5584a and an opposing second edge 5586a extending between the first end 5580a and the second end 5582a. A first plurality of mounting connectors 5590a are spaced apart longitudinally along the first edge 5584a and slidably receive the first mounting cable 5512 thereby attaching the first edge 5584a to the first mounting cable 5512. A second plurality of mounting connectors 5592a are spaced apart longitudinally along the second edge 5586a and slidably receive a first intermediate mounting cable 5594a thereby attaching the second edge 5586a to the first intermediate mounting cable 5594a.

[00217] The second subpanel 5574 is generally identical to the first subpanel 5572. The second subpanel 5574 extends between a first end 5580b and a second end 5582b. The first end 5580b is connectable to the first crossmember 5508 and the second end 5582b is connectable to the second crossmember 5510. The second subpanel 5574 comprises a first edge 5584b and an opposing second edge 5586b extending between the first end 5580b and the second end 5582b. A first plurality of mounting connectors 5590b are spaced apart longitudinally along the first edge 5584b and slidably receive the second mounting cable 5514 thereby attaching the first edge 5584b to the second mounting cable 5514. A second plurality of mounting connectors 5592b are spaced apart longitudinally along the second edge 5586b and slidably receive a second intermediate mounting cable 5594b thereby attaching the second edge 5586b to the second intermediate mounting cable 5594b. It is appreciated that alternate configurations are possible. For example, the first subpanel 5572 may slidably receive the second mounting cable 5514 and the second intermediate mounting cable 5594b and the second subpanel 5574 may slidably receive the first mounting cable 5512 and the first intermediate mounting cable 5594a. In some cases, they system 5110 may include more intermediate mounting cables which may be slidably received by mounting connectors on the intermediate connecting panel 5570 or additional mounting connectors on the first subpanel 5572 and the second subpanel 5574.

[00218] In some cases, the first intermediate mounting cable 5594a and the second intermediate mounting cable 5594b are fed through the feedthroughs 5516 and are

securable to the first anchor system 5518 and the second anchor system 5520 similar to the first mounting cable 5512 and the second mounting cable 5514. The first intermediate mounting cable 5594a and the second intermediate mounting cable 5594b are tensioned and secured to the first anchor system 5518 and the second anchor system 5520 to maintain the tension. The first intermediate mounting cable 5594a and the second intermediate mounting cable 5594b are generally identical to the first mounting cable 5512 and the second mounting cable 5514 and provide additional support for the plant support layer 5130 in the longitudinal direction 5507.

[00219] The intermediate connecting panel 5570 attaches to the first subpanel 5572 of the at least two plant support subpanels 5568 at a first side 5576 and to a second subpanel 5574 of the at least two plant support subpanels 5568 at a second side 5578. The access point 5562 is disposed in the intermediate connecting panel 5570. The intermediate connecting panel 5570 is attachable to the subpanels 5568 by any suitable means such as stitching, a hook and loop fastener, bonding or similar. The first side 5576 of the intermediate connecting panel 5570 overlaps a portion of the first subpanel 5572. The second side 5578 of the intermediate connecting panel 5570 overlaps a portion of the second subpanel 5574.

[00220] Optionally, the system 5100 includes the outer shell 110 overlying the plant support layer 5130. The outer shell 110 defines a longitudinally extending plant chamber is at least partially bound by the outer shell 110 and the upper surface 5550 of the plant support layer 5130.

[00221] The plant growing segment 5502 further includes a runway 5124 extending longitudinally within the root chamber 5122 between a first terminus 5618 and a second terminus 5620. The first terminus 5618 is proximate the first chamber end 5554 and the second terminus 5620 is proximate the second chamber end 5556. The watering pod 5150 is supported by and movable along the runway 5124 within the root chamber 5122 and between the first terminus 5618 and the second terminus 5620. The watering pod 5150 has a watering mechanism 5153 fluidly connectable to a water supply and configured to emit water within the root chamber 5122 while the watering pod 5150 is moving between the first terminus 5618 and the second terminus 5620. The system 5100

includes a drive system 5310 configured to move the watering pod 5150 along the runway 5124 between the first terminus 5618 and the second terminus 5620.

[00222] In this example, the runway 5124 extends generally longitudinally along the length of the growing segment 5502, beneath the plant support layer 5130, with the first terminus 5618 and the second terminus 5620 at each longitudinal end of the runway 5124. Preferably, the runway 5124 may be positioned toward the lateral centreline of the plant support layer 5130, with a generally equal distribution of plants 140 on either side of the runway 5124. This may help provide a relatively even misting of the plants 140 on either side of the runway 5124 when the watering pod 5150 is in use. Alternatively, the runway 5124 may be positioned laterally offset from the middle of the plant support layer 5130 (e.g., toward one edge of the plant support layer 5130) such that the plants 140 are distributed only on one side of the runway 5124.

[00223] Suspended from the runway 5124 is the watering pod 5150. The watering pod 5150 is movable between the first terminus 5618 and the second terminus 5620 of the runway 5124 and is preferably configured to emit a generally laterally extending spray/mist of water to the roots while the watering pod 5150 is moving longitudinally along the length of the runway 5124 within the root chamber 5122. The first terminus 5618 and the second terminus 5620 of the runway 5124 can be understood to be the locations where the watering pod 5150 is intended to stop when it reaches the practical end of its range of travel. Optionally, the water/mist may be emitted continuously as the watering pod 5150 moves or alternatively the water/mist may be emitted at intervals while the watering pod 5150 remains in motion.

[00224] The runway 5124 is preferably configured to be a structure that can extend through the root chamber 5122 to help define the travel path of the watering pod 5150, and preferably is configured to support at least most, and optionally the entire weight of the watering pod 5150 while it is in use. The runway 5124 may include rigid or flexible, tension loaded members. For example, the runway 5124 may include one or more supporting cable (where a cable is understood to include a flexible tensile member and could be a rope or wire or the like), with the watering pod 5150 suspended in a fixed position on the rope or wire, with the rope or wire being movable longitudinally along the

runway 5124 path. Cables can include any type of tension member, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. Alternatively, the supporting cable(s) forming the runway 5124 may be fixed and the watering pod 5150 may travel along and be supported by the cables. Preferably each runway 5124 will extend along all, or at least a majority of the longitudinal length of its associated plant support layer 5130.

[00225] In some cases, the runway 5124 extends through the first crossmember 5508 and couples to the first anchor system 5518 and extends through the second crossmember 5510 and couples to the second anchor system 5520. The first anchor system 5518 and the second anchor system 5520 provide a fastening point for the runway 5124 such that, when the runway cables 5526 are tensioned, they can be secured to the first anchor system 5518 and the second anchor system 5520 to maintain the tension. The runway cables 5526 may generally extend from the first crossmember 5508 generally level, meet the first anchor post 5519a and the second anchor post 5519b of the first anchor system 5518, turn through an angle of approximately 90 degrees, extend down the first anchor post 5519a and the second anchor post 5519b, and secure to a fastener at a first end of the runway cables 5526. The runway cables 5526 may generally extend from the second crossmember 5510 generally level, meet the first anchor post 5521a and the second anchor post 5521b of the second anchor system 5520, turn through an angle of approximately 90 degrees, extend down the first anchor post 5521a and the second anchor post 5521b, and secure to a fastener at a second end of the runway cables 5526. In some cases, the runway cables 5526 may couple to the first crossmember 5508 and the second crossmember 5510.

[00226] The system 5100 includes a drive system 5310 configured to for motivate/drive the watering pod 5150 along the runway 5124. The drive system 5310 may include an elongate drive connector 5628 extending between the watering pod 5150 and a first actuating mechanism 5630. The first actuating mechanism 5630 is configured to drive the watering pod 5150 along the runway 5124 at least toward the first terminus 5618. The elongate drive connector 5628 couples the watering pod 5150 to the first actuating mechanism 5630 such that operation of the first actuating mechanism 5630 causes the

elongate drive connector 5628 to move in the longitudinal direction 5507 and causing the watering pod 5150 to move in the longitudinal direction 5507 as a result.

[00227] The first actuating mechanism 5630 is disposed proximate to the first crossmember 5508. The first actuating mechanism 5630 may be a winch for example. The winch is operable to move the elongate drive connector 5628. Preferably, the elongate drive connector 5628 is formed of a tension member such as a cable, including but not limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated cables. In some cases, the elongate drive connector 5628 is a rigid rod such as a metal or plastic or similar rod, which may allow the watering pod 5150 to be pushed as well as pulled under tension. The elongate drive connector 5628 couples the watering pod 5150 to the first actuating mechanism 5630 / winch. When the winch operates, the elongate drive connector 5628 moves the watering pod 5150 at least towards the first terminus 5618. The winch is operable to pull the elongate drive connector 5628. The pulling of the elongate drive connector 5628 pulls the watering pod 5150 towards the winch. In the case where the elongate drive connector 5628 is a rigid rod, the winch can push or pull the elongate drive connector 5628 such that the watering pod 5150 moves towards the first terminus 5618 or towards the second terminus 5620.

[00228] In some cases, the drive system 5310 may include a second elongate drive connector 5632 extending between the watering pod 5150 and a second actuating mechanism 5634. The second actuating mechanism 5634 is configured to drive the watering pod 5150 along the runway 5124 at least towards the second terminus 5620. The second elongate drive connector 5632 couples the watering pod 5150 to the second actuating mechanism 5634 such that operation of the second actuating mechanism 5634 causes the second elongate drive connector 5632 to move in the longitudinal direction 5507 and causing the watering pod 5150 to move in the longitudinal direction 5507 as a result.

[00229] The second actuating mechanism 5634 is disposed proximate to the second crossmember 5510. The second actuating mechanism 5634 may be a winch for example. The winch is operable to move the second elongate drive connector 5632. Preferably, the second elongate drive connector 5632 is formed of a tension member, including but not

limited to metal, rope, plastic, composite, single filament, braided, coated, uncoated. In some cases, the second elongate drive connector 5632 is a rigid rod such as a metal or plastic or similar rod. The second elongate drive connector 5632 couples the watering pod 5150 to the second actuating mechanism 5634 / winch. When the winch operates, the second elongate drive connector 5632 moves the watering pod 5150 at least towards the second terminus 5620. The winch is operable to pull the second elongate drive connector 5632. The pulling of the second elongate drive connector 5632 pulls the watering pod 5150 towards the winch. The first actuating mechanism 5630 pulls the elongate drive connector 5628 moving the watering pod 5150 towards the first terminus 5618. The second actuating mechanism 5634 pulls the second elongate drive connector 5632 moving the watering pod 5150 towards the second terminus 5620.

[00230] The watering pod 5150 has a water chamber 5151 housed within and moveable with the watering pod 5150. The water chamber 5151 is configured to hold a volume of water. Providing an onboard water chamber 5151 may eliminate the need to have a water supply hose connected to the watering pod 5150 as it is moving along the runway 5124. In this example, the watering pod 5150 includes the water chamber 5151, the watering mechanism 5153 that is fluidly connected to the water chamber 5151 and is operable to spray/mist the water from the watering pod 5150 into the root chamber 5122. In this example, the watering mechanism 5153 at least one centrifugal nozzle 5636.

[00231] The system 5100 can also include a refilling station 5190 that can be used to re-fill the onboard water chamber 5150 when it is getting low. Optionally, the refilling station 5190 can be provided along the runway 5124 and re-fill the watering pod 5150. This may allow the use of a relatively smaller water chamber 5151 that can supply the watering pod 5150 with enough water for at least one trip along the runway 5124, and preferably at least a few trips along the runway 5124 before the watering pod 5150 can pause at the refilling station 5190 to receive more water. For example, as shown in FIGs. 13 to 18 the watering pod 5150 may dock with a complimentary refilling station 5190.

[00232] Preferably, the watering pod 5150 is configured so that it can travel along the runway at a rate of speed that allows it to cover the length of its associated plant support layer 5130 (or at least a portion thereof) in a predetermined period of time, such as once

every 20 sec, 30 sec, 40 sec, 50 sec, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes or more. This can allow the watering pod 5150 to travel past the roots of at least a majority of the plants 140 in the plant support layer 5130 at a desired frequency to help keep the roots sufficiently moist. Optionally, the watering pod 5150 may be capable of moving along the runway 5124 at speeds in the range of between a higher speed that preferably less than about 100, 90, 80, 70, 60, 50, 40, 35, 30, 25, 20, 19, 18, 17, 16 or 15 feet per minute to lower speed that is at least about 1, 2, 3, 4, 5, 6, 7 or 8 feet per minute or more to help ensure the humidity of the root chamber 5122 is maintained at a desired humidity level by spraying the roots while moving. The desired humidity level may be selected based on a number of parameters, including the type of plants 140 being grown and the surrounding atmospheric conditions, and may be at level of at least 80% humidity. The humidity in the root chamber 5122 need not be uniform throughout the entire root chamber interior. Instead, the humidity level may vary in different locations, and may be relatively higher in closer proximity to the watering pod 5150. For example, as the watering pod 5150 moves the humidity in the vicinity of the watering pod 5150 may increase to at least 80%. As an example, the humidity within 1 ft of the watering pod 5150 may be at 80%, but beyond the 1ft the humidity may be lower than 80%. As the watering pod 5150 moves along the runway 5124, the humidity in the vicinity of the watering pod 5150 is preferably at about 80%.

[00233] Optionally, when the watering pod 5150 reaches the end of the runway 5124, it may stop emitting the mist before returning along the runway 5124. In such instances the humidity in the vicinity of the watering pod 5150 may drop below 80% until the watering pod 5150 emits the mist when movement resumes.

[00234] In some cases, the watering pod 5150 may preferably move at a speed of about 0.1 feet per second.

[00235] The water chamber 5151 contains water and/or a water-based mixture that can also include nutrients and the like. The water chamber 5151 has an onboard volume of water that is preferably at least enough to spray the roots while moving from one end of the runway 5124 to the other. The water tank 5151 is fluidly connected to the watering mechanism 5153. The mist emitted by the watering pod 5150 in this example is a

relatively fine mist with a droplet size that is preferably less than 50 µm per droplet. The use of the at least one centrifugal nozzle 5636 removes the requirement for a separate water pump and/or air pump to pressurize the water before spraying it.

[00236] In some cases, the watering mechanism 5153 may be moveable with respect to the watering pod 5150 allowing the watering mechanism 5153 to move through various degrees of freedom, such as up, down, side to side etc. This results in the watering pod 5150 spraying a greater area while the watering pod 5150 moves. An actuation mechanism (not shown, but may be similar to actuator 157), operatively coupled to the watering mechanism 5153, controls the movement.

[00237] The watering pod 5150 has a controller (not shown) powered by an onboard power supply (e.g. battery 310). The controller is operably connected to the watering mechanism 5153 and is configured to control the watering mechanism 5153 such that the watering mechanism 5153 emits water while the watering pod 5150 is moving along the runway 5124.

[00238] Optionally, the system 5100 may include, at both or one of the ends of the runway 5124, a refilling station 5190 that is configured to receive and preferably service/engage with the watering pod 5150. For example, the refilling station 5190 is configured to fluidly connect to the watering pod 5150 to help resupply the onboard water chamber 5151. In this arrangement the water chamber 5151 can be refilled when needed at either both ends or one end of the runway 5124. This ensures that the watering pod 5150 has an adequate water reserve for misting the roots while moving. In this example the refilling station 5190 fluidly connects to the watering pod 5150 via complimentary refilling pipe 5191.

[00239] As shown in FIGs. 15 and 16, in some cases, the system 5100 includes an external water supply in the form of an external water tank 5710. The external water tank 5710 is sized such that it can accommodate a volume of water useable by the watering pod 5150 to allow the watering pod 5150 to travel the runway 5124, refilling its water chamber 5151 at the refining station 5190 multiple times before the external water tank 5710 requires refilling. The external water tank 5701 may include water and/or a water-

based mixture that can also include nutrients and the like. The external water tank 5710 is fluidly connected to the refilling station 5190 by a supply pip 5712.

[00240] Preferably, the external water tank 5710 is elevated such that gravity directs water from the external water tank 5710 down through the supply pipe 5712. This removes the requirement for a pump. In some cases, the external water tank 5710 may not be elevated, and it may include a pump in order to direct water along the supply pipe 5712. At least a portion of the supply pipe 5710 is slanted such that gravity can be leveraged for moving water. The remainder of the supply pipe 5710 is generally parallel to along the longitudinal length 5503 of the growing segment 5502.

[00241] Preferably, the supply pipe 5710 is above the plant support layer 5130. In some cases, the supply pipe 5710 is below the plant support layer 5130. The supply pipe 5712 is fluidly connected to the refilling station 5190 by a connection pipe. In some cases, the connection pipe is internal to the first crossmember 5508. Preferably, the connection pipe extends upwardly from the supply pipe 5710 before continuing to connect with the refilling pipe 5191.

[00242] The supply pipe 5712 is configured to supply water to the refilling station 5190 via the connection pipe such that, when the watering pod 5150 is at the refilling station 5190, water from the refilling pipe 5191 refills the water chamber 5151 in the watering pod 5150. The external water tank 5710 may include a valve of values to control the flow of water into the supply pipe 5712. The refilling station 5190 may include a valve or valves for controlling the flow of water into the refilling pipe 5191.

[00243] Optionally, the refilling station 5190 can include a sensor or actuator to help determine when the watering pod 5150 is present in the refilling station 5190. This information can be provided to the controller and can help determine when refilling systems should be activated.

[00244] In some cases, the growing segment 5502 comprises a second refilling station configured to refill the water chamber 5151 of the watering pod 5150. The second refilling station is generally identical to the refilling station 5190. The second refilling station fluidly connects to the watering pod 5150 via a complimentary refilling pipe. The second refilling station may include a valve or valves for controlling the flow of water into the refilling pipe.

[00245] The supply pipe 5712 is fluidly connected to the second refilling station by a connection pipe. In some cases, the connection pipe is internal to the second crossmember 5510.

[00246] The supply pipe 5712 is configured to supply water to the second refilling station via the connection pipe such that, when the watering pod 5150 is at the second refilling station, water from the second refilling pipe refills the water chamber 5151 in the watering pod 5150.

[00247] Although the runway 5124 is described as having at least one cable, other configurations are possible. In some cases, the runway 5124 is a rail. In this case, the engagement member 5315 is configured to engage the rail for moving the watering pod 5124 along the rail. In this case, the drive system 5310 includes an onboard motor configured to drive the one or more engagement member 5315 to move the watering pod 5150 along the runway.

[00248] The liquid capture sheet 5160 is attachable to the plant support layer 5130. The liquid capture sheet 5160, as well as being a sheet of flexible material that is generally water resistant, also prohibits or limits permeability of light into the root chamber 5122. In some cases, the liquid capture sheet 5160 is multiple panels stitched together. In some cases, the liquid capture sheet 5160 comprises trapezoidal panels stitched together, such that when attached to the plant support layer 5130, the liquid capture sheet 5160 forms an inverted pyramidal shape.

[00249] The lowest point 5610 of the liquid capture sheet 5160 is generally at a midpoint 5612 of the liquid capture sheet 5160. The liquid capture sheet 5160 captures excess run-off water in the root chamber 5122 which is directed towards the lowest point 5610. The liquid capture 5160 has a first end and an opposing second end. The first end is proximate the first base support 5504. The second end is proximate the second base support 5506. At each of the first end and the second end the liquid capture sheet has an opening 5616. The openings 5616 are configured to accommodate the runway 5124, the first actuating mechanism 5630, and the second actuating mechanism 5634.

[00250] The first actuating mechanism 5630 and the second actuating mechanism 5634 are operable discretely such that only one is operating at a time to ensure the watering pod 5150 is being moved in one direction only.

[00251] At the lowest point 5610, the liquid capture sheet 5160 has a drain 5614. In some cases, the drain 5614 is an opening in the material at the lowest point 5610. In some cases, the drain 5614 is a reinforced opening at the lowest point 5610. The run-off water is collected in a recollection pipe 5714 and may be reused by the system 5100. The recollection pipe 5714 directs the collected run-off water and directs it back towards the external water tank 5710 for reuse in the system 5100.

[00252] In some cases, the recollection pipe 5714 is situated below the external water tank 5710. In this case, a pump can be used to direct the recollected water to the external water tank 5710 such that it can be reused in the refilling station 5190 and/or the second refilling station 5912. In some cases, the collected run-off water may be purified via a reverse osmosis process. In some cases, more nutrients may be added to the collected run-off water before being directed to the external water tank 5710.

[00253] Optionally, the liquid capture sheet 5160 has a releasable fastener along a length of the liquid capture sheet 5160. The releasable fastener may be one of a hook and loop fastener, pop studs, zipper or similar. The releasable fastener is configured to allow access to the root chamber 5122 for inspection of the roots and the watering pod 5150.

[00254] Optionally, the liquid capture sheet 5160 includes a flood valve. The flood valve is disposed at a side of the drain 5614. Optionally, there may be a flood valve situated on two opposing sides of the drain 5614. In the event of significant precipitation, the system 5100 can accumulate a significant volume of rain water and the extra weight of such water could damage the system 5100. The flood valve is operable, optionally via a pressure sensitive release system (such as a spring biased valve that opens when facing a pre-set pressure) or via an automated valve that is controllable by the system controller or another suitable valve arrangement, to release all collected run-off water and rain water. This reduces the likelihood of damage to the system from significant volumes of excess rainwater accumulating within the liquid capture sheet 5160.

[00255] In operation, a radio frequency (RF) transmission may be used to control the system 5100, and other suitable controllers and signals may be used (such as cellular or Wi-Fi signals, infrared transmission systems and the like). The first actuating mechanism 5630 and the second actuating mechanism 5634 operate on receipt of the appropriate RF transmission instructing one of the first actuating mechanism 5630 and the second actuating mechanism 5634 to operate. When the RF transmission stops, the one of the first actuating mechanism 5630 and the second actuating mechanism 5634 stops. The controller in the watering pod 5150 operates the watering mechanism 5153 on receipt of the appropriate RF transmission instructing the watering mechanism 5153 to emit water. When the RF transmission stops, the controller stops the watering mechanism 5153 emitting water. The other of the first actuating mechanism 5630 and the second actuating mechanism 5634 operate on receipt of the appropriate RF transmission instructing the other one of the first actuating mechanism 5630 and the second actuating mechanism 5634 to operate. When the RF transmission stops, the one of the first actuating mechanism 5630 and the second actuating mechanism 5634 stops. This ensures that the watering pod 5150 is moved in only one direction at a time, and the first actuating mechanism 5630 and the second actuating mechanism 5634 are not competing to move the watering pod 5150.

[00256] Although FIGs. 13 to 18 shows the growing segment 5502 as having a single liquid capture sheet 5160, other configurations are possible. In some cases, the growing segment 5502 may have multiple liquid capture sheets 5160. In this case, the openings 5616 in each liquid capture sheet 5160 accommodate the runway 5124 and the drive system 5130 such that the watering pod 5150 can move along the length of the runway 5124 without interference from the liquid capture sheets 5160. Each liquid capture sheet 5160 comprises the drain 5614 fluidly connected to the recollection pipe 5714.

[00257] Multiple growing segments 5502 can be installed parallel and coplanar to provide a larger system. In some cases, the system 5100 has at least a second generally identical growing segment 5502a. The second growing segment 5502a includes a second plant support layer 5130a, a second flexible liquid capture sheet 5160a, a second runway 5124a, and a second watering pod 5150a.

[00258] The second plant support layer 5130a is generally identical to the plant support layer 5130. In some cases, the second plant support player 5130a is integral to the plant support layer 5130. The second plant support layer 5130a is configured to support plants. The second plant support layer 5130a has an upper exposed surface 5550a and an opposing lower surface 5552a and is configured to shield roots from light.

[00259] The second liquid capture sheet 5160a is generally identical to the liquid capture sheet 5160. The second liquid capture sheet 5160a is a flexible sheet of material that is generally water resistant. The second liquid capture sheet 5160a and the lower surface 5552a of the second plant support layer 5130a cooperate to at least partially bound a second root chamber 5122a. The second root chamber 5122a extends longitudinally between a first chamber end 5554a and a second chamber 5556a end and is disposed longitudinally between the first chamber end 5554a of the second root chamber 5122a and the first root chamber 5122.

[00260] The second runway 5124a extends longitudinally within the second root chamber 5122a between a third terminus 5618a and a fourth terminus 5620a. The third terminus 5618a is proximate the first end 5554a of the second root chamber 5122a. The fourth terminus 5620a is proximate the second end 5556a of the second root chamber 5122a. The second runway 5124a is defined as the span of runway that the second watering pod 5150a moves along. The watering pod 5150 in the growing segment 5502 does not, in this example, travel beyond the second crossmember 5510 into the second growing segment 5502a. Similarly, the second watering pod 5150a does not travel beyond the second crossmember 5510 into the growing segment 5502. The runway 5124 spans across the growing segment 5502 and the second growing segment 5502a with the watering pod 5150 and the second watering pod 5150a moving along their respective portions of the runway. There second runway 5124a is a portion of the runway 5124.

[00261] The second watering pod 5150a is generally identical to the watering pod 5150. The second watering pod 5150a is supported by and movable along the second runway 5124a within the second root chamber 5122a between the third terminus 5618a and the fourth terminus 5620a. The second watering pod 5150a has a watering mechanism 5153a fluidly connectable to the water supply and configured to emit water within the second

root chamber 5122a while the second watering pod 5150a is moving between the third terminus 5618a and the fourth terminus 5620a.

[00262] The drive system 5310 spans the growing segment 5502 and the second growing segment 5502a. In this case, the second actuating mechanism 5634 is disposed proximate the third terminus 5618a. The second elongate drive connector 5632 extends between the second watering pod 5150a and the second actuating mechanism 5634. The second actuating mechanism 5634 is configured to drive the second watering pod 5150 along the second runway 5124a at least towards the third terminus 5618a.

[00263] The watering pod 5150 and the second watering pod 5150a are coupled by at least a first intermediate drive connector 5640. Preferably, the intermediate drive connector 5640 generally identical to the elongate drive connector 5628 and the second elongate drive connector 5632. In some cases, the intermediate drive connector 5640 is a rigid rod. The first actuating mechanism 5630 is configured to move the watering pod 5150 and the second watering pod 5150a at least towards the first terminus 5618 and the fourth terminus 5620a respectively. The second actuating mechanism 5634 is configured to move the watering pod 5150 and the second watering pod 5150a at least towards the second terminus 5620 and the third terminus respectively 5618a.

[00264] The pulling of the elongate drive connector 5628 by the first actuating mechanism 5630 pulls the watering pod 5150 and the second watering pod 5150a towards the first terminus 5618 and the fourth terminus 5620a respectively. As the first watering pod 5150 and the second watering pod 5150a are connected by the intermediate drive connector 5640, the watering pod 5150 and the second watering pod 5150a move in a synchronised manner when the first actuating mechanism 5630 and the second actuating mechanism 5634 operate respectively. The intermediate drive connector 5640 is sized such that, when the watering pod 5150 is at the first terminus 5618, the second watering pod 5150a is at the fourth terminus 5620a.

[00265] The pulling of the second elongate drive connector 5632 by the second actuating mechanism 5634 pulls the watering pod 5150 and the second watering pod 5150a towards the second terminus 5620 and third terminus respectively 5618a. The

intermediate drive connector 5640 is sized such that, when the watering pod 5150 is at the second terminus 5620, the second watering pod 5150a is at the third terminus 5618a.

[00266] Referring now to FIG. 19, the system 5100 is illustrated to show that repeating multiple growing segments is possible. The system 5100 may have growing segment 5502, another growing segment 5502a, and another growing segment 5502b etc.

[00267] Referring now to FIGs. 20 and 21, the system 5100 is illustrated with three growing segments 5502, 5502a, 5502b. It is appreciated that, although three growing segments 5502, 5502a, 5502b are shown, the system 5100 can include any number of growing segments, as indicated in FIG. 19. FIG. 20 illustrates respective watering pods 5150, 5150a, 5150b positioned at respective refilling stations 5190. FIG. 21 illustrates the respective watering pods 5150, 5150a, 5150b at a position along respective runways 5124, 5124a, 5124b. As the watering pods 5150, 5150a, 5150b are linked, the move in a synchronised manner when the drive system 5310 operates.

[00268] Each growing segment 5502, 5502a, 5502b is generally identical. Each growing segment 5502, 5502a, 5502b includes the respective watering pod 5150, 5150a, 5150b. The watering pods 5150, 5150a, 5150b are linked by intermediate drive connectors 5640 to form a train of linked watering pods. As the first actuating mechanism 5630 is operable to move the watering pod 5150, the second watering pod 5150a and the third watering pod 5150b are also moved, i.e. the train of watering pods is moved. The watering pod 5150, the second watering pod 5150a, and the third watering pod 5150b move in a synchronised manner. Similarly, when the second actuating mechanism is operable to move the third watering pod 5150b, the watering pod 5150 and the second watering pod 5150a are also moved, i.e. the train of watering pods is moved. The third watering pod 5150b, the watering pod 5150, and the second watering pod 5150a move in a synchronised manner.

[00269] Although FIG. 15 shows drive system 5310 as including the first actuating mechanism 5630 and the second actuating mechanism 5634 as being winches, as described in relation to FIGs. 13 to 18, other configurations are possible. For example, the first drive system 5130 may incorporate the drive system 310 as shown in FIG. 3A, FIG. 3B, FIG. 3C and FIG. 4. For example, the system 5100 may include watering pod

150 as shown in FIG. 3A, FIG. 3B, FIG. 3C and FIG. 4 at an end position on the train of watering pods taking the position of watering pod 5150. The second watering pod 5150a and the third watering pod 5150b remain relatively unchanged. The drive system 310 is operable to move the train of watering pods along their respective runway 5124, 5124a, 5124b. As the watering pods 150, 5150a, 5150b are linked, as the drive system 310 operates to move the watering pod 150, the second watering pod 5150a and the third watering pod 5150b are also moved. The drive system 310 is operable to move the train of watering pods in both directions along their respective runways 5124, 5124a, 5124b.

[00270] In some cases, the third watering pod 5150b may also include a watering pod 150 as shown in FIG. 3A, FIG. 3B, FIG. 3C and FIG. 4 at the other end position of the train of watering pods (e.g. as watering pod 5150b). The drive system 310 of the third watering pod 5150b is operable to move the train of watering pods along their respective runway 5124, 5124a, 5124b in only one direction. The drive system 310 of the watering pod 150 is operable to move the train of watering pods along their respective runways in only one direction. As the watering pods 150, 5150a, 5150b are linked, as the drive system 310 of the watering pod 150 operates to move the watering pod 150, the second watering pod 5150a and the third watering pod 5150b are also moved in one direction. The drive system 310 of the third watering pod 5150b is operable to move the train of watering pods in the other direction along their respective runways 5124, 5124a, 5124b.

[00271] Preferably, the controller is operable to ensure that one of the drive system 310 of the watering pod 150 and the drive system 310 of the third watering pod 5150b are operable at a time. This ensures that the drive systems 310 are not competing with each other move the train of watering pods in opposing directions at the same time.

[00272] Referring now to FIG. 22, there is illustrated an alternate arrangement of the system 5100 with the multiple growing segments 5502, 5502a, 5502b. In this arrangement, the first anchor system 5518 is positioned at one end of the system 5100, and the second anchor system is positioned at the other end of the system 5100. In between each growing segment 5502, 5502a, 5502b is an intermediate anchor system 5596. Each intermediate anchor system 5596 is generally identical to the first anchor system 5518 and the second anchor system 5520. Each intermediate anchor system

5596 receives the mounting cables and intermediate mounting cables for the adjacent growing segments 5502, 5502a, 5502b.

[00273] Each intermediate anchor system 5596 provides a fastening point for the respective mounting cables and intermediate mounting cables such that, when the respective mounting cables and intermediate mounting cables are tensioned, they can be secured to the intermediate anchor system 5596 to maintain the tension.

[00274] The intermediate drive connectors 5640 span the gap in between the growing segments 5502, 5502a, 5502b, such that operation of the drive system 5310 causes the watering pods 5150, 5150a, 5150b to move in a synchronised manner in their respective growing segment 5502, 5502a, 5502b.

[00275] Although the example illustrated in FIG. 22 shows three separate plant support layers 5130, alterative configurations are possible. For example, the plant support layer 5130 could be singular and span across the growing segments 5502, 5502a, 5502b.

[00276] Referring now to FIG. 12, there is illustrated an example method of watering plants. The method 400 may be carried out, for example, by the system 100 of Fig. 1 or by the system 5100 of FIGs 13 to 18.

[00277] The method 400 begins at step 410, with housing plants 140 within the plant support layer 130, 5130. The plants 140 are individually housed in plant holders 134, which are placed within the apertures 132, 5312 of the plant support 130, 5130. The leaves and stems of the plants 140 are exposed to light and air on the upper side of the plant support layer 130, 5130 and the roots are exposed to air in the root chamber 122, 5122.

[00278] At step 420, the watering pod 150, 1150, 2150, 3150, 5150 moves along the runway 124,5124 that extends through the root chamber 122, 5122. The watering pod 150, 1150, 2150, 3150, 5150 is capable of moving along the runway 124, 5124.

[00279] In the case where the runway 124 is a rail, the watering pod 150, 1150, 2150, 3150 may be coupled to the runway 124 by an interface, such as wheels 315, whereby as the wheels 315 move the watering pod 150, 1150, 2150, 3150 moves. In the case where the runway 5124 is a cable, the watering pod 5150 may be coupled to the runway

5154 by one or more engagement member 5315, whereby as the engagement member move, the watering pod 5150 moves.

[00280] At step 430, the watering pod 150, 1150, 2150, 3150,5150 emits water while moving along the runway 124, 5124. This ensures the humidity of the root chamber 122, 5122 is maintained at a level of at least 80% humidity by emitting the mist to the roots while moving along the runway 124, 5124. Emitting the mist may involve raising and lowering the watering mechanism 153, 1153, 2153, 3153, 5153. A controller may control the emission of the mist and the raising and lowering of the watering mechanism 153,1153,2153,3153, 5153.

[00281] The method 400 may also include docking the watering pod 150, 1150, 2150, 3150, 5150 at the docking station 190 or refilling station 5190. There may be a docking station 190 or refilling station 5190 at both or one of the ends of the runway 124, 5124. The docking station 190 or refilling station 5190 is configured to receive the watering pod 150, 1150, 2150, 5150. The docking station 190 may electrically connect to the watering pod 150 to charge a battery 320. By docking at the docking station 190 at either both ends or one end of the runway 124, the battery 320 is charged to ensure continued operation of the watering pod 150. The docking station 190 or refilling station 5190 may fluidly connect to the watering pod 150, 5150. The water tank 151, 5151 is refilled at either both ends or one end of the runway 124,5124. This ensures that the watering pod 150, 5150 has an adequate water reserve for misting the roots while moving.

[00282] The method 400 may also include capturing excess runoff water in the water capture structure 160, or liquid capture sheet 5160. The sheet or sheets 160, 5160 are positioned underneath the root chamber 122, 5122 and configured so that the mid point of the sheet or sheets 160, 5160 is the lowest point. The excess runoff water lands on the sheet or sheets 160, 5160 and flows towards the lower midpoint. At the midpoint the sheet 166 is an aperture or drain 5614. The water may be reapplied to the roots either by being reintroduced to the external water supply, or being put into the water tank internal to the watering pod 150.

[00283] The described system provides several advantages over conventional aeroponic systems. By using cables, supported by the base supports and crossmembers, the

aeroponic system is much cheaper to implement than conventional aeroponic systems. For example, implementing the system can be achieved for costs less than $20,000 per acre in comparison with costs in the region of $200,000 per acre for conventional aeroponic systems.

[00284] The use of base supports, e.g. the first base support 5504 and the second base support 5506, each having a body 5522, 5527, results in only one ground hole per base support being required. This helps to reduce installation labor and costs.

[00285] The mounting cables used to secure the plant support layer to the crossmembers have a lesser strength than the base supports. Conventional aeroponic systems that employ a rigid metal frame structure, typically of aluminum, are susceptible to permanent disfigurement in the event of extreme weather conditions such as wind or heavy rainfall. This results in costly and time-consuming repairs, with the aeroponic system being out of service. The use of mounting cables that are weaker than the base supports results in the cable deforming in reaction to extreme weather. The mounting cables can stretch or even break and repair is less involved. In the event one or more mounting cable stretches, it can be re-tensioned. In the event one or more mounting cable breaks, it can be replaced without significant downtime of the aeroponic system.

[00286] The disclosed system is scalable providing opportunity for small farmers to implement small aeroponic systems, or larger farmers or organizations to implement large-scale aeroponic farms.

[00287] The aeroponic systems described herein maybe suitable for installation in different climates. In regions where the there is neither extreme heat nor cold, the system may be implemented without the outer shell (such as shown in Figure 13). In climates where there are well defined seasons or extreme weather can occur, the outer shell can be implement with the system to shield the plants from the seasons and extreme weather, and promote year round harvesting (such as shown in Figure 1).

[00288] There may be further advantages of the system. For example, in some cases, the watering pod can include one or more UV light mounted to the watering pod. The UV light emits UV light while the watering pod is moving within the root chamber to eliminate or reduce the presence of bacteria or pathogens that could affect the roots.

[00289] Although in embodiments described above the drive system is within the watering pod 150, in other embodiments the drive system may be external to the watering pod 150. In some cases, if the watering pod 150 is fixed in place on the runway 124 and the runway 124 is moveable, the drive system moves the runway 124. The drive system may incorporate an electric motor that drives a pulley system that moves the runway 124.

[00290] Although in embodiments described above the watering pod interfaces with the runway 124 with wheels 315, the watering pod may interface with the runway 124 in other ways. For example, if the watering pod 150 is fixed in place on the runway 124 and the runway 124 is moveable, the watering pod may be clamped in place with any suitable clamping or attaching means.

[00291] Although in embodiments described above, the system 100 includes only one runway 124 within the root chamber 122, in some cases the system 100 may have more than one runway 124. For example, in the case of a very long system, there may be a runway 124 with a corresponding watering pod 150 extending along only a portion of the length of the root chamber 122, with another runway with corresponding watering pod extending along another portion.

[00292] The system 100 may also include a second runway and a second watering pod in the plant chamber 120. The second watering pod emits a mist of water in the plant chamber 120 to cool the plant chamber 120.

[00293] Although in embodiments described above, the engine 2322 is described as being a petrol engine or a diesel engine, other engines and fuels may be used. For example, the engine may be configured to use natural gas or hydrogen as fuel.

[00294] Although in embodiments described above, the docking station 190 is described as having a limit switch 370, other configurations are possible. For example, the docking station 190 may include a motion sensor or a laser to determine that the watering pod has reached the end of the runway. Any method to sense that the watering pod has reached the end of the runway, and that the watering pod should change direction, may be used.

[00295] Although in embodiments described above, the watering pod, 150, 1150, 2150, 3150 is described as having nozzles and an atomizer in the watering mechanism 153, other configurations are possible. For example, the watering pod may include only nozzles, or only an atomizer. The watering pod may include one or more centrifugal nozzle to create mist without an air pump. The watering pod may include one or more atomization discs or ultrasonic humidifier modules.

[00296] As used herein, an element or feature introduced in the singular and preceded by the word "a" or "an" should be understood as not necessarily excluding the plural of the elements or features. Further, references to "one example" or “one embodiment” are not intended to be interpreted as excluding the existence of additional examples or embodiments that also incorporate the described elements or features. Reference herein to “example” means that one or more feature, structure, element, component, characteristic and/or operational step described in connection with the example is included in at least one embodiment and/or implementation of the subject matter according to the subject disclosure. Thus, the phrases “an example,” “another example” and similar language throughout the subject disclosure may, but do not necessarily, refer to the same example. Further, the subject matter characterizing any one example may, but does not necessarily, include the subject matter characterizing any other example.

[00297] Unless explicitly stated to the contrary, examples or embodiments "comprising" or "having" or “including” an element or feature or a plurality of elements or features having a particular property may include additional elements or features not having that property. Also, it will be appreciated that the terms “comprises”, “has”, “includes” means “including but not limited to” and the terms “comprising”, “having” and “including” have equivalent meanings.

[00298] As used herein, the term “and/or” can include any and all combinations of one or more of the associated listed elements or features.

[00299] It will be understood that when an element or feature is referred to as being “on”, “attached” to, “affixed” to, “connected” to, “coupled” with, “contacting”, etc. another element or feature, that element or feature can be directly on, attached to, connected to, coupled with or contacting the other element or feature or intervening elements may also

be present. In contrast, when an element or feature is referred to as being, for example, “directly on”, “directly attached” to, “directly affixed” to, “directly connected” to, “directly coupled” with or “directly contacting” another element of feature, there are no intervening elements or features present.

[00300] It will be understood that spatially relative terms, such as “under”, “below”, “lower”, “over”, “above”, “upper”, “front”, “back” and the like, may be used herein for ease of description to describe the relationship of an element or feature to another element or feature as illustrated in the figures. The spatially relative terms can however, encompass different orientations in use or operation in addition to the orientation depicted in the figures.

[00301] Reference herein to “configured” denotes an actual state of configuration that fundamentally ties the element or feature to the physical characteristics of the element or feature preceding the phrase “configured to.”

[00302] Unless otherwise indicated, the terms “first,” “second,” etc. are used herein merely as labels, and are not intended to impose ordinal, positional, or hierarchical requirements on the items to which these terms refer. Moreover, reference to a “second” item does not require or preclude the existence of a lower-numbered item (e.g., a “first” item) and/or a higher-numbered item (e.g., a “third” item).

[00303] As used herein, the terms “approximately” and “about” represent an amount close to the stated amount that still performs the desired function or achieves the desired result. For example, the terms “approximately” and “about” may refer to an amount that is within engineering tolerances that would be readily appreciated by a person skilled in the art. Although embodiments have been described above with reference to the accompanying drawings, those of skill in the art will appreciate that variations and modifications may be made without departing from the scope thereof as defined by the appended claims.

[00304] Features and elements described with reference to one embodiment herein may be used, alone or in combination, with features of other embodiments described herein and other applications of the teachings described herein.

[00305] All publications, patents, and patent applications referred to herein are incorporated by reference in their entirety to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference in its entirety.

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What is claimed is:

1. A system for growing plants, the system comprising:

at least one growing segment comprising:

a plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the plant support configured to shield roots from light;

a flexible liquid capture sheet underlying the plant support layer whereby the liquid capture sheet and the lower surface cooperate to at least partially bound a root chamber extending longitudinally between a first chamber end and a second chamber end, the root chamber configured to receive the roots of the plants in the plant support layer so that the roots are suspended within the root chamber are exposed and to shield the roots from light;

a runway extending longitudinally within the root chamber between a first terminus proximate the first chamber end and a second terminus proximate the second chamber end;

a watering pod supported by and movable along the runway within the root chamber between the first terminus and the second terminus, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and

a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

2. The system of claim 1, wherein the runway comprises at least one cable and wherein the watering pod comprises one or more engagement member configured to engage the at least one cable for moving the watering pod along the at least one cable, and

wherein the drive system comprises an elongate drive connector extending between the watering pod and a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

3. The system of claim 2, wherein the drive system further comprises a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

4. The system of any one of claims 1 to 3, further comprising at least a second growing segment, the at least a second growing segment comprising:

a second plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the second plant configured to shield roots from light;

a second flexible liquid capture sheet underlying the second plant support layer whereby the second liquid capture sheet and the lower surface cooperate to at least partially bound a second root chamber extending longitudinally between a first chamber end and a second chamber end and that is disposed longitudinally between the first end of the second root chamber and the first root chamber, the second root chamber configured to receive the roots of the plants in the second plant support layer so that the roots are suspended within the second root chamber and exposed and to shield the roots from light;

a second runway extending longitudinally within the second root chamber between a third terminus proximate the first end of the second root chamber and a fourth terminus proximate the second end of the second root chamber; and

a second watering pod supported by and movable along the second runway within the second root chamber between the third terminus and the fourth terminus, the second watering pod comprising a watering mechanism fluidly connectable to the water supply and configured to emit water within the root chamber while the second watering pod is moving between the third terminus and the fourth terminus.

5. The system of claim 4, wherein the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the second runway at least towards the third terminus.

6. The system of claim 5, wherein the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus and the fourth terminus respectively, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus and the third terminus respectively.

7. The system of claim 1, wherein the runway comprises a rail.

8. The system of claim 7, wherein the watering pod comprises one or more engagement member configured to engage the rail for moving the watering pod along the rail, and wherein the drive system comprises an onboard motor configured to the drive the one or more engagement member.

9. The system of any one of claims 1 to 9, wherein the water supply comprises a water chamber housed within and movable with the watering pod.

10. The system of claim 10 or 11, further comprising a refilling station configured to refill the water chamber of the watering pod.

11. The system of claim 12, further comprising a second refilling station configured to refill a water chamber of the second watering pod.

12. The system of any one of claims 1 to 13, wherein the watering pod further comprises a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

13. The system of any one of claims 1 to 12, wherein the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

14. The system of any one of claims 1 to 12, wherein the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

15. The system of any one of claims 1 to 12, wherein the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

16. The system of claim 15, wherein the watering mechanism comprises an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

17. The system of any one of claims 1 to 16, further comprising a housing overlying the plant support layer whereby a longitudinally extending plant chamber is at least partially bound by the housing and the upper surface of the plant support layer.

18. The system of any one of claims 1 to 17, wherein the liquid capture sheet comprises a drain configured to direct run-off water to the water supply.

19. The system of any one of claims 1 to 18, wherein the at least one growing segment further comprises:

a first base support, having a body extending between a lower end and an upper end, and a second base support spaced longitudinally from the first base support, each base support having a body extending between a lower end and an upper end;

a first crossmember coupled to and supported by the first base support, the first crossmember extending in a lateral direction, and a second crossmember coupled to and supported by the second base support, the second crossmember extending in the lateral direction;

a first mounting cable extending between the first crossmember and the second crossmember, and a second mounting cable laterally spaced from the first mounting cable and extending between the first crossmember and the second crossmember; and

the plant support layer formed from a sheet of flexible material supported by the first mounting cable and the second mounting cable, the sheet of flexible material extending between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising:

a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving the first mounting cable thereby attaching the first edge to the first mounting cable; and

a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving the second mounting cable thereby attaching the second edge to the second mounting cable.

20. The system of claim 19, wherein the plant support layer is slidable along the first mounting cable and second mounting cable to secure the first end to the first crossmember and the second end to the second crossmember and wherein the first mounting cable and second mounting cable resist lateral sagging of the plant support layer when tensioned.

21. The system of claim 19 or 20, wherein each base support having a pair of supporting arms extending outwardly from the body, each supporting arm extending from opposing sides of the base support upwardly and outwardly.

22. The system of any one of claims 19 to 21, wherein the first mounting cable and the second mounting cable are connectable to the first crossmember and the second crossmember at each end whereby the first mounting cable and the second mounting cable are tensioned to support the plant support layer.

23. The system of any one of claims 19 to 23, wherein the first mounting support and the second mounting support comprise feedthroughs configured to receive a respective one of the first mounting cable and the second mounting cable, the first mounting cable and the second mounting cable attachable to a first ground anchor proximate the first mounting support and a second ground anchor proximate the second mounting support.

24. The system of any one of claims 19 to 23, wherein the first and second crossmembers comprise rigid beams.

25. The system of any one of claims 19 to 23, wherein the crossmembers are one of cables, wires, and ropes.

26. The system of claim 25, wherein the one of cables, wires, and ropes have a thermal expansion coefficient that is less than about 0.0017 m/m-°C.

27. The system of any one of claims 19 to 26, wherein the first edge and second edge of the sheet of flexible material are arcuate such that the sheet of flexible material has a width at a location between the first end and second end of the sheet of flexible material that is less than a width at the first end of the sheet of flexible material.

28. The system of any one of claims 19 to 27, wherein the plant support sheet is attachable to the crossmembers by a plurality of fasteners.

29. The system of any one of claims 19 to 28, further comprising at least one intermediate crossmember positioned longitudinally between the first cross member and the second cross member and slidably engaging the first mounting cable and the second mounting cable and supporting the plant support layer, the at least one intermediate crossmember supported by an intermediate base support.

30. The system of claim 29, wherein the at least one intermediate crossmember is cable, the at least one intermediate crossmember receivable through an opening at each of the mounting supports and configured to support the plant support sheet.

31. The system of any one of claims 19 to 30, wherein the plant support sheet comprises a selectably openable access point extending through the sheet of flexible materials and securable using a releasable fastener, whereby when the fastener is disengaged the access point is open and provides communication between a lower side of the plant support layer and an upper side of the plant support layer and when the fastener is engaged the access point is closed and isolates the upper side from the lower side.

32. The system of claim 31, wherein the releasable fastener comprises a hook and loop fastener.

33. The system of claim 31, wherein the releasable fastener comprises a zipper.

34. The system of any one of claims 19 to 33, wherein the plant support layer comprises at least two plant support subpanels, joined together by an intermediate connecting panel, each of the at least two plant support subpanels comprising the plurality of apertures configured to receive and support plants and formed from a sheet of flexible material.

35. The system of claim 34, wherein each subpanel extends between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising:

a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving one of the first mounting cable and the second mounting cable thereby attaching the first edge to the one of first mounting cable and the second mounting cable; and

a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving one of a first intermediate mounting cable and a second intermediate mounting cable, thereby attaching the second edge to the one of the first intermediate mounting cable and the second intermediate mounting cable.

36. The system of claim 35, wherein the selectable closable access point is disposed in the intermediate connecting panel.

37. The system of any one of claims 1 to 36, wherein the plant growing system spans a length of approximately 50 feet.

38. An apparatus for watering plants, the apparatus comprising:

a watering pod supported by and movable along a runway within a root chamber between a first terminus and a second terminus of the runway, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and

a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

39. The apparatus of claim 38, wherein the water supply comprises a water chamber housed within and movable with the watering pod.

40. The apparatus of 38 and 39, further comprising a complementary refilling station configured to refill the water chamber of the watering pod.

41. The apparatus of any one of claims 38 to 40, wherein the watering pod further comprises a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

42. The apparatus of any one of claims 38 to 41, wherein the drive system comprises an elongate drive connector extending between the watering pod and a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

43. The apparatus of claim 42, wherein the drive system comprises further comprises a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

44. The apparatus of claim 43, further comprising a second watering pod and wherein the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

45. The apparatus of claim 43, wherein the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus.

46. The apparatus of any one of claims 38 to 45, wherein the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

47. The apparatus of any one of claims 38 to 45, wherein the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

48. The apparatus of any one of claims 38 to 46, wherein the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

49. The apparatus of claim 48, further comprising an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

50. A system for growing plants, the system comprising:

at least one growing segment comprising:

a first base support, having a body extending between a lower end and an upper end, and a second base support spaced longitudinally from the first base support, each base support having a body extending between a lower end and an upper end;

a first crossmember coupled to and supported by the first base support, the first crossmember extending in a lateral direction, and a second crossmember coupled to and supported by the second base support, the second crossmember extending in the lateral direction;

a first mounting cable extending between the first crossmember and the second crossmember, and a second mounting cable laterally spaced from the first mounting cable and extending between the first crossmember and the second crossmember;

a plant support layer comprising a plurality of apertures configured to receive and support plants and formed from a sheet of flexible material supported by the first mounting cable and the second mounting cable, the sheet of flexible material extending between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising:

a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving the first mounting cable thereby attaching the first edge to the first mounting cable; and

a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving the second mounting cable thereby attaching the second edge to the second mounting cable; and

a flexible, liquid capture sheet underlying the plant support layer whereby the liquid capture sheet and a lower surface of the plant support layer cooperate to at least partially bound a root chamber extending longitudinally between a first chamber end and a second chamber end, the root chamber configured to receive roots of the plants in the plant support layer so that the roots are suspended within the root chamber and exposed and to shield the roots from light.

51. The system of claim 50, wherein the plant support layer is slidable along the first mounting cable and second mounting cable to secure the first end to the first crossmember and the second end to the second crossmember and wherein the first mounting cable and second mounting cable resist lateral sagging of the plant support layer when tensioned.

52. The system of claim 50 or 51, wherein each base support having a pair of supporting arms extending outwardly from the body, each supporting arm extending from opposing sides of the base support upwardly and outwardly.

53. The system of any one of claims 50 to 52, wherein the first mounting cable and the second mounting cable are connectable to the first crossmember and the second crossmember at each end whereby the first mounting cable and the second mounting cable are tensioned to support the plant support layer.

54. The system of any one of claims 50 to 53, wherein the first mounting support and the second mounting support comprise feedthroughs configured to receive a respective one of the first mounting cable and the second mounting cable, the first mounting cable and the second mounting cable attachable to a first ground anchor proximate the first mounting support and a second ground anchor proximate the second mounting support.

55. The system of any one of claims 50 to 54, wherein the first and second crossmembers comprise rigid beams.

56. The system of any one of claims 50 to 54, wherein the crossmembers are one of cables, wires, and ropes.

57. The system of claim 56, wherein the one of cables, wires, and ropes have a thermal expansion coefficient that is less than about 0.0017 m/m-°C.

58. The system of any one of claims 50 to 57, wherein the first edge and second edge of the sheet of flexible material are arcuate such that the sheet of flexible material has a width at a location between the first end and second end of the sheet of flexible material that is less than a width at the first end of the sheet of flexible material.

59. The system of any one of claims 50 to 58, wherein the plant support sheet is attachable to the crossmembers by a plurality of fasteners.

60. The system of any one of claims 50 to 59, further comprising at least one intermediate crossmember positioned longitudinally between the first cross member and the second cross member and slidably engaging the first mounting cable and the second mounting cable and supporting the plant support layer, the at least one intermediate crossmember supported by an intermediate base support.

61. The system of claim 60, wherein the at least one intermediate crossmember is cable, the at least one intermediate crossmember receivable through an opening at each of the mounting supports and configured to support the plant support sheet.

62. The system of any one of claims 50 to 61, wherein the plant support sheet comprises a selectably openable access point extending through the sheet of flexible materials and securable using a releasable fastener, whereby when the fastener is disengaged the access point is open and provides communication between a lower side of the plant support layer and an upper side of the plant support layer and when the fastener is engaged the access point is closed and isolates the upper side from the lower side.

63. The system of claim 62, wherein the releasable fastener comprises a hook and loop fastener.

64. The system of claim 62, wherein the releasable fastener comprises a zipper.

65. The system of any one of claims 50 to 64, wherein the plant support layer comprises at least two plant support subpanels, joined together by an intermediate connecting panel, each of the at least two plant support subpanels comprising the plurality of apertures configured to receive and support plants and formed from a sheet of flexible material.

66. The system of claim 65, wherein each subpanel extends between a first end connectable to the first crossmember and a second end connectable to the second crossmember and comprising:

a first edge and an opposing second edge each extending between the first end and the second end, a first plurality of mounting connectors longitudinally spaced apart from each other along the first edge and slidably receiving one of the first mounting cable and the second mounting cable thereby attaching the first edge to the one of first mounting cable and the second mounting cable; and

a second plurality of mounting connectors longitudinally spaced apart from each other along the second edge and slidably receiving one of a first intermediate mounting cable and a second intermediate mounting cable, thereby attaching the second edge to the one of the first intermediate mounting cable and the second intermediate mounting cable.

67. The system of claim 66, wherein the selectable closable access point is disposed in the intermediate connecting panel.

68. The system of any one of claims 50 to 67, wherein the plant growing system spans a length of approximately 50 feet.

69. The system of any one of claims 50 to 68, further comprising a housing overlying the plant support layer whereby a longitudinally extending plant chamber is at least partially bound by the housing and the upper surface of the plant support layer.

70. The system of any one of claims 50 to 69, further comprising:

a runway disposed below the plant support layer and extending between the first crossmember and the second crossmember in the root chamber, and having a first terminus proximate the first crossmember and a second terminus proximate the second crossmember, the runway attachable to and supported by the first crossmember and the second crossmember;

a watering pod supported by and movable along the runway within the root chamber between the first terminus and the second terminus, the watering pod comprising a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving between the first terminus and the second terminus; and

a drive system, configured to move the watering pod along the runway between the first terminus and the second terminus.

71. The system of claim 70, wherein the runway underlies the at least one intermediate crossmember.

72. The system of claim 70 or 71, wherein the runway comprises at least one cable and wherein the watering pod comprises one or more engagement member configured to engage the at least one cable for moving the watering pod along the at least one cable, and

wherein the drive system comprises an elongate drive connector extending between the watering pod and a first actuating mechanism, the first actuating mechanism configured to drive the watering pod along the runway at least toward the first terminus.

73. The system of claim 72, wherein the drive system further comprises a second elongate drive connector extending between the watering pod and a second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the runway at least towards the second terminus.

74. The system of any one of claims 70 to 73, further comprising at least a second growing segment, the at least a second growing segment comprising:

a second plant support layer configured to support plants, and having an upper exposed surface and an opposing lower surface, the second plant support layer comprising a light-impermeable material;

a second flexible liquid capture sheet underlying the second plant support layer whereby the second liquid capture sheet and the lower surface cooperate to at least partially bound a second root chamber extending longitudinally between a first chamber end and a second chamber end and that is disposed longitudinally between the first end of the second root chamber and the first root chamber, the second root chamber configured to receive roots of the plants in the second plant support layer so that the roots are suspended within the second root chamber and exposed and to shield the roots from light;

a second runway extending longitudinally within the second root chamber between a third terminus proximate the first end of the second root chamber and a fourth terminus proximate the second end of the second root chamber; and

a second watering pod supported by and movable along the second runway within the second root chamber between the third terminus and the fourth terminus, the second watering pod comprising a watering mechanism fluidly connectable to the water supply and configured to emit water within the root chamber while the second watering pod is moving between the third terminus and the fourth terminus.

75. The system of claim 74, wherein the second elongate drive connector extends between the second watering pod and the second actuating mechanism, the second actuating mechanism configured to drive the watering pod along the second runway at least towards the third terminus.

76. The system of claim 74, wherein the watering pod and the second watering pod are coupled by at least a first intermediate drive connector, the first actuating mechanism configured to move the watering pod and the second watering pod at least towards the first terminus and the fourth terminus respectively, and the second actuating mechanism configured to move the watering pod and the second watering pod at least towards the second terminus and the third terminus respectively.

77. The system of claim 70, wherein the runway comprises a rail.

78. The system of claim 77, wherein the watering pod comprises one or more engagement member configured to engage the rail for moving the watering pod along the rail, and wherein the drive system comprises an onboard motor configured to the drive the one or more engagement member.

79. The system of any one of claims 70 to 78, wherein the water supply comprises a water chamber housed within and movable with the watering pod.

80. The system of claim 78 or 79, further comprising a refilling station configured to refill the water chamber of the watering pod.

81. The system of claim 78, further comprising a second refilling station configured to refill a water chamber of the second watering pod.

82. The system of any one of claims 74 to 81, wherein the watering pod further comprises a controller operably connected to the watering mechanism and an onboard power supply to provide power to the controller.

83. The system of any one of claims 74 to 81, wherein the watering mechanism comprises at least one nozzle movably mounted to the watering pod, and an actuation mechanism configured to move the at least one nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

84. The system of any one of claims 74 to 82, wherein the watering mechanism comprises an array of nozzles movably mounted to the watering pod, and an actuation mechanism configured to move the array of nozzles relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

85. The system of any one of claims 75 to 82, wherein the watering mechanism comprises at least one centrifugal nozzle mounted to the watering pod.

86. The system of claim 85, wherein the watering mechanism further comprises an actuation mechanism configured to move the at least one centrifugal nozzle relative the watering pod in a second, non-longitudinal direction while the watering pod moves along the runway.

87. The system of any one of claims 70 to 86, wherein the liquid capture sheet comprises a drain configured to direct run-off water to the water supply.

Abstract

A system and method for growing plants. The system comprises at least one growing segment. Each segment comprises a plant support layer configured to support plants and shield roots from light, and a flexible liquid capture sheet underlying the plant support layer to at least partially bound a root chamber. The root chamber is configured to receive the roots of the plants such that the roots suspended within the root chamber are exposed, and to shield the roots from light. Each growing segment has a runway extending longitudinally within the root chamber. A watering pod is supported by and movable along the runway within the root chamber. The watering pod comprises a watering mechanism fluidly connectable to a water supply and configured to emit water within the root chamber while the watering pod is moving. The system has a drive system, configured to move the watering pod along the runway.

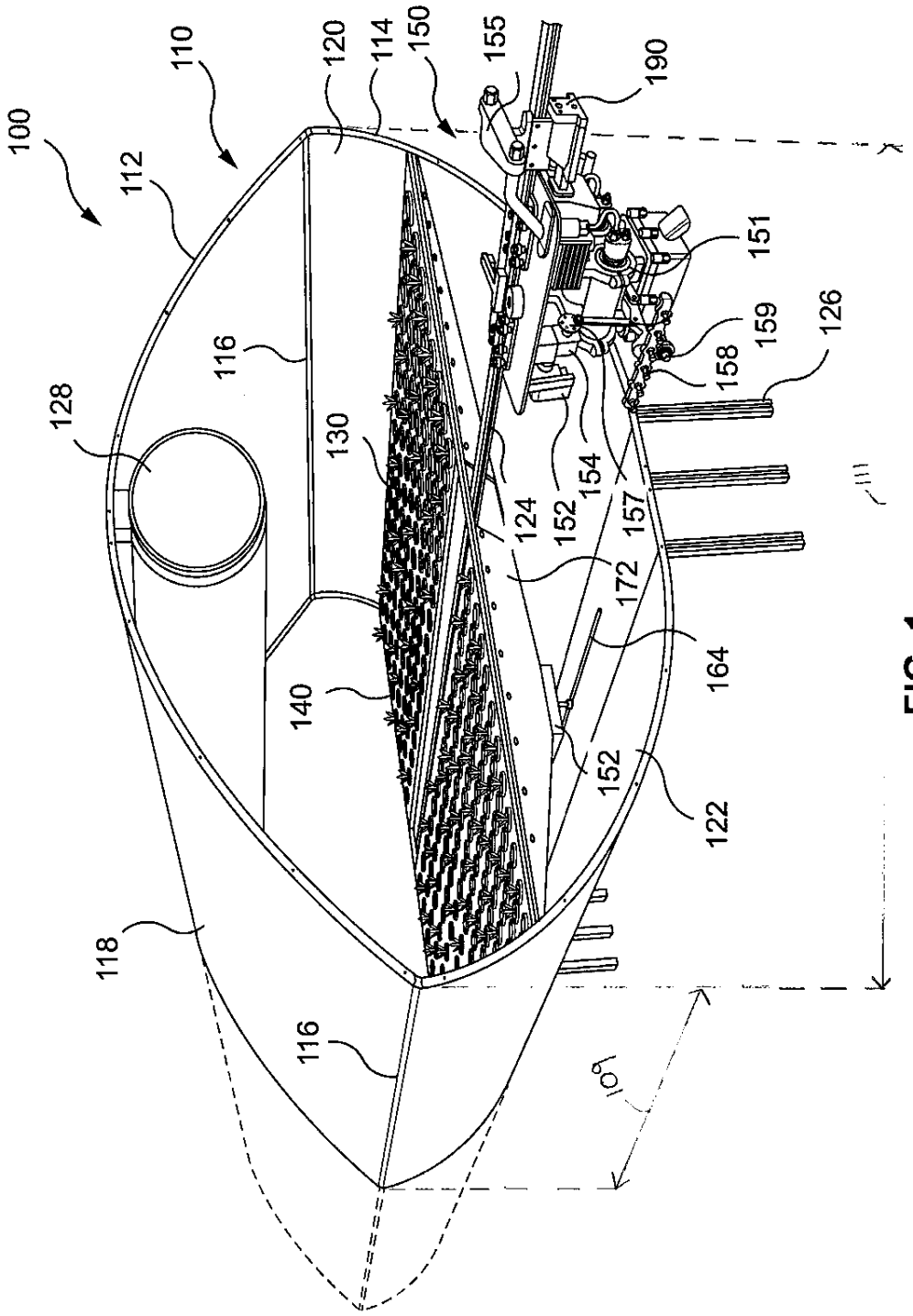
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FIG. 1

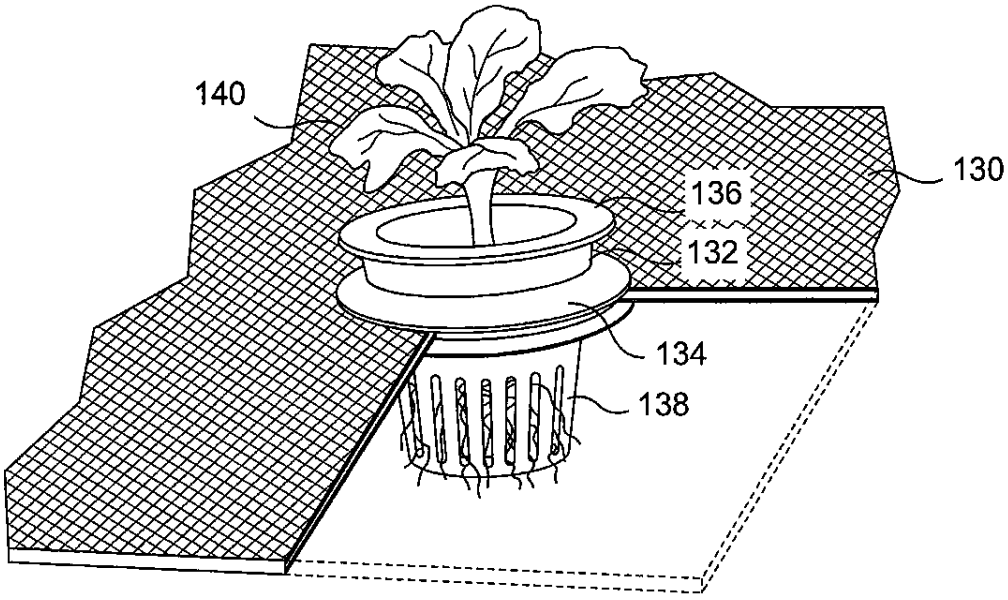

FIG. 2

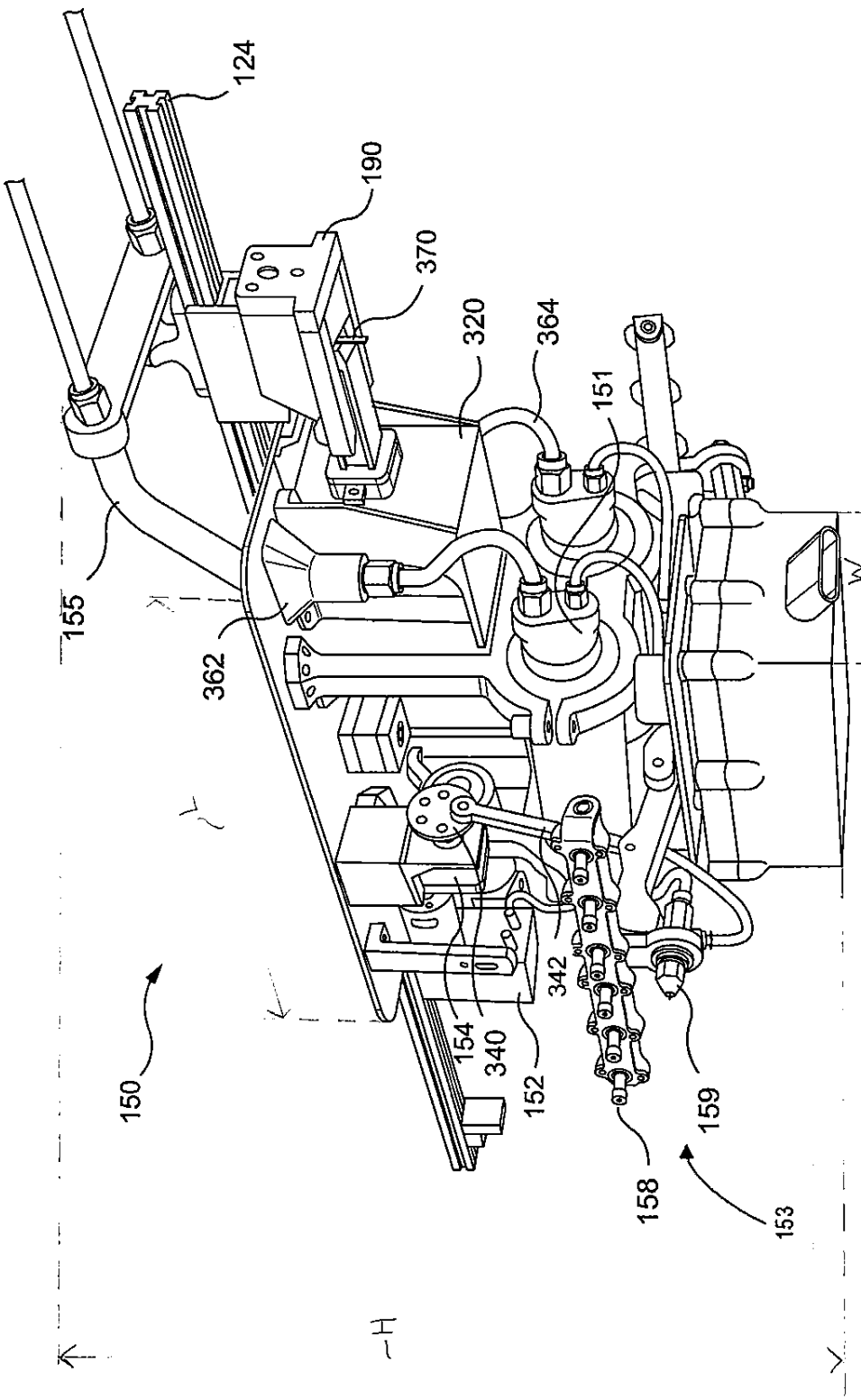
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FIG. 3A

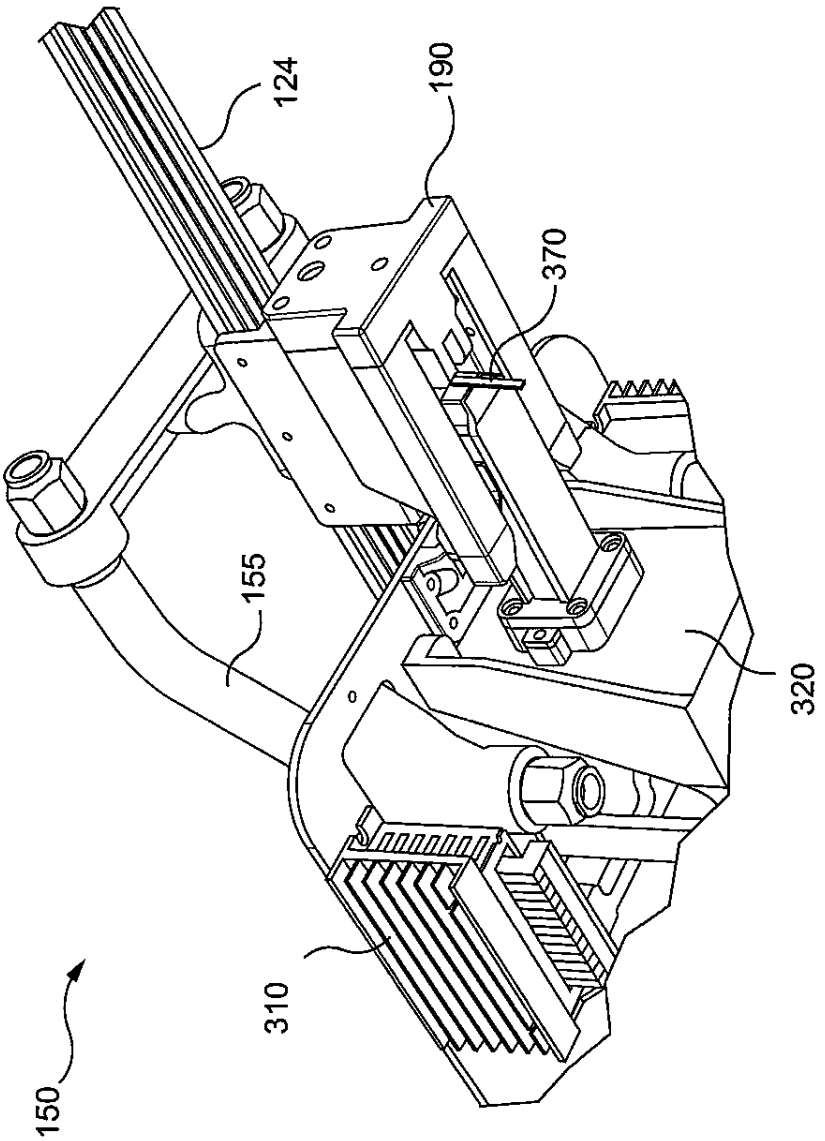


FIG. 3B

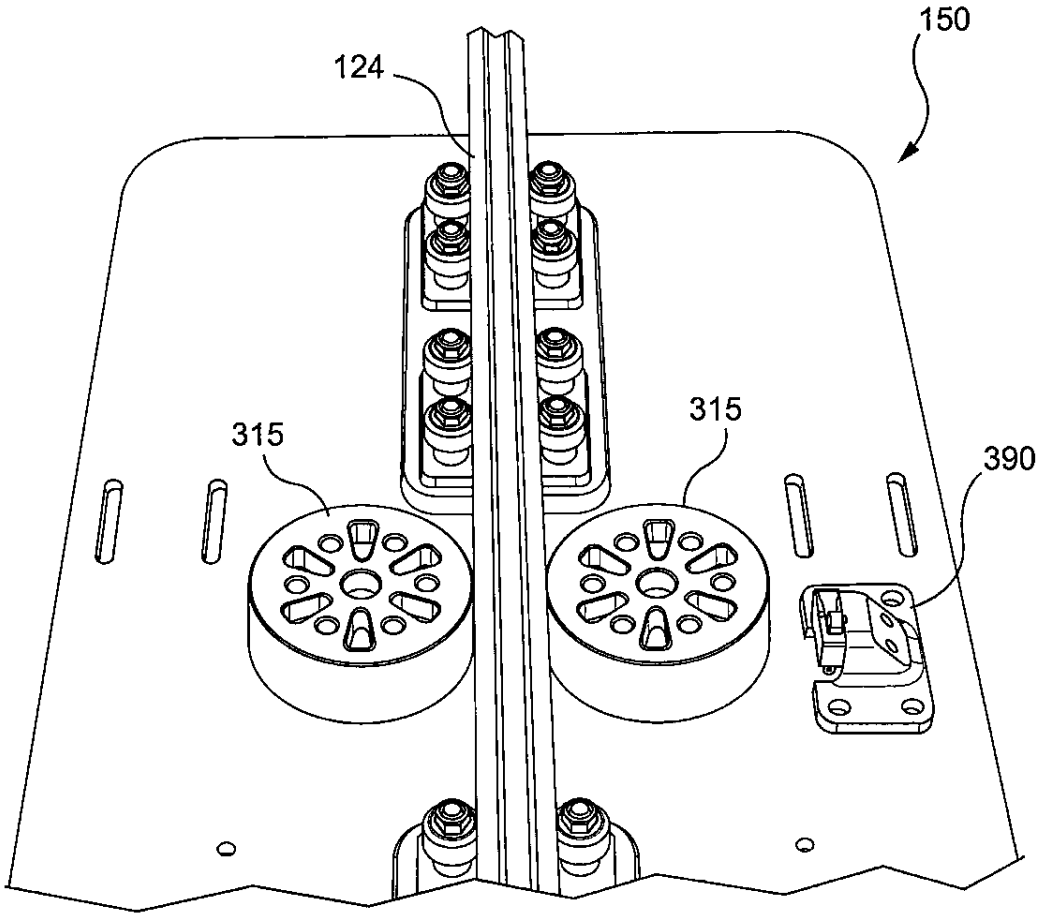
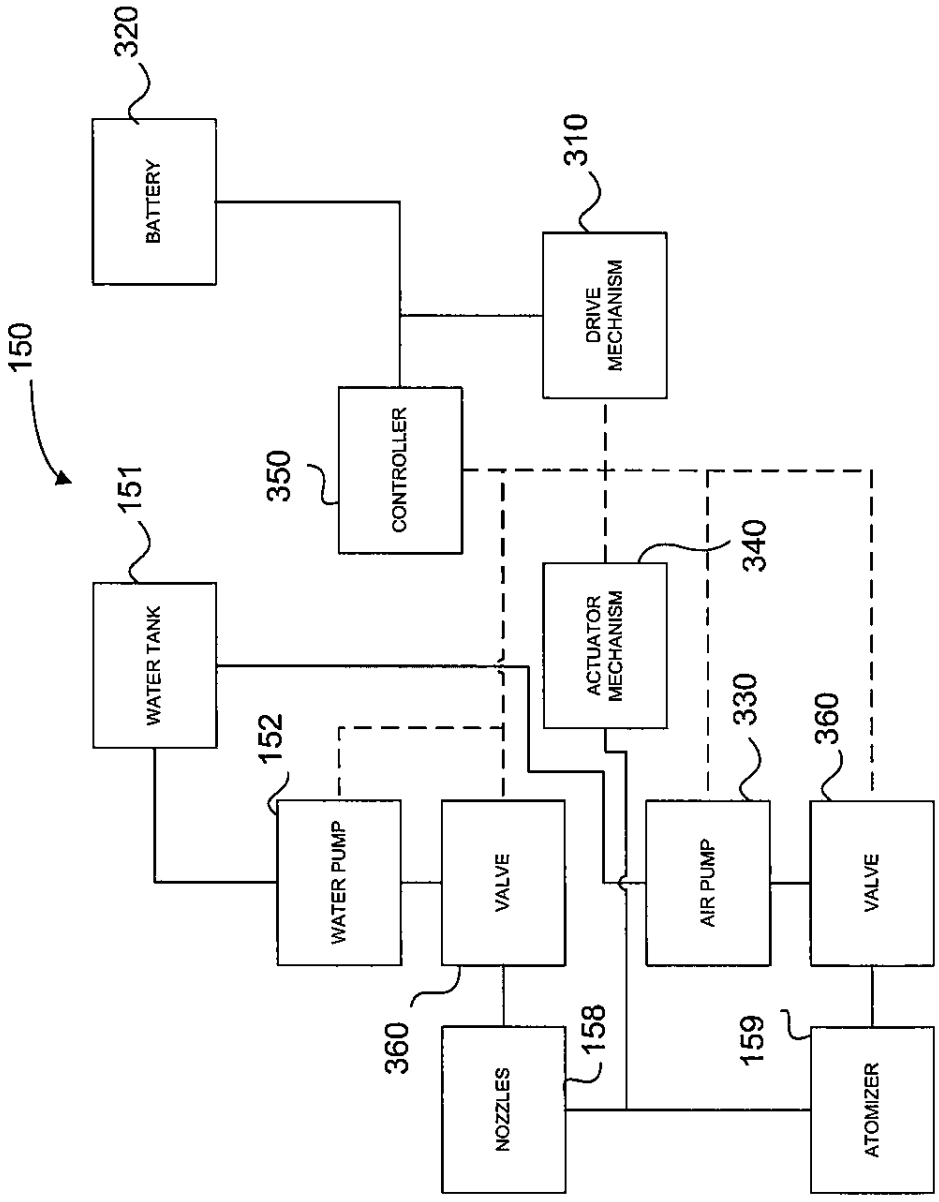


FIG. 3C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WATER TANK
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360
WATER PUMP
VALVE
AIR PUMP
VALVE
360
158
159
NOZZLES
ATOMIZER

FIG. 4

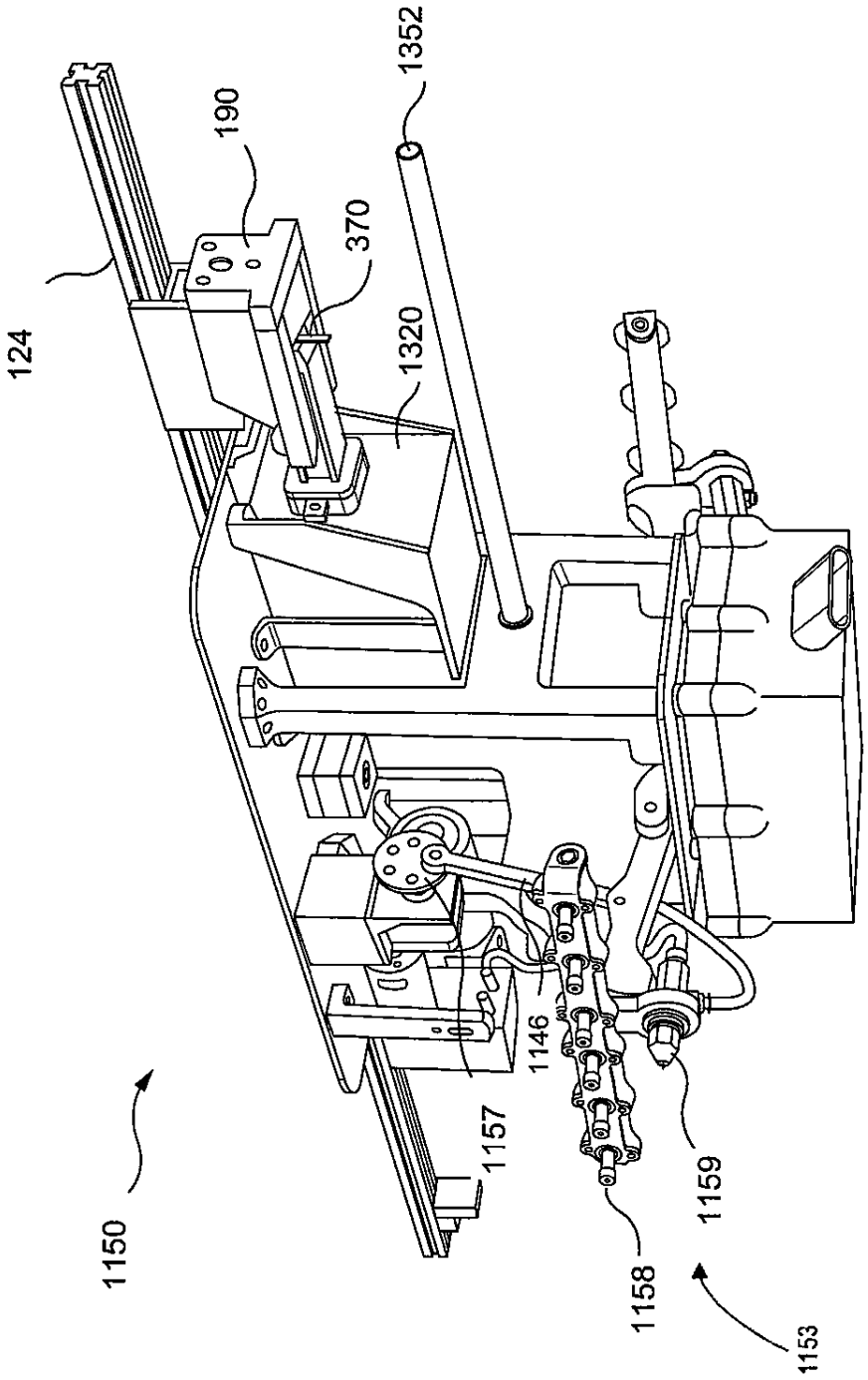
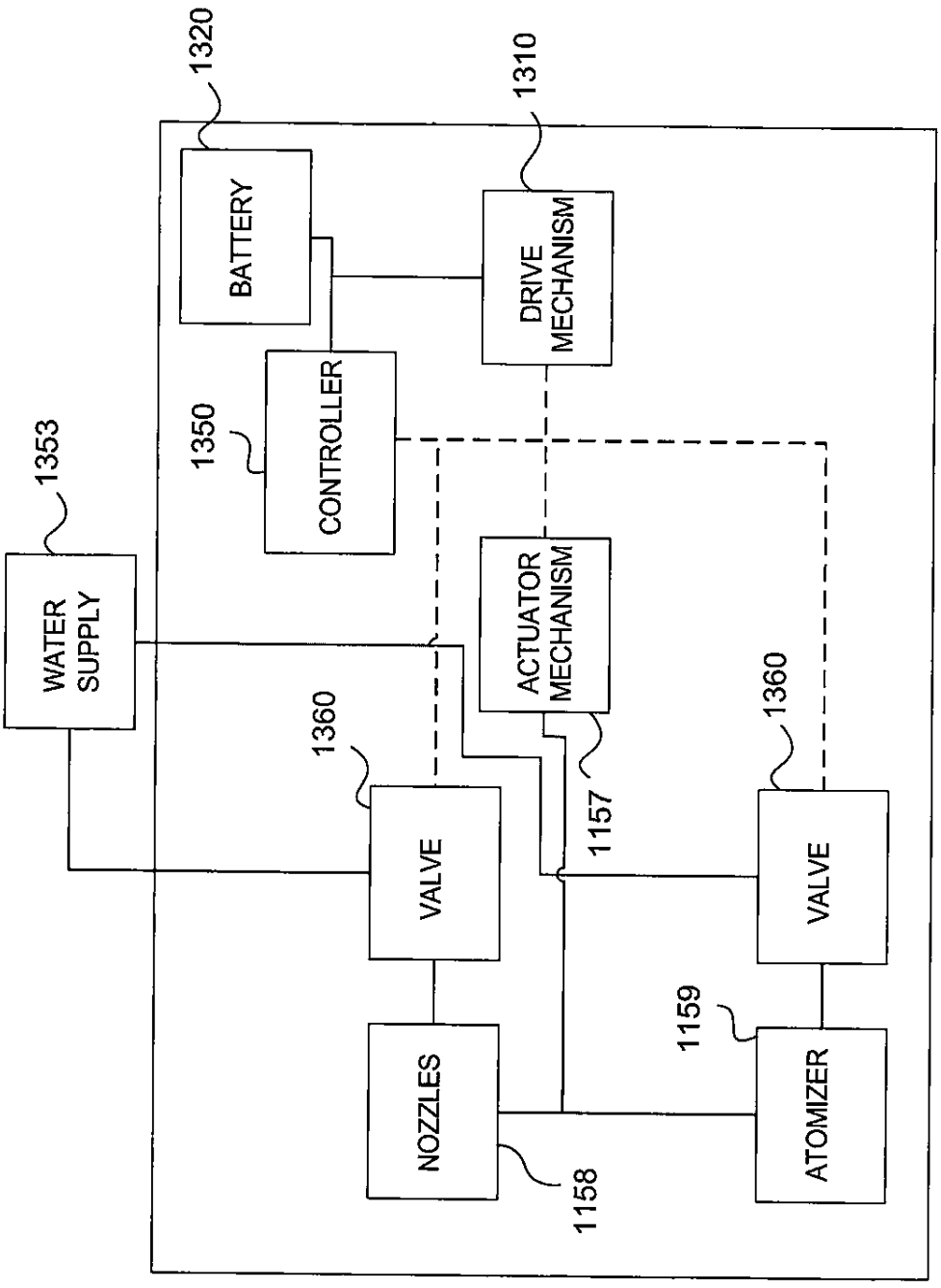


FIG. 5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VALVE
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NOZZLES
ATOMIZER
1158

FIG. 6

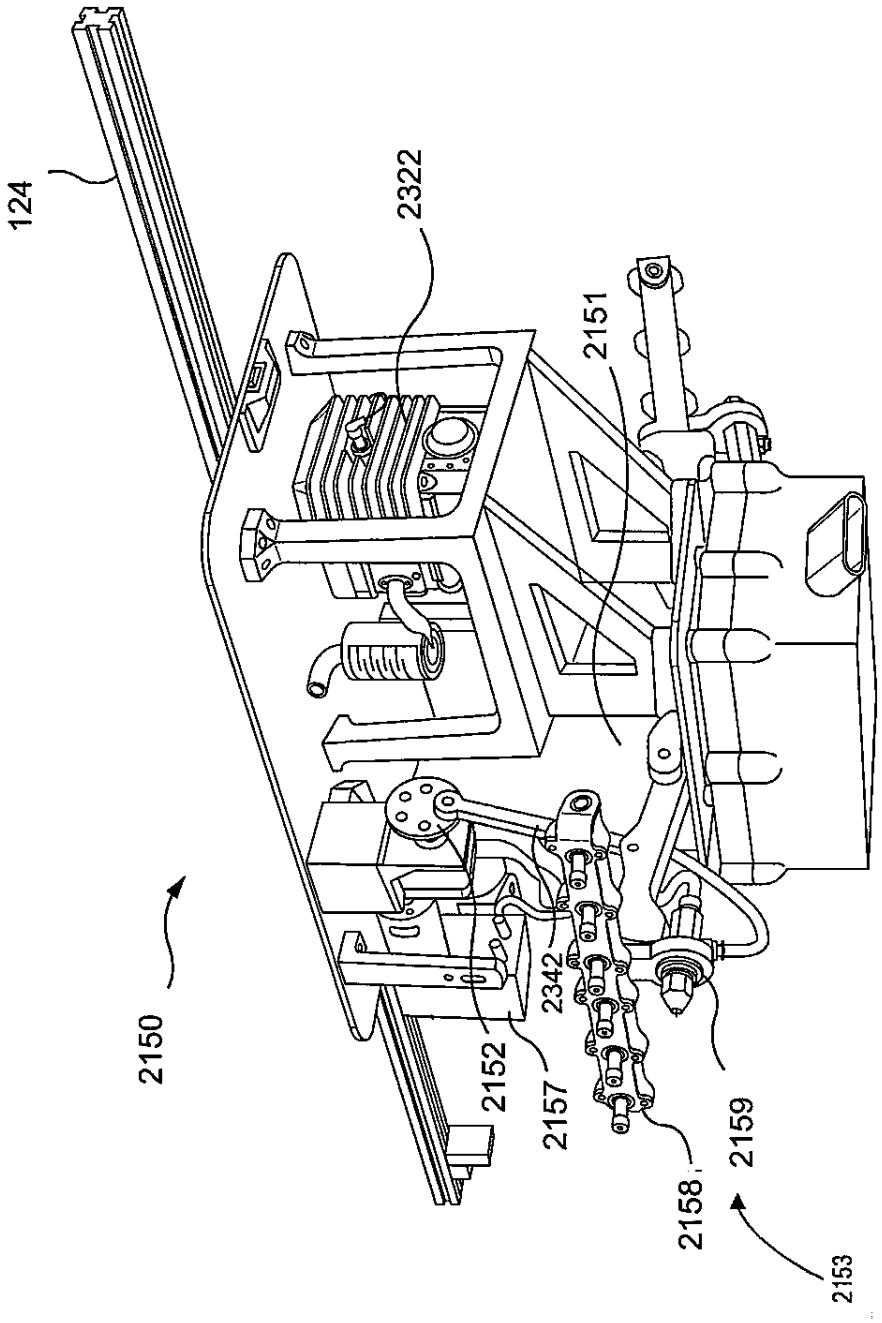
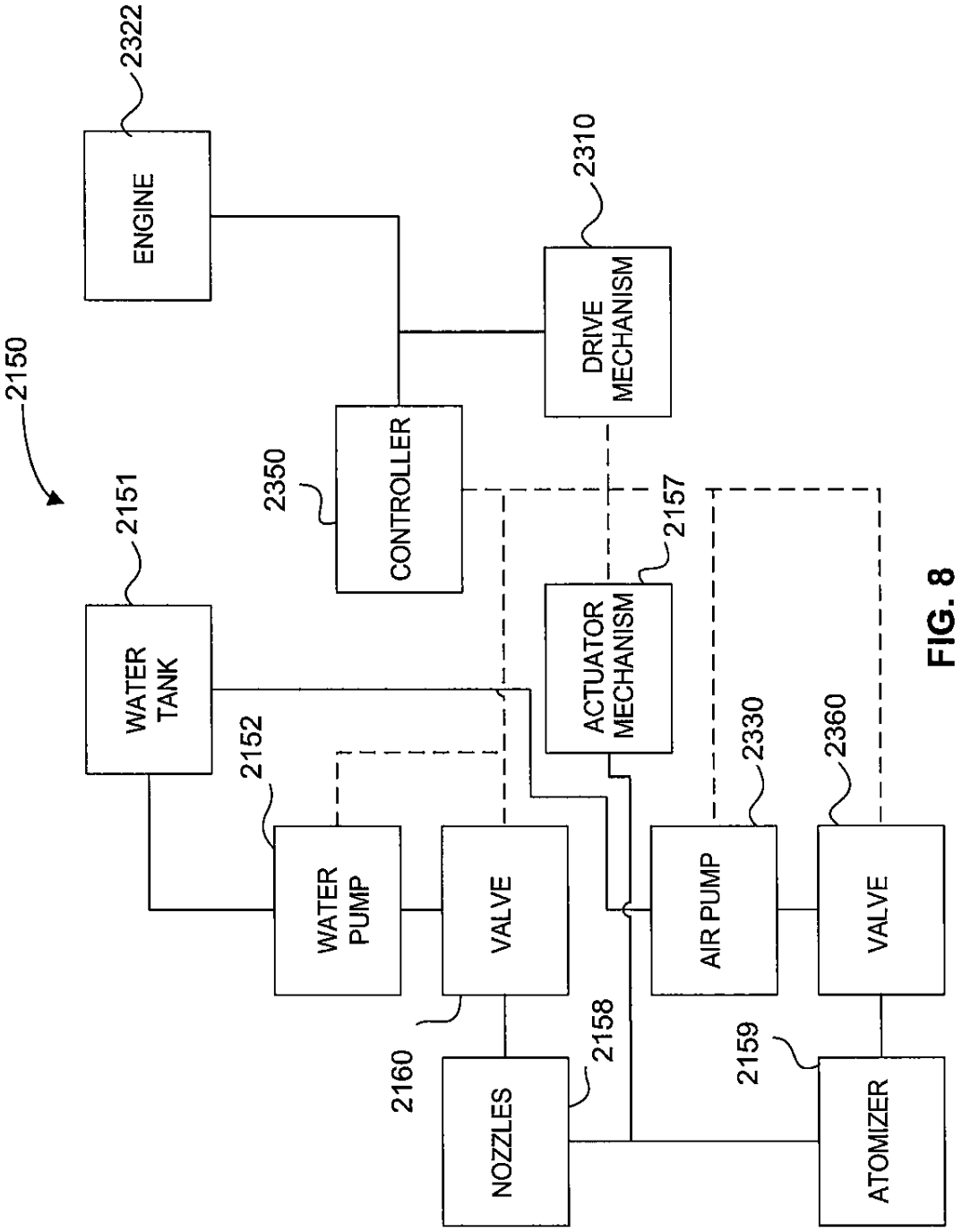


FIG. 7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NOZZLES
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2159
ATOMIZER

FIG. 8

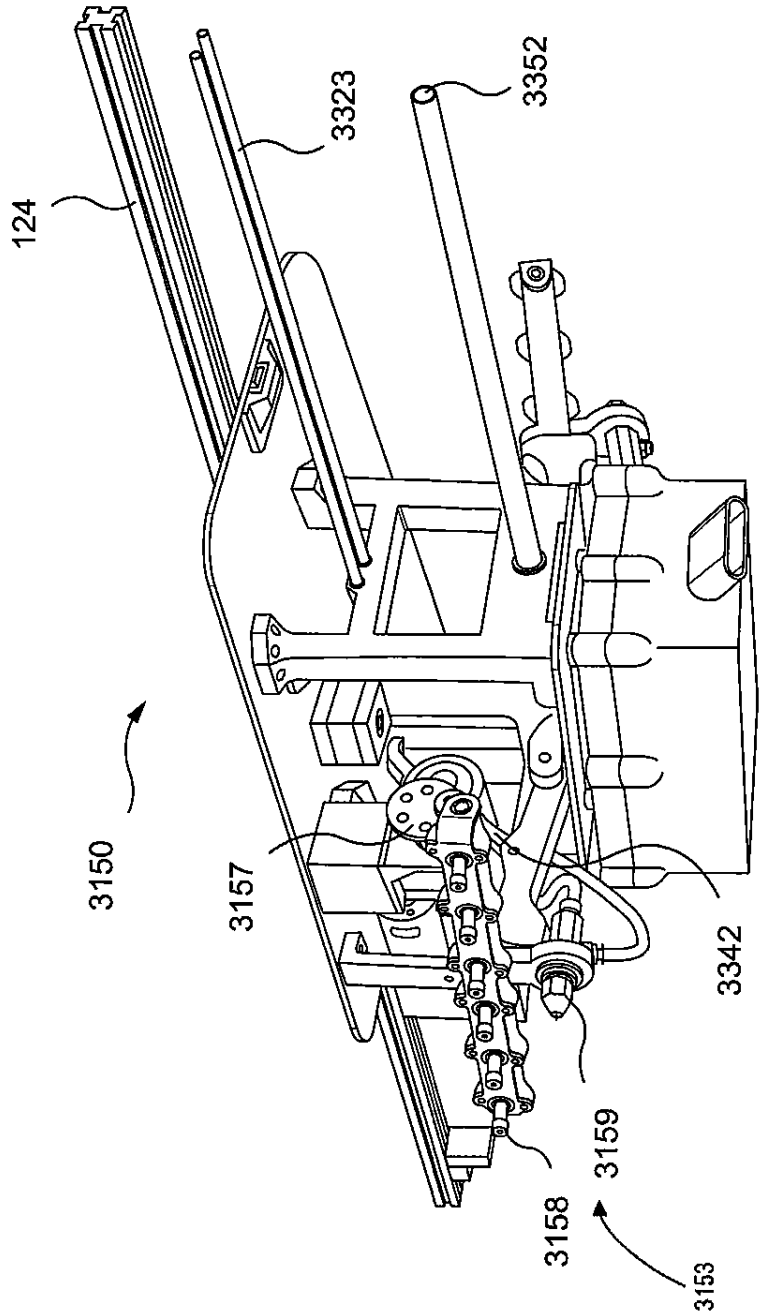
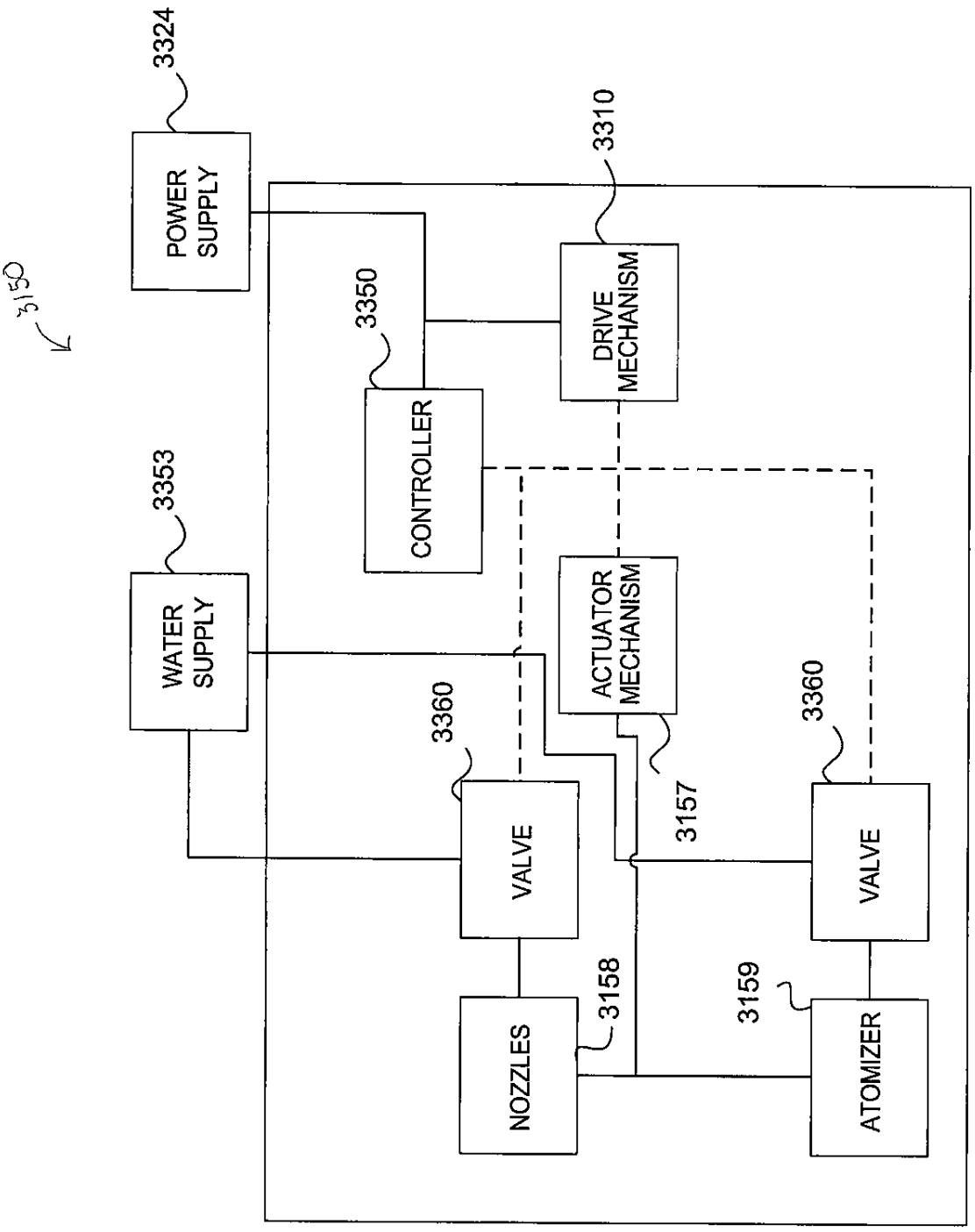


FIG. 9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VALVE
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3360
VALVE
3158
NOZZLES
3159
ATOMIZER

FIG. 10

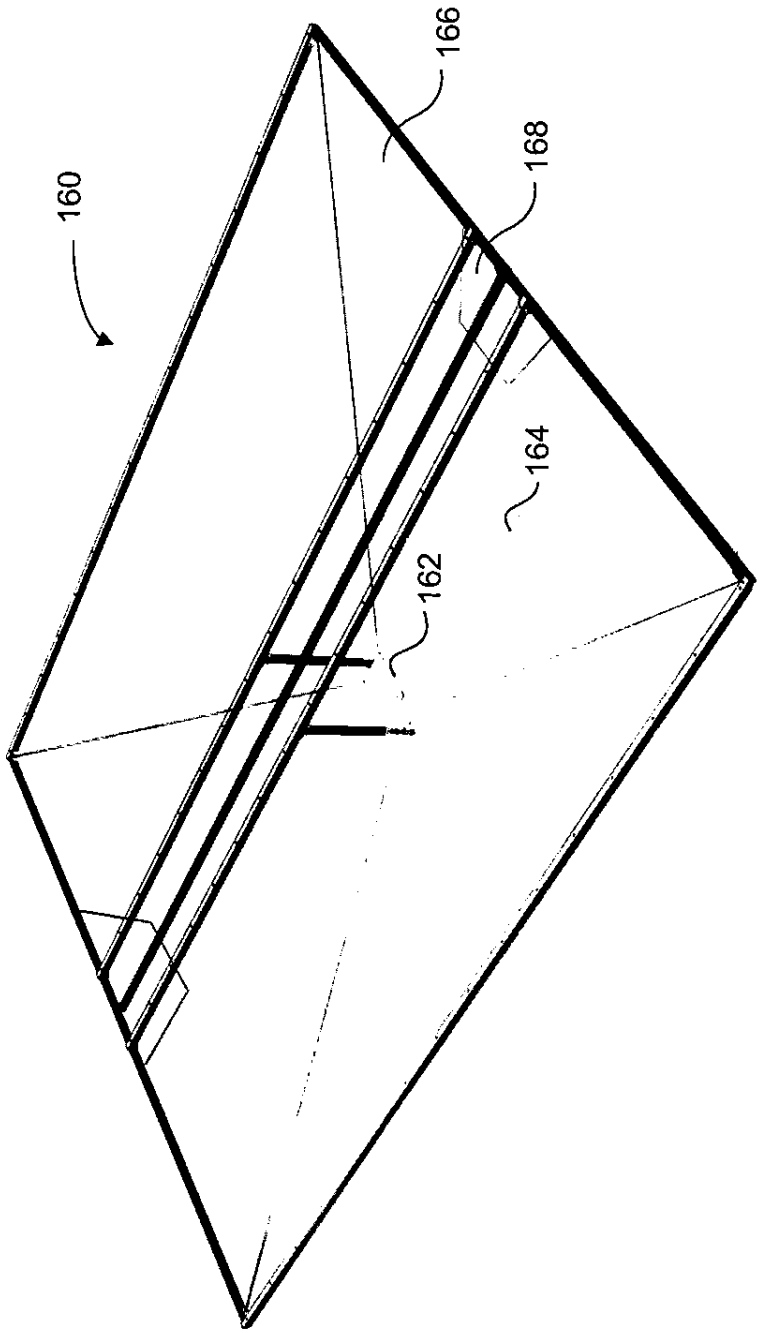


FIG. 11

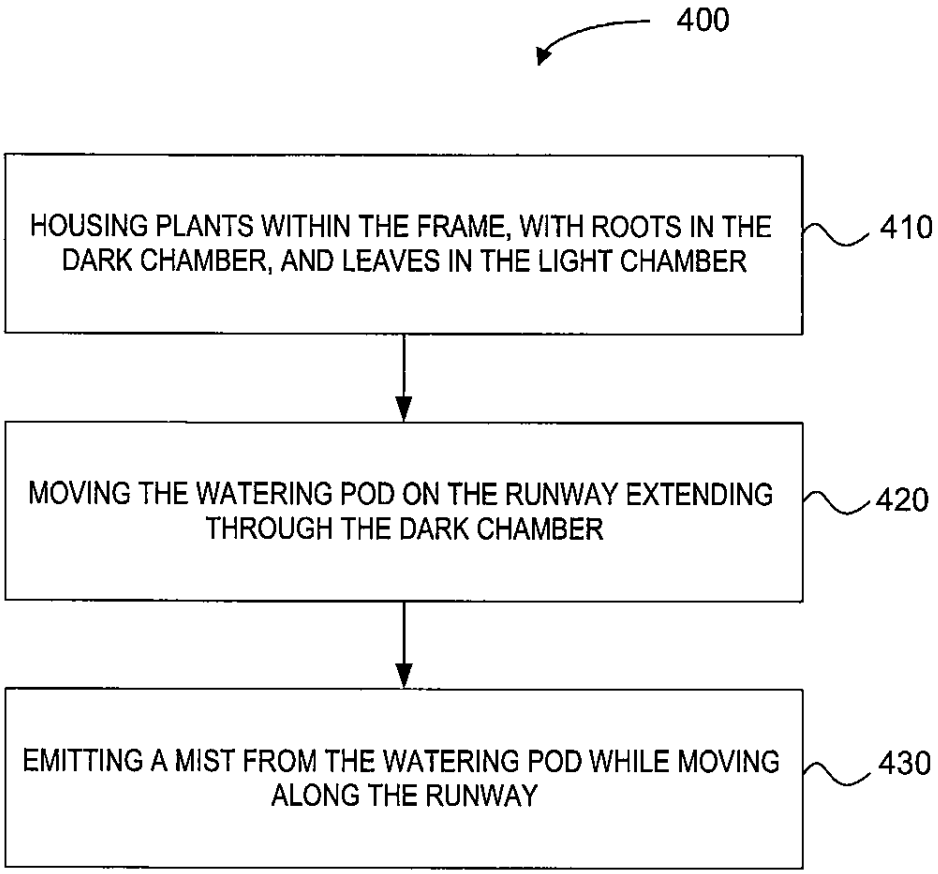
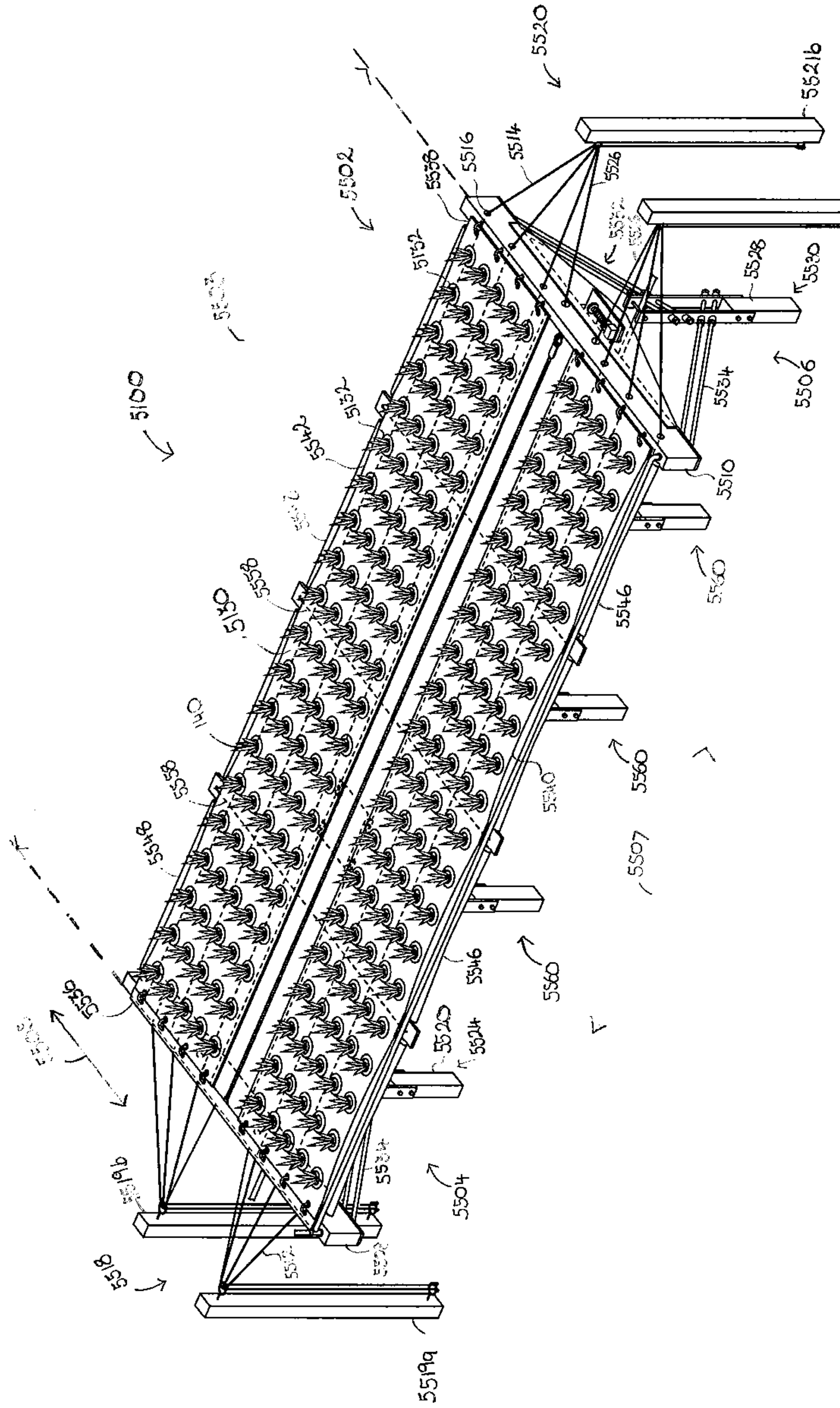

400
HOUSING PLANTS WITHIN THE FRAME, WITH ROOTS IN THE DARK CHAMBER, AND LEAVES IN THE LIGHT CHAMBER
410
MOVING THE WATERING POD ON THE RUNWAY EXTENDING THROUGH THE DARK CHAMBER
420
EMITTING A MIST FROM THE WATERING POD WHILE MOVING ALONG THE RUNWAY
430

FIG. 12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5518
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5524

FIG. 13

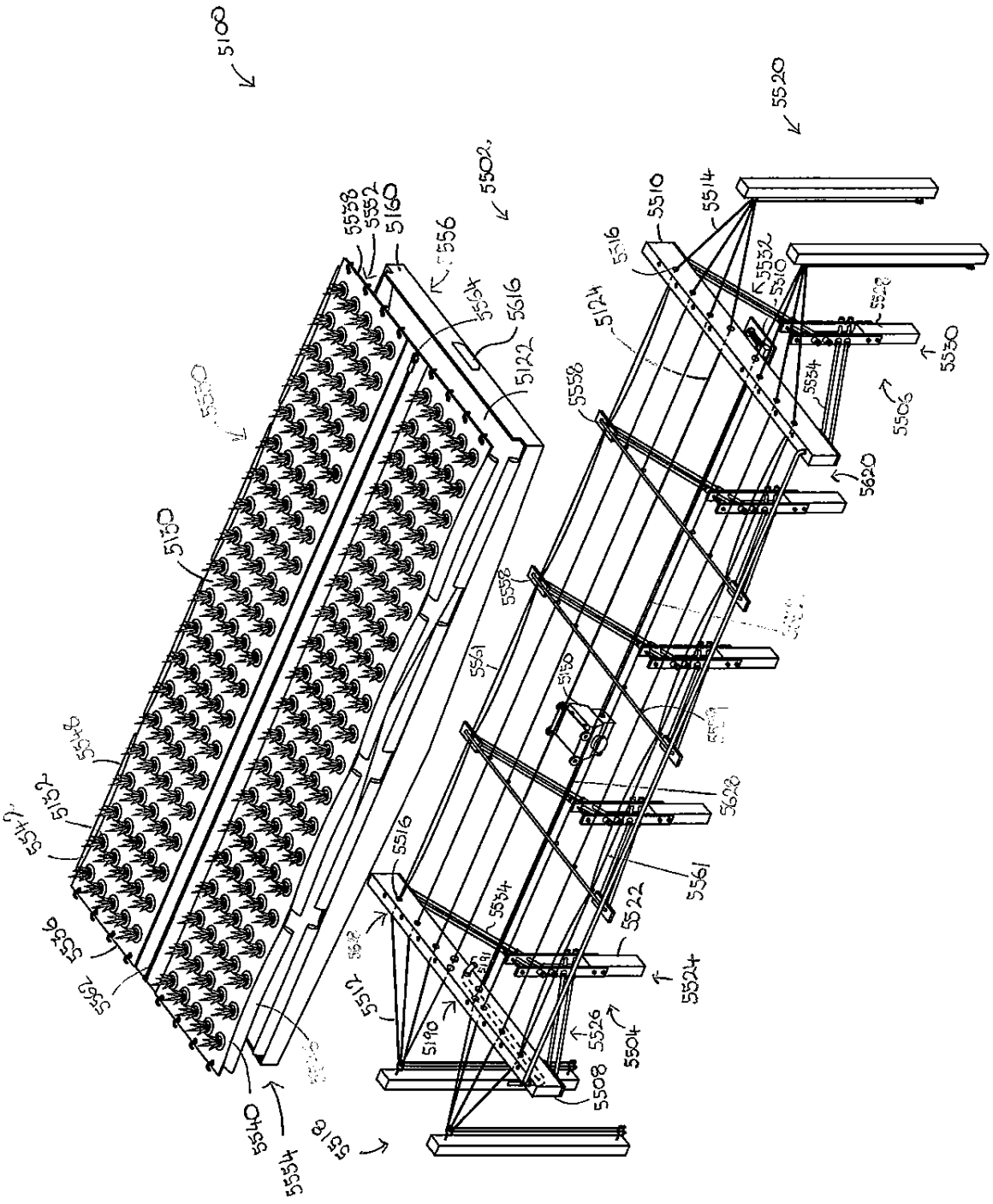

5100
5502
5520
5150
5160
5556
5558
5552
5534
5516
5122
5510
5514
5532
5524
5550
5530
5506
5620
5628
5561
5522
5526
5504
5508
5540
5518
5190

FIG. 14

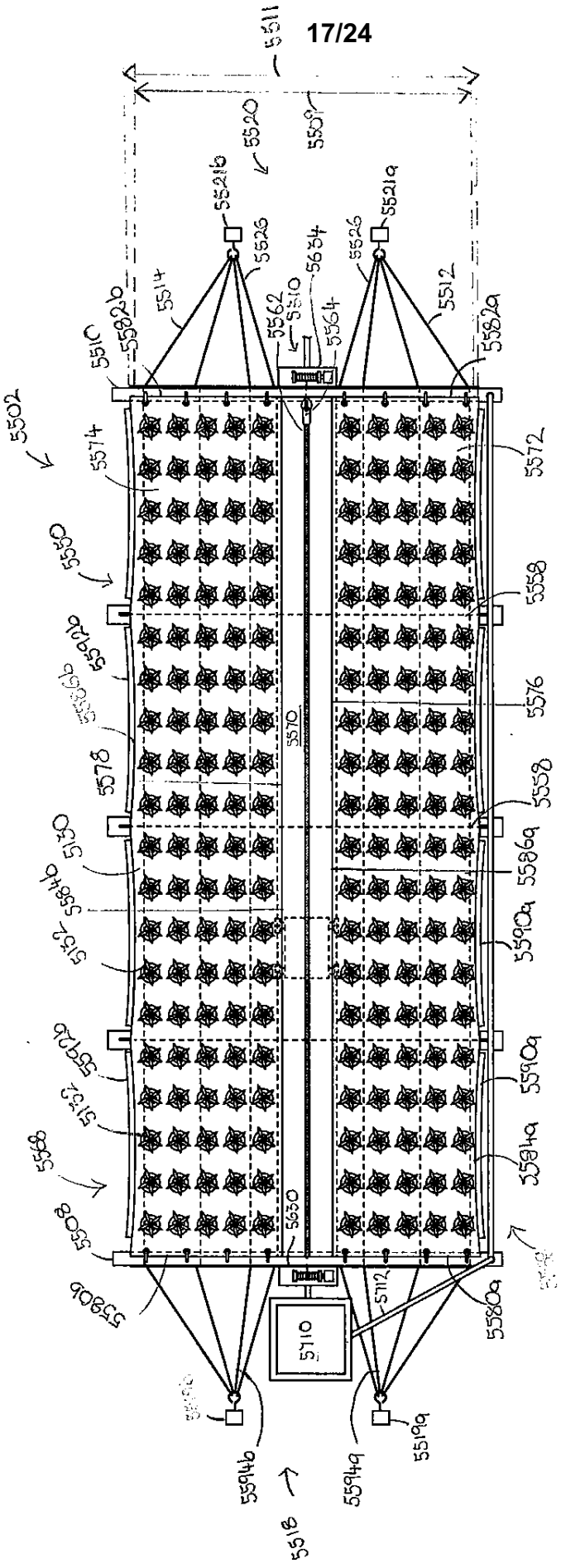
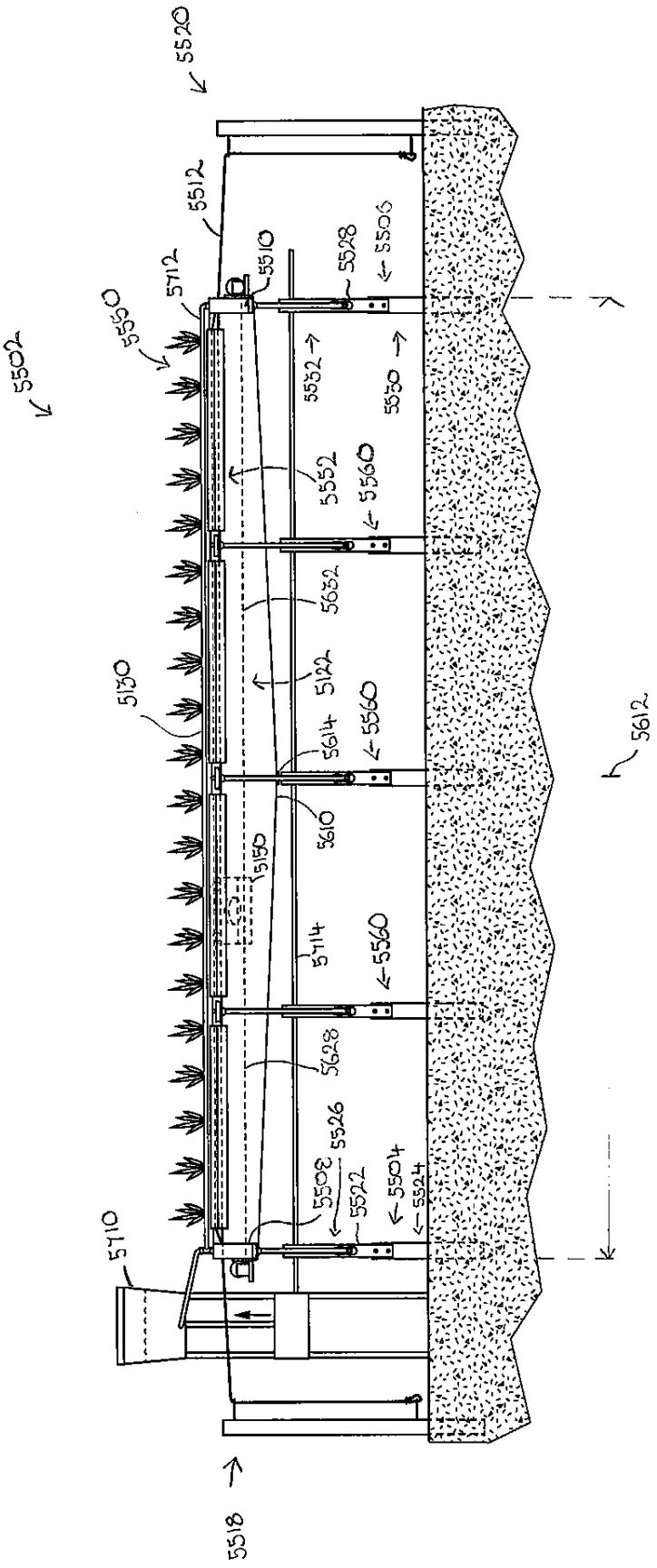

5511
5520
5509
5521b
5521a
5526
5526
5514
5562
5510
5564
5512
5582b
5582a
5510
5502
5574
5572
5550
5558
5576
5570
5578
5558
5586b
5586a
5590a
5590a
5594a
5594b
5590b
5590b
5568
5580b
5580a
5530
5712
5710
5580a
5594b
5594a
5519a
5518

FIG. 15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5506
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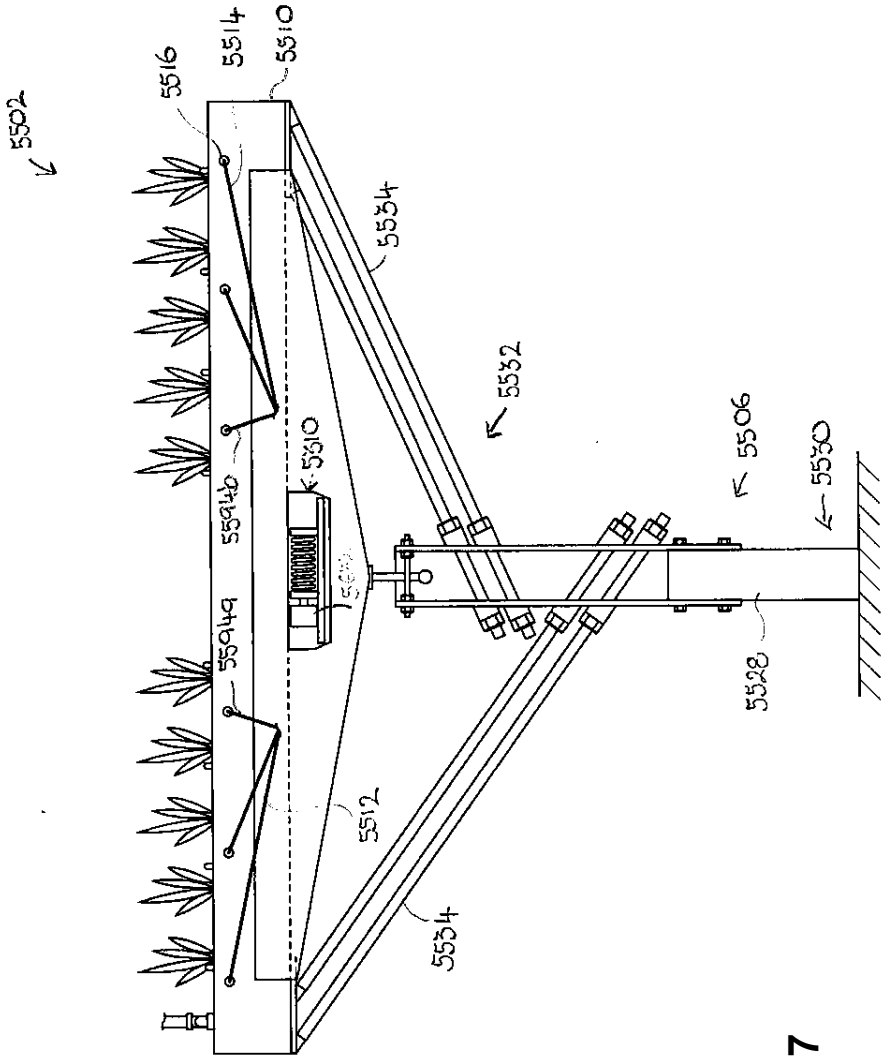
5632
5130
5122
5614
5612
5610
5150
5114
5628
5526
5508
5522
5504
5524
5710
5518

FIG. 16


5502
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5506
5530
5310
55949
55949
5512
5534
5528

FIG. 17

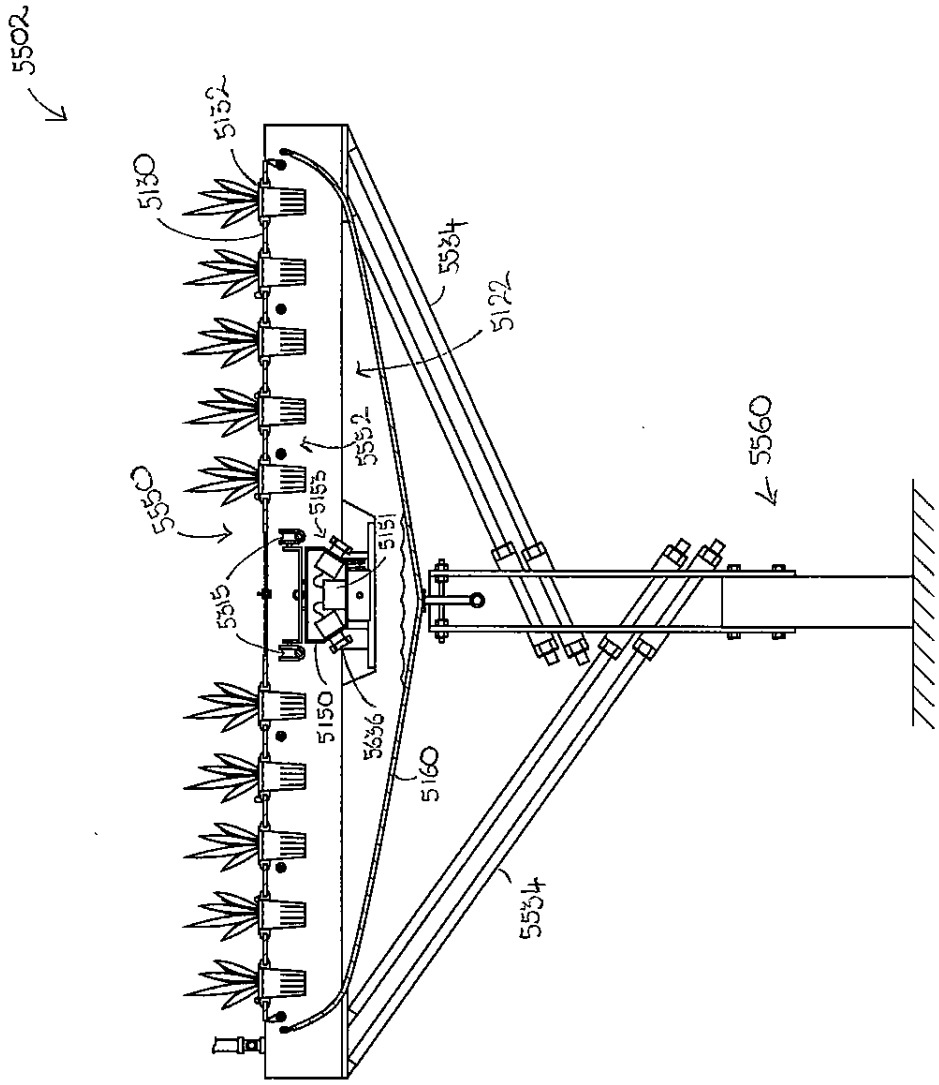

5502
5132
5130
5534
5122
5560
5552
5555
5550
5151
5515
5150
5536
5160
5534

FIG. 18

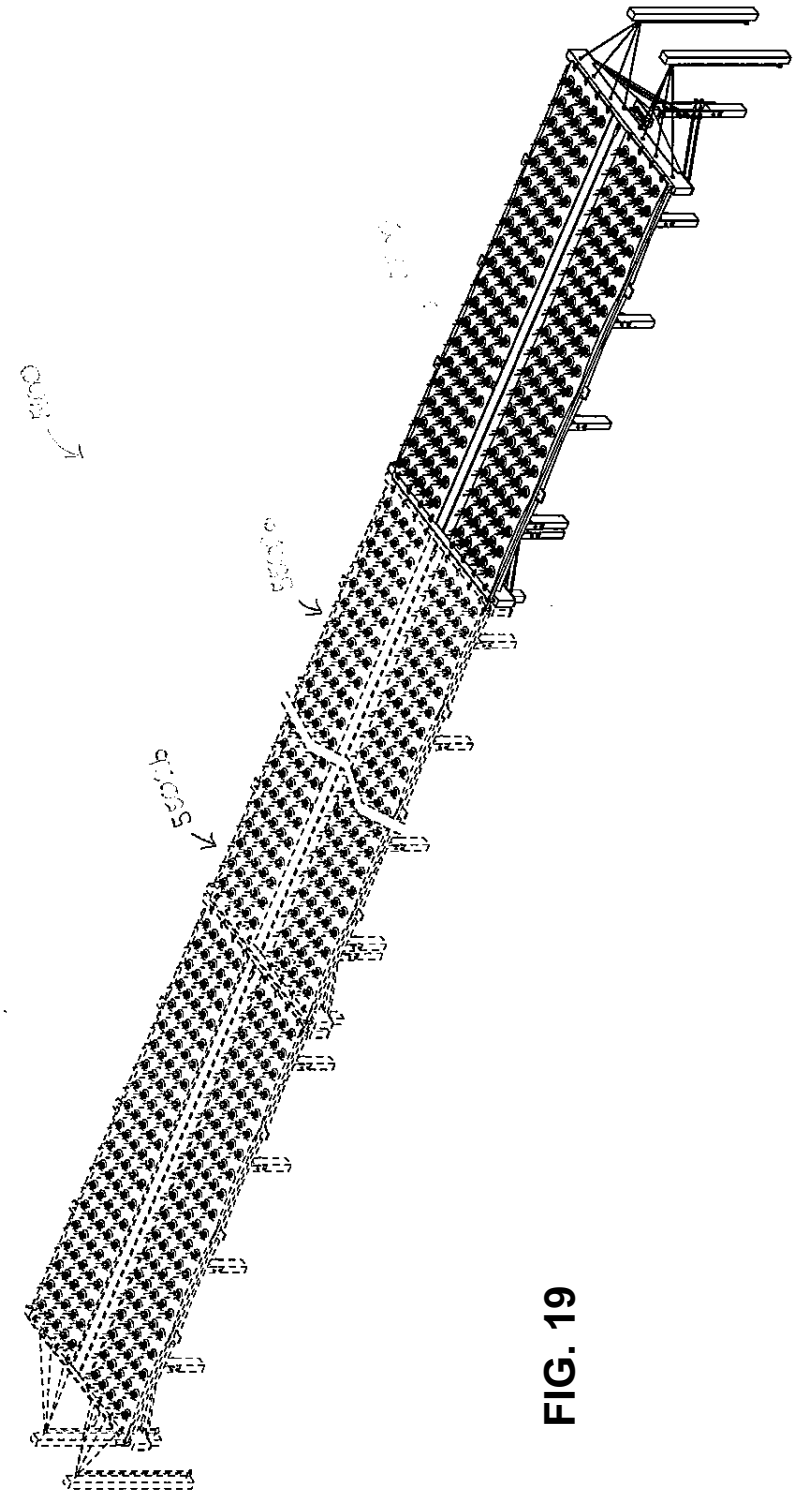


FIG. 19

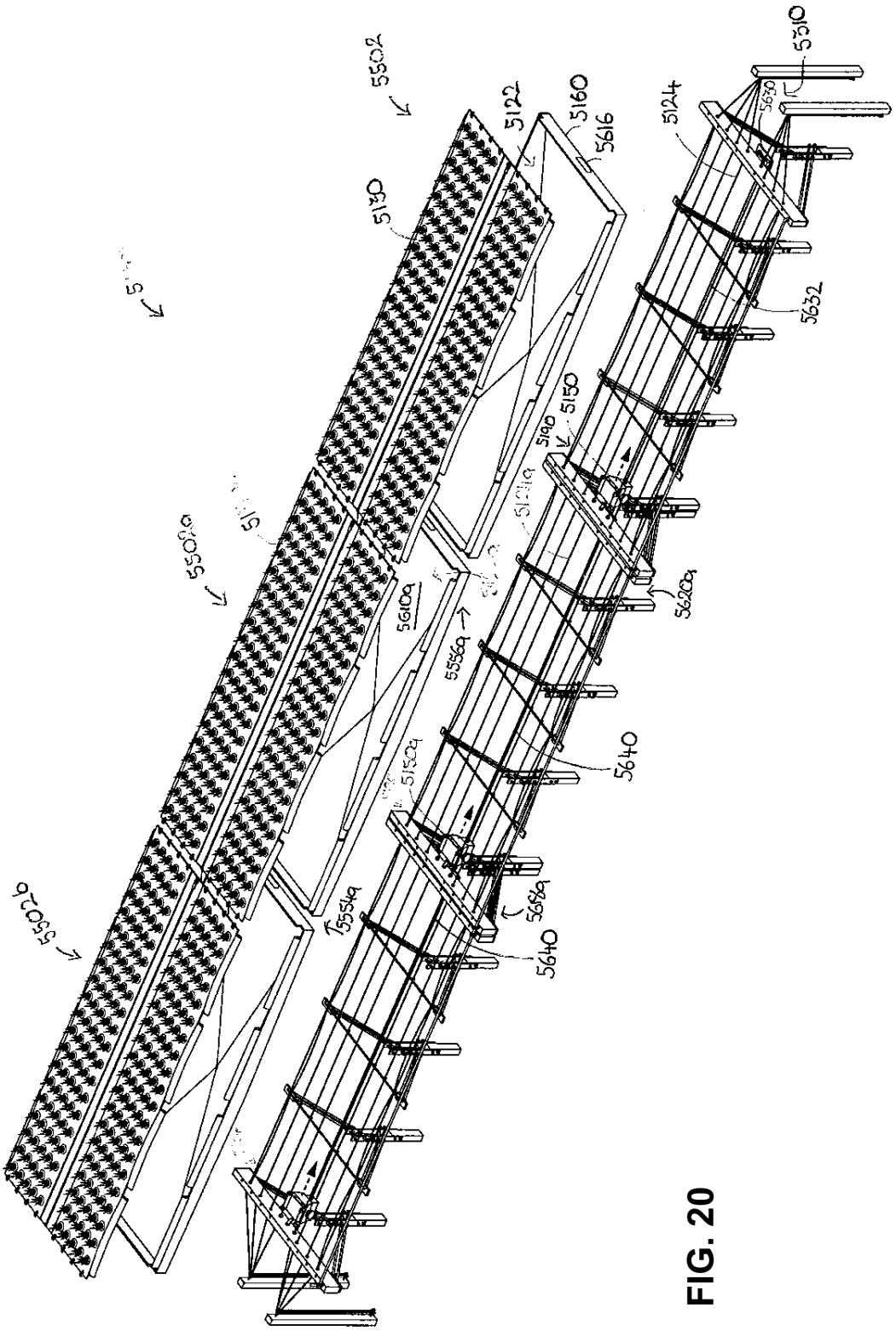

5502
5122
5160
5616
5124
5310
5630
5130
5632
5150
5140
5620a
5610a
5556a
5640
5152a
5554a
5658a
5640
5502a
5502b

FIG. 20

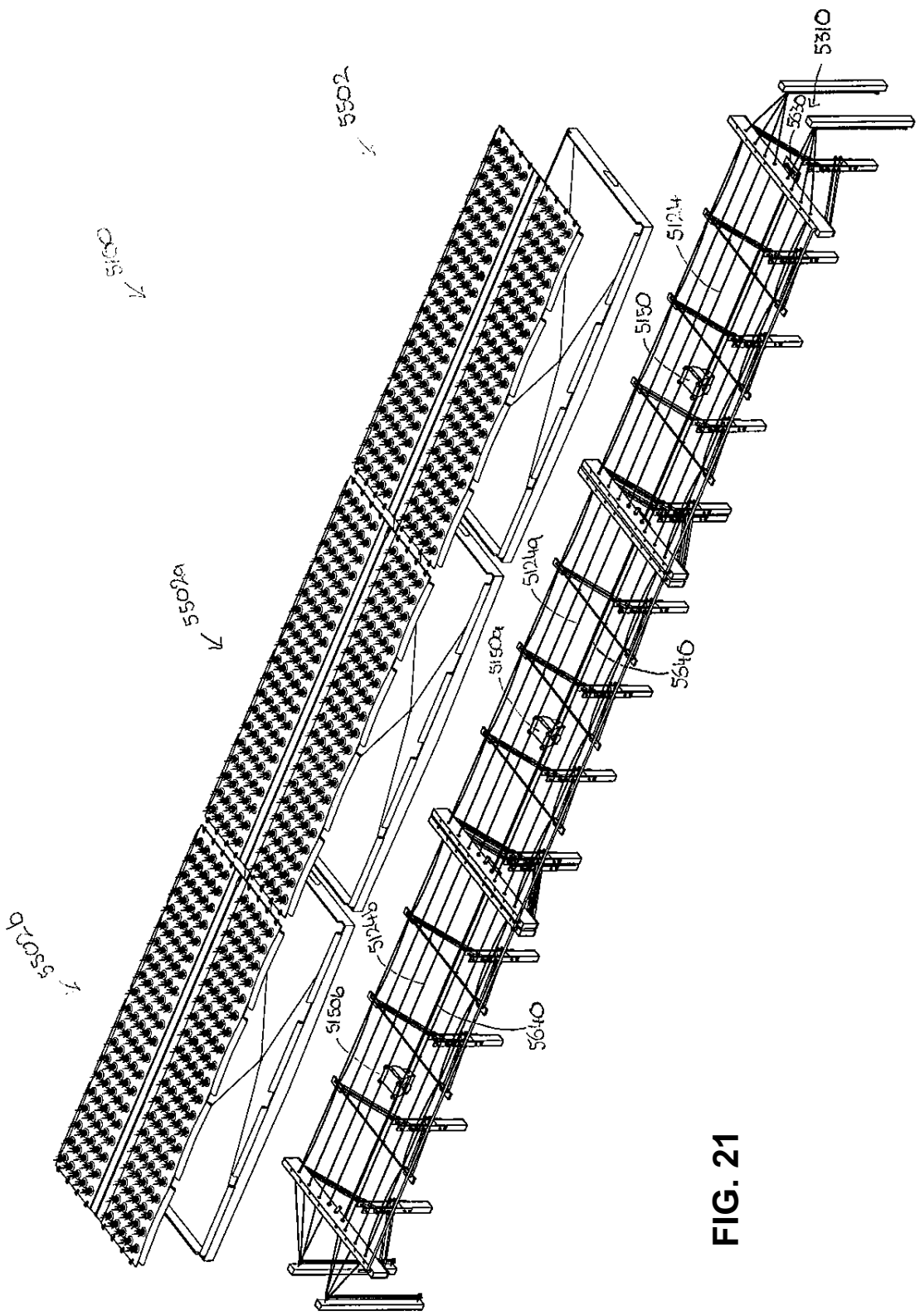
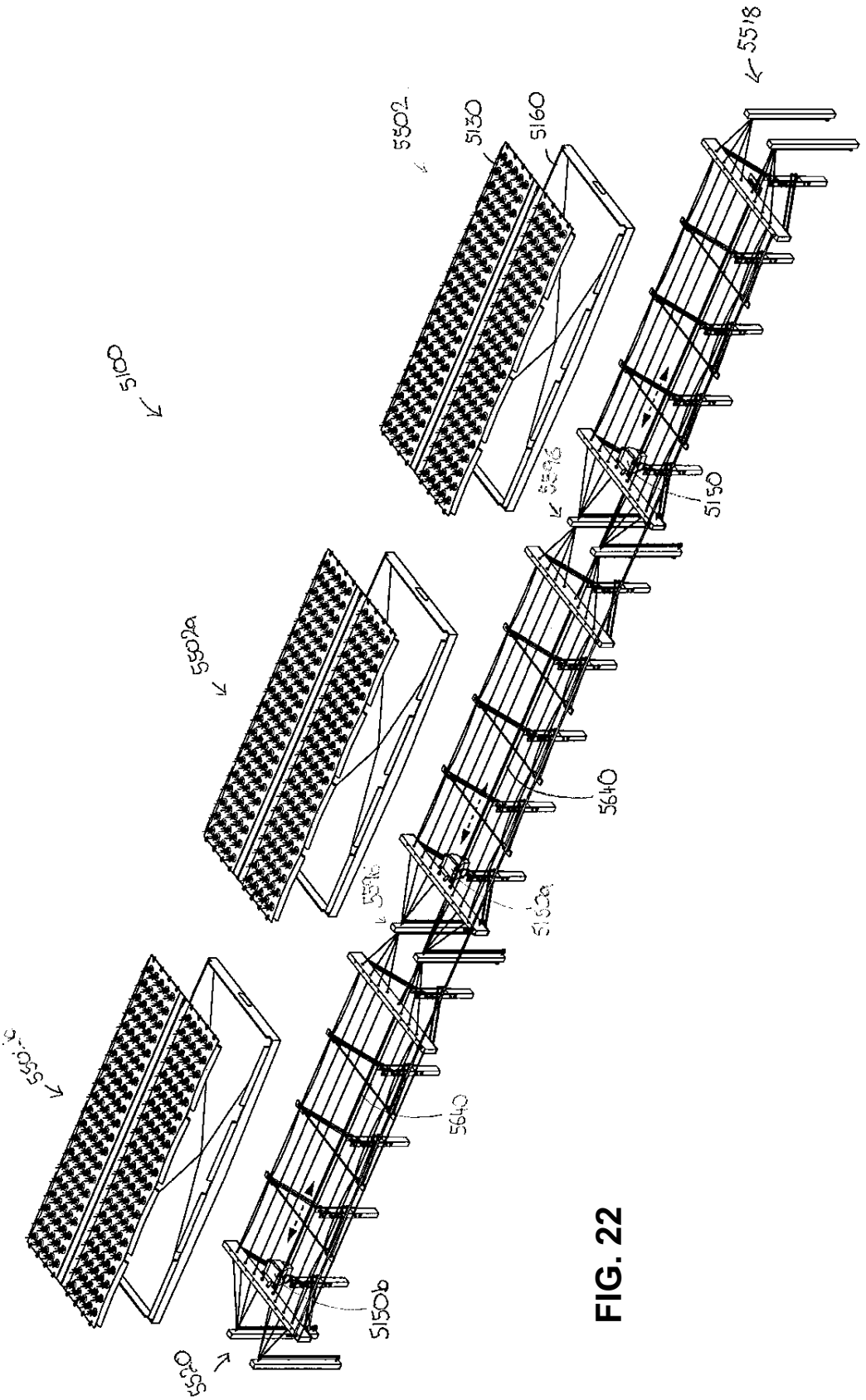

5310
5320
5502
5500
5502a
5500b
5130
5124
5124a
5150a
5150b
5150c
5640
5640

FIG. 21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5502
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5160
5518
5150
5502a
5640
5150a
5640
5150b
5502b

FIG. 22