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(54) **HYDROPONIC GROWING SYSTEM**

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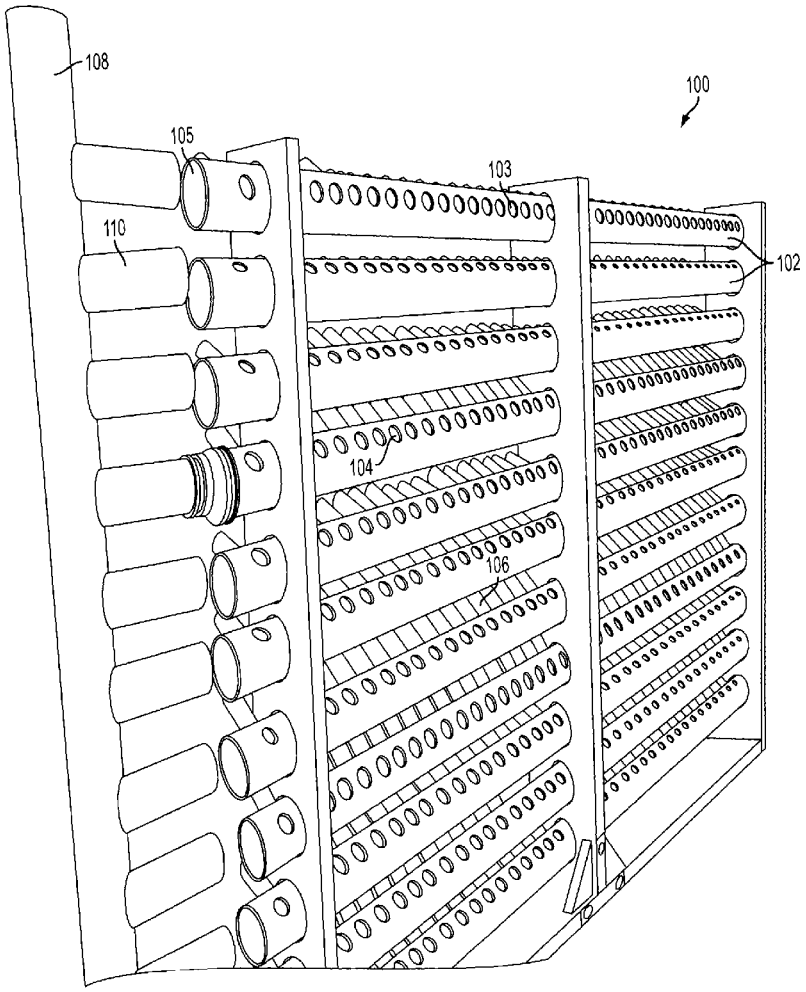
(57) **ABSTRACT**

A hydroponic growing system that comprises a plurality of parallel horizontal pipes, a vertical drain pipe, and a plurality of nutrient-delivering tubes. The horizontal pipes are adapted to support crops that receive nutrients from the nutrient-delivering tubes and grow in high density. The horizontal pipes have opposite first and second ends, as well as a plurality of openings along a length, and a plurality of pipe segments extending angularly from an outer surface. The vertical drain pipe has a plurality of angular pipe extensions along a length, which mate with one of the first and second ends of the horizontal pipes. The nutrient-delivering tubes have openings along a length and extend from the vertical drain pipe, branching through the pipe segments extending from the horizontal pipes.



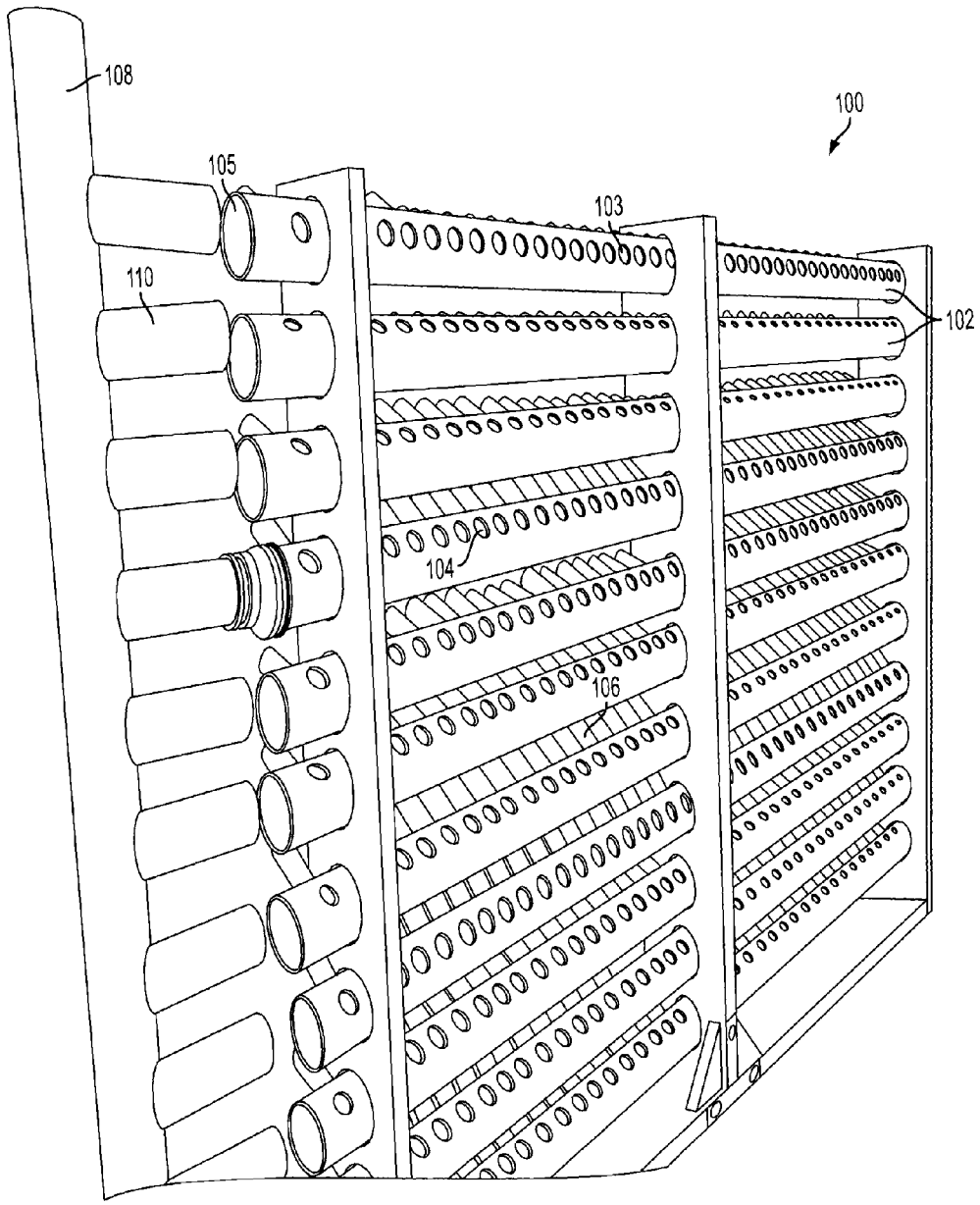


FIG. 1

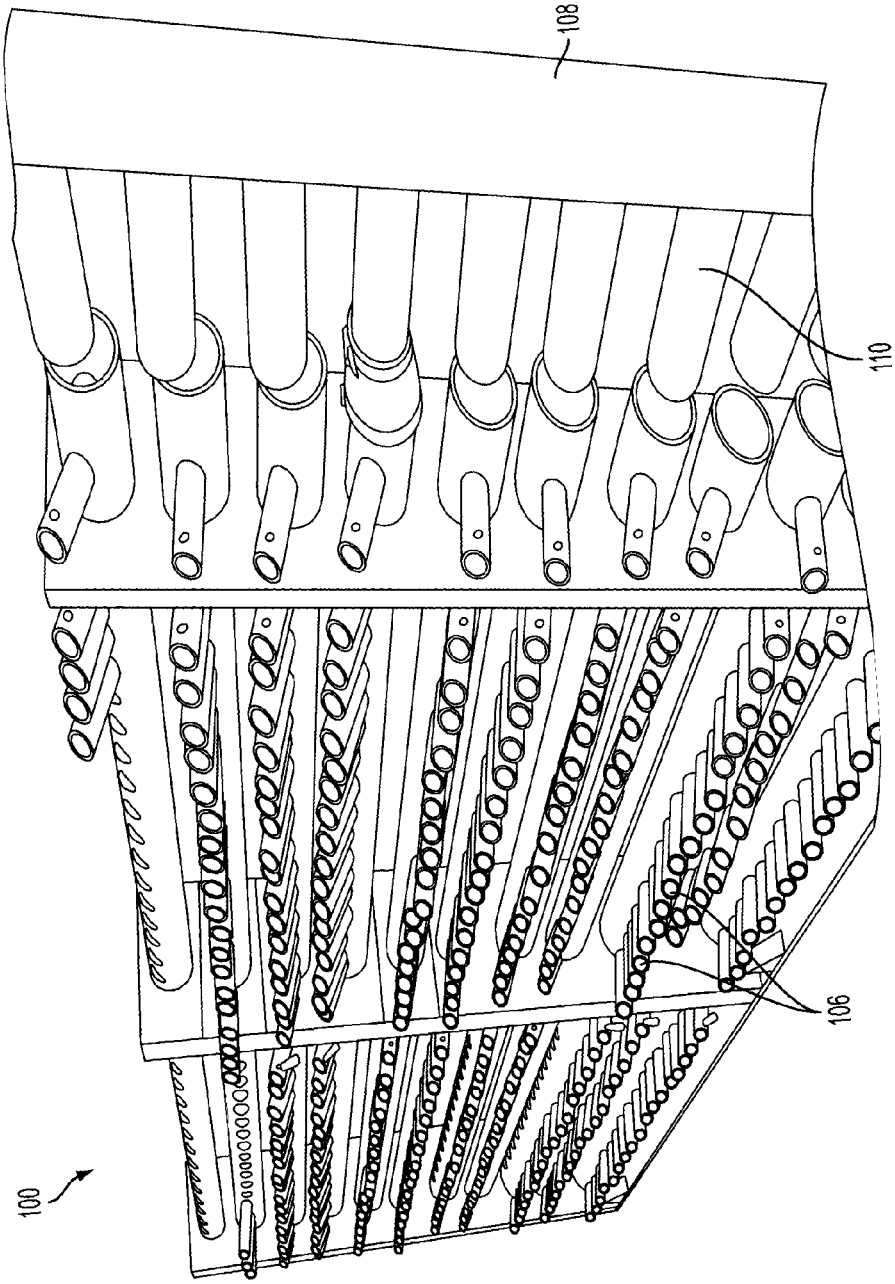


FIG. 2

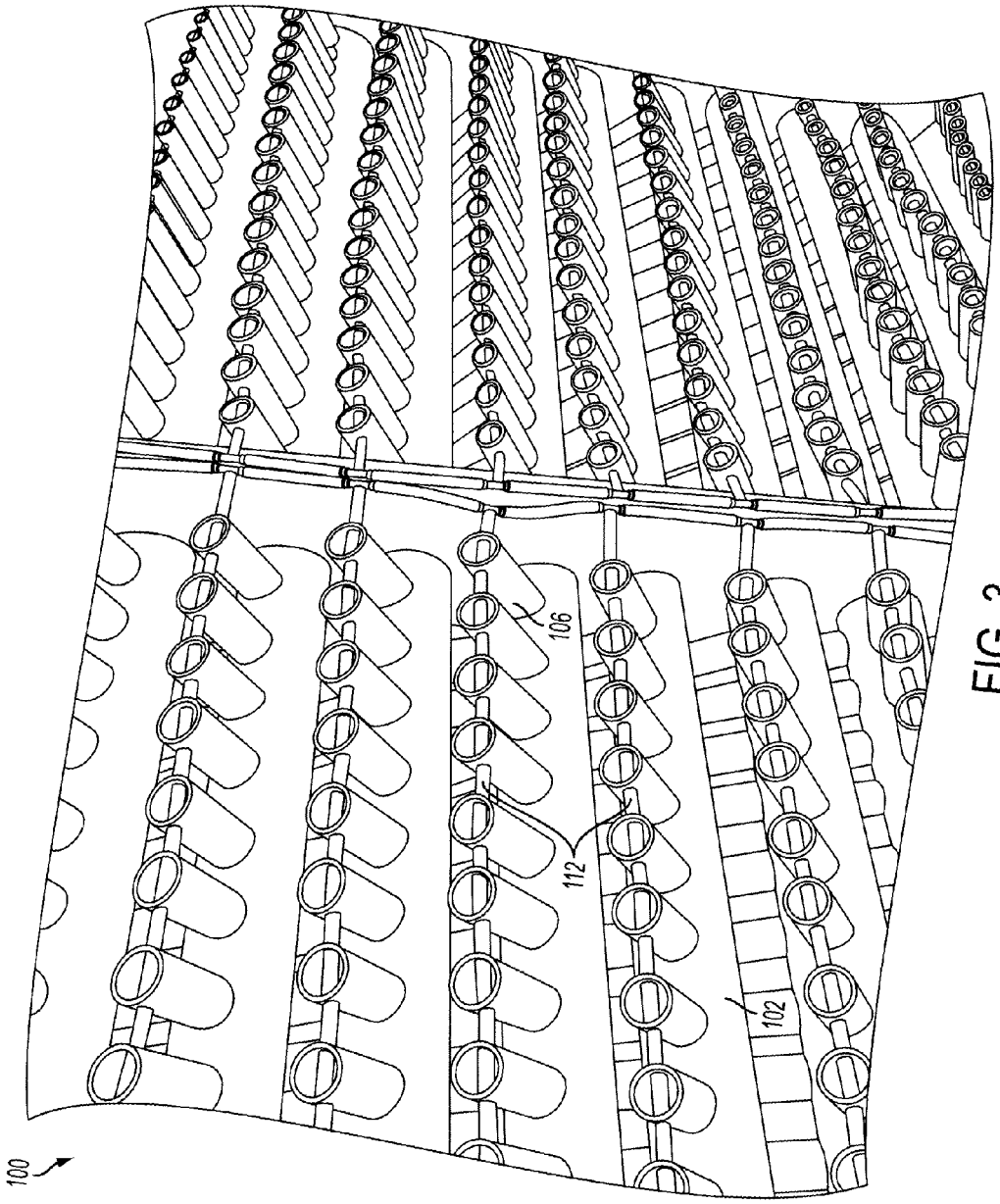


FIG. 3

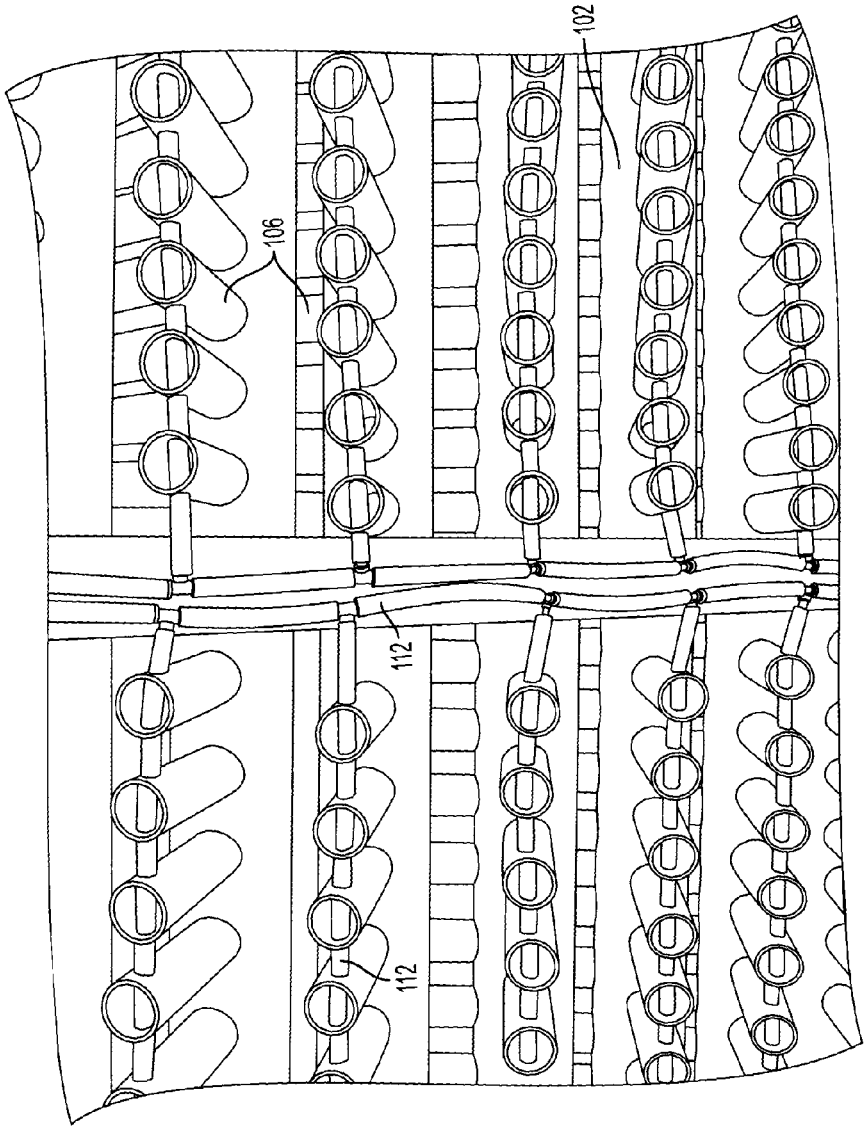


FIG. 4

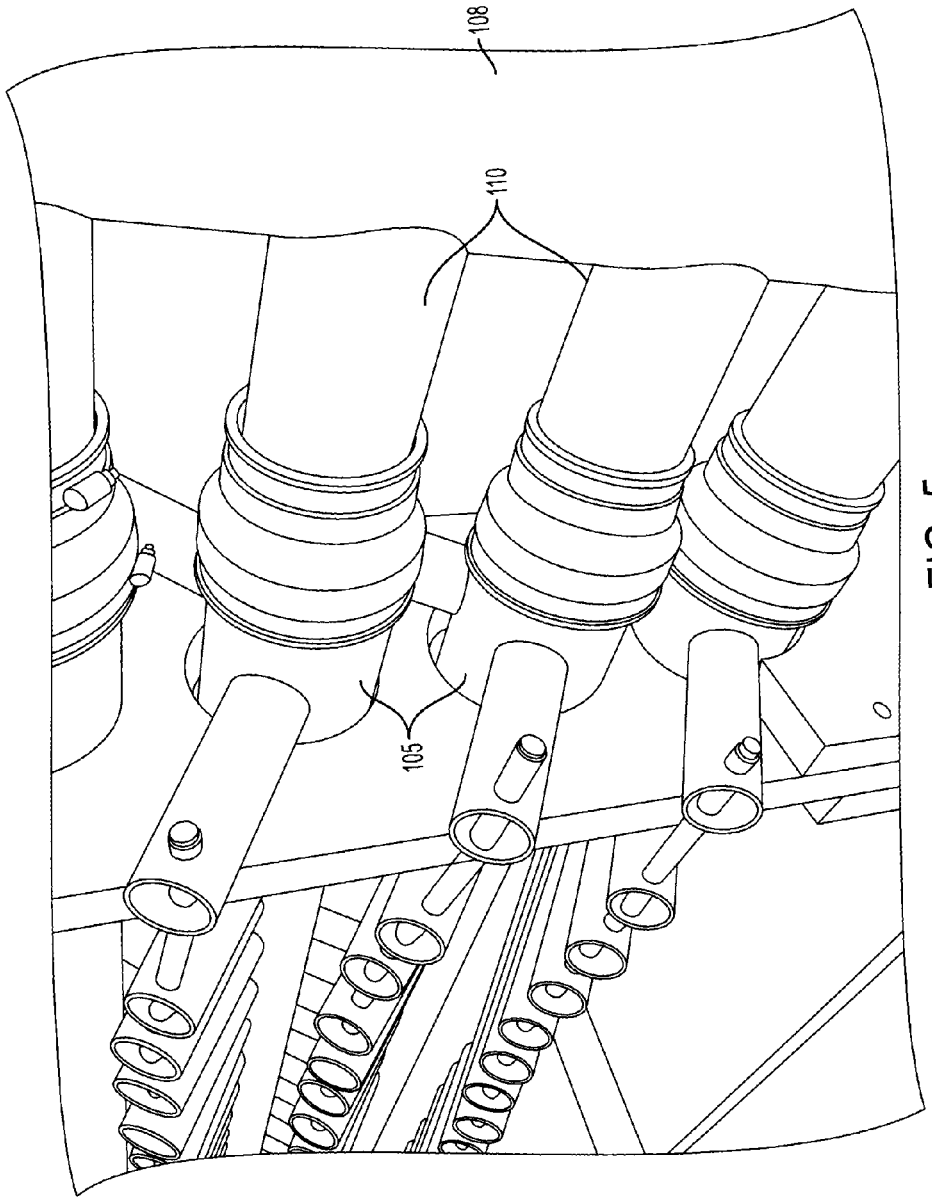


FIG. 5

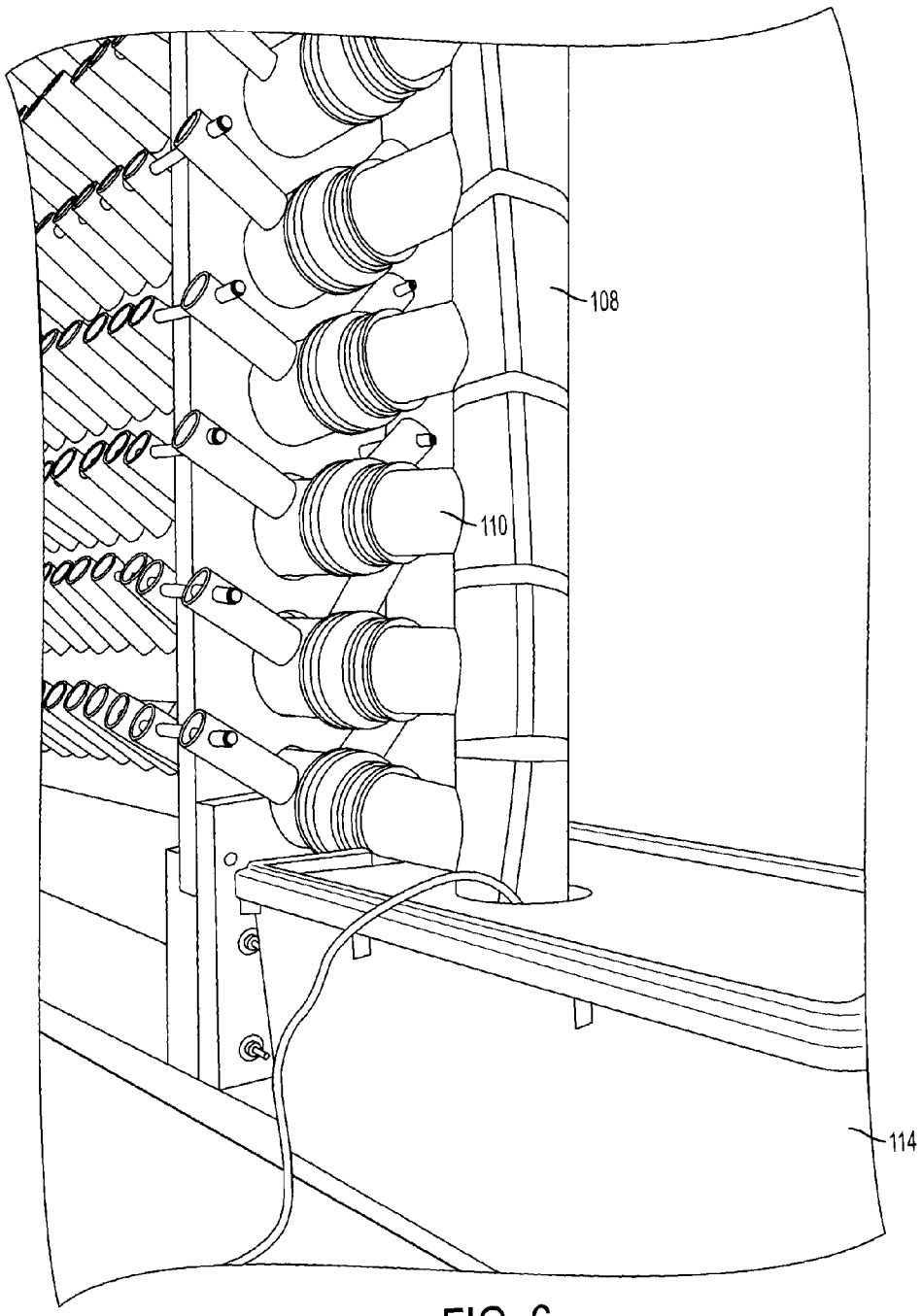


FIG. 6

HYDROPONIC GROWING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional App. No. 61/703,995, filed Sep. 21, 2012, the disclosure of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present application relates to a hydroponic system for growing crops, produce and other plants. The hydroponic system allows for the growth of a large volume of crops and can fit in a compact area. Further, the system provides for recycling of the nutrient-rich water used to feed the plant life.

BACKGROUND OF THE INVENTION

[0003] The field of hydroponics involves a method of growing plants without soil. The roots of the plants may be in solution supported with or without gravel, mineral wool, clay, and the like. Hydroponics has become very popular over the last century around the world because no soil is needed to grow plants, the system is highly controlled, which reduces nutrition pollution and pesticide damage, and crop yields are high.

[0004] A hydroponic system is needed that can allow for the growth of a large volume of plants and crops in a small space. Additionally, systems which optimize the recycling of nutrients are desirable.

SUMMARY OF THE INVENTION

[0005] Accordingly, the present invention relates to a hydroponic growing system comprising a plurality of parallel horizontal pipes, a vertical drain pipe and a plurality of nutrient-delivering tubes. The plurality of parallel horizontal pipes have opposite first and second ends, a plurality of openings along a length between the first and second ends on one side thereof through which crops grow, and a plurality of pipe segments extending angularly from an outer surface on an opposing side thereof. The vertical drain pipe has a plurality of angular pipe extensions along a length thereof. The pipe extensions mate with one of the first and second ends of the plurality of parallel horizontal pipes. The nutrient-delivering tubes have openings along a length thereof and extend from the vertical drain pipe and branch through the plurality of pipe segments. Each horizontal pipe is adapted to support crops that receive nutrients from the nutrient-delivering tubes, thereby producing crops in high density.

[0006] The present invention also relates to a method of growing crops using a hydroponic growing system, comprising the steps of providing a plurality of parallel horizontal pipes, a vertical drain pipe and a plurality of nutrient-delivering tubes. The plurality of parallel horizontal pipes have opposite first and second ends, a plurality of openings along a length between the first and second ends on one side thereof through which crops grow, and a plurality of pipe segments extending angularly from an outer surface on an opposing side thereof. The vertical drain pipe has a plurality of angular pipe extensions along a length thereof. The pipe extensions mate with one of the first and second ends of the plurality of parallel horizontal pipes. The nutrient-delivering tubes have openings along a length thereof and extend from the vertical drain pipe and branch through the plurality of pipe segments. Each horizontal pipe is adapted to support crops that receive nutrients from the nutrient-delivering tubes, thereby producing crops in high density. Crops are then placed in the horizontal pipes adjacent to said openings, the vertical drain pipe is filled with nutrient-enriched water, and the water is then pumped from the vertical drainpipe through the nutrient-delivering tubes. The water exits the openings in the nutrient-delivering tubes, feeds the crops, and then drains back to the vertical drain pipe through the angular pipe extensions and pipe segments for recycling.

[0007] Other objects, advantages and salient features of the invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

[0009] FIG. **1** is a front perspective view of a hydroponic growing system in accordance with an exemplary embodiment of the present invention;

[0010] FIG. **2** is a rear perspective view of the hydroponic growing system illustrated in FIG. **1**;

[0011] FIG. **3** is a rear perspective view of the hydroponic growing system illustrated in FIG. **1**;

[0012] FIG. **4** is a plan view of the hydroponic piping system in accordance with an exemplary embodiment of the present invention; and

[0013] FIG. **5** is a perspective view of the vertical drain in accordance with an exemplary embodiment of the present invention; and

[0014] FIG. **6** is a perspective view of the vertical drain and reservoir in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0015] Hydroponic systems where the roots of the plants are sustained only in solution are known as solution cultures. Within the category of solution cultures, there are three different types of systems: static solution cultures, continuous-flow solution cultures, and aeroponics. In a continuous-flow solution culture, the nutrient-rich solution constantly flows past the roots, which requires some automation, but allows for adjustments to the temperature and composition of the solution.

[0016] Referring to FIGS. **1-6**, the hydroponic growing system **100** of the present invention is a continuous-flow solution culture that generally comprises a plurality of parallel horizontal pipes **102**, a vertical drain pipe **108** and a plurality of nutrient-delivering tubes **112**. The horizontal pipes **102** are adapted such that they house the crops or plants which are to be grown in the system. The crops or plants are grown from seed in a support structure, e.g., a starter tray, and when they reach approximately four inches in height, they are transferred to the horizontal pipes **102**. The vertical drain pipe **108** allows for the recycling of nutrient-enriched water, which is supplied to the crops via the nutrient-delivering tubes **112**. The entire system is preferably designed to fit into a small footprint, such as a 12 foot×12 foot area, and provides for the

high-density growth of crops, e.g., up to 850 small crops, such as bell peppers, tomatoes, cucumbers, zucchini, squash and the like.

[0017] As seen in FIGS. **1-2** and **5**, the horizontal pipes **102** have opposite first and second ends **103** and **105**, respectively, and a plurality of openings **104** along a length between the first and second ends **103** and **105** on one side. The horizontal pipes **102** may be substantially cylindrical. The crops grow inside of the horizontal pipes **102** and extend outward through the openings **104**. A plurality of pipe segments **106** extend angularly, preferably substantially perpendicularly, from an outer surface on an opposing side of the horizontal pipes **102**. As seen in FIG. **5**, the vertical drain pipe **108** is situated adjacent to the second ends **105** of the horizontal pipes **102** and has a plurality of angular pipe extensions **110** along a length thereof. The angular pipe extensions **110** mate with the second ends **105** of the horizontal pipes **102**.

[0018] As seen in FIGS. **3** and **4**, a plurality of nutrient-delivering tubes **112** having openings along a length thereof branch through a portion of the plurality of pipe segments **106** extending from the horizontal pipes **102**. The nutrient-delivering tubes **112** preferably extend from the base of the vertical drain pipe **108**, where they receive recycled nutrient-enriched water. As depicted in FIG. **4**, the nutrient-delivering tubes **112** are fed through opposing circular openings on the pipe segments **106**, which hold the nutrient-delivering tubes **112** in place.

[0019] As the nutrient-enriched water flows through the nutrient-delivering tubes **112**, it exits through the openings in the nutrient-delivering tubes **112**, flows down the pipe segments **106** to the crops and provides nutrients for their growth. The depleted water then drains through the remaining portion of the pipe segments **106**, which are coupled to adjacent horizontal pipes **102**, and then drains through the horizontal pipes **102** returning back to the vertical drain pipe **108**. As shown in FIG. **5**, the nutrient-delivering tubes **112** may be capped at their ends such that there is no escape of the nutrient-enriched water from the hydroponic growing system **100**. The horizontal pipes may be slanted to help the depleted water flow back to the vertical drain pipe **108** to be recycled. As seen in FIG. **6**, the hydroponic growing system **100** may have a reservoir **114** in which the nutrient-enriched water is stored. The depleted water may also drain back to the reservoir **114**. The system may also comprise a water pump coupled to one of the nutrient-delivering tubes to provide adequate water pressure.

[0020] As seen in FIGS. **1-2**, the hydroponic growing system **100** may have a plurality of parallel vertical support members, which have a plurality of openings along their length. The openings receive the first and second ends **103** and **105** of the horizontal pipes **102**, and the second end **105** of the horizontal pipes **102** extend through the openings of one of the vertical support members.

[0021] As seen in FIG. **4**, the nutrient-delivering tubes **112** may extend vertically up one of the parallel vertical support members before branching through the pipe segments **106**. The system may also have a horizontal support member coupled to the bottom end of each of the plurality of vertical support members. The vertical and horizontal support members may be slanted to aid in the recycling of the depleted water.

[0022] The method of growing crops in a hydroponic system **100** comprises a first step of placing young crops in the horizontal pipes **102** adjacent to the openings **104** in the horizontal pipes **102**. The vertical drain pipe **108** is then filled with nutrient-enriched water, which is pumped through the nutrient-delivering tubes **112**. The nutrient-enriched water exits the nutrient-delivering tubes **112** through the openings on the nutrient-delivering tubes **112** and feeds the crops by draining down the pipe segments **106** extending from the horizontal pipes **102**. The depleted water then drains back to the vertical drain pipe **108**, going through the pipe segments **106** and horizontal pipes **102**, through the angular pipe extensions **110**, and back into the vertical drain pipe **108** where it is recycled.

[0023] While particular embodiments have been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A hydroponic growing system comprising:

a plurality of parallel horizontal pipes each having opposite first and second ends, a plurality of openings along a length between said first and second ends on one side thereof through which crops grow, and a plurality of pipe segments extending angularly from an outer surface on an opposing side thereof;

a vertical drain pipe having a plurality of angular pipe extensions along a length thereof, said pipe extensions mating with one of said first and second ends of said plurality of parallel horizontal pipes; and

a plurality of nutrient-delivering tubes having openings along a length thereof and extending from said vertical drain pipe and branching through said plurality of pipe segments,

wherein each of said horizontal pipes being adapted to support crops that receive nutrients from said nutrient-delivering tubes, thereby producing crops in high density.

2. A hydroponic growing system according to claim **1**, further comprising:

a plurality of parallel vertical support members having a plurality of circular openings along a length; and

at least one horizontal support member coupled to a bottom end of each of said plurality of vertical support members,

wherein each of said opposing ends of said horizontal pipes rests within said circular openings of said parallel vertical support members, and at least one end of said horizontal pipes extends through said circular openings.

3. A hydroponic growing system according to claim **1**, wherein

said horizontal pipes are substantially cylindrical.

4. A hydroponic growing system according to claim **1**, wherein

said plurality of nutrient-delivering tubes extend vertically up one of said plurality of parallel vertical support members.

5. A hydroponic growing system according to claim **1**, further comprising

a reservoir for storing said nutrient-enriched water.

6. A hydroponic growing system according to claim **1**, further comprising

a water pump coupled to one of said plurality of nutrient-delivering tubes.

7. A hydroponic growing system according to claim **1**, wherein

said plurality of pipe segments have opposing circular openings at one end to receive said nutrient-delivering tubes.

8. A hydroponic growing system according to claim **1**, wherein

a portion of said plurality of pipe segments are coupled to adjacent said horizontal pipes.

9. A hydroponic growing system according to claim **1**, wherein

said nutrient-delivering tubes include nutrient-enriched water.

10. A hydroponic growing system according to claim **1**, wherein

said angular pipe extensions on said vertical drain pipe are perpendicular.

11. A hydroponic growing system according to claim **1**, wherein

said horizontal pipes and said vertical and horizontal support members are slanted to allow for reuse of said nutrient-enriched water.

12. A method of growing crops using a hydroponic growing system, comprising the steps of:

providing,

a plurality of parallel horizontal pipes each having opposite first and second ends, a plurality of openings along a length between said first and second ends on one side thereof, and a plurality of pipe segments extending angularly from an outer surface on an opposing side thereof;

a vertical drain pipe having a plurality of angular pipe extensions along a length thereof, said pipe extensions mating with one of said first and second ends of said plurality of parallel horizontal pipes; and

a plurality of nutrient-delivering tubes having openings along a length thereof and extending from said vertical drain pipe and branching through said plurality of pipe segments,

wherein each of said horizontal pipes being adapted to support crops that receive nutrients from said nutrient-delivering tubes, thereby producing crops in high density;

placing said crops in said horizontal pipes adjacent to said openings;

filling said vertical drain pipe with nutrient-enriched water; and

pumping said nutrient-enriched water from said vertical drain pipe through said nutrient-delivering tubes,

whereby water exits said openings in said nutrient-delivering tubes, feeds crops, and drains back to said vertical drain pipe through said horizontal pipes and said pipe segments for recycling.

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