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Williams et al.

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(45) **Date of Patent: Jun. 26, 2018**

(54) **GROWING SYSTEM**

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(73) Assignee: **Apex Farms Corp.**, Wilmington, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days. days.

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Related U.S. Application Data

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(51) **Int. Cl.**

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A01G 31/06	(2006.01)
A01G 1/00	(2006.01)
A01G 22/00	(2018.01)

(52) **U.S. Cl.**

CPC ***A01G 31/06*** (2013.01); *A01G 1/001* (2013.01); *A01G 22/00* (2018.02); *A01G 2031/006* (2013.01)

(58) **Field of Classification Search**

CPC A01G 31/06; A01G 31/02; A01G 31/00

See application file for complete search history.

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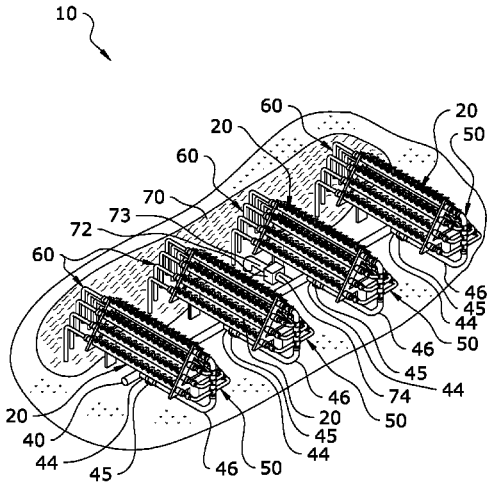
(57) **ABSTRACT**

A growing system for providing fluids to a plurality of growing assemblies using only a single pump and fluid source. The growing system generally includes a single fluid source such as a reservoir from which fluids are drawn by a single pump. A main manifold connected to the pump outlet splits the fluids drawn from the fluid source into a plurality of feeder pipes. Each of the feeder pipes provides fluid to a separate growing assembly; with the present invention providing support for a plurality of growing assemblies. Each growing assembly comprises an inlet manifold for receiving the fluids, a plurality of growing pipes for providing the fluids to a plurality of planters, and a drainage device for discharging fluids back into the fluid source for further use.

17 Claims, 19 Drawing Sheets



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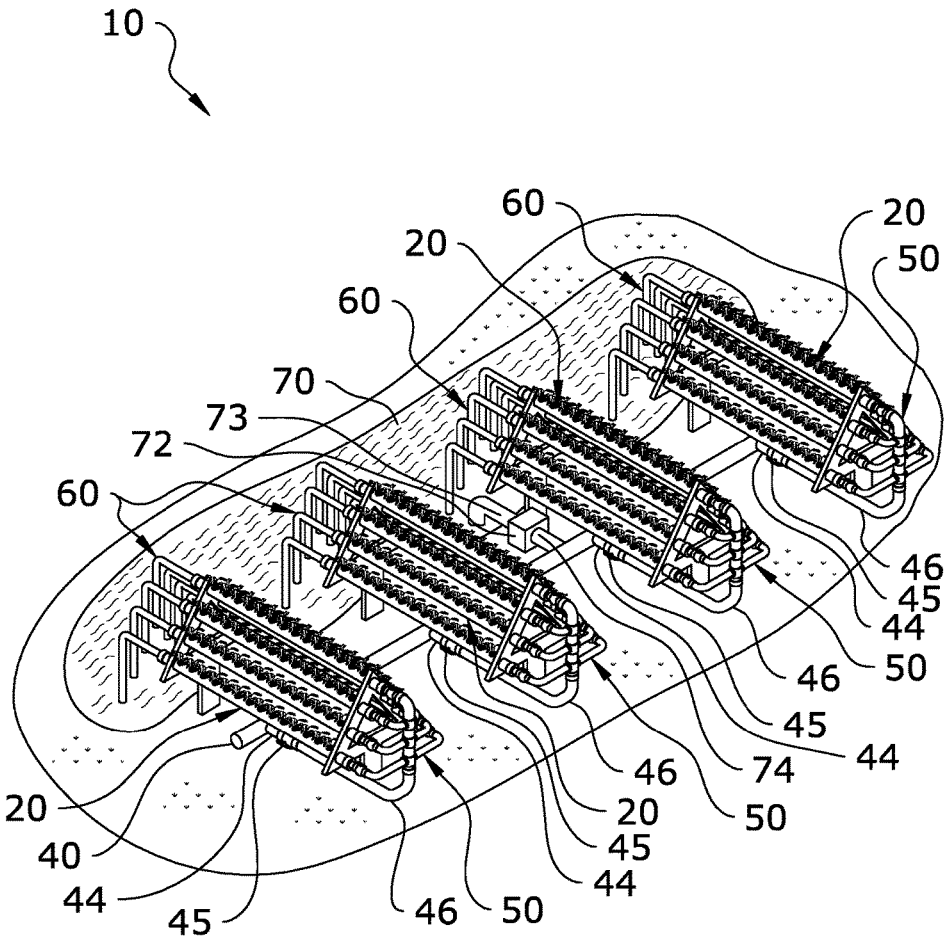
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FIG. 1

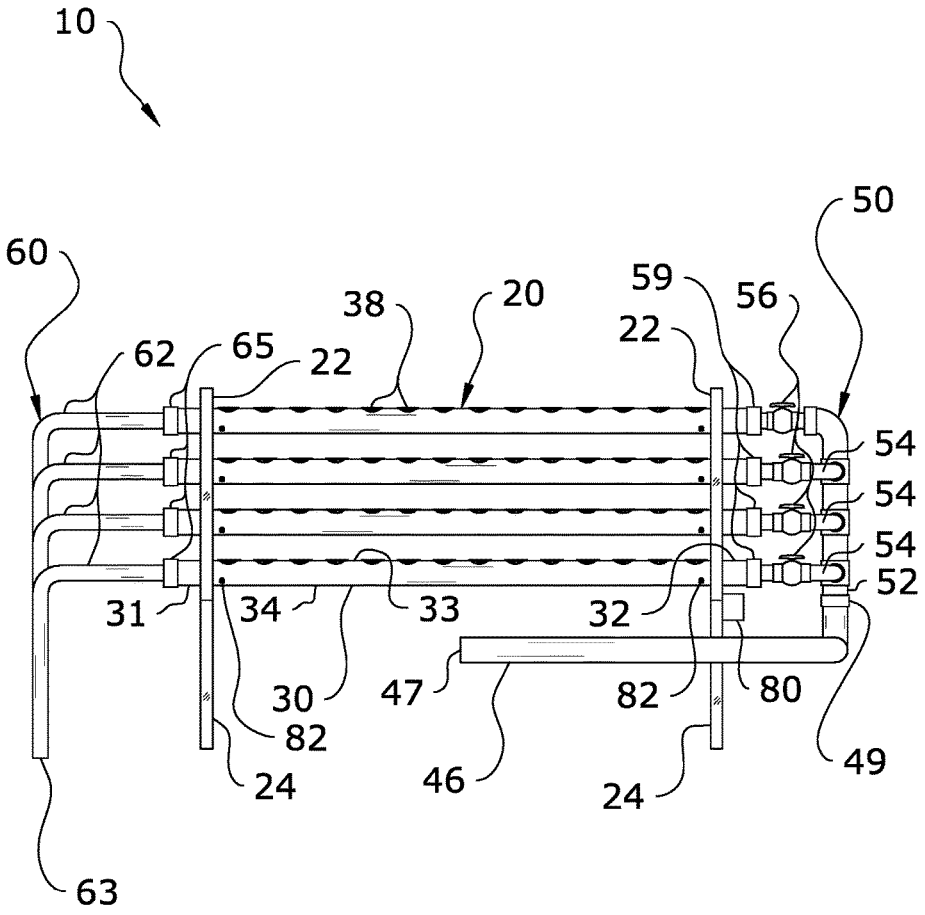
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FIG. 2

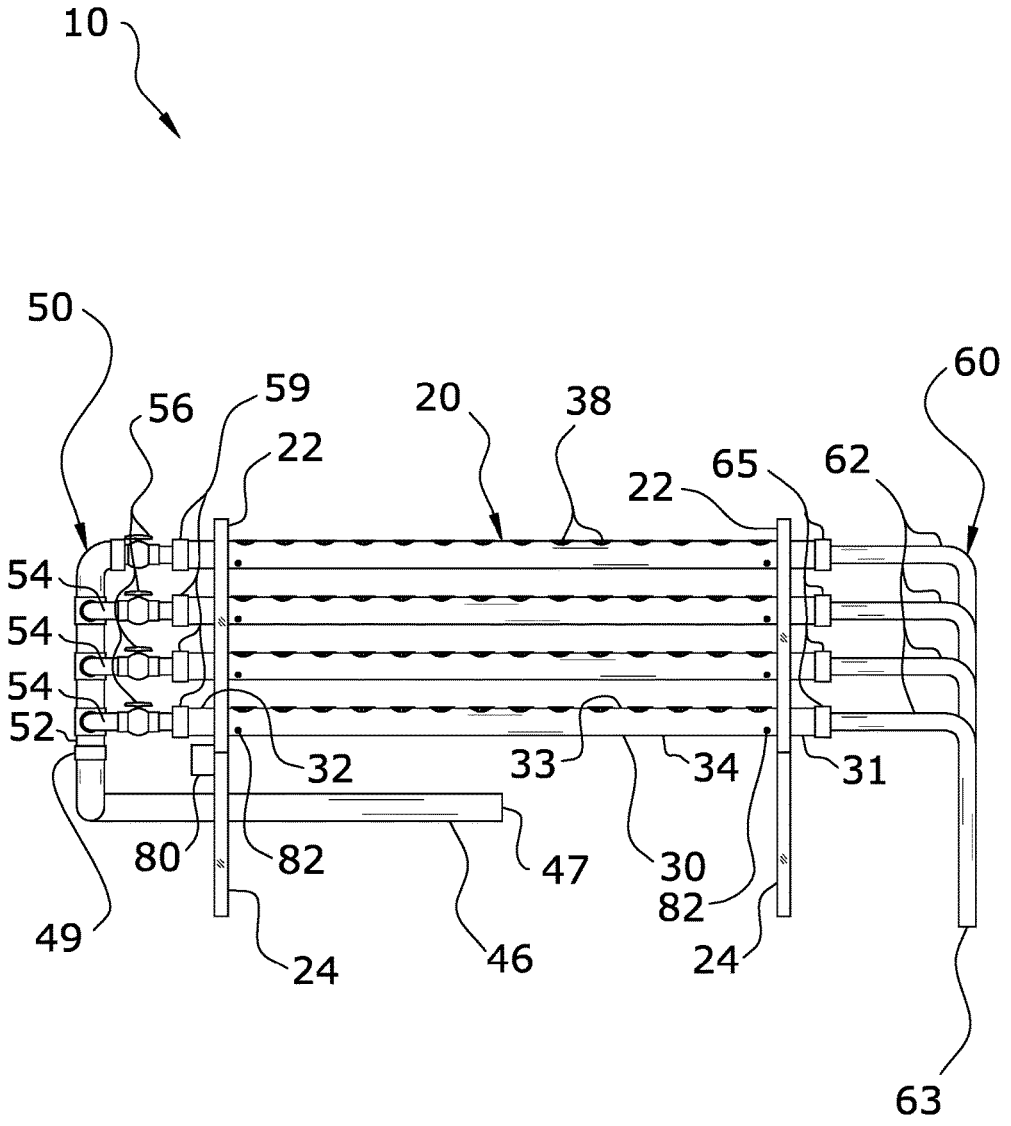
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FIG. 3

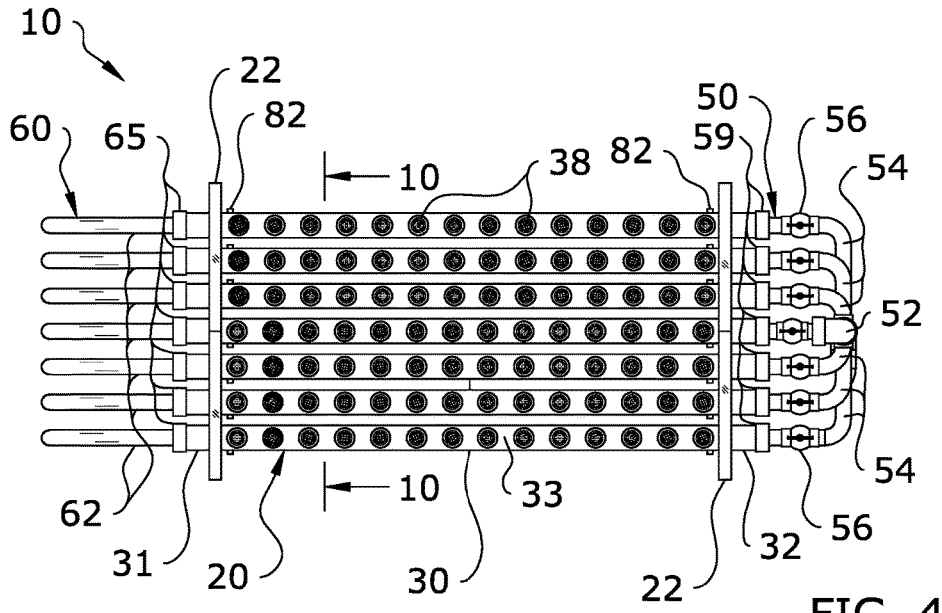
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FIG. 4

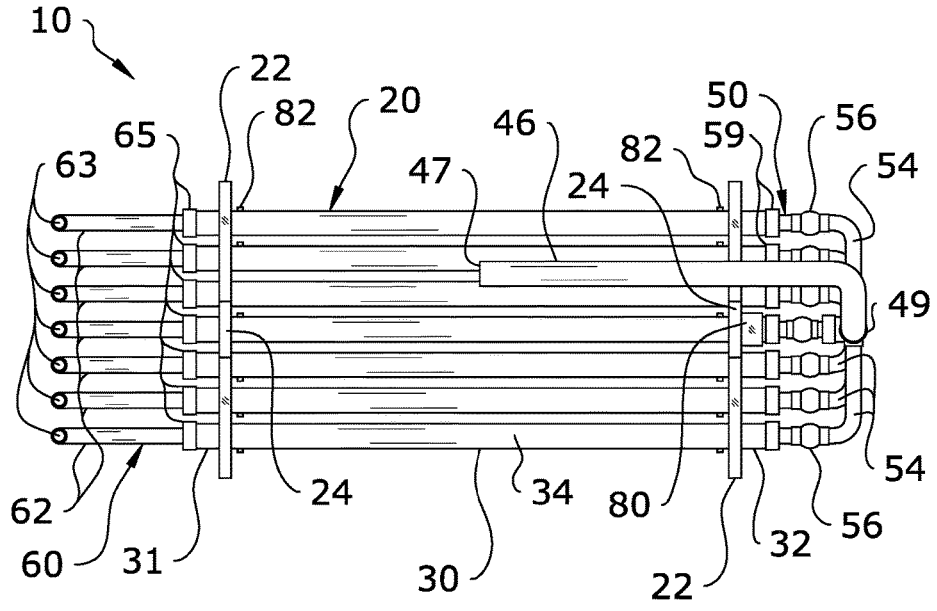
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FIG. 5

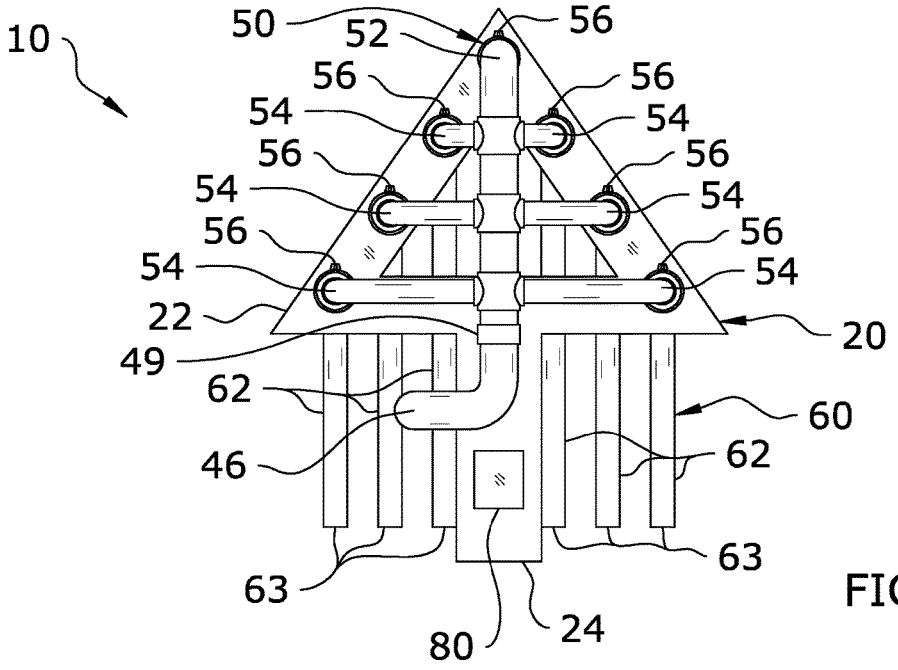
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FIG. 6

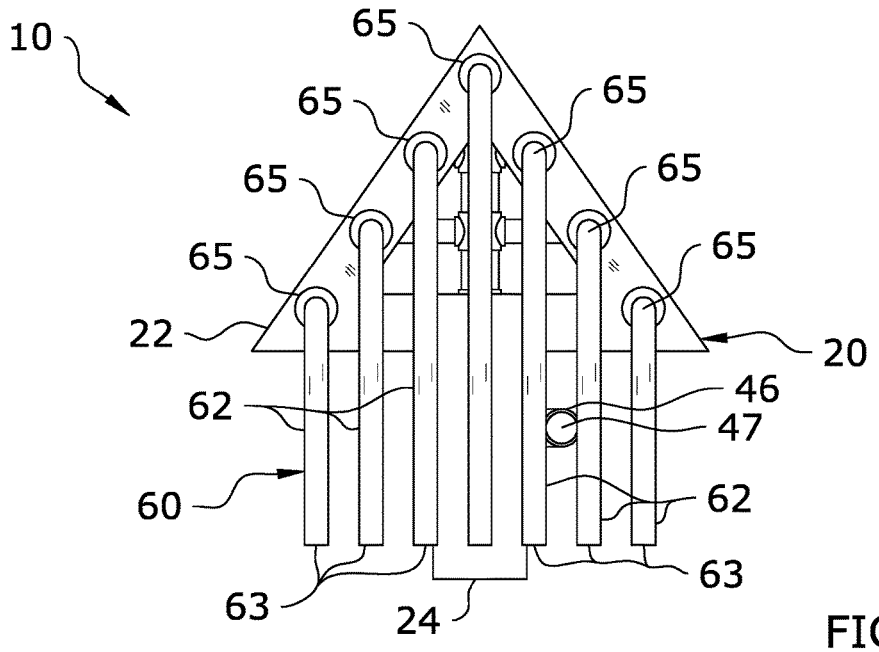
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FIG. 7

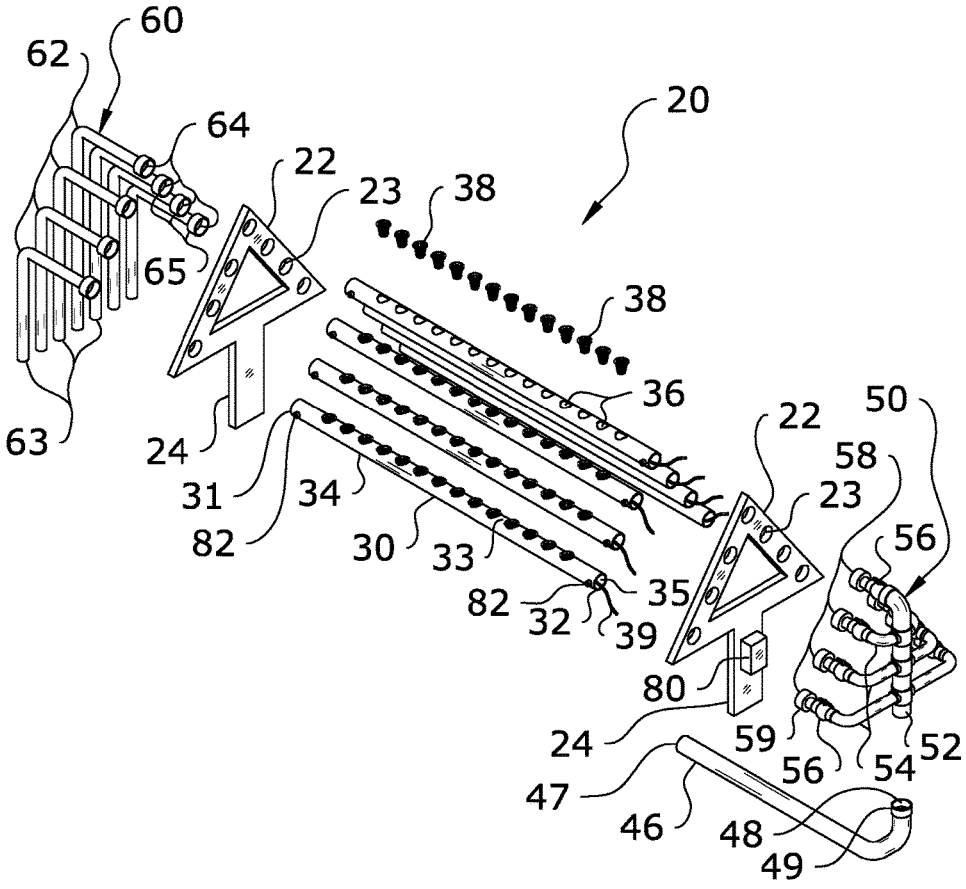
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FIG. 8

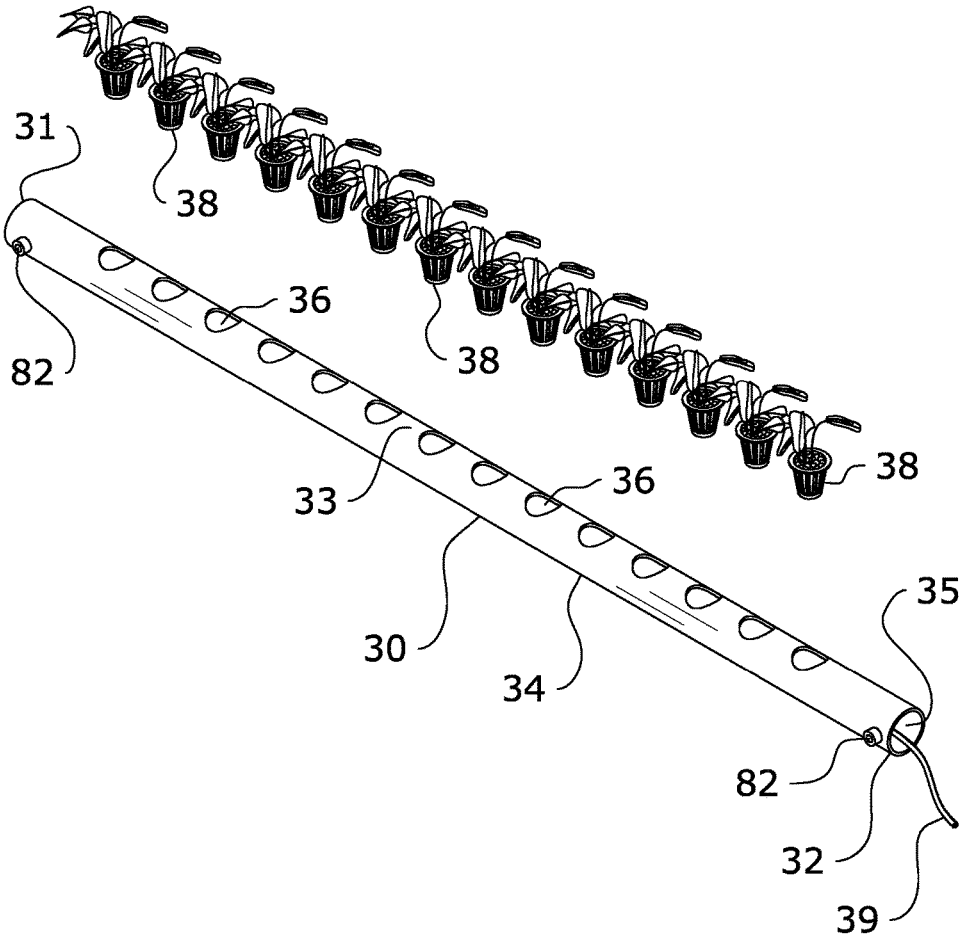

FIG. 9

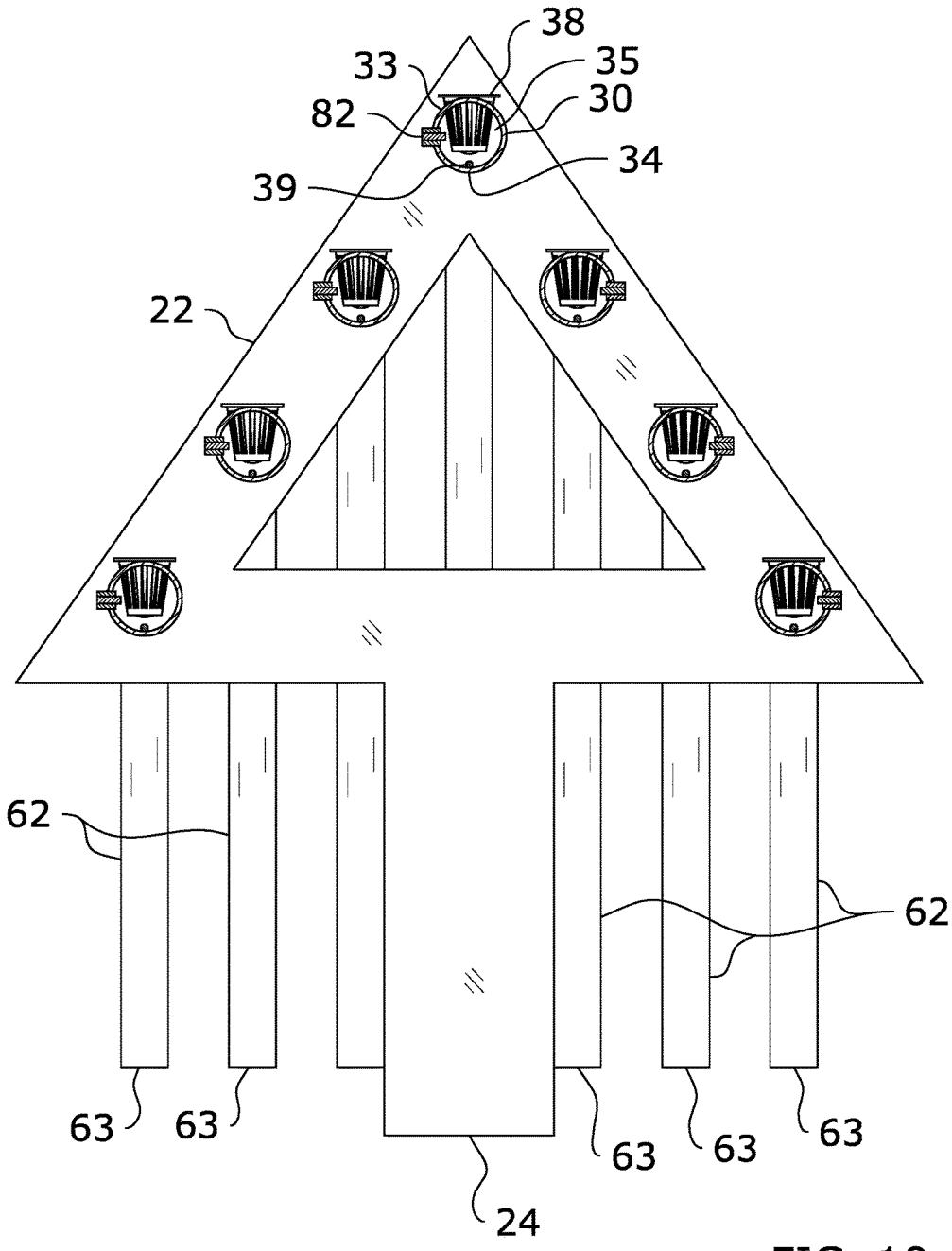

FIG. 10

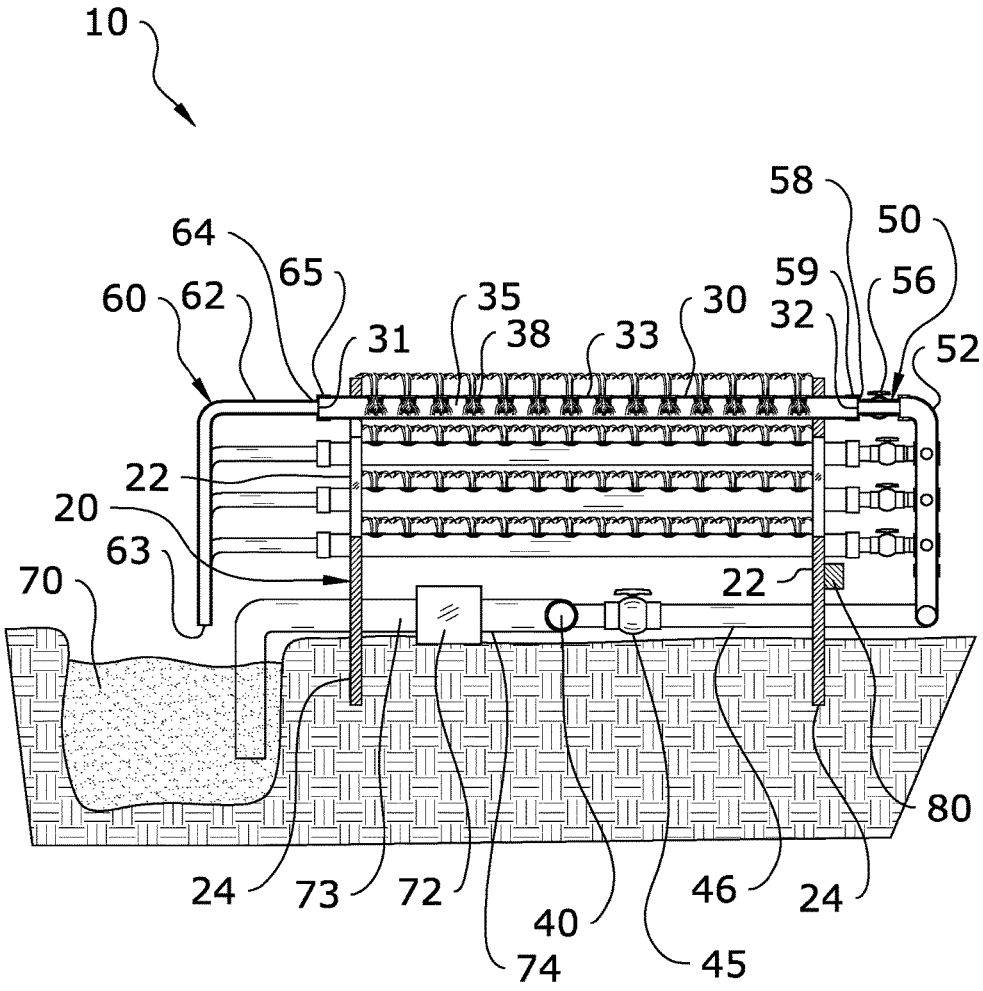
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FIG. 11

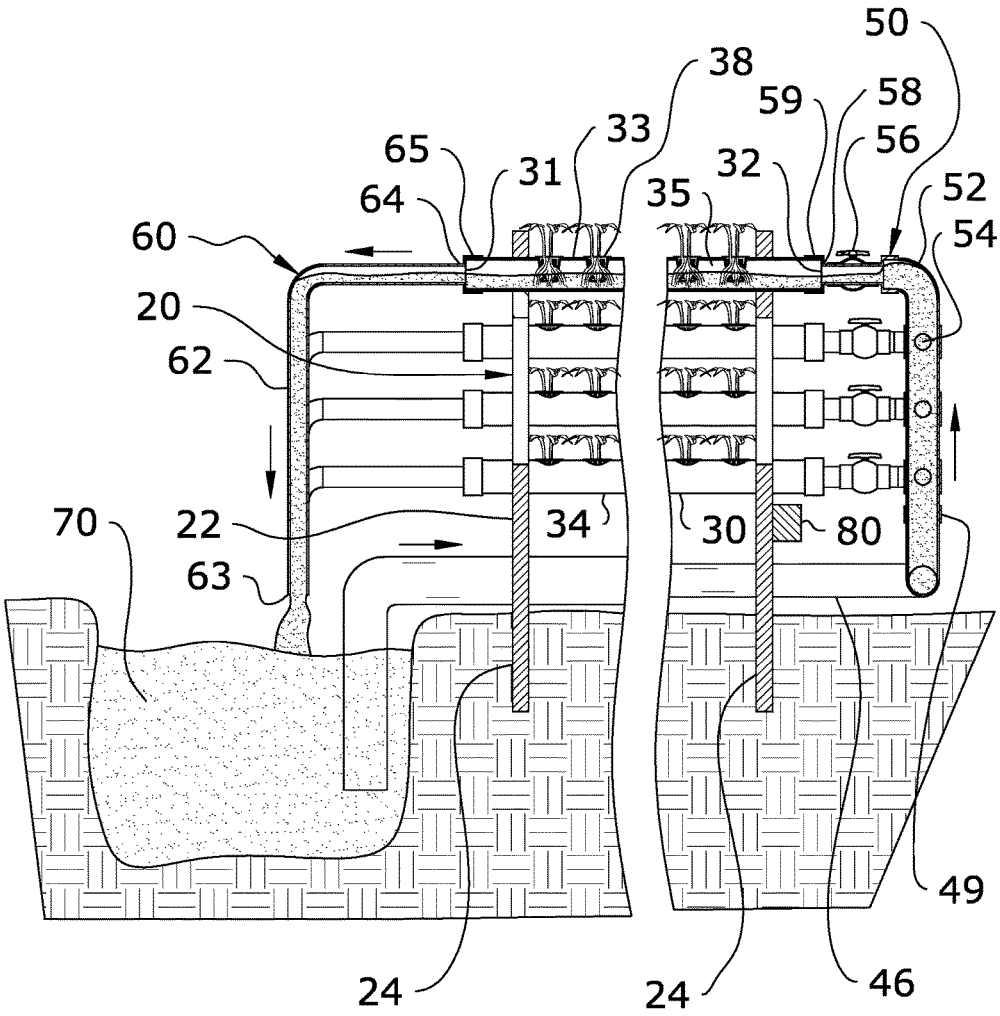
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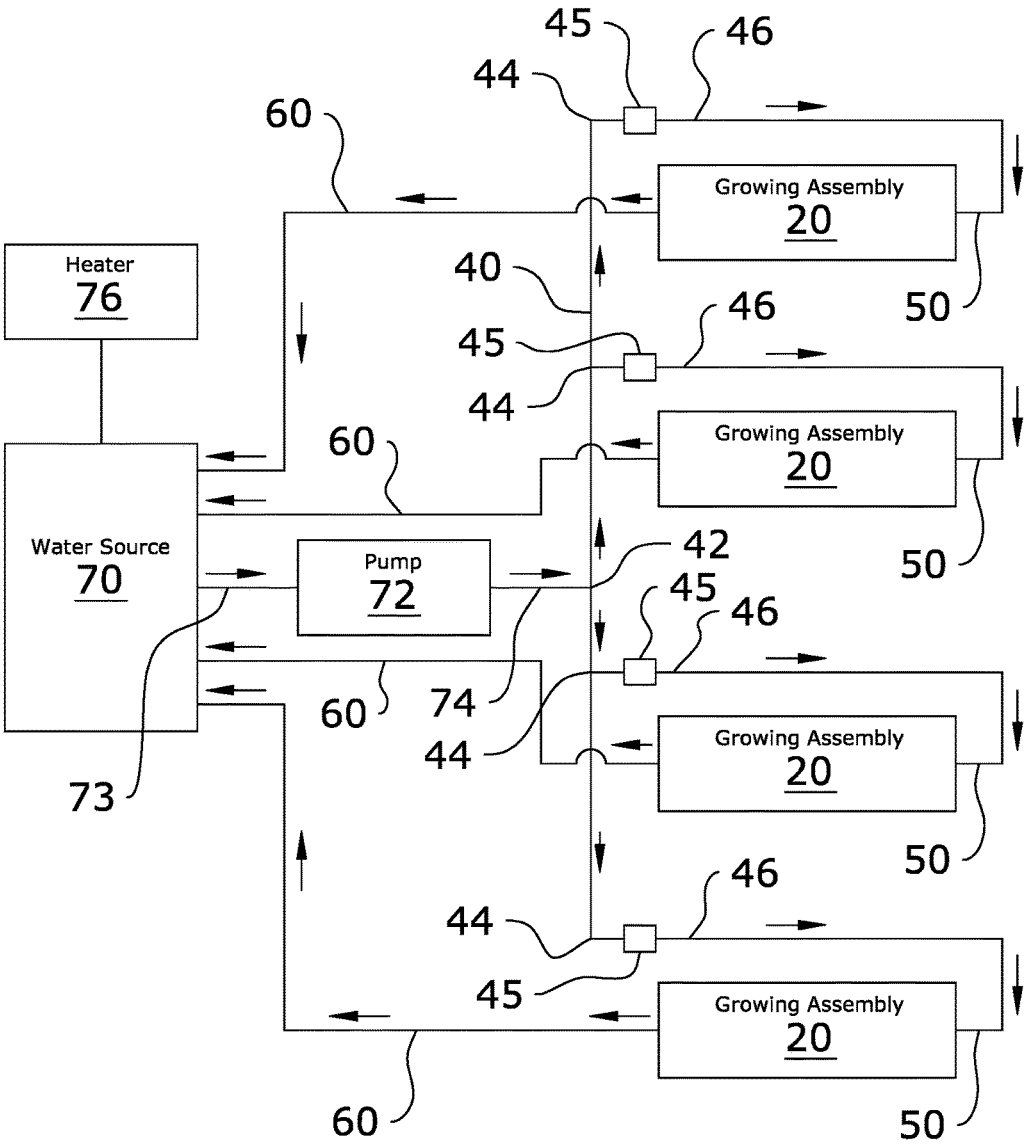
FIG. 12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Growing Assembly
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Heater
76
40
50
45
46
44
Growing Assembly
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60
Water Source
70
Pump
72
42
50
45
46
60
74
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Growing Assembly
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Growing Assembly
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60
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FIG. 13

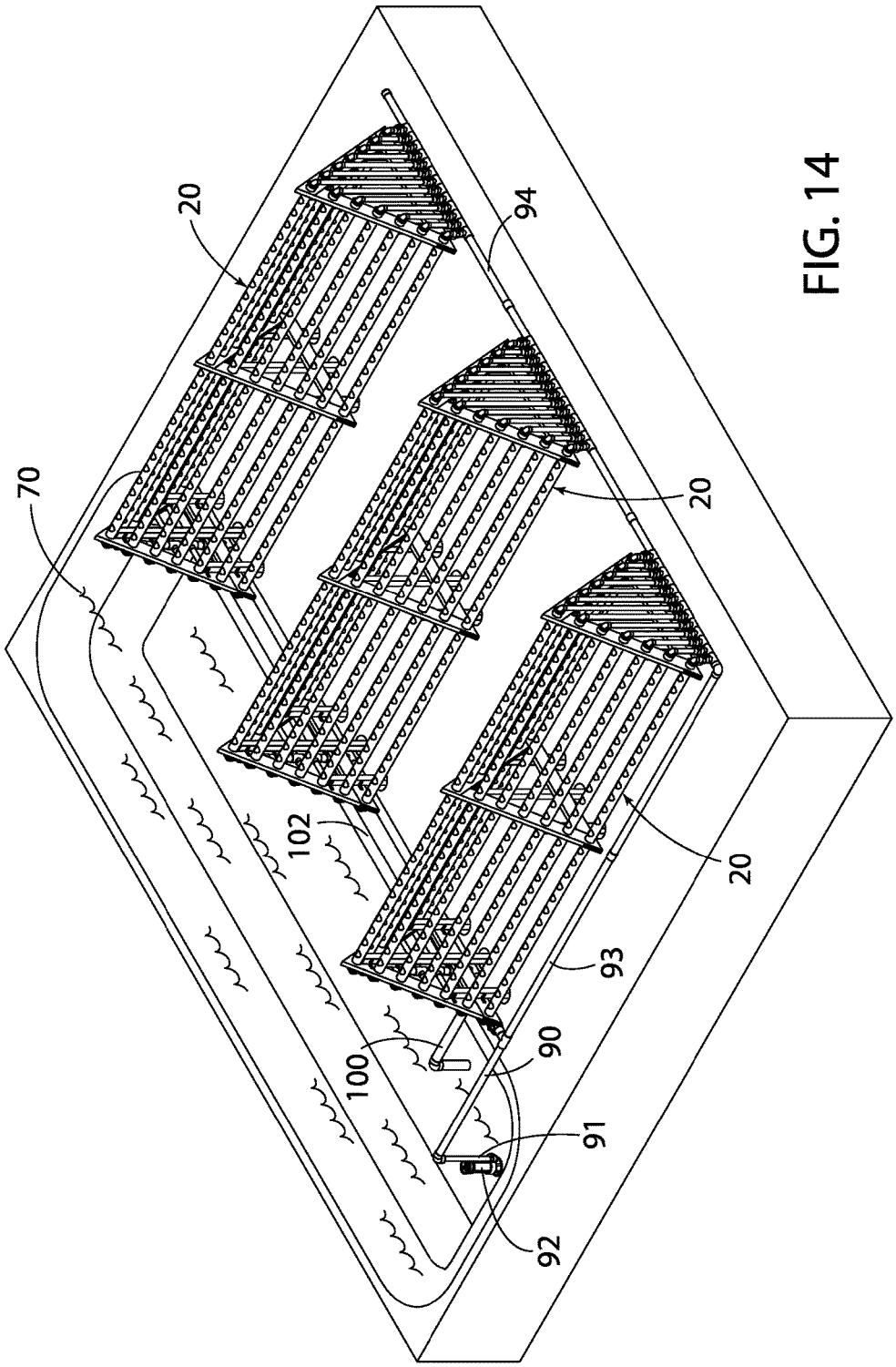
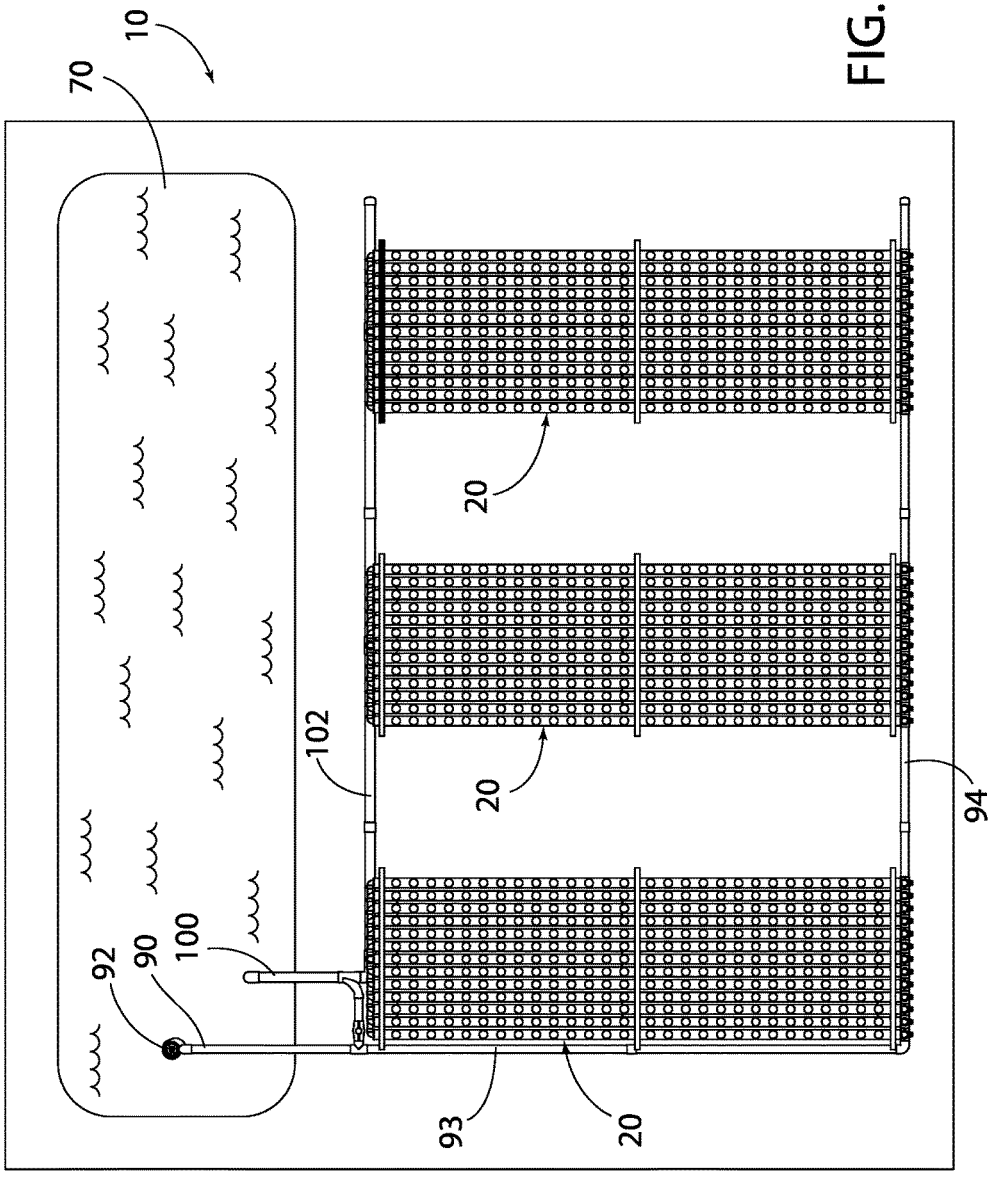


FIG. 14

FIG. 15



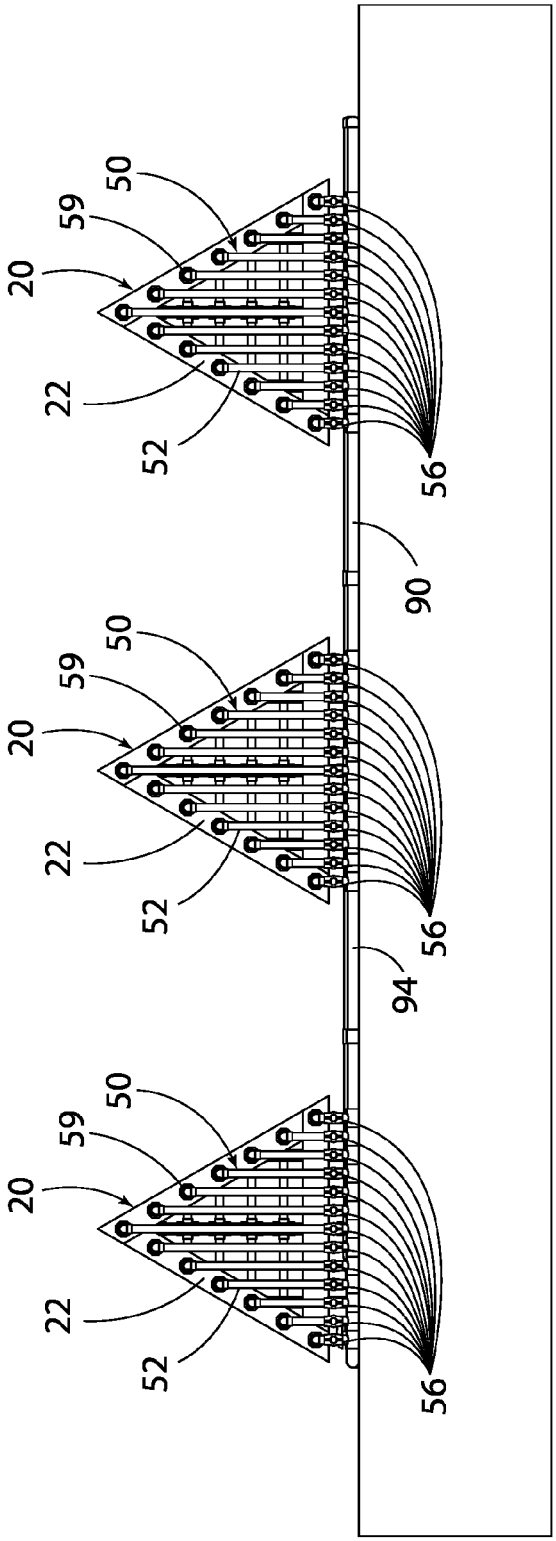


FIG. 16

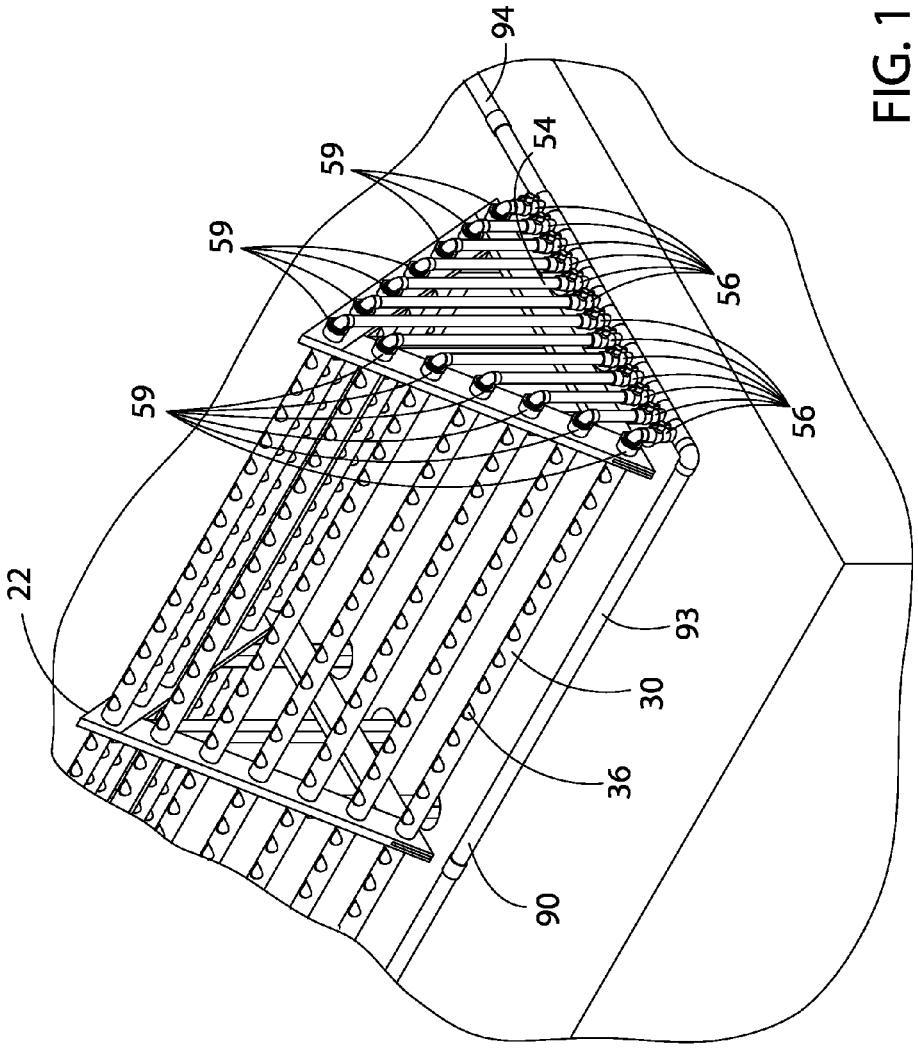


FIG. 17

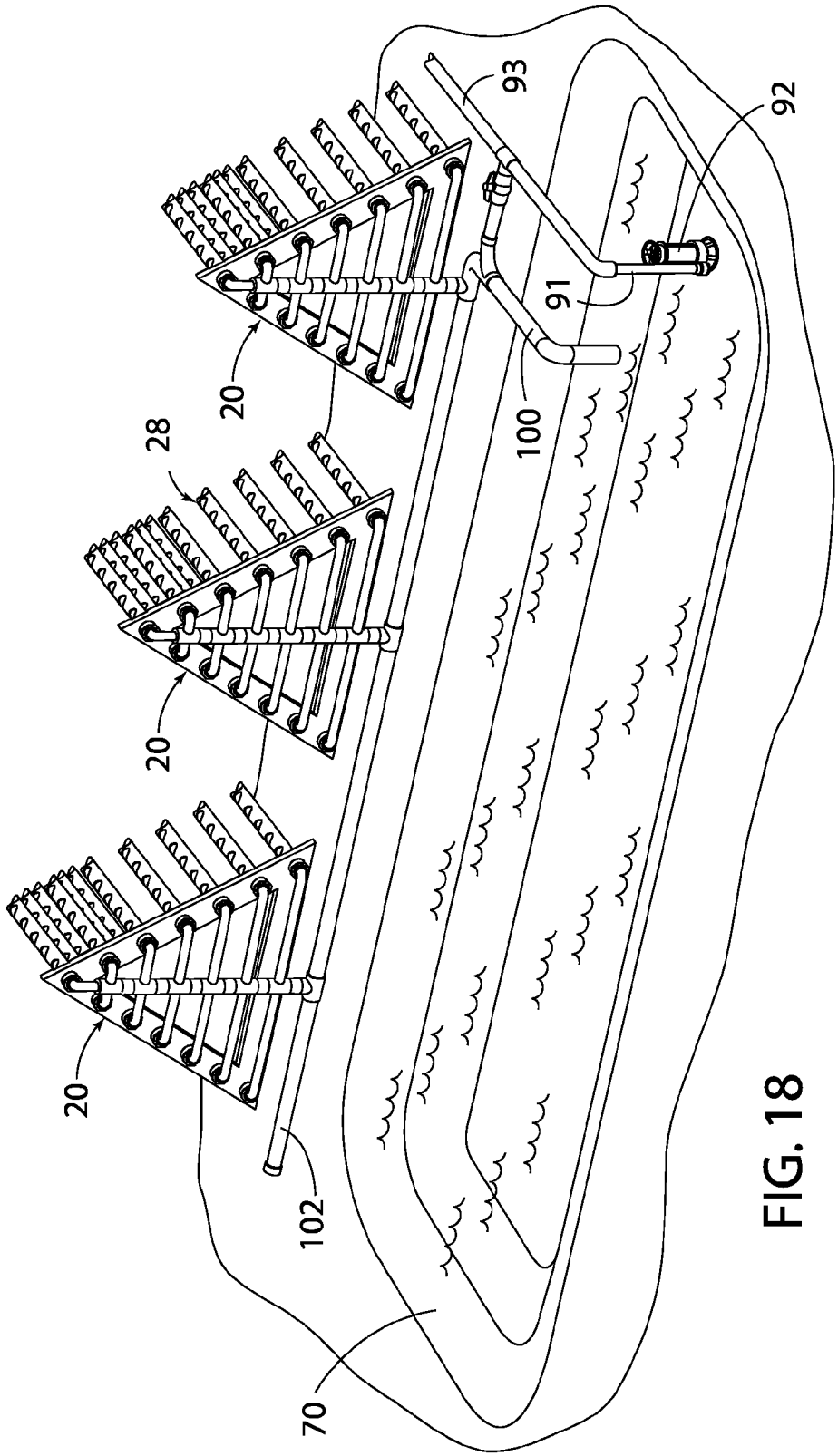


FIG. 18

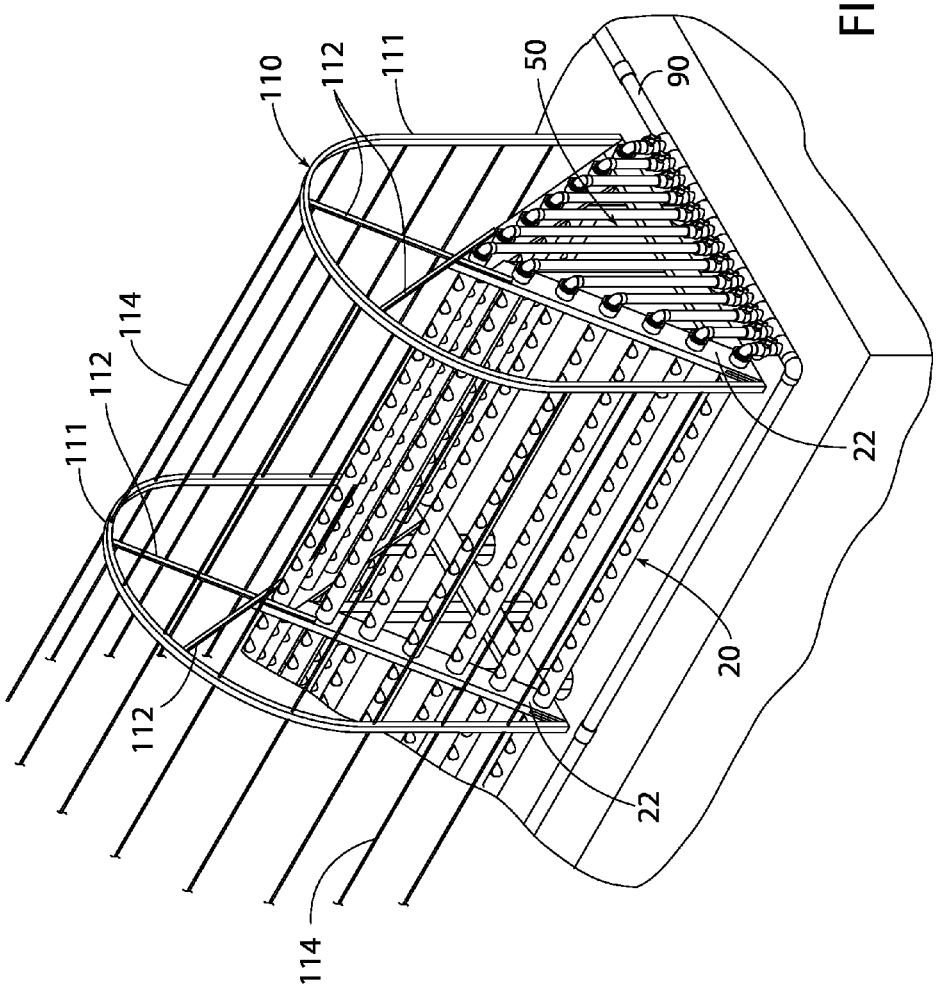


FIG. 19

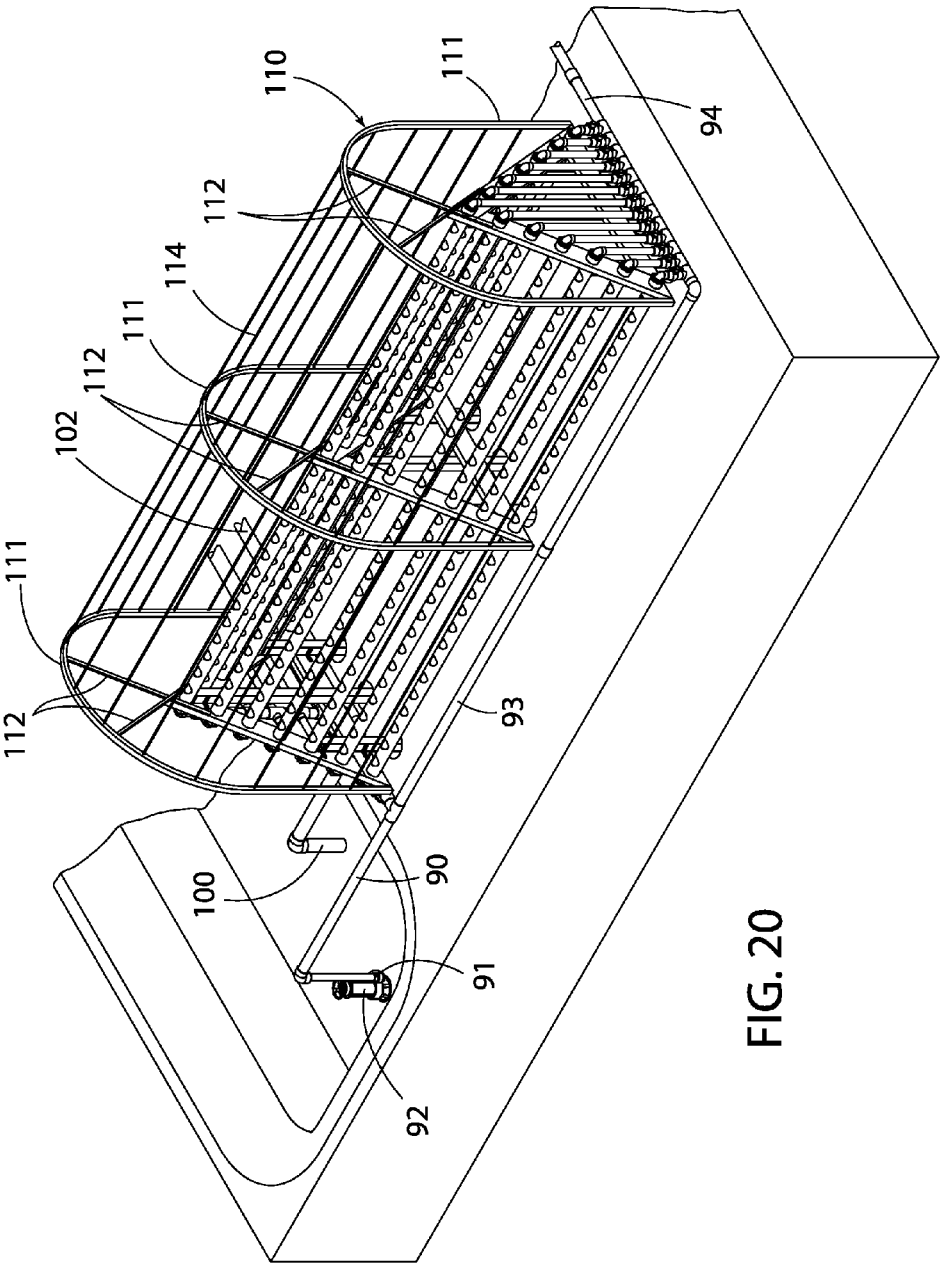


FIG. 20

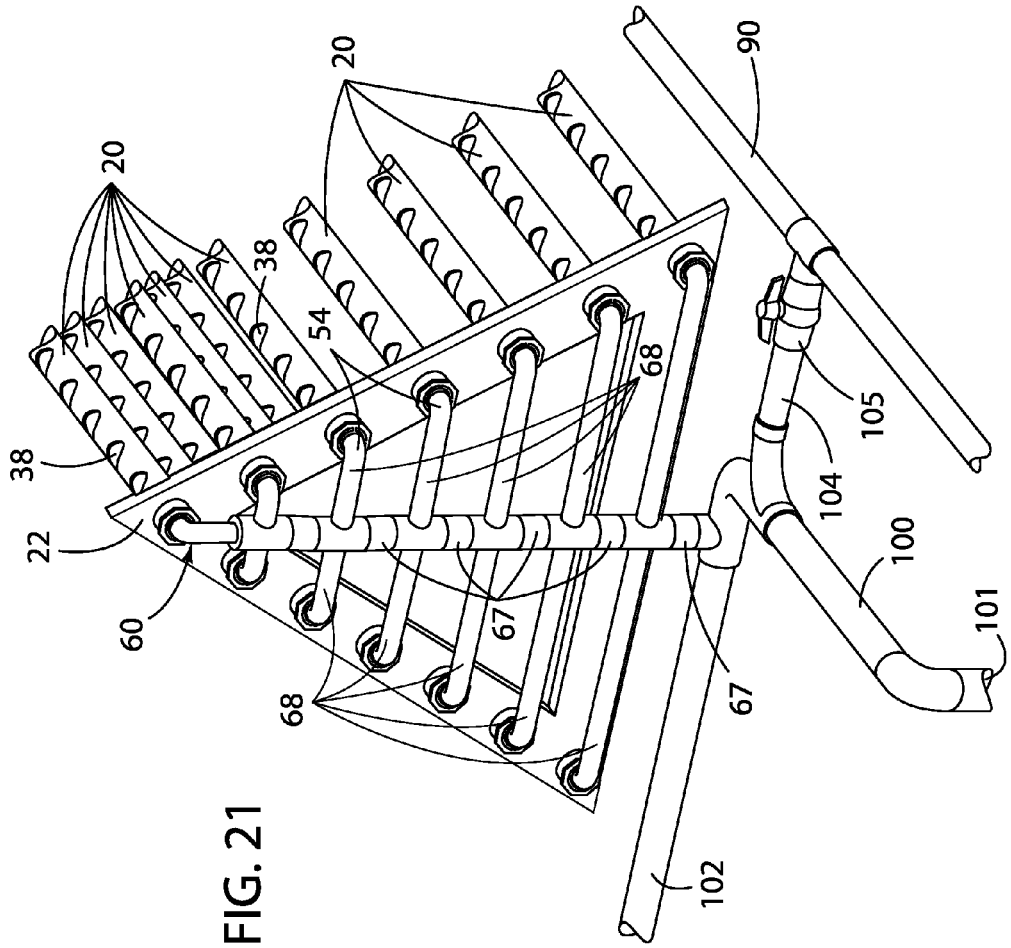


FIG. 21

GROWING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. application Ser. No. 14/846,298 filed on Sep. 4, 2015, which claims priority to U.S. Provisional Application No. 62/046,485 filed Sep. 5, 2014. Each of the aforementioned patent applications, and any applications related thereto, is herein incorporated by reference in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable to this application.

BACKGROUND

Field

Example embodiments in general relate to a Growing System for providing fluids to a plurality of growing assemblies using only a single pump and fluid source.

Related Art

Any discussion of the related art throughout the specification should in no way be considered as an admission that such related art is widely known or forms part of common general knowledge in the field.

The market for growing systems is growing in size and demand. The demand for these types of systems will increase as land for farming decreases due to population growth. There is also a need to conserve water resources and minimize the number of separate pumping installations for multiple growing systems. Vertical planting towers are known in the art; however these planting devices each require an individual reservoir. If used outdoors with sunlight, the plantings only receive direct sunlight for part of the day. Other prior art systems contain rows disposed in a rectangular arrangement. However, these systems are not suitable for large scale farming where each growing site must be exposed to direct sunlight throughout the day without significant shading issues.

Because of the inherent problems with the related art, there is therefore a need for a new and improved growing system that is able to operate multiple rows of plantings from one reservoir, with a triangular design to maximize direct sunlight, minimize shading, and enable direct access to each growing site from either side of the system for easy maintenance of the plants that would not be as accessible with a rectangular configuration. There is furthermore a need to maximize plant yield and conserve water resources over conventional farming methods.

SUMMARY

An example embodiment is directed to a Growing System having tiered rows of enclosed rigid pipe for the growing sites. The growing system is preferably a hydroponic aquaponic system, but may also be used for soil-based systems. Unlike previous growing systems, the rows are unslanted and use the force of a pump, rather than gravity, to distribute water to the rows. With the rows arranged in a north-south direction, the growing sites are subject to limited shading. The triangular design further enables direct access to each growing site from either side of the system. Because of its ease of cultivation access and maximized exposure to sunlight, the invention described herein triples plant yield per square foot over other vertical growing systems. By recycling water from the vertical growing system back to a reservoir, the invention described herein uses 75% less water than conventional farming methods. By utilizing a single fluid source and pump to feed multiple such growing assemblies, the present invention provides even more conservation and efficiency in growing operations.

There has thus been outlined, rather broadly, some of the embodiments of the Growing System in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional embodiments of the Growing System that will be described hereinafter and that will form the subject matter of the claims appended hereto. In this respect, before explaining at least one embodiment of the Growing System in detail, it is to be understood that the Growing System is not limited in its application to the details of construction or to the arrangements of the components set forth in the following description or illustrated in the drawings. The Growing System is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

Example embodiments will become more fully understood from the detailed description given herein below and the accompanying drawings, wherein like elements are represented by like reference characters, which are given by way of illustration only and thus are not limitative of the example embodiments herein.

FIG. **1** is an upper perspective view of the present invention.

FIG. **2** is a first side view of a growing assembly of the present invention.

FIG. **3** is a second side view of a growing assembly of the present invention.

FIG. **4** is a top view of a growing assembly of the present invention.

FIG. **5** is a bottom view of a growing assembly of the present invention.

FIG. **6** is a rear view of a growing assembly of the present invention.

FIG. **7** is a front view of a growing assembly of the present invention.

FIG. **8** is an exploded perspective view of a growing assembly of the present invention.

FIG. **9** is an upper perspective view of a growing pipe and planters of the present invention.

FIG. **10** is a frontal sectional view of a growing assembly of the present invention.

FIG. **11** is a side sectional view of the present invention.

FIG. **12** is a side sectional view of the present invention illustrating fluid flow.

FIG. **13** is a block diagram of the present invention illustrating fluid flow.

FIG. **14** is an upper perspective view of a growing system in accordance with an example embodiment.

FIG. **15** is a top view of a growing system in accordance with an example embodiment.

FIG. **16** is a first end view of a growing system in accordance with an example embodiment.

FIG. **17** is an upper perspective view of the outlet side of a growing assembly of a growing system in accordance with an example embodiment.

FIG. **18** is an end view of a growing system in accordance with an example embodiment.

FIG. **19** is an upper perspective view of the inlet side of a growing assembly of a growing system in accordance with an example embodiment.

FIG. **20** is an upper perspective view of a growing system in accordance with an example embodiment.

FIG. **21** is an upper perspective view of a growing system in accordance with an example embodiment.

DETAILED DESCRIPTION

A. Overview

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIGS. **1** through **13** illustrate an exemplary embodiment of the growing system **10** of the present invention. The growing system **10** may comprise a plurality of growing assemblies **20**; each having triangle-shaped frames **22** made of steel, aluminum or other suitable materials, with stainless steel being preferable due to its ability to resist rusting. The frames **22** can vary in height and width and, when comprised of a triangular configuration, are configured to have one side of the triangle parallel to the ground.

The frames **22** are spaced apart and are parallel to one another to support a plurality of non-inclined, removable, enclosed growing pipes **30** uniformly distributed in tiered rows. The length of the growing assemblies **20** may vary depending on the length of the growing pipes **30**. In one embodiment, the length of the growing assemblies **20** may each be approximately 20 feet long at its base and approximately 6 feet in height at the apex of the triangle. The plurality of growing assemblies **20** are fed by a singular main manifold **40**, which is preferably 6-inch round pipe, containing manifold valves **45** to control the flow of water through each growing assembly **20**.

The rigid pipe **14** may be at least partially comprised of PVC pipe or other suitable material. The size of the rigid pipe **14** can vary but may be approximately 2-3 inches in diameter, and approximately 20 feet in length. At the end of each rigid pipe **14** is a pipe reducer **18**. The size of the pipe reducer **18** is selected based on the size of the rigid pipe **14** but preferably comprises a 75% reduction in diameter from the system manifold pipe **13**. The pipe reducer **18** serves the purpose of slowing down the water flow rate within the rigid pipe **14** and ensuring that every plant in the rigid pipe **14** receives a uniform amount of water.

As shown in FIGS. **8** and **9**, the growing pipes **30** may comprise a plurality of openings **36** in which plants can grow. The size and spacing of the openings **36** is selected depending on the size of the growing pipes **30** and the type of crop that will be grown. The plants may be placed in planters **38** that vary in size depending on the size of the openings **36** but may be 3.75 inches in diameter. The planters **38** may be net cups or pots comprised of plastic or other suitable materials and perforated on the sides and bottom to allow water to flow through. The planters **38** may be smaller than the openings **36**, which leaves room around the planters **38** for water to flow. The planters **38** may contain rocks and/or fertilizer, such as worm casting.

Referring now to FIGS. **1** and **13**, a single fluid source **70** feeds the entire growing system **10** and is capable of feeding multiple growing assemblies **20** simultaneously. The fluid source **70** may be any container suitable for holding water or growth medium, such as water with liquid fertilizer. In one embodiment, the fluid source **70** may be a hole dug into the ground which may be lined with a pond liner (not shown) to help retain water.

The fluid from the fluid source **70** is pumped through a main manifold **40**, which may be 2- or 3-inch PVC pipe, to feed a plurality of feeder pipes **46** which feed the various growing assemblies **20**. The fluid then flows back through the growing assemblies **20** in the direction of the fluid source **70** by force of a single pump **72**. Any excess fluid in the growing assemblies **20** returns back to the fluid source **70** via one or more drain pipes **62** which may, in some embodiments, be configured into a drainage device **60** which is attached to the growing pipes **30** as shown in FIG. **7**.

The drain pipes **62** are preferably of a smaller diameter than the growing pipes **30** and may comprise a 50% reduction in diameter size compared to the growing pipes **30**. The fluid source **70** is preferably placed as close as possible to the growing system **10**. Its size is selected depending on the number of growing pipes **20** and the number of growing assemblies **20** it will feed.

As illustrated in FIG. **13**, a pump **72** is placed in fluid communication with the fluid source **70**. The pump **72** may be a 3-horsepower sewage lift pump or other suitable pump **72** which may have a pump rate at least up to 13,000 gallons per hour. A pump rate of 13,000 gallons per hour is capable of supplying water simultaneously to at least three growing assemblies **20**. The pump **72** moves the water to a main manifold **40**, preferably made of 6-inch round pipe and containing manifold valves **45** that evenly disperse the fluid to each growing assembly **20**. The fluid entering each growing assembly **20** from the main manifold **40** is dispersed through the feeder pipes **46** to control the flow of water through each rigid growing pipe **30** as described above. Each growing assembly **20** contains its own feeder pipe **46**. Multiple growing assemblies **20** can be disposed in adjacent north-south configurations with a common fluid source **70** and pump **72**, with the excess fluid from each growing assembly **20** returning to the fluid source **70**. FIG. **13** further illustrates the direction of flow of water through each growing assembly **20**.

In other embodiments, sealed electrical heat trace cables **39** can be run through each of the growing pipes **30** to be used in the colder months to help prolong growing seasons such as shown in FIGS. **8** and **9**. A pond heater **76** can be used in the fluid source **70** to also help prolong growing seasons. The fluid exiting the drain pipes **62** may be dispersed in a controlled manner to a plurality of trays (not shown) suspended over the fluid source **70**, with each tray also having a drain to return water back to the fluid source **70**. The trays are of an appropriate size to span across the reservoir **20**, and in one embodiment may be 4 feet wide×8 feet long. The trays can be filled with an appropriate amount of fluid, preferably 3-4 inches of water, to start plants for the growing system **10**.

In further embodiments, probes **82** can be placed at various positions within and around the system to monitor parameters such as watering (pressure, flow rate, volume), temperature, light exposure, nutrient levels, growth rate, etc. Such probes **82** can transmit data regarding the various parameters to a remote location via control unit **80** such as a computer to be evaluated manually or may be automatically transmitted to the control unit **80**, which can adjust various devices (such as manifold valves **45** and/or control valves **56**), including turning them on or oft in response to

the data received from the probes **82**. Such automation can be valuable for monitoring and controlling multiple growing assemblies **20** for large-scale farming.

Although exemplary embodiments are presented in order to better describe and illustrate the invention, it should be noted that the invention is not limited to only those exemplary embodiments. Although the invention has been described with respect to various embodiments, it should be realized that the invention is also capable of a wide variety of further and other embodiments within the spirit and scope of these teachings.

B. Growing Assemblies

As best shown in FIGS. **1** and **13**, the present invention comprises a plurality of growing assemblies **20** which are fed from a single fluid source **70** by a single pump **72**. The growing assemblies **20** may be oriented in various configurations, and thus should not be construed as limited to the orientation shown in the figures. While the growing assemblies **20** are preferably positioned near the fluid source **70** as shown in the figures, it should be appreciated that in some embodiments, one or more of the growing assemblies **20** may be positioned any distance from the fluid source **70**.

The growing assemblies **20** may comprise various configurations known in the art to efficiently grow plants or other crops. In a preferred embodiment as shown in the figures, the growing assemblies **20** each comprise a triangular configuration to maximize sunlight exposure to each of the planters **38**. In such an embodiment, each of the growing assemblies **20** comprise an inlet manifold **50**, a drainage device **60**, and a plurality of growing pipes **30** extending between the inlet manifold **50** and the drainage device **60**. Each inlet manifold **50** is separately fed fluids from its own feeder pipe **46**; with the feeder pipes **46** each being separately connected to a single main manifold **40**. The main manifold **40** is connected to a pump outlet **74** to receive fluids from the fluid source **70**.

Each growing assembly **20** may comprise one or more frames **22**. In the embodiment shown in the figures, each of the frames **22** comprises a triangular configuration, though other configurations may be utilized. The frames **22** include a plurality of receivers **23**, typically comprising openings or ports formed within the frames **22**, which are adapted to removably receive and retain the growing pipes **30**. Each of the frames **22** may also include a stand **24** which rests or is driven into the ground surface to retain the frames **22** in an upright configuration.

As best shown in FIG. **8**, each of the growing assemblies **20** includes a plurality of growing pipes **30**. The growing pipes **30** will generally comprise elongated, rigid pipe structures having a first end **31**, a second end **32**, an upper end **33**, and a lower end **34**. A channel **35** extends through each of the growing pipes **30** between their respective first and second ends **31**, **32**. A plurality of openings **36** formed in the upper end **33** of the growing pipes **30** to removably receive one or more planters **38** as discussed herein. Thus, each of the growing pipes **30** will generally include a row of openings **36** extending across its upper end **33** between its first end **31** and its second end **32**. As mentioned previously, one or more of the growing pipes **30** may also include heat trace cables **39** to elongate the growing season in colder climates.

As shown in FIG. **4**, each of the growing pipes **30** are each connected at a first end **31** to a drain pipe **62** and at a second end **32** to an inlet pipe **52**. Thus, a plurality of inlet pipes **52** feed fluid into the growing pipes **30** and a plurality of drain pipes **62** discharge fluids from the growing pipes **30**. In a preferred embodiment, the plurality of inlet pipes **52** are configured to form an inlet manifold **50** and the plurality of drain pipes **62** are configured to form a drainage device **60**.

FIG. **6** best illustrates an inlet manifold **50** of a growing assembly **20** of the present invention. The inlet manifold **50** is generally positioned at an inlet end of each of the growing assemblies **20**. As shown, the inlet manifold **50** will generally comprise an inlet pipe **52** and a plurality of pipe reducers **54** extending in various directions off of the inlet pipe **52**. The number of pipe reducers **54** will be the same as the number of growing pipes **30** in the growing assembly **20**; with each of the pipe reducers **54** being connected to feed its own growing pipe **30**. As shown in FIG. **3**, the growing pipes **30** may extend through the receivers **23** of the frame **22** of the growing assembly **20**.

Control valves **56** may be positioned between the pipe reducers **54** and the growing pipes **30** so as to control the flow of fluids therethrough. The control valves **56** may also be positioned in-line with the pipe reducers **54**. Each of the pipe reducers **54** may include an outlet **58** which is connected to the second end **32** of each of the growing pipes **30**, such as by an outlet coupler **59**. The outlet coupler **59** can serve to reduce the time necessary for connecting or disconnecting the growing pipes **30** and the inlet pipes **52**. The pipe reducers **54** are generally comprised of a smaller diameter than the inlet pipe **52** so as to restrict and control flow of fluids therethrough prior to entering the growing pipes **30** at their respective second ends **32**.

FIG. **7** best illustrates a drainage device **60** of a growing assembly **20** of the present invention. As shown, the drainage device **60** will generally comprise a plurality of drain pipes **62** positioned at an outlet end of the growing assemblies **20**. The drain pipes **62** need not be interconnected in any way, though they may each be arranged to connect through the receivers **23** of the frame **22** of the growing assembly **20**.

Each of the drain pipes **62** of the drainage device **60** comprises a first end **63** and a second end **64**. The first ends **63** of each of the drain pipes **62** serve as an outlet for the drain pipes **62** and thus are positioned over the fluid source **70** so that fluids exiting through the first ends **63** of the drain pipes **62** flows directly into the fluid source **70** for re-use. The second ends **64** of the drain pipes **62** are each connected to a first end **31** of a growing pipe **30**, such as through use of a drainage coupler **65**. The use of a drainage coupler **65** can reduce time necessary for connecting or disconnecting the drain pipes **62** to/from the growing pipes **30**. To control flow, the diameter of the drain pipes **62** will preferably be smaller than the diameter of the growing pipes **30** to which they are connected.

C. Manifold and Feeder Pipes

As best shown in FIGS. **1** and **13**, the present invention utilizes a single main manifold **40** which receives fluids from the fluid source **70** via a single pump **72** and splits into multiple flows of the fluid; each going through a respective feeder pipe **46** to reach each respective growing assembly **20**. By using the main manifold **40** and feeder pipes **46**, a single fluid source **70** can feed a plurality of growing assemblies **20** using only a single pump **72**. In a preferred embodiment, the main manifold **40** extends beneath all of the plurality of growing assemblies **20** of the present invention.

The main manifold **40** of the present invention is best shown in FIG. **1**. As shown, the main manifold **40** will

generally comprise an elongated, rigid pipe which extends perpendicular with respect to the growing assemblies **20** (i.e., the orientation of the main manifold **40** is generally perpendicular with respect to the orientation of the growing pipes **30** of each growing assembly **20**). However, other configurations and orientations may be utilized in different embodiments of the present invention. The main manifold **40** may be positioned at various distances from the fluid source **70**, but will preferably be near the fluid source **70** to improve water pressure and reduce the amount of piping needed.

The main manifold **40** includes an inlet **42** and a plurality of outlets **44**. The inlet **42** of the main manifold **40** is fed fluid from the pump **72**. Thus, the inlet **42** of the main manifold **40** is generally fluidly connected with the pump outlet **74** as shown in FIG. **13**. The outlets **44** of the main manifold **40** are fluidly connected to a plurality of feeder pipes **46**. Preferably, a plurality of manifold valves **45** are provided to control flow at each of the outlets **44**. The manifold valves **45** may be connected at the juncture of the outlets **44** of the main manifold **40** and the first ends **47** of the feeder pipes **46**. Alternatively, the manifold valves **45** could be in-line on the feeder pipes **46**. In any case, the use of manifold valves **45** will enable an operator of the present invention to selectively restrict flow to one or more of the growing assemblies **20**. A control unit **80** may also be provided which can be utilized to control the manifold valves **45** automatically or in response to an input.

Each growing assembly **20** of the present invention receives its fluids from one of the feeder pipes **46** extending from the main manifold **40**. The first end **47** of each feeder pipe **46** is thus fluidly connected to an outlet **44** of the main manifold **40**. The second end **48** of each feeder pipe **46** is fluidly connected with an inlet manifold **50** of a growing assembly **20**. More specifically, the second end **48** of each feeder pipe **46** is generally connected to the inlet pipe **52** of the inlet manifold **50** of each growing assembly **20**.

D. Fluid Source and Pump

The plurality of growing assemblies **20** of the present invention are all fed by a single fluid source **70** through use of a single pump **72**. The use of pipes, rather than tubing, for all fluid flow components of the present invention allows such a configuration to be possible as mentioned previously.

The figures illustrate the fluid source **70** as comprising a ground reservoir. However, this exemplary embodiment should not be construed as limiting on the scope of the present invention. Any fluid source **70** may be utilized so long as it contains an adequate volume of fluids for continuous use of the present invention. For example, the fluid source **70** in some embodiments may comprise an above-ground or below-ground container. In other embodiments, the fluid source **70** could comprise a water main or other type of water-transferring conduit.

It should also be appreciated that any type of fluid may be utilized with the present invention, and thus its scope should not construed as limited to water or any other specific type of fluid. In some cases, a mixture of fluid and particulate material, such as fluid and a growing aid such as fertilizer (liquid or solid), may be utilized for the present invention.

Various types of pumps **72** may be utilized with the present invention so long as the proper pumping force is provided. It is noted that the strength of the pump **72** utilized will vary depending on how many growing assemblies **20** are being used with the present invention. As more growing assemblies **20** are added to the system, a higher strength pump **72** will be necessary.

The pump **72** is preferably positioned near the fluid source **70**, with the pump inlet **73** being fluidly connected directly to the fluid source **70** to draw fluids up into the pump **72**. The pump outlet **74** is connected to the main manifold **40** to be further distributed to the growing assemblies **20** via the feeder pipes **46**. A separate heater **76** may be provided as well, or integrated with the pump **72**, to warm the fluids stored in the fluid source **70**. Use of such a heater **76** may increase growing time in colder climates. The heater **76** may be controlled by the control unit **80**, or be manually controlled by hand.

E. Operation of Preferred Embodiment

FIG. **13** illustrates the interconnection of the various components of the present invention. In use, the system is first set up. Preferably, the present invention will be set up near an existing fluid source **70** such as a reservoir. Alternatively, a separate fluid source **70** may be set up or provided by the operator of the present invention, such as by installing a container such as a tank. In any case, after ensuring availability of a fluid source **70**, the present invention may be installed for use.

The pump **72** is positioned near the fluid source **70**, with the pump inlet **73** being fluidly connected to the fluid source **70**. The pump outlet **74** is connected to a main manifold **40** that is set up near the fluid source **70**. After installation of the pump **72** and main manifold **40**, one or more growing assemblies **20** may be connected to the system.

Each growing assembly **20** is installed by first connecting a feeder pipe **46** to the main manifold **40**. Generally, one feeder pipe **46** will be utilized for each growing assembly **20**, though in some embodiments multiple growing assemblies **20** could share one feeder pipe **46**. The feeder pipes **46** may be connected to the main manifold **40** so that the feeder pipe **46** extends perpendicularly with respect to the main manifold **40** as shown in the figures, or other orientations may be utilized.

The outlet of the feeder pipes **46**, generally comprised of their second ends **48**, will be connected to the inlet manifold **50** of the growing assemblies **20** being installed. Any number of growing assemblies **20** may be supported by the present invention. Generally, the second end **48** of each feeder pipe **46** is connected to an inlet pipe **52** of each growing assembly **20**. As discussed previously, the growing pipes **30** connect to a plurality of pipe reducers **54** which extend from the inlet pipe **52**. A plurality of planters **38** are positioned within the openings **36** of the growing pipes **30**, with any type of plant or crop being grown within the planters **38**. The drain pipes **62** are connected to the growing pipes **30** such that fluids discharged from each growing assembly **20** are fed back into the fluid source **70** for further use.

FIG. **13** provides an exemplary illustration of fluid flow in the present invention. As shown there, fluids from the fluid source **70** are drawn via the pump **72** into the main manifold **40**. The main manifold **40** distributes the fluids to a plurality of feeder pipes **46**; with each feeder pipe **46** being connected to one of the growing assemblies **20**. Fluid will flow through the inlet manifold **50** of each growing assembly **20**, through the growing pipes **30** to provide fluids to the planters **38**, and exit through the drainage device **60** to be discharged into the same fluid source **70** that the fluids were drawn from.

The manifold valves **45** may be manipulated to control fluid flow to one or more of the growing assemblies **20**. For example, if one of the growing assemblies **20** ceases functioning (such as due to a blockage at some location in the system), that particular growing assembly **20** may be shut off via one of the manifold valves **45** without affecting operation of the other growing assemblies **20** during service.

The control valves **56** at the inlet manifolds **50** of each growing assembly **20** may also be utilized to control flow rate. For example, different growing assemblies **20** within the same system of the present invention may house different crops. Because different types of plants require different watering schedules and amounts, the control valves **56** at the inlet manifolds **50** may be manipulated so that less fluid flows into a first growing assembly **20** growing a first crop while more fluid flows into a second growing assembly **20** growing a second crop. The control unit **80** may be utilized to automate this process and the probes **82** may be utilized to monitor the overall functionality of the system as a whole.

F. Alternate Embodiment

FIGS. **14-21** illustrate an alternate embodiment of a growing system **10** in which an inlet conduit **90** draws from a fluid source **70** utilizing a pump **92** which is submerged in the fluid source **70**. The pump **92** could comprise any mechanism, device, or system known to pump fluids from a fluid source **70**, such as a submersible shredder sewage pump. The pump **92** could include a filter to filter fluids being pulled from the fluid source **70**.

Each of the growing assemblies **20** is fed fluid by the inlet conduit **90**. In the exemplary embodiment shown in FIGS. **14-16**, three growing assemblies **20** are positioned in a row. It should be appreciated that more or less growing assemblies **20** could be utilized depending on the particular application and the volume of the fluid source **70**.

As shown in FIG. **15**, the inlet conduit **90** comprises a first section **93** extending in a first direction along the length of a growing assembly **20**. A second section **94** of the inlet conduit **90** extends in a second direction at a right angle with respect to the first section **93**. In this manner, the second section **94** of the inlet conduit **90** may extend across the rear ends of the growing assemblies **20** to feed fluid from the fluid source **70** to the growing assemblies **20** via their inlet hubs **50**. It should be appreciated that alternate routing could be utilized for the inlet conduit **90** in certain embodiments to accommodate different layouts of growing assemblies **20**.

The fluid may pass through the growing assembles **20** as discussed previously. As shown in FIGS. **16-17**, each growing assembly **20** may include an inlet hub **50** which receives the fluid from the inlet conduit **90** and distributes the fluid through each growing pipe **30** of that particular growing assembly **20**.

As shown in FIGS. **16-17**, the inlet hub **50** may comprise a plurality of inlet pipes **52** which are each fluidly connected to the inlet conduit **90** by a control valve **56**. By having a control valve **56** on each inlet pipe **52** of the inlet hub **50**, individual growing pipes **30** may be shut off for service or the like without impacting operation of the overall growing system **10**. Pipe reducers **54** and outlet couplers **59** may also be utilized as discussed previously. As shown in FIG. **18**, each growing assembly **20** may include a drainage hub **60** through which the fluid will exit the growing assemblies **20** to enter the outlet conduit **100** to be returned to the fluid source **70**. The drainage hubs **60** are illustrated as each comprising a central drainage pipe **67** which is connected to an outlet manifold **102**. Drainage connectors **68** comprising conduits are connected between the outlets of the growing pipes **30**; with each drainage connector **68** feeding fluid from a growing pipe **30** to the central drainage pipe **67**.

As shown in FIG. **18**, each growing assembly **20** of the growing system **10** feeds into an outlet manifold **102** which extends across outlet side of the growing assemblies **20**. As seen in FIG. **18**, the outlet manifold **102** may extend in parallel with respect to the second section **92** of the inlet conduit **90**. The outlet manifold **102** is fluidly connected to an outlet conduit **100** which provides an outlet **101** for the fluid over the fluid source **70** such as shown in FIG. **18**. As shown in FIG. **21**, a backflow connector **104** may be connected between the inlet conduit **90** and the outlet conduit **100**. The backflow connector **104** may include a backflow valve **105** which may be selectively opened or closed.

FIGS. **19-20** illustrate an embodiment of the growing system **10** in which the growing assemblies **20** may each include plant supports **110** for supporting growing plants such as vines. The plant supports **110** may each comprise inverted U-shaped end frames **110** which are connected to the frames **23** of the growing assemblies **20** by stabilizers **112**. Support lines **114** extend horizontally between the end frames **111** over the growing pipes **30**. Plants from the growing pipes **30** may latch onto the support lines **114**, such as tomatoes or other vining plants.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar to or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described above. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety to the extent allowed by applicable law and regulations. The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive. Any headings utilized within the description are for convenience only and have no legal or limiting effect.

What is claimed is:

1. A growing system, comprising:

an inlet conduit fluidly connected to a fluid source;

a pump for feeding a fluid from the fluid source to the inlet conduit;

a growing assembly comprising a plurality of growing pipes for growing plants, wherein the growing assembly is fluidly connected to the inlet conduit such that the fluid passes through the growing assembly, wherein the growing assembly includes a plant support for supporting the plants grown in the growing pipes, wherein the plant support comprises a plurality of end frames and a plurality of support lines extending between the end frames; and

an outlet conduit fluidly connected to the growing assembly, wherein the outlet conduit is positioned so as to dispense fluids from the growing assembly back into the fluid source.

2. The growing system of claim **1**, wherein the growing assembly comprises an outlet end and an inlet end.

3. The growing system of claim **2**, wherein the inlet conduit extends alongside the growing assembly from the outlet end to the inlet end.

4. The growing system of claim 1, wherein the growing assembly comprises an inlet hub fluidly connected to the inlet conduit.

5. The growing system of claim 4, wherein the inlet hub comprises a plurality of inlet pipes connected between the inlet conduit and each of the growing pipes of the growing assembly.

6. The growing system of claim 5, wherein the growing assembly comprises a drainage hub connected to the outlet conduit.

7. The growing system of claim 6, wherein the drainage hub comprises a central drainage pipe which is fluidly connected between the outlet conduit and each of the plurality of growing pipes of the growing assembly.

8. The growing system of claim 7, further comprising a plurality of drainage connectors each being connected between one of the growing pipes of the growing assembly and the central drainage pipe of the drainage hub.

9. The growing system of claim 1, wherein each of the support lines extends above one of the plurality of growing pipes.

10. A growing system, comprising:

an inlet conduit fluidly connected to a fluid source;

a pump for feeding a fluid from the fluid source to the inlet conduit;

a plurality of growing assemblies each comprising a plurality of growing pipes for growing plants, wherein each of the growing assemblies is fluidly connected to the inlet conduit such that the fluid passes through the growing assemblies;

an outlet conduit fluidly connected to each of the growing assemblies, wherein the outlet conduit is positioned so as to dispense fluids from the growing assemblies back into the fluid source; and

a backflow connector fluidly connected between the outlet conduit and the inlet conduit.

11. The growing system of claim 10, wherein the inlet conduit comprises a first section extending alongside one of the growing assemblies and a second section extending across each of the growing assemblies.

12. The growing system of claim 11, further comprising an outlet manifold extending across each of the growing assemblies, wherein the outlet manifold is fluidly connected between each of the growing assemblies and the outlet conduit.

13. The growing system of claim 12, wherein each of the growing assemblies comprises an inlet hub fluidly connected to the second section of the inlet conduit.

14. The growing system of claim 13, wherein the inlet hub of each of the growing assemblies comprises a plurality of inlet pipes connected between the inlet conduit and each of the growing assemblies.

15. The growing system of claim 14, wherein each of the growing assemblies comprises a drainage hub fluidly connected to the outlet manifold.

16. The growing system of claim 15, wherein the drainage hub of each of the growing assemblies comprises a central drainage pipe which is fluidly connected to the outlet manifold.

17. A growing system, comprising:

an inlet conduit fluidly connected to a fluid source;

a pump for feeding a fluid from the fluid source to the inlet conduit;

a growing assembly comprising a plurality of growing pipes for growing plants, wherein the growing assembly is fluidly connected to the inlet conduit such that the fluid passes through the growing assembly, wherein the growing assembly includes a plant support for supporting the plants grown in the growing pipes;

a plurality of support lines, wherein each of the plurality of support lines extends above one of the plurality of growing pipes; and

an outlet conduit fluidly connected to the growing assembly, wherein the outlet conduit is positioned so as to dispense fluids from the growing assembly back into the fluid source.

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