

A Device and system for irrigation

Field

- 5 The invention relates to devices and systems for irrigation in particular plant irrigation in potted plants.

Background

- 10 Plants require a steady supply of water and nutrients for growth and function. People often forget to water their pot plants resulting in the plants getting sick and in severe cases dying. When a large number of pot plants are involved the burden of having someone water all the pot plants greatly increases. There is a need to keep all the pots hydrated in a cost effective manner. When plants are on roof tops and on the side of
15 buildings watering becomes an even bigger challenge.

- Various irrigation systems have been designed to provide adequate water supply to plant pots. Some include having a reservoir within the plant pot. These are often unsuccessful because they have roots growing into the reservoir and blocking the way for the water to
20 enter the plant growth medium. Series of interconnected drip systems have also been designed but due to the level of integration the maintenance required is for the entire system even when the problem is only for one pot plant.

- In areas with high rainfall or where an artificial irrigation system is in place there may be
25 the additional problem of the plants being overwatered leading to root rot, root hypoxia or other similar problems.

A new system is required to ameliorate some of these problems.

- 30 **Summary**

The inventor has designed a discreet unit for each plant pot that is able to be placed at a location in a plant pot that minimizes root growth into the device.

Accordingly, a first aspect of the invention relates to an irrigation device for placing in a growth medium comprising

- a container for holding a volume of liquid;
- an inlet into the container through which liquid can pass into the container;
- a sensor for detecting the liquid level within the container;
- a valve within the inlet for selectively blocking the flow of liquid through the inlet when the sensor indicates that the water level is at a predetermined level; and
- a series of elongate through holes on one side of the container through which the liquid in the container exits into the plant growth medium.

Another aspect of the invention relates to a system for delivering liquid to a cultivation medium comprising;

- a container for holding a volume of liquid;
- an inlet through which the liquid can pass into the container;
- a sensor for detecting the liquid level within the container;
- a valve for selectively blocking the flow of liquid through the inlet when the sensor indicates the liquid level is at a predetermined level
- a series of elongate through holes on one side of the container for the liquid in the container to exit into the growth medium

Another aspect of the invention relates to a method of using a device or system as described herein with a plant pot comprising filling the plant pot with a layer of plant growth medium; placing the container on the layer of plant growth medium; surrounding the device on all sides with plant growth medium; adding a liquid into the container through the inlet to a predetermined level whereby the liquid exits into the plant growth medium through the elongate through holes into the plant growth medium; and maintaining the predetermined level of liquid in the container via the sensor.

Other aspects of the invention will be apparent to a person skilled in the art with reference to the following drawings and description of various non-limiting embodiments.

Brief description of the drawings

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The drawings are not necessarily drawn to scale, emphasis instead generally being placed upon illustrating the principles of various embodiments. In the following description, various embodiments of the invention are described with reference to the following drawings.

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Figure 1. A stylized drawing of an embodiment of the device.

Figure 2. A stylized drawing of an embodiment of the sensor.

Figure 3. A stylized drawing of an embodiment of the device in use within a plant pot.

Figure 4. A stylized drawing of an embodiment of the device depicting a service hatch.

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Detailed description

A first aspect of the invention relates to an irrigation device for placing in a growth medium comprising

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a container for holding a volume of liquid;

an inlet into the container through which liquid can pass into the container;

a sensor for detecting the liquid level within the container;

a valve within the inlet for selectively blocking the flow of liquid through the inlet

when the sensor indicates that the water level is at a predetermined level; and

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a series of elongate through holes on one side of the container through which the liquid in the container exits into the growth medium.

The device is a discreet unit. If something is wrong with one plant pot then only one device needs to be maintained or replaced.

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As used herein the term “growth medium” may refer to either a plant growth medium or a growth medium for cultivation of microorganisms. Plant growth medium may include soil, gel, stones, liquid or any substrate in which a plant can be supported for growth. Preferably the substrate is able to assist the plant in having access to water and nutrients.

5 A growth medium for cultivation of microorganisms may include any medium that contains an energy source on which the microorganisms may grow such as a source of carbohydrate. A suitable growth medium may include a liquid such as rice water runoff, fermented liquids cultivated with any microorganisms.

10 As used herein the term “liquid” refers to any liquid that is suitable for plant or microorganism growth. This may include water, waste water or recycled water, grey water, nutrient enriched water or any other substance that is suitable for plant or microorganism growth.

15 In various embodiments the sensor is a float. The float is preferably made of a buoyant material such as light weight plastic or cork or any similar material that is suitably buoyant.

Referring to Figure 1 the container 2 may be any shape such as cylindrical in the case of
20 figure 1A or an elongated cuboid as depicted in figure 1B. The inlet 4 is adapted to be connected to any suitable source of water or growth liquid so as to enable a float 6 actuated valve 7 to control the flow of liquid into the container when the valve 7 is moved from a closed position (Figure 2A) into an open position (Figure 2B). An actuator arm 8 actuates the valve 7. The relative position of the float 6 with respect to the valve 7
25 can be adjustably changed to a predetermined level 9 so as to obtain optimum fluid level within the container 2 via an adjuster. The adjuster may be an adjustable screw shank or any other known adjustment means. The elongate through holes 10 are placed at a location that will be on the upstanding side wall of the container 2 when the device is in use. Preferably, the inlet 4 is on the side wall opposite the elongate through holes 10 but
30 it may be located anywhere that allows the liquid to enter the container.

Elongate slots 10 are less likely to be blocked by plant roots and the slots allow a larger volume of water to exit into the plant growth medium adequately supplying the roots with suitable water. Adequate supply of water should minimize the roots reaction of growing towards the water source. The elongate slots 10 may be oval in shape (figure 1A) or rectangular (figure 1B) or diamond or any suitable elongate shape that has an exit area able to allow an adequate supply of liquid to the plant growth medium.

In various embodiments the elongate through holes 10 are a series of slots and the predetermined level 9 is set between the two ends of each elongate slot when in use.

Having the predetermined level 9 set between the two ends (10a and 10b) of each elongate slot 10 in use will allow the upper end 10a of the each elongate slot to operate as an overflow mechanism. Such that when there is too much water entering into the container in times of rain or flood the slots 10 act as an initial overflow drainage.

In various embodiments further mechanisms for overflow may include a runoff outlet 13 such as a valve sensor at the upper level of the container 2a above the elongate through holes 10. Alternatively, a runoff tube or outlet may be included at the upper level of the container 2a above the elongate through holes 10 to facilitate runoff. In this way the upper section of the container 2a may be kept depleted of liquid. This may allow space for maintenance of the sensor 6 and additional space for placing solid nutrient sources that can slowly degrade and add to the nutrient supply of the plant growth medium.

In various embodiments the float 6 has a filter sleeve 6a. A filter sleeve 6a will protect the float from insects. Preferably the filter sleeve 6a is made of a woven cloth material such as nylon, cotton or any other suitable material. The weave will provide flexibility for movement of the float 6 while still protecting the float 6 from insects by acting as a filter. Any flexible material that provides the same function would also be suitable.

In various embodiments the sensor 6 comprises an indicator 11 designed to be seen outside the plant growth medium. In various embodiments the indicator 11 includes a transparent tube with level markings and a stick in the center of the tube, the stick being

associated with the sensor 6 (Figure 2C). The tube is designed to be located above the plant growth medium in use so that it can be seen by the naked eye. In this embodiment the stick is attached at one end to the float 6 and moves integrally in the liquid with the float 6 and the other end of the stick moves vertically in the tube, the markings on the reading tube 12 are measured to reflect the predetermined level 9.

In various other embodiments the indicator 11 comprises an electronic readout. In cases where the pot plants are on roof tops or the sides of buildings it may be difficult to determine if there is a problem with the device. In this embodiment the sensor is able to convert the water level to a digital format that can be visualized at a distance far away from the device.

In various embodiments the device further comprising a plant pot 14 capable of being filled with a plant growth medium wherein the container 2 is designed to be placed on a layer of plant growth medium and then covered such that the container is surrounded by plant growth medium on all sides.

As a discreet unit the device can be placed in a plant pot 14 at a location that minimizes root growth into the container 2. As depicted in Figure 3 generally roots 21 of a plant 20 grow downwardly and if they are being adequately supplied with water and nutrients they will not start growing upwards. By placing the device such that the container 2 is surrounded by plant growth medium on all sides as depicted, in general the roots 21 will be below or growing down past the container 2 (Figure 3).

In various embodiments the inlet 4 is attached to a tube 5 able to provide a constant supply of liquid to the device. In the case where long tubes 5 are used this will be sufficient to provide enough pressure in the system to adequately supply the container with suitable amount of liquid. Where shorter tubing 5 is used a pump 16 may be used to increase the pressure to break the water surface tension. Such a pump may be used at a pressure in the range of 10 to 100 pounds per square inch (psi), preferably 40 to 60 psi or

at least below 120 psi to ensure that the valve strength remains intact and closed in the closed position.

5 The device may be attached to a hose or tube 5 that is connected to a circulating water system such as a municipal water supply or any recycled water system. Alternatively, the tube 5 may be connected to a reservoir of water specifically for supplying water to the plants this may include grey water collected from bathtub and washing machine runoff.

10 In various embodiments the tube 5 or inlet 4 may further include a semipermeable membrane or a thin film composite membrane to act as a filter.

15 In various embodiments the container 2 may further include a hatch 16 for maintenance of the float 6 and the valve or to allow the adjustment of the predetermined level 9 by adjusting the distance between the float 6 and the valve (Figure 4). The hatch may also be used to place solid nutrient source such as a carbon source a nitrogen source or other nutrient sources that break down slowly over a period of time. Examples of solid nutrient source may include food scraps rapped in newspaper or cardboard whereby the waste will be slowly broken down via naturally occurring microorganisms. Alternatively the solid nutrient source may be synthetic nutrients embedded in a biodegradable form designed for slow release.

20 In various embodiments the container 2 may further include a support base 18 for the solid nutrient source to keep it above the liquid in the container 2. The support base 18 may be in the form of bars, a tray or a basket or anything that is able to support the solid nutrient source above the liquid in the container 2.

Another aspect of the invention relates to a system for delivering liquid to a cultivation medium comprising;

- 30 a container 2 for holding a volume of liquid;
- an inlet 4 through which the liquid can pass into the container 2;
- a sensor 6 for detecting the liquid level within the container 2;

a valve 7 for selectively blocking the flow of liquid through the inlet 4 when the sensor 6 indicates the liquid level is at a predetermined level 9; and
a series of elongate through holes 10 on one side of the container 2 for the liquid in the container 2 to exit into the growth medium

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The same numerals are used for the like features in the device described above.

In various embodiments the sensor 6 is a float for interaction with the valve 7 such that when the liquid level is at or above the predetermined level 9 the valve 7 blocks the flow
10 of liquid through the inlet 4 and when the liquid level is below the predetermined level 9 the valve 7 opens permitting the flow of liquid through the inlet 4 as described above. The control may be electronic where by signals are converted to digital format. Whereby when the water level drops below the predetermined level a digital signal is sent to open the valve.

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In various embodiments the float 6 has a filter sleeve 6a for protecting the float from insects as described above.

In various embodiments the sensor 6 comprises an indicator 11 for visualization of the
20 liquid level.

In various embodiments the indicator 11 comprises a transparent tube with level markings and a stick in the center of the tube, the stick associated with the sensor 6 for coordination of the sensor 6 and the stick indicator 11 as described above.

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In various embodiments the sensor 6 comprises an electronic readout for visualization of the liquid level at a distance far from the sensor 6 as described above.

In various embodiments the system further comprises a plant pot 14 for placing the
30 container 2 such that the container 2 is surrounded by plant growth medium on all sides as described above.

In various embodiments the inlet 4 is attached to a tube for supply of liquid to the device as described above.

- 5 In various embodiments the system further comprises an access hatch on the container for allowing access to the float and the valve as described above.

In various embodiments the system further comprises a runoff outlet for draining any excess water above a second predetermined level. Preferably, the second predetermined
10 level is above the upper end of the elongate slot 10a. In this way the system allows the upper section of the container 2a may be kept depleted of liquid. This may allows space for maintenance of the sensor 6 and additional space for placing solid nutrient sources that can slowly degrade and add to the nutrient supply of the plant growth medium.

- 15 In various embodiments the system further comprises a support base for holding a solid nutrient source above the liquid in the container in use. The support base is included above the runoff outlet as described above.

Another aspect of the invention relates to a method of using a device or system as
20 described herein with a plant pot comprising filling the plant pot 14 with a layer of plant growth medium; placing the container 2 on the layer of plant growth medium; surrounding the container 2 on all sides with plant growth medium; adding a liquid into the container 2 through the inlet 4 to a predetermined level 9 whereby the liquid exits into the plant growth medium through the elongate through holes 10 into the plant growth
25 medium; and maintaining the predetermined level 9 of liquid in the container via the sensor 6.

The location at which the device or system is placed within a pot plant will effectively determine the water level within the pot plant. When the layer of plant growth medium is
30 thinner the container will be placed lower in the plant pot and the water level within the pot plant will be low. Conversely, when the layer of plant growth medium is thicker the

container will be placed higher in the plant pot and the water level within the pot plant will be relatively higher. This allows you to adjust the water level in a plant pot to one that is suitable for the plant that you are growing.

5 Another aspect of the invention relates to a method of using a device or system as described herein in the process of making nutrient rich medium comprising fermenting microorganisms in the process of preparing the nutrient rich medium. The microorganisms may include rhizobia, lactobacilli, streptococcus, bifidobacteria or any other suitable microorganism. These microorganisms are effectively growing in a growth
10 medium. The microorganisms are placed in a fermentor together with a growth medium that contains a source of carbohydrate. In various examples the growth medium may be rice water, or any other suitable liquid that has a carbohydrate source. The container is placed into the fermentor so that it is surrounded by the growth medium where the microorganisms are growing and liquid enters the fermentor through the device or system
15 in the same way as described above.

The inlet 4 is connected to a suitable water or growth liquid so as to enable the liquid to enter the container. A float 6 actuated valve 7 controls the flow of liquid into the container when the valve 7 is moved from a closed position (Figure 2A) into an open
20 position (Figure 2B) the liquid enters the container through the inlet. An actuator arm 8 actuates the valve 7. The relative position of the float 6 with respect to the valve 7 can be adjustably changed to a predetermined level 9 so as to obtain optimum liquid level within the container 2 via an adjuster. The liquid exits the container via the elongate through holes 10 located on the upstanding side wall of the container 2 into the fermentor
25 allowing suitable microorganism growth and fermentation.

Generally, the terms used herein have, unless explicitly stated otherwise, the accepted meaning in the art.

30 By "comprising", as used herein, it is meant including, but not limited to, whatever follows the word "comprising". Thus, use of the term "comprising" indicates that the

listed elements are required or mandatory, but that other elements are optional and may or may not be present.

By "consisting of" is meant including, and limited to, whatever follows the phrase
5 "consisting of". Thus, the phrase "consisting of" indicates that the listed elements are required or mandatory, and that no other elements may be present.

The inventions illustratively described herein may suitably be practiced in the absence of any element or elements, limitation or limitations, not specifically disclosed herein. Thus,
10 for example, the terms "comprising", "including", "containing", etc. shall be read expansively and without limitation. Additionally, the terms and expressions employed herein have been used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various
15 modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification and variation of the inventions embodied therein herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of
20 this invention.

The invention has been described broadly and generically herein. Each of the narrower species and sub-generic groupings falling within the generic disclosure also form part of the invention. This includes the generic description of the invention with a proviso or
25 negative limitation removing any subject matter from the genus, regardless of whether or not the excised material is specifically recited herein.

The following examples are illustrative of the invention and its preferred embodiments, and are not to be taken as limiting the disclosure or claims in any way.

Claims

1. An irrigation device for placing in a growth medium comprising
 - a. a container for holding a volume of liquid;
 - 5 b. an inlet into the container through which liquid can pass into the container;
 - c. a sensor for detecting the liquid level within the container;
 - d. a valve within the inlet for selectively blocking the flow of liquid through the inlet when the sensor indicates that the liquid level is at a predetermined level; and
 - 10 e. a series of elongate through holes on one side of the container through which the liquid in the container exits into the growth medium.
2. The device according to claim 1, wherein the predetermined level is between the two ends of each elongate through hole.
3. The device according to claim 1 or 2, further comprising a runoff outlet.
- 15 4. The device according to any one of claims 1-3, wherein the sensor is a float.
5. The device according to claim 4, wherein the float has a filter sleeve.
6. The device according to claim 1, wherein the sensor comprises an indicator designed to be seen above the growth medium.
7. The device according to claim 6, wherein the indicator comprises a transparent
20 tube with level markings and a stick in the center of the tube, the stick being associated with the sensor.
8. The device according to claim 6, wherein the indicator comprises an electronic readout.
9. The device according to any one of claims 1-8, further comprising a plant pot
25 capable of being filled with a plant growth medium wherein the container is designed to be placed on a layer of plant growth medium and then covered such that the container is surrounded by plant growth medium on all sides.
10. The device according to any one of claims 1-9, wherein the inlet is attached to a tube able to provide a constant supply of liquid to the device.
- 30 11. The device according to any one of claims 1-10, further comprising an access hatch at one portion of the container.

12. The device according to any one of claims 1-11, further comprising a support base.
13. A system for delivering liquid to a cultivation medium comprising;
- a. a container for holding a volume of liquid;
 - b. an inlet through which the liquid can pass into the container;
 - 5 c. a sensor for detecting the liquid level within the container;
 - d. a valve for selectively blocking the flow of liquid through the inlet when the sensor indicates the liquid level is at a predetermined level
 - e. a series of elongate through holes on one side of the container for the liquid in the container to exit into the plant growth medium.
- 10 14. The system according to claim 13, wherein the predetermined level is set between the two ends of each elongate through hole for adequate irrigation.
- 15 15. The system according to claim 13 or 14, wherein the sensor is a float for interaction with the valve such that when the liquid level is at or above the predetermined level the valve blocks the flow of liquid through the inlet and when the liquid level is below the predetermined level the valve opens permitting the flow of liquid through the inlet.
16. The system according to claim 15, wherein the float has a filter sleeve for protecting the float from insects.
17. The system according to claim 13, wherein the sensor comprises an indicator for visualization of the liquid level.
- 20 18. The system according to claim 17, wherein the indicator comprises a transparent tube with level markings and a stick in the center of the tube, the stick associated with the sensor for coordination of the sensor and the stick.
19. The system according to claim 17, wherein the sensor comprises an electronic readout for visualization of the liquid level at a distance far from the sensor.
- 25 20. The system according to any one of claims 10 - 16, further comprising a plant pot for placing the container such that the container is surrounded by a plant growth medium on all sides.
21. The system according to any one of claims 13 - 20, wherein the inlet is attached to a tube for supply of liquid to the device.
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22. The system according to any one of claims 13 - 21, further comprising an access hatch on the container for allowing access to the float and the valve.
23. The system according to any one of claims 13-22, further comprising a support base for holding a solid nutrient source above the liquid in the container in use.
- 5 24. The system according to any one of claims 13-23, further comprising a runoff outlet for draining any excess water above a second predetermined level.
25. A method of using the device according to any one of claims 1-12 or system according to any one of claims 13-24 with a plant pot comprising:
- 10 a. filling the plant pot with a layer of plant growth medium;
- b. placing the container on the layer of plant growth medium;
- c. surrounding the container on all sides with plant growth medium;
- d. adding liquid into the container through the inlet to a predetermined level whereby the liquid exits into the plant growth medium through the elongate through holes into the plant growth medium; and
- 15 e. maintaining the predetermined level of liquid in the container via the sensor.