[004] Canadian Patent No. 1,106,607 discloses an apparatus for the continuous growing of plants in an enclosed growing room, wherein a meandering conveyor carrying plants in a grid pattern moves the plants past lamps, in a serpentine pattern. The lamps are arranged in a grid pattern and have a spatial light distribution curve which matches the spatial path curve of the conveyor so that the illumination near the plants is substantially constant.

[005] Within the field of hydroponics, known watering systems include floating ponds, flood and drain systems and nutrient film techniques. In the mechanical plant growing systems mentioned above, after a growth-sustaining liquid (typically consisting of water and, if applicable, a nutrient mix) is applied to the plants, such growth-sustaining liquid is then typically carried around in the growing trays or cradles holding the plants.

[006] As described herein, it is contemplated that the watering apparatus, system and method of the present invention can provide a number of advantages.

SUMMARY

[006a] In an aspect, the present disclosure refers to an apparatus for watering plants comprising: a watering trough, for receiving and holding a growth-sustaining liquid therein; an actuator means configured to actuate the watering trough between a first position and a second position; and a carrier system comprising a pair of conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each one of the plurality of cradles supporting one or more supported plants therein; wherein the pair of conveyors is configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at the watering position and the watering trough is in the second position, said one or more supported plants is at least partially

immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when said one of the plurality of cradles is at the watering position and the watering trough is in the first position, said one or more supported plants is removed from the growth-sustaining liquid in the watering trough.

[006b] In another aspect, the present disclosure refers to an apparatus for watering plants comprising: a watering trough, for receiving and holding a growth-sustaining liquid therein; an actuator configured to actuate the watering trough between a first position and a second position; and a carrier system comprising a pair of conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each cradle supporting a growing tray, the growing tray adapted to receive and support one or more supported plants therein; wherein the pair of conveyors is configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at the watering position and the watering trough is in the second position, said one or more supported plants is at least partially immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when said one of the plurality of cradles is at the watering position and the watering trough is in the first position, said one or more supported plants is removed from the growth-sustaining liquid in the watering trough.

[006c] In another aspect, the present disclosure refers to an apparatus for watering plants comprising: a watering trough, for receiving and holding a growth-sustaining liquid therein; an actuator configured to actuate the watering trough between an access position and a dunking position; and a carrier system comprising a pair of conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each cradle supporting a growing tray, the growing tray adapted to receive and support one or more supported plants therein; wherein the pair of conveyors is configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at

the watering position and the watering trough is in the dunking position, said one or more supported plants is at least partially immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when the watering trough is in the access position, the said one of the plurality of cradles may be conveyed by the conveyor away from the watering position and a successive one of the plurality of cradles may be conveyed by the conveyor to the watering position.

[006d] In another aspect, the present disclosure refers to a method for watering plants comprising the steps of: (i) providing a watering apparatus comprising: a watering trough, for receiving and holding a growth-sustaining liquid therein; an actuator configured to actuate the watering trough between a first position and a second position; and a carrier system comprising a pair of conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each one of the plurality of cradles supporting one or more supported plants therein; wherein the pair of conveyors is configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position; (ii) operating the pair of conveyors to convey a first one of the plurality of cradles to the watering position; (iii) filling the watering trough with growth-sustaining liquid; (iv) activating the actuator to actuate the watering trough from the first position to the second position, thereby immersing the supported plants in the growth-sustaining liquid; (v) deactivating the actuators to return the watering trough from the second position to the first position; (vi) operating the pair of conveyors to convey the cradle away from the watering position and to convey a successive cradle to the watering position; and (vii) repeating from step (iii) for successive cradles.

[007] In accordance with an example of the present disclosure, disclosed herein is an apparatus, system and method for watering plants, wherein such plants are being grown in a plurality of cradles supported by a conveyor. A watering trough is mounted on or supported by a lifting mechanism in the form of one or more actuators. The watering trough is provided to receive and hold a growth-sustaining liquid. The watering trough is actuable between a lower first position and an elevated second position, through operation of one or more actuators. When one of the cradles supporting one or more supported plants therein, is conveyed to a watering position disposed above the watering trough, and the watering trough

is actuated to the second position, this wholly or partially immerses the one or more supported plants in the growth-sustaining liquid, thus providing the plants with desired irrigation. When the watering trough is actuated to the first position, the one or more supported plants is removed from the growth-sustaining liquid. This watering is repeated for each successive cradles (and the supported plants therein), in what may be a continuous process.

[008] In one example, an apparatus for watering plants is provided comprising: (i) a watering trough, for receiving and holding a growth-sustaining liquid therein; (ii) an actuator means configured to actuate the watering trough between a first position and a second position;

and (iii) a carrier system comprising a pair of conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each cradle supporting one or more supported plants therein; wherein the pair of conveyors are configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at the watering position and the watering trough is in the second position, said one or more supported plants is at least partially immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when said one of the plurality of cradles is at the watering position and the watering trough is in the first position, said one of the plurality of cradles is removed from the growth-sustaining liquid in the watering trough.

[009] In another example, an apparatus for watering plants is provided comprising: (i) a watering trough, for receiving and holding a growth-sustaining liquid therein; (ii) an actuator configured to actuate the watering trough between a first position and a second position; and (iii) a carrier system comprising a pair of parallel conveyors and a plurality of cradles, the plurality of cradles supported by the pair of conveyors and spaced apart therealong, each cradle supporting one or more growing trays, said one or more growing trays adapted to support one or more supported plants therein; wherein the pair of conveyors are configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at the watering position and the watering trough is in the second position, said one or more supported plants is at least partially immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when said one of the plurality of cradles is at the watering position and the watering trough is in the first position, said one or more supported plants is removed from the growth-sustaining liquid in the watering trough.

[0010] In another example, an apparatus for watering plants is provided comprising: (i) a watering trough, for receiving and holding a growth-sustaining liquid therein; (ii) an actuator configured to actuate the watering trough between an access position and a dunking position; and (iii) a carrier system comprising a pair of parallel conveyors and a plurality of cradles, the

plurality of cradles supported by the pair of conveyors and spaced apart therealong, each cradle supporting one or more growing trays, said one or more growing trays adapted to support one or more supported plants therein; wherein the pair of conveyors are configured to convey the plurality of cradles along a path, thereby transporting each one of the plurality of cradles to and from a watering position, wherein when said one of the plurality of cradles is at the watering position and the watering trough is in the dunking position, the one or more supported plants in said one of the plurality of cradles is at least partially immersed in the growth-sustaining liquid in the watering trough so as to permit uptake of the growth-sustaining liquid by the one or more supported plants, and when the watering trough is in the access position, the said one of the plurality of cradles may be conveyed by the conveyor away from the watering position and a successive one of the plurality of cradles may be conveyed by the conveyor to the watering position.

[0011] In one example, the pair of conveyors is an endless conveyor, and the path is a continuous loop. In another example, the growing trays may be provided with one or more openings to allow growth-sustaining liquid to flow into the growing trays when the growing trays are wholly or partially immersed into the watering trough. In one example, the supported plants are seeds or seedlings.

[0012] In one example, the second position is elevated above the first position. In another example, the second position is disposed substantially vertically above the first position.

[0013] In one example, each one of the plurality of cradles, when in the watering position, is disposed substantially above the watering trough.

[0014] In one example the carrier system is additionally provided with a motor for mechanically driving the conveyor, thereby conveying the cradles along the path. In another example, the carrier system may be manually-driven.

[0015] In one example, the actuator means is an actuator. In another example the actuator comprises one or more pneumatically or hydraulically-driven mechanisms.

[0016] In one example, the types of supported plants may be selected from the group consisting of lettuces, leafy greens, cucumbers, peppers, tomatoes, cucumbers, herbs and flowers, and also

long vine plants, trees, etc. In another example, the supported plants being grown on the watering apparatus or in a particular growing tray may be of different types. In another example, the supported plants may be at varying stages of growth.

[0017] In another example, disclosed herein is a method of watering plants comprising: the steps of: (i) providing a watering apparatus described above; (ii) operating the pair of conveyors to convey a cradle to the watering position; (iii) filling the watering trough with growth-sustaining liquid; (iv) activating the actuators to actuate the watering trough from the first position to the second position, thereby immersing the supported plants in the growth-sustaining liquid; deactivating the actuators to return the watering trough from the second position to the first position; operating the pair of conveyors to convey the cradle away from the watering position and to convey a successive cradle to the watering position; and repeating the cycle from step (iii).

[0018] In another example, a plant growing system is disclosed comprising the disclosed apparatus for watering plants combined with a machine for growing plants along an undulating path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Embodiments of the present invention are described below with reference to the accompanying drawings in which:

Fig. 1 is an isometric view of a diagrammatic representation of a portion of the watering apparatus in accordance with an aspect of the present invention, wherein the watering trough is in a first position.

Fig. 2 is an isometric view of a diagrammatic representation of a portion of the watering apparatus in accordance with an aspect of the present invention, wherein the watering trough is in a second position.

Fig. 3 illustrates a sectional isometric view of the watering trough immersing an array of plant/seedling trays in the growth-sustaining liquid that is contained in the watering trough.