A modular and customisable planting system comprising a plurality of panels connected to one another to form an enclosure therein, the panels adapted to be connected laterally and/or vertically.
A MODULAR AND CUSTOMISABLE PLANTING SYSTEM

FIELD OF INVENTION

The invention relates to a modular and customisable planting system.

BACKGROUND TO THE INVENTION

The following discussion of the background to the invention is intended to facilitate an understanding of the present invention. However, it should be appreciated that the discussion is not an acknowledgment or admission that any of the material referred to was published, known or part of the common general knowledge in any jurisdiction as at the priority date of the application.

Urban heat island effect (UHIE) refers to the phenomenon when city temperatures run higher than those in suburban and rural areas. UHIE occurs primarily due to the growing numbers of buildings being built as a consequence of urbanization and economic growth, and these growing numbers of buildings have supplanted vegetation and trees previously filling the city area. In addition, human activities generate heat and such generation of heat contributes to the rise in city temperatures.

In an attempt to reduce the adverse influence of the UHIE, vegetations are grown on rooftops (i.e. green roof) to compensate for the loss of supplanted vegetation and trees. The vegetations serve to filter greenhouse gases such as carbon dioxide and other toxins in the city. It has been studied and demonstrated that such green roofs help to reduce roof ambient temperature and that heat transfer
from the roof to the rooms directly underneath the roof is lowered. A reduced ambient temperature and a lowered heat transfer from the roof to the rooms directly underneath the roof may result in lesser dependence on air-conditioning, thereby lessening the building's energy consumption.

In a typical green roof system, plants are conveniently housed in individual plant trays connected together to provide a larger surface area of greenery. Even though plant trays are commonly found in a variety of different sizes and shapes, most of them, if not all, are configured in almost the same way, that being a container (conveniently a box-shaped design) having an orifice near the bottom end of a side wall of the plant tray as a drainage means. The drainage means allows excess fluids such as water, fertilizers, chemicals and other liquids poured into the plant soil or plant substrate to advantageously drain out of the plant tray instead of building up in the plant tray and harming the plant (i.e. root rot, leaching of nutrients and the like).

Up to now, the above provides a low maintenance extensive green roof system that may be deployed quickly to provide instant greening or vegetation for both new and existing buildings. For extensive greening, the design of the green roof system is often limited by the choice of plant species due to its limited substrate thickness. In other words, the types of plants suitable for extensive green roof systems are those that do not require deep substrates for healthy growth. There are not many varieties of such plant species and the limited selection therefore translates to a somewhat monotonous green roof system.
It is desirable to provide for a planting system that accommodates more varieties of plant species, including those requiring deep substrates for healthy growth.

SUMMARY OF THE INVENTION

Throughout this document, unless otherwise indicated to the contrary, the terms "comprising", "consisting of, and the like, are to be construed as non-exhaustive, or in other words, as meaning "including, but not limited to".

In a first aspect of the present invention, there is provided a modular and
customisable planting system comprising a plurality of panels connected to one another to form an enclosure therein, each panel adapted to be connected laterally and/or vertically to at least one other panel. Advantageously, the plurality of panels provides modular and customisable design to afford landscape design.

Advantageously, each panel is adapted to be connected to its adjacent panel by connecting means. Preferably, the connecting means is a locking stud.

Advantageously, the upper and lower end of each panel comprises a flange. When in use, these flanges are flushed to the surface which they contact to provide greater stability and contact area.

Preferably, each panel is formed using lightweight and durable materials for easy portability and installation, so that it is able to withstand harsh weather conditions.

Preferably, such lightweight and durable materials include high density polypropylene, high density polyethylene, acrylics. Alternatively, wood and composites may also be used to form the panels.

Preferably, the flange is bent substantially perpendicular to a face of the panel.
Preferably, the bottom end and/or top end of each panel is provided with at least one hole.

Preferably, the sides of each panel are provided with at least one hole.

Preferably, the planting system further comprises stiffening means for stiffening the structure of the planting system.

In a second aspect of the present invention, there is provided a panel for use in a modular and customisable planting system, the panel adapted to stack onto a plant tray, each panel further securable to the plant tray via locking studs.

BRIEF DESCRIPTION OF THE DRAWINGS

In the figures, which illustrate, by way of example only, embodiments of the present invention,

Figure 1 shows a first embodiment of the present planting system positioned on the ground;

Figure 2 shows the planting system of the first embodiment arranged in a variety of shapes and size.

Figure 3 shows a second embodiment of the present planting system positioned on plant trays.

Figure 4 shows how each panel of the second embodiment may be stacked vertically/laterally with other similar panels to create a 'layering effect'; and

Figure 5 shows an example of the different planting depth arising from the 'layering effect' as depicted in Figure 4.
DETAILED DESCRIPTION

The invention relates to a modular and customisable planting system that is capable of accommodating more varieties of plant species, including those requiring deep substrates for healthy growth.

Figure 1 shows an embodiment of the modular and customisable planting system in accordance with a first aspect of the invention. The planting system comprises a plurality of panels connected to one another to form an enclosure therein. Each panel comprises an upper panel part and a lower panel part. In the embodiment illustrated, a 6x5-panel rectangular enclosure is formed. It is to be appreciated that the plurality of panels may be arranged to be formed into other shaped enclosures such as triangle, square or polygon, such as those illustrated in Figure 2.

The enclosure formed by the plurality of panels may be a closed one (as illustrated in Figure 1) or an open one. To form an open enclosure, a wall or any vertical surface such as a fence, may be used in place of one side of the enclosure. For example, a rectangular enclosure may be created by forming a three-sided structure having generally a U-shape, and positioning the three-sided structure against the wall or vertical surface at the open side of the enclosure. In this arrangement, the wall or vertical surface substitutes one side of the rectangular enclosure. This arrangement is particularly useful in areas where spaces are restricted. Besides the ability to customise the shape of the enclosure, there is better utilisation of existing structures and a reduction in the number of panels needed to form the enclosure, thereby saving materials and costs.
Conveniently, each panel 12 is rectangular in shape and comprises a first face 14 and a second opposing face 16, a first lateral side 18 and a second opposing lateral side 20, a top end 22 and a bottom end 24. The top end 22 and bottom end 24 of the panel 12 are typically flanges bent substantially perpendicular to the first face 14 and second face 16. For the convenience of orientation and illustration, the first face 14 may be defined as the side facing the interior of the enclosure and the second face 16 may be defined as the side facing away from the interior of the enclosure.

The first lateral side 18 and the second lateral side 20 are each provided with at least one hole 26. The position of the at least one hole 26 in the first lateral side 18 and the second lateral side 20 are at identical interval and location. The first lateral side 18 of the panel 12 is positioned immediately adjacent the second lateral side 20 of an adjacent panel 12. The first lateral side 18 of the panel 12 is connected to the second lateral side 20 of the adjacent panel 12 by connecting means such as locking studs via the corresponding holes in the first lateral side 18 and the second lateral side 20. Advantageously, the locking studs provide a strong connection between adjacent panels 12 and yet at the same time they may be easily unlocked for dismantling purposes. It is to be appreciated that other connecting means such as brackets, hinges, slide bolts, or hook/eye fasteners may also be used.

The bottom end 24 and/or top end 22 of each panel 12 or panel part 12a, 12b is preferably provided with at least one hole 28. When the planting system 10 is to be positioned on the ground, securing means such as screws or pipes may be
inserted into the ground via the hole 28 to hold the planting system 10 firmly in place. Alternatively, when the planting system 10 is to be positioned on a horizontal platform such as a table or stage, securing means such as screws, bolts and nuts may be inserted through the hole 28 to hold the planting system 10 firmly in place. The advantage of doing so is to prevent accidental toppling or slipping of the planting system 10.

The panel 12 is preferably formed of lightweight and durable materials for easy portability and installation, and able to withstand harsh weather conditions. Such materials include plastics such as high density polypropylene, high density polyethylene, acrylics, etc. Wood and composites may also be used as panels. The panel may also be made transparent for viewing pleasure or opaque for privacy. The planting system 10 may also comprise a combination of transparent panels 12 and opaque panels 12 for decorative purpose, for example.

**Figure 3** shows a typical arrangement of a plurality of plant trays 40 for use in a green roof system. In the simplest and most common form, the plant trays 40 are formed of a rectangular structure having a base having four walls extending upwards therefrom to define a tray interior. The tray interiors are subsequently filled with plant substrates. The commonly available trays come in standard, non-customisable sizes and dimensions. Some species of plants require a deeper substrate depth than others. Hence, the depth of the commonly available trays may not be adequate for optimal plant growth for such plants.
Utilisation of the present planting system 10 will provide a customisable plant tray depth. The panels 12 are stacked onto the plant trays 40 and are secured to the plant trays 40 by locking studs, for example. The plant trays preferably have corresponding holes provided on the top end 22 to accommodate the locking studs inserted through the holes 28 provided on the bottom end 24 of the panels 12. Conveniently, the dimensions of each panel 12 correspond to those of each plant tray 40. With the stacking of panels 12 on top of the plant trays 40, the depth for accommodating plant substrates may be customised and varied. The panels 12 help to ensure that the plant substrates are contained within the planting system and will not collapse. Although it has been illustrated in Figure 3 that the panels 12 are formed on the perimeter of the 3x3 plant trays arrangement, it is to be appreciated that panels 12 may additionally be formed in the interior of the arrangement to form several sections therein. In this manner, the arrangement may contain different sections having different plant substrate depths, and therefore different species of plants. This creates a more varied viewing pleasure and surrounding. Advantageously, the top ends 22 of the panels 12 may be used to support irrigation pipes providing irrigation to the interior of the arrangement. For example, to include a mechanical irrigation system (not shown), such as a drip-line system, to the planting system 10, the irrigation system can be run and secured along the top ends 22 of the panels 12. The irrigation system can be secured to the top ends 22 by securing means such as wires, brackets or screws.

Advantageously, the planting system 10 may further comprise stiffening means for stiffening the structure of the planting system 10 (not shown). The stiffening means can be in the form of a rib or the like. The stiffening means is coupled to at
least one panel 12, and at least a portion of the stiffening means is positioned within the enclosure formed by the panels 12. In the arrangement where there is a plurality of plant trays 40, the stiffening means may be coupled to at least one wall of the plant tray 40, and at least a portion of the stiffening means is positioned within the plant tray 40. It is to be appreciated that the stiffening means may also be coupled to at least one of the panels 12 that are stacked on the plant tray 40.

In one embodiment, the stiffening means is arranged along the two diagonals of the enclosure formed by the panels 12. It is to be appreciated that the stiffening means may be arranged along only one of the diagonals of the enclosure instead of both diagonals. It is to be further appreciated that the stiffening means may be arranged between any two panels 12 of the enclosure instead of along one or both of the diagonals. The stiffening means may also be arranged between one of the panels 12 and the base of the enclosure. Similarly, it is to be appreciated that in the arrangement where there is a plurality of plant trays 40, the stiffening means may be arranged along one or two of the diagonals of the plant tray 40, between any two walls of the plant tray 40, or between one of the walls and the base of the plant tray 40. It is to be further appreciated that the stiffening means may be arranged between one of the panels 12 that is stacked on the plant tray 40 and the base of the plant tray 40.

The afore-described planting system provides a cost effective and low maintenance system for achieving variable and customisable/scalable plant substrate depths. The planting system is easily assembled and dismantled for re-construction, and the panels are reusable. The planting system affords simplicity:
one type of connecting means may be used for both vertical stacking and lateral joining of panels, and one standard panel size as the basic building structure. Further, the vertical stacking and lateral joining of panels 12 may be easily customized to achieve a layering effect, as illustrated in Figure 4. Such layering, as mentioned earlier, allows for different planting depth within the planting system as illustrated in Figure 5.

By using low cost panels and connecting them together laterally and/or vertically, it is possible to construct a modular planting system on existing green roofs and achieve instant greening effects, stimulating creativity and promoting community harmony. Communal activities such as urban gardening help to promote and encourage more people to participate in the same activity. For example, the green roof may comprise different sections having different heights and different plant species. A mixture of children, adults and elderly may be simultaneously involved in maintaining the different sections of the green roof. Besides improving the landscape designs of green roofs, community harmony and social responsibility may be instilled within the community.

Although the foregoing invention has been described in some detail by way of illustration and example, and with regard to one or more embodiments, for the purposes of clarity of understanding, it is readily apparent to those of ordinary skill in the art in light of the teachings of this invention that certain changes, variations and modifications may be made thereto without departing from the spirit or scope of the invention as described in the appended claims. For example, one of the panels 12 may be pivotally connected via a hinge at either the first lateral side 18.
or second lateral side 20. That panel 20 may then serve as a swinging door for entry into and exit from the enclosure.

While each panel 12 comprises an upper panel part 12a and a lower panel part 12b as depicted in Figure 1, it is easily appreciated that each panel 12 may comprise entirely of an upper panel part 12a or 12b lower panel part 12b (see Figure 4).

It should be further appreciated that although the invention covers individual embodiments, it also includes combinations of the embodiments discussed. For example, the features described in one embodiment is not being mutually exclusive to a feature described in another embodiment, and may be combined to form yet further embodiments of the invention.
WE CLAIM:

1. A modular and customisable planting system comprising a plurality of panels connected to one another to form an enclosure therein, each panel adapted to be connected laterally and/or vertically to at least one other panel.

2. A modular and customisable planting system according to claim 1, wherein each panel is adapted to be connected to its adjacent panel by connecting means.

3. A modular and customisable planting system according to claim 2, wherein the connecting means is a locking stud.

4. A modular and customisable planting system according to any preceding claim, wherein the upper and lower end of each panel comprises a flange.

5. A modular and customisable planting system according to claim 4, wherein the flange is flushed to the surface which it contacts.

6. A modular and customisable planting system according to any preceding claim, wherein each panel is formed using one or more of the following: high density polypropylene, high density polyethylene, acrylics or wood.

7. A modular and customisable planting system according to claim 4, wherein the flange is bent substantially perpendicular to a face of the panel.
8. A modular and customisable planting system according to any preceding
claim, wherein the bottom end and/or top end of each panel is provided with at
least one hole.

9. A modular and customisable planting system according to any preceding
claim, wherein the sides of each panel are provided with at least one hole.

10. A modular and customisable planting system according to any preceding
claim, wherein the planting system further comprises stiffening means for stiffening
the structure of the planting system.

11. A panel for use in a modular and customisable planting system, the panel
adapted to stack onto a plant tray, each panel further securable to the plant tray
via locking studs.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.
A01G 9/02 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPDOC IPC A01G9/02, 9/1- and KEYWORDS (frame, enclosure, surround, bed, box, panel, beam, edge, module, component and similar terms)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search
24 May 2012

Date of mailing of the international search report
7 June 2012

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Form PCT/ISA/210 (second sheet) (July 2009)
**INTERNATIONAL SEARCH REPORT**

**INTERNATIONAL APPLICATION**

**International application No.**

PCT / SG20 12/000059

**C (Continuation).**

**DOCUMENTS CONSIDERED TO BE RELEVANT**

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Form PCT/ISA/210 (continuation of second sheet) (July 2009)
This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   - because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   - because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.:
   - because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

This International Searching Authority found multiple inventions in this international application, as follows:

See additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. X As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
- □ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.
- □ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- □ No protest accompanied the payment of additional search fees.
International application No.
PCT/SG2012/000059

Supplemental Box I
(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1 to 10 are directed to a modular and customisable planting system comprising a plurality of panels connected to one another to form an enclosure therein, each panel adapted to be connected laterally and/or vertically to at least one other panel. The feature of each panel adapted to be connected laterally and/or vertically to at least one other panel is specific to this group of claims.

- Claim 11 is directed to a panel for use in a modular and customisable planting system, the panel adapted to stack onto a plant tray, each panel further securable to the plant tray via locking studs. The feature of the panel adapted to stack onto a plant tray, each panel further securable to the plant tray via locking studs is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is a modular and customisable planting system comprising a plurality of panels. However this feature does not make a contribution over the prior art because it is disclosed in:

US 2010/0242357 A1 (VOGEL et al) 30 September 2010

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied a posteriori.
This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX