Description

MODULAR PLANT CONTAINER

Technical Field

The present invention relates generally to containers for vegetation, and more specifically to applications in which it is desirable to minimize container weight load, overall assembly cost, and restrain the plant roots to within the container.

Background

A common container for vegetation typically has holes in the bottom to allow water to drain out so that the plant roots are exposed to the proper amounts of soil, water, and air for plant health. For most plants, roots can follow the drain path of the water, regardless of the path diameter. This means that the roots of plants in a container may follow the water path outside of the container regardless of the size of the drain holes and continue growing outside of the container as long as they are exposed to favorable conditions. In some situations where such favorable conditions exist for roots outside of the container, the roots can grow into undesirable places such as the surface on which the planter rests, adjacent surfaces, adjacent planters, nearby ground, or out where they are visible. Some plant root systems also contain enzymes that can stain or damage many types of surfaces.

At the same time, inadequate aeration of the planting medium, as well as the bottom of the container, can result in propagation of undesirable bacteria and mold.

Additionally, container systems where root migration outside of the container is undesirable, such as those found in green roof systems or other landscaping on man-made surfaces, it may also be desirable to minimize the non-vegetated areas between containers while allowing air to access the bottom portions of the containers. Wide edges or gaps at the tops of many types of containers are often visible, interrupting the typically desirable appearance of a

continuous area of vegetation. For such container systems, it may also be desirable to retain a predetermined amount of water at the bottom of the planting medium to extend the length of time needed between irrigation or rain events.

Typically, root migration in plant containers is controlled with the use of geo-textile fabrics or in some cases, copper sheets. These methods still need additional support elements, inhibiting desirable aeration and adding to the cost and complexity of the container system.

The present invention addresses the problem of undesirable root migration by incorporating into a plant container a cavity at the bottom portion where an overly-aerated environment exists for roots, which inhibits their growth, but allows water to continue flowing out of the container and also promotes greater aeration of the planting medium. If the distance between the planting medium and the drain holes at the bottom of the container is large enough to effectively stop root growth for the plant species existing in the planting medium, the root systems for the plants will be entirely restricted to the container. The phenomenon of root migration being controlled by over-aeration, or air pruning, is well known in horticulture; however, incorporating the use of air pruning with the specific intent of limiting root migration completely within the boundaries of a container has not been identified.

Another form of the present invention addresses the issue of container proximity in container systems while providing air access to the bottom portions of the containers by incorporating a sloping wall design with an interlocking configuration that eliminates gaps between system containers and provides mechanical strength to the overall container design.

Another form of the present invention addresses the issue of water retention by incorporating recesses in the barrier plate such that water within the recesses cannot drain out of the container.

The present invention addresses the issues of container system cost and complexity by incorporating all desirable features in as few as two elements that can be produced from inexpensive materials, including, but not limited to, polyethylene, polypropylene, PVC, recycled forms of these plastics, ceramic materials, or metallic materials.

Summary of the Invention

In one embodiment of the present invention, a stationary plant container has an upper section in which planting media is contained and supports plant life and an attached lower section where root growth is inhibited while allowing water to drain out. The upper section of the container is comprised of open top, solid walls, and a pervious base comprising an approximately horizontal barrier plate between the planting medium and the lower section and a plurality of drain passages of sufficient size that water can pass through the base to the lower section while constraining planting medium to the upper section. The lower section is comprised of a top that is formed by the barrier plate, a base in which a plurality of large drain holes are located, and walls of sufficient distance between an upper section drain passage and a lower section drain hole to facilitate air pruning of the roots before they can migrate through the lower section drain holes. The barrier plate may be attached to the upper section base or it may be a separate piece that rests on portions of the upper section base. The barrier plate may also be attached to the upper section wall. Means of attachment may include welding, gluing, or the use of fasteners. The barrier plate may also be an integral part of the upper section base. The barrier plate may also be formed to incorporate recesses such that they retain a predetermined amount of water.

In another embodiment of the invention, the upper section of the container is comprised of open top, solid walls, a solid base, and a pervious diagonal barrier plate that contacts the wall along the uppermost edge of a barrier plate and contacts the base along the lowermost edge of said barrier plate. At its lower edge, the barrier plate may have a plurality of drain passages of sufficient size that water can pass through to the lower section while planting medium is constrained to the upper section. The barrier plate may also have similar drain passages at other locations above the lower edge. The lower section is formed on one side by an extension of the lower portion of the container wall, on another side by an extension of the perimeter of the base, and on another side by a barrier plate. The lower section base may also contain drain passages. A plurality of large drain holes may be located in the base of the lower section. A plurality of large drain holes may also be located at the bottom of the lower section wall segment. The distance between the barrier drain passages and the large drain holes is sufficient to prevent roots from growing through the lower section drain holes. The barrier plate may be attached to the upper section base or it may be a separate piece that rests on portions of the upper section base. The

barrier plate may also be attached to the upper section wall or it may be a separate piece that rests against the upper section wall. Means of attachment may include welding, gluing, or the use of fasteners. The barrier plate may also be an integral part of the upper section base. The barrier plate may also be an integral part of the upper section wall.

In yet another embodiment of the invention, the upper section of the container is comprised of an open top, a plurality of solid walls, a solid base, and one or more approximately horizontal barrier plates that contact one or more walls dividing the lower portion of the container. The lower section dividers may also contain drain passages. A plurality of large drain holes may be located in the base of the lower section. A plurality of large drain holes may also be located at the bottom of a lower section wall segment. The distance between a barrier drain passage and a large drain hole is sufficient to prevent roots from growing through the lower section drain holes. A barrier plate may also be formed to incorporate recesses such that they retain a predetermined amount of water.

In yet another embodiment of the invention, the walls of the upper section of the container may be configured such that each wall interlocks with an adjacent container of similar design.

The container can be configured in any number of shapes (as generally shown in a top plan view of the container). For example, the container can have a generally round shape, a generally square shape, a generally rectangular shape, a generally hexagonal shape, or a shape with complex geometry. The plant container components can be formed from materials including, but not limited to, thermoplastics, ceramics, or metals.

Other systems, methods, features, and advantages of the present invention will be, or will become, apparent to one having ordinary skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

Brief Description of the Drawings

The invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

Figure 1 is a cross-sectional side diagrammatic view of the present invention.

Figure 2 is a top plan view of the present invention.

Figure 3 is a cross-sectional side diagrammatic view of the diagonal-barrier form of the present invention.

Figure 4 is a cross-sectional side diagrammatic view of the present invention with the lower section divided into multiple sections.

Figure 5 is a top view of the present invention with the lower portion divided into multiple sections and the upper portion configured to interlock with similarly configured containers.

Figure 6 is a cross-sectional side diagrammatic view of the present invention with a barrier plate configured with recesses for retaining water.

Detailed Description

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspects of the invention to the embodiments illustrated.

The present invention is a stationary container system that incorporates into a plant container an open area at the bottom where an overly-aerated environment exists for air-pruning of roots.

Referring to Figure 1, a cross-sectional side diagrammatic view of the plant container 1 is shown. The plant container 1 has an upper section 2 in which planting media 10 is contained and supports plant life 8 which includes the roots 9 of a plant. Attached to the bottom of the upper section 2 is a lower section 3. The upper section of the container is comprised of open top, solid

walls 18, and a pervious base 4. The base 4 comprises a barrier plate 5 that separates the planting medium 10 from the lower section 3. The barrier plate may be porous or otherwise contain drain passages 7. Between the planting medium and the lower section may be a plurality of drain passages 7 of sufficient size that water and roots can pass through the base along the drain path 11 to the lower section while constraining planting medium 10 to the upper section 2. The lower section is comprised of a top that is formed by the upper section base 4, a base in which a plurality of large drain holes 12 are located, and solid walls. The walls are of sufficient height to form a gap 6 between an upper section drain passage 7 and a lower section drain hole 12 large enough to prevent roots 9 from growing through the lower section drain holes 12. The desired distance of the air gap 6 is largely determined by the requirements of the species of plant 8 that exists in the upper section 2. The desired dimensions of a drain passage 7 are largely determined by the size of the planting medium 10 grains to be retained in the upper section 2 and the desired rate of water flow out of the container. The barrier plate 5 may be attached to the upper section base 4 or it may be a separate piece that rests on portions of the upper section base 4. The barrier plate 5 may also extend to and be attached to the upper section wall 18. The barrier plate 5 may also be an integral part of the upper section base 4.

Referring to Figure 2, a top plan view of the plant container 1 is shown. In this view, the lower section large drain holes 12 are located midway between upper section drain passages 7, emphasizing the intent of the air gap 6 to be of maximum practical length.

Referring to Figure 3, a cross-sectional side diagrammatic view of a form of the present invention in which the barrier plate is diagonal such that it contacts both the wall and base of the plant container is shown. The upper section 14 of the diagonal-barrier plant container 13 is comprised of open top, solid walls 19, a solid base 20, and a pervious barrier plate 16 that contacts the wall 19 along the uppermost edge of the barrier plate 22 and contacts the base 20 along the lowermost edge of the barrier plate 23. At its lower edge 23, the diagonal barrier plate 16 may have a plurality of drain passages 17 of sufficient size that water and roots can pass from the upper section 14 to the lower section 15 along the drain path 11 while planting medium 10 is constrained to the upper section 14. The barrier plate 16 may also have similar drain passages 17 at other locations above the lower edge 23. The lower section 15 is formed on one side by an extension of the lower portion of the container wall 19, on another side by an extension of the perimeter of the base 20, and on another side by the diagonal barrier plate 16. A plurality of large

drain holes 12 may be located in the base of the lower section 15. A plurality of large drain holes 12 may also be located at the bottom of the lower section wall segment. The lower section base may also contain drain passages 24. The barrier plate is of sufficient dimensions to form an air gap 6 between an upper section drain passage 17 and a lower section drain hole 12 large enough to prevent roots 9 from growing through the lower section drain holes 12. The desired distance of the air gap 6 is largely determined by the requirements of the species of plant 8 that exists in the upper section 2. The desired dimensions of barrier plate drain passages 17 and lower section base drain passages 24 are largely determined by the size of the planting medium 10 grains to be retained in the upper section 2 and the desired rate of water flow out of the container. The barrier plate 16 may be attached to the upper section base 20 or it may be a separate piece that rests on portions of the upper section base 20. The barrier plate may also be attached to the upper section wall 19 or it may be a separate piece that rests against the upper section wall 19. The barrier plate 16 may also be an integral part of the upper section base 20. The barrier plate may also be an integral part of the upper section wall 19.

Referring to Figure 4, a cross-sectional side diagrammatic view of a form of the present invention in which the lower section incorporates one or more dividers is shown. The plant container with lower section dividers 21 has an upper section 2 and a lower section 3. The upper section of the container is comprised of open top, solid walls 18, and a pervious base 4. The base 4 comprises a barrier plate 5 that separates the planting medium from the lower section 3. The barrier plate may be porous or otherwise contain drain passages 7. Between the planting medium and the lower section 3 may be a plurality of drain passages 7 of sufficient size that water and roots can pass through the base along the drain path 11 to the lower section 3 while constraining planting medium to the upper section 2. The lower section is comprised of a top that is formed by the upper section base 4, barrier plate 5, and lower section dividers 25. The walls are of sufficient height to form a gap 6 between an upper section drain passage 7 and a lower section drain hole 12. Lower section drain holes 12 may be located at the bottom of outer walls of the container or along the bottom portion of a lower section divider. The barrier plate 5 may be partially supported by a lower section divider 25.

Referring to Figure 5, a top plan view of a form of the present invention in which the upper section wall is configured to facilitate interlocking with an adjacent container of similar design is shown. The interlocking plant container module 26 has an upper section 2 and a lower

section 3 separated by a barrier plate 5. Each upper section wall 18 is formed into an interlocking configuration 27 containing a series of angles such that the convex portion of one wall is in contact with the concave portion of another wall, inhibiting lateral and perpendicular movement while allowing vertical movement for installation or on uneven surfaces. The upper wall interlocking configuration 27 portion of the upper section wall 18 may extend as far down the side of the container wall as preferred for a specific design and allowed by manufacturing and assembly limitations. Between the upper section 2 and the lower section 3 may be a plurality of drain passages 7 of sufficient size that water and roots can pass through the base along the drain path 11 to the lower section 3 while constraining planting medium to the upper section 2. This form of the present invention may also incorporate lower section dividers 25.

Referring to Figure 6, a cross-sectional side diagrammatic view of a form of the present invention in which a barrier plate incorporates recesses that retain a predetermined amount of water. The Plant Container with Water-Retaining Barrier Plate 28 has an upper section 2 and a lower section 3. The upper section of the container is comprised of open top, solid walls 18, and a pervious base 4. The base 4 comprises a barrier plate 5 that separates the planting medium from the lower section 3. The barrier plate 5 is configured with water-retaining recesses Plate 29 of a volume determined to be optimal for the amount of water to be retained. Between the planting medium and the lower section 3 may be a plurality of drain passages 7 of sufficient size that water and roots can pass through the base along the drain path 11 to the lower section 3 while constraining planting medium to the upper section 2. The walls are of sufficient height to form a gap 6 between an upper section drain passage 7 and a lower section drain hole 12. This form of the present invention may also incorporate lower section dividers 25.

The overall dimensions and shape of the plant container 1 in all its forms are generally unlimited, however, those practiced in the art will appreciate that specific dimensions are dictated by a particular application.

Each of the components of the present invention can be constructed of a wide range of solid materials including but not limited to high density thermoplastics, thermoset composites, various metals, rigid porous media, ceramics, glass, or wood. Those practiced in the art will appreciate that each of the components described can be formed through a variety of techniques including but not limited to injection molding, casting, or milling as dictated by the specific

application.

Specific examples of applications of the present invention include vegetation containers located on building rooftops, balconies, decks, patios, soil, indoors, or adjacent to other types of containers.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely setting forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without substantially departing from the spirit and principles of the invention. All such modifications are intended to be included herein within the scope of this disclosure and the present invention and protected by the following claims.

LIST OF ELEMENTS

1. Plant Container
2. Upper Section
3. Lower Section
4. Upper Section Base
5. Barrier Plate
6. Air Gap
7. Drain Passage
8. Plant
9. Roots
10. Planting Medium
11. Water and Root Flow Path
12. Large Drain Hole
13. Diagonal-Barrier Plant Container
14. Diagonal-Barrier Container Upper Section
15. Diagonal-Barrier Container Lower Section
16. Diagonal Barrier Plate
17. Diagonal Barrier Plate Drain Passage
18. Upper Section Wall
19. Diagonal-Barrier Container Upper Section Wall
20. Diagonal-Barrier Container Upper Section Base
21. Plant Container with Lower Section Dividers
22. Diagonal Barrier Upper Edge
23. Diagonal Barrier Lower Edge
24. Diagonal-Barrier Container Base Drain Passage
25. Lower Section Divider
26. Interlocking Plant Container Module
27. Upper Wall Interlocking Configuration
28. Plant Container with Water-Retaining Barrier Plate
29. Water-Retaining Recesses in the Barrier Plate

Figure 1

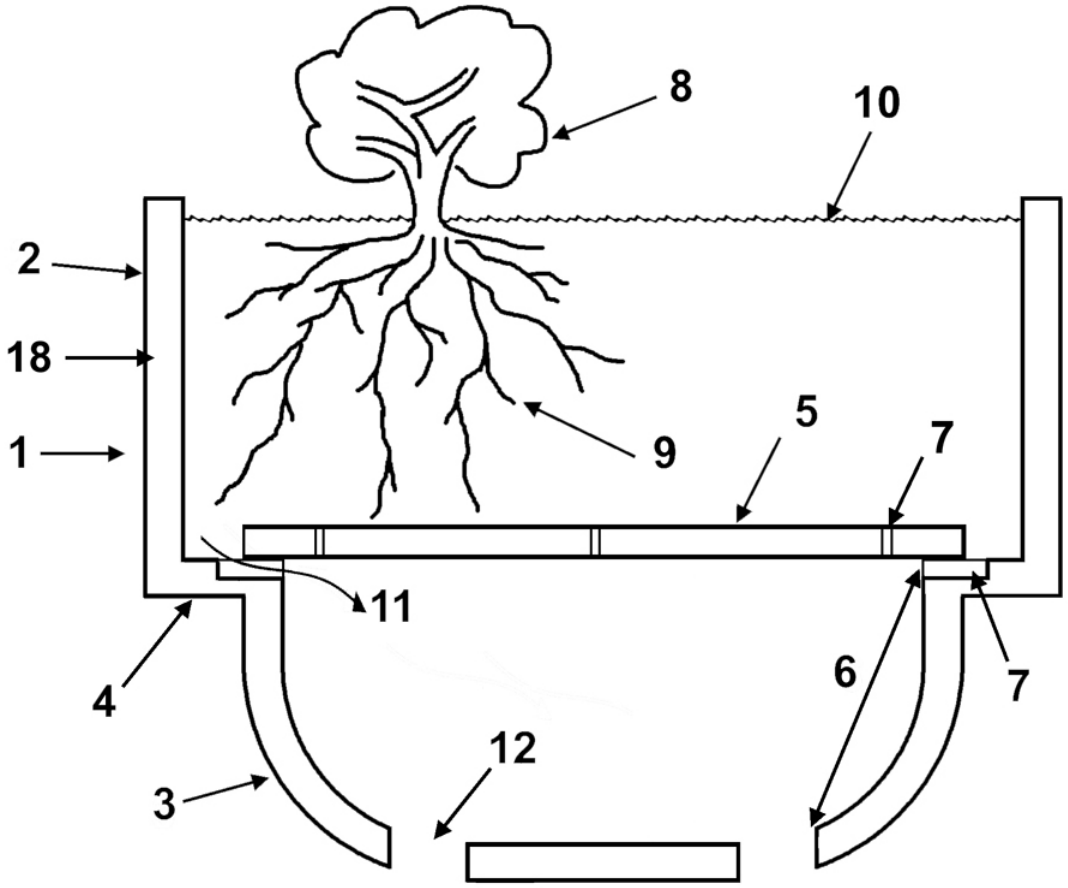

Figure 2

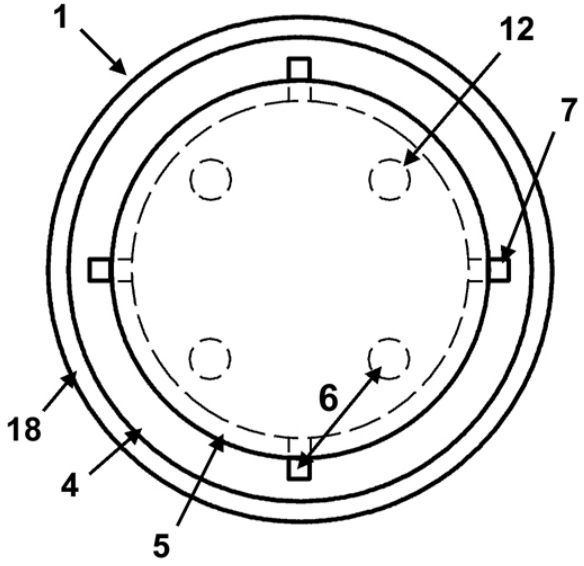

Figure 3

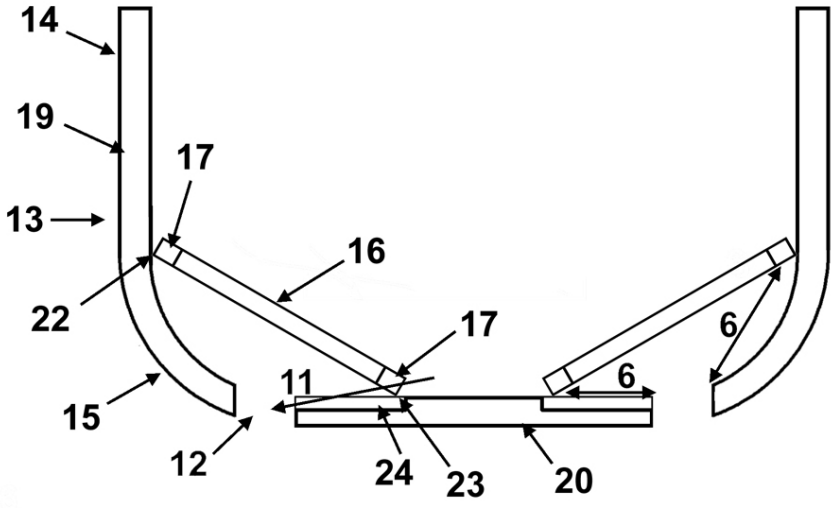

Figure 4

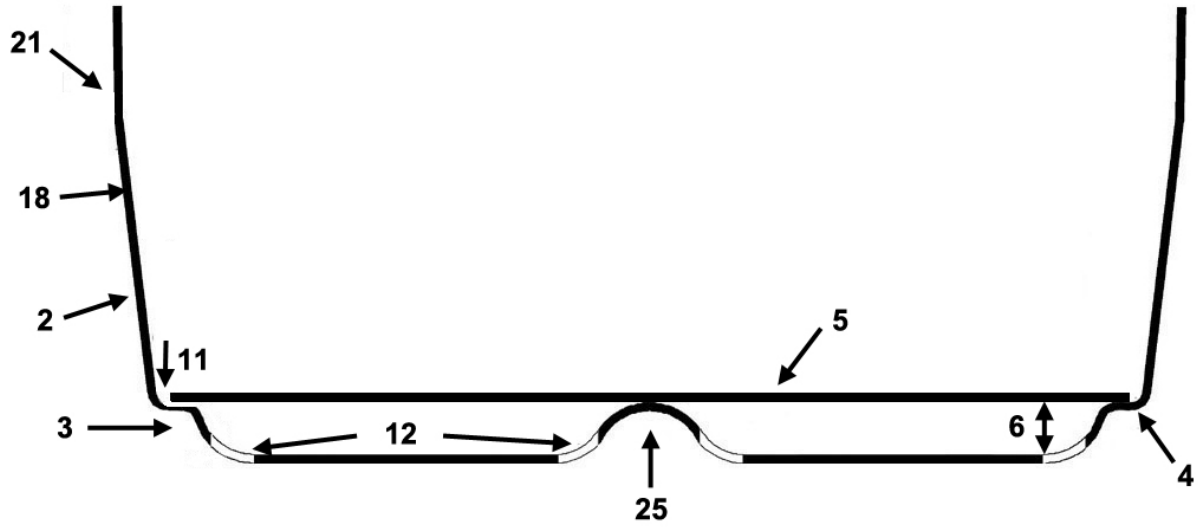

Figure 5

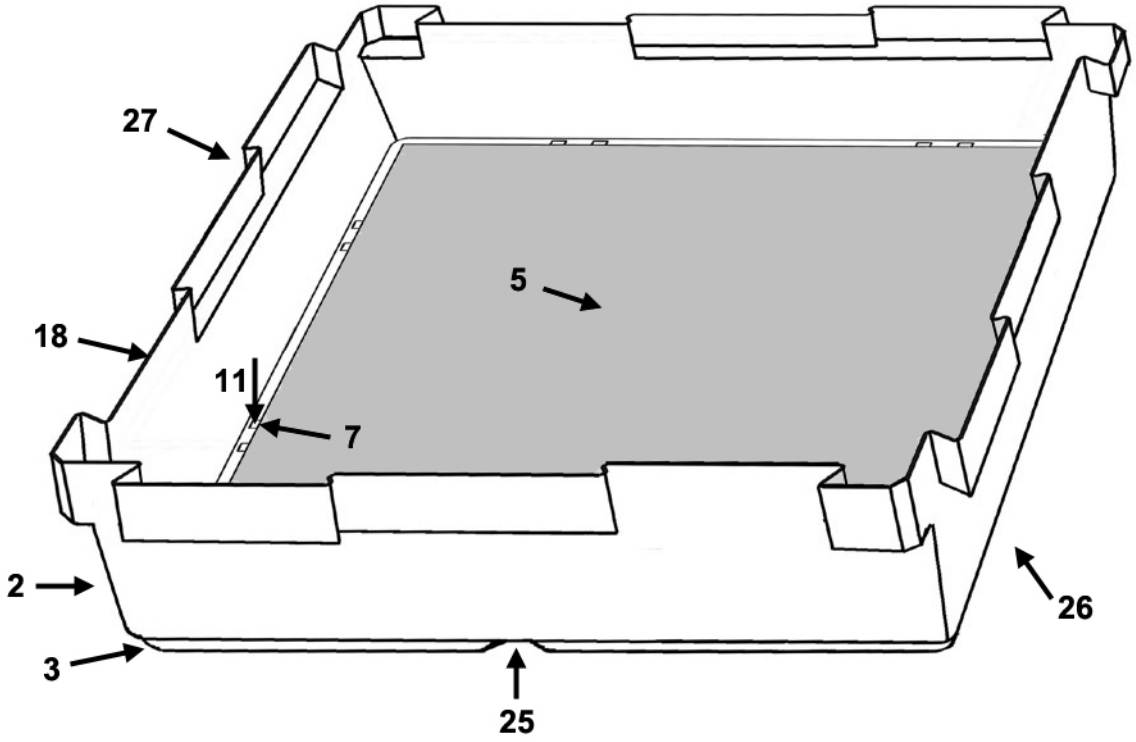

Figure 6