



US 20130152499A1

(19) **United States**

(12) **Patent Application Publication**
Kriekemeier

(10) **Pub. No.: US 2013/0152499 A1**

(43) **Pub. Date: Jun. 20, 2013**

(54) **WATER RETENTION/DETENTION
STRUCTURE FORMED FROM IDENTICAL
PANELS**

Publication Classification

(51) **Int. Cl.**
E02B 11/00 (2006.01)
E04B 1/38 (2006.01)
(52) **U.S. Cl.**
USPC **52/588.1; 405/52**

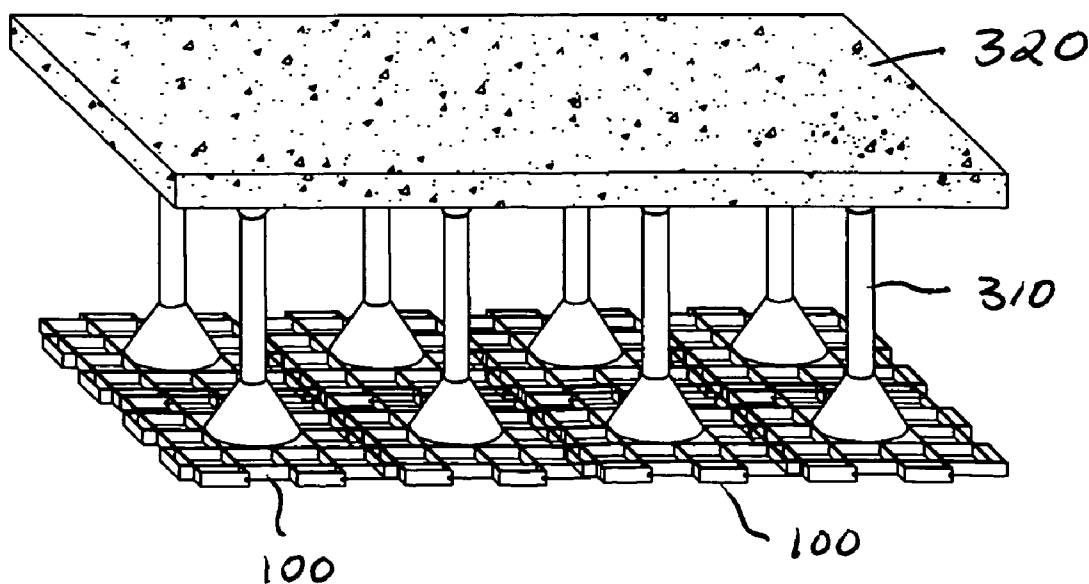
(76) Inventor: **John E. Kriekemeier**, Alpharetta, GA
(US)

(21) Appl. No.: **13/374,236**

(22) Filed: **Dec. 19, 2011**

(57) **ABSTRACT**

A water retention and detention assembly formed of a plurality of panels that may be interconnected edge to edge in a range of 90 through 270 degrees using a unique connector tab arrangement.



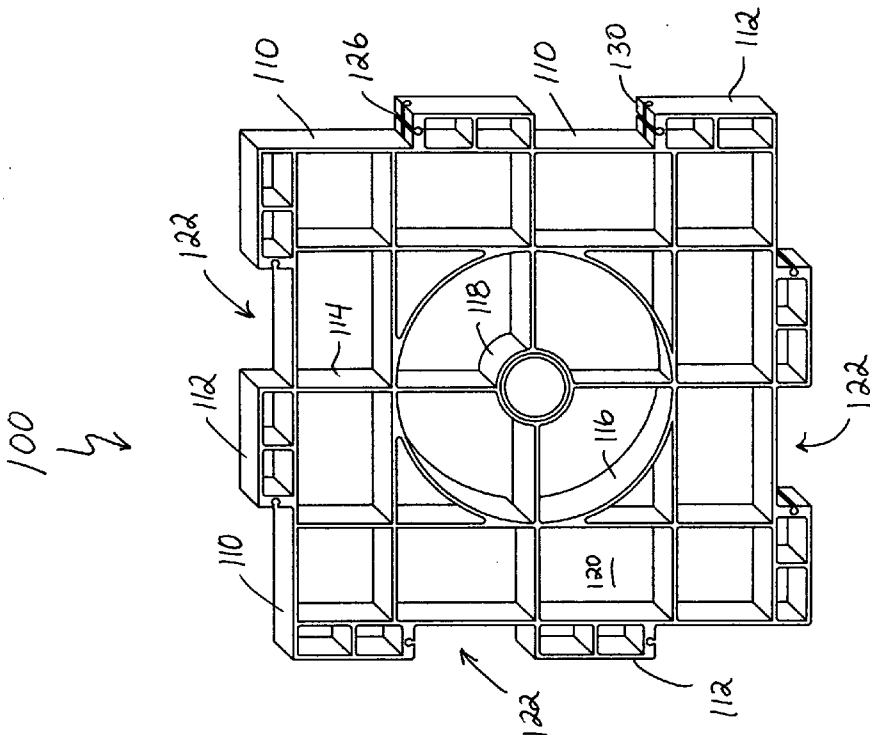


FIG 1

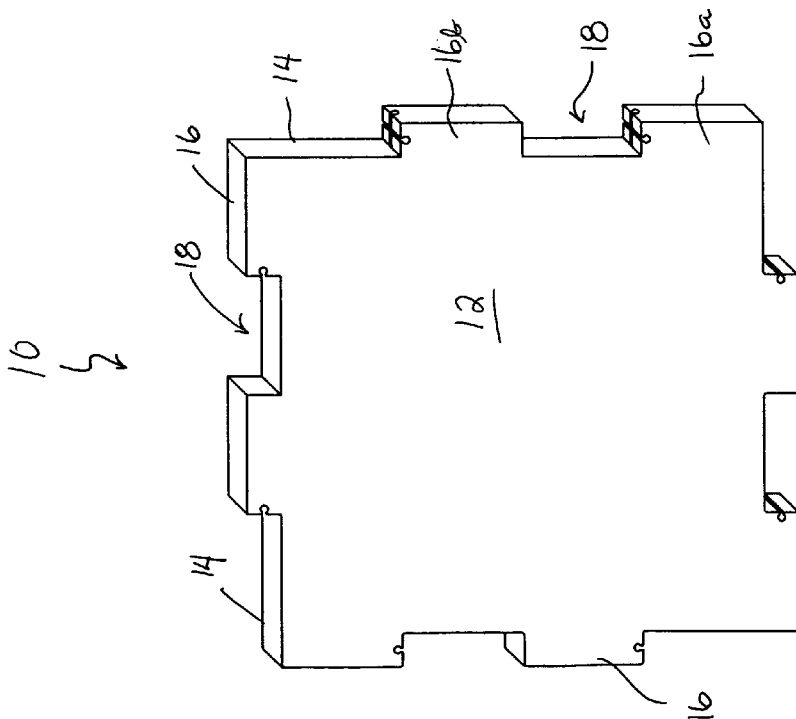


FIG 2

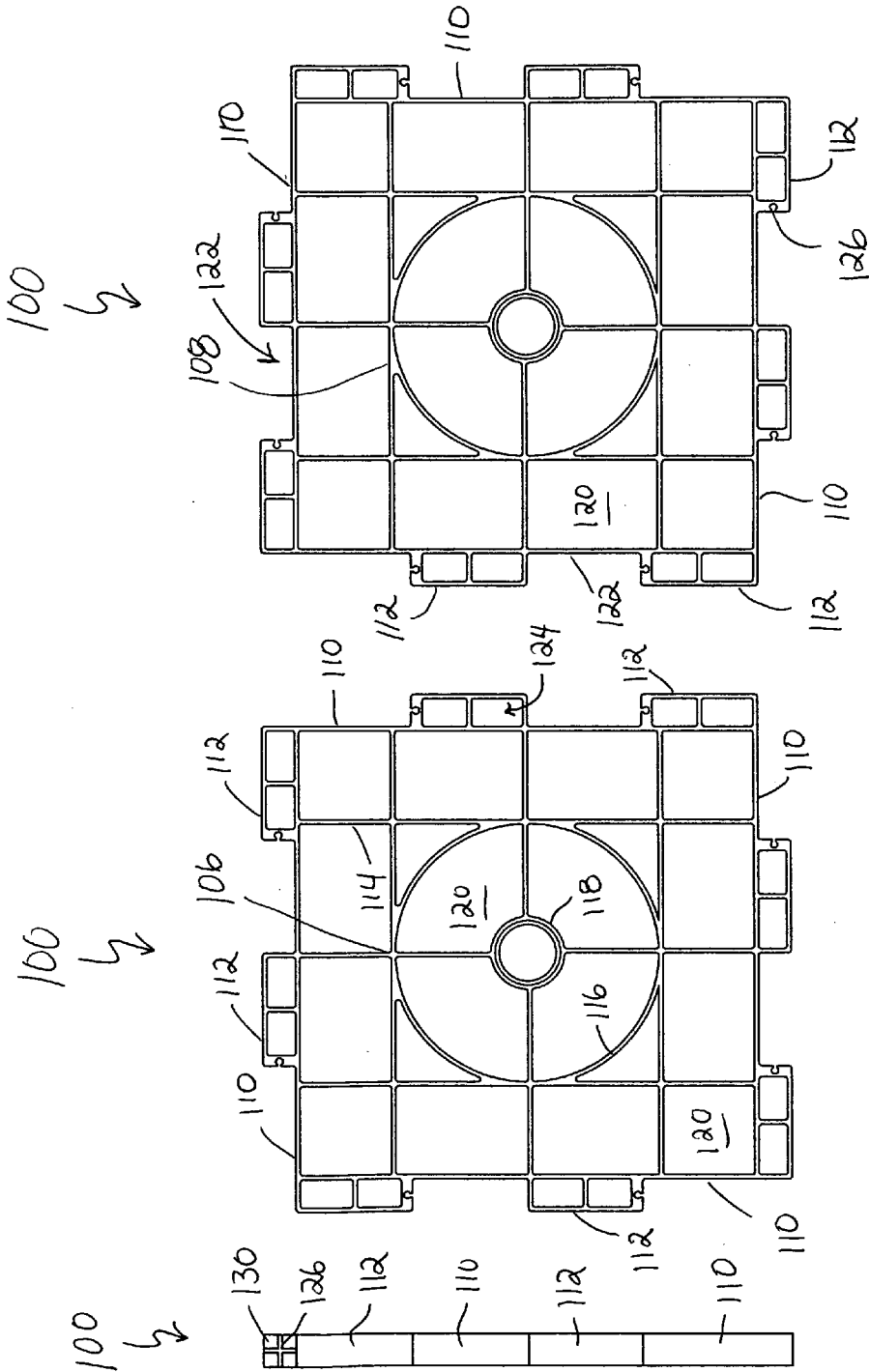


FIG 3

FIG 4

FIG 5

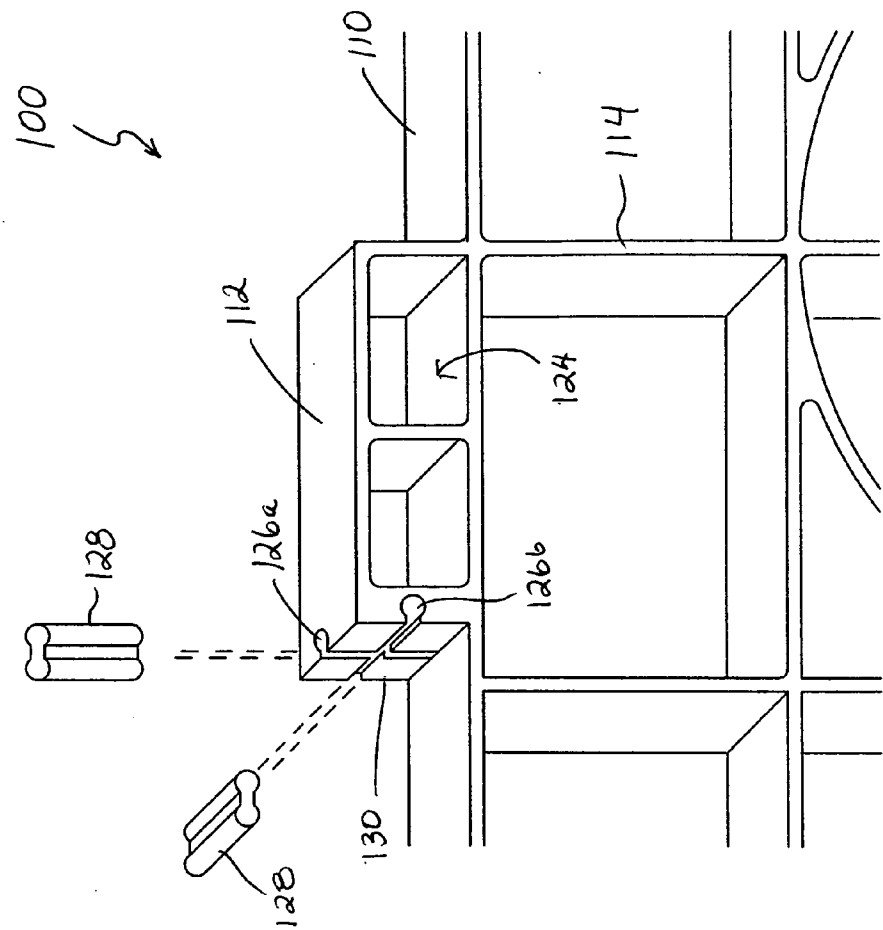
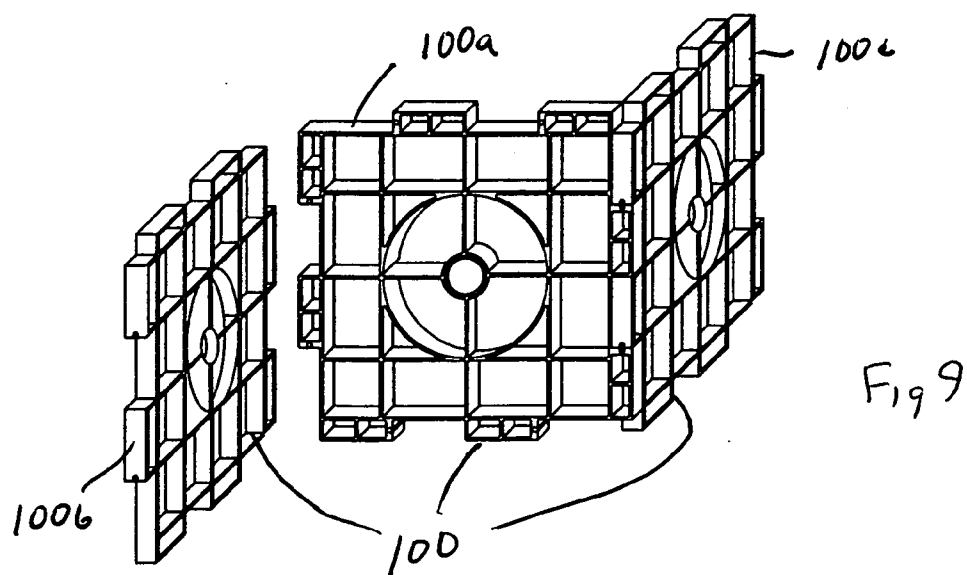
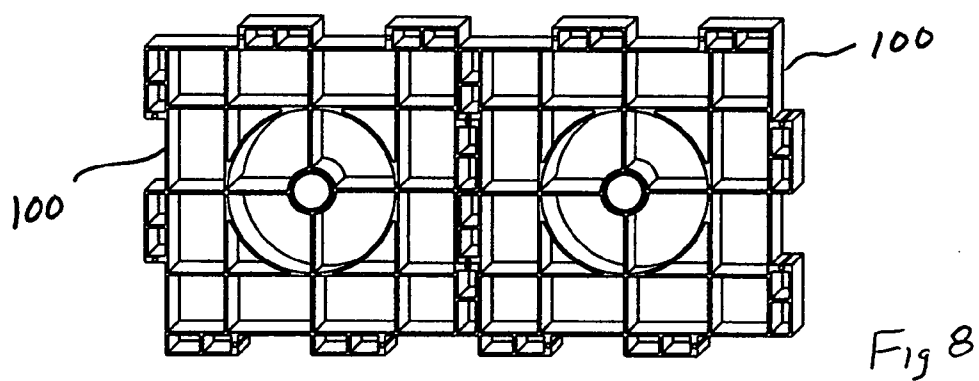
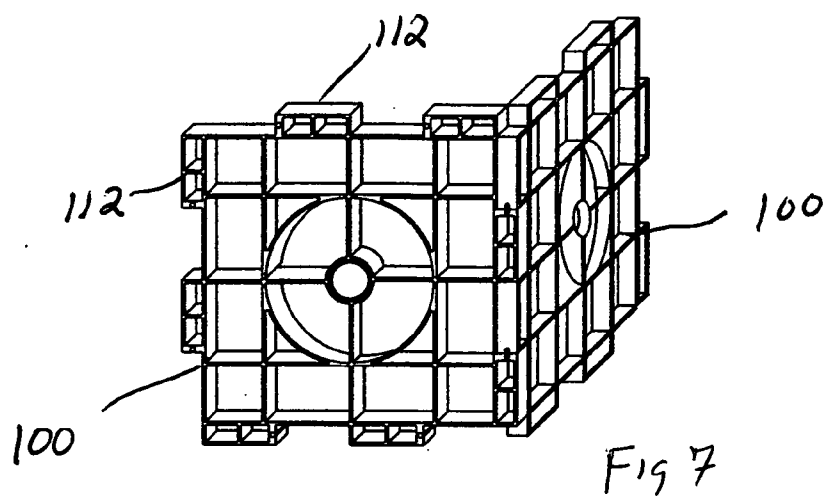
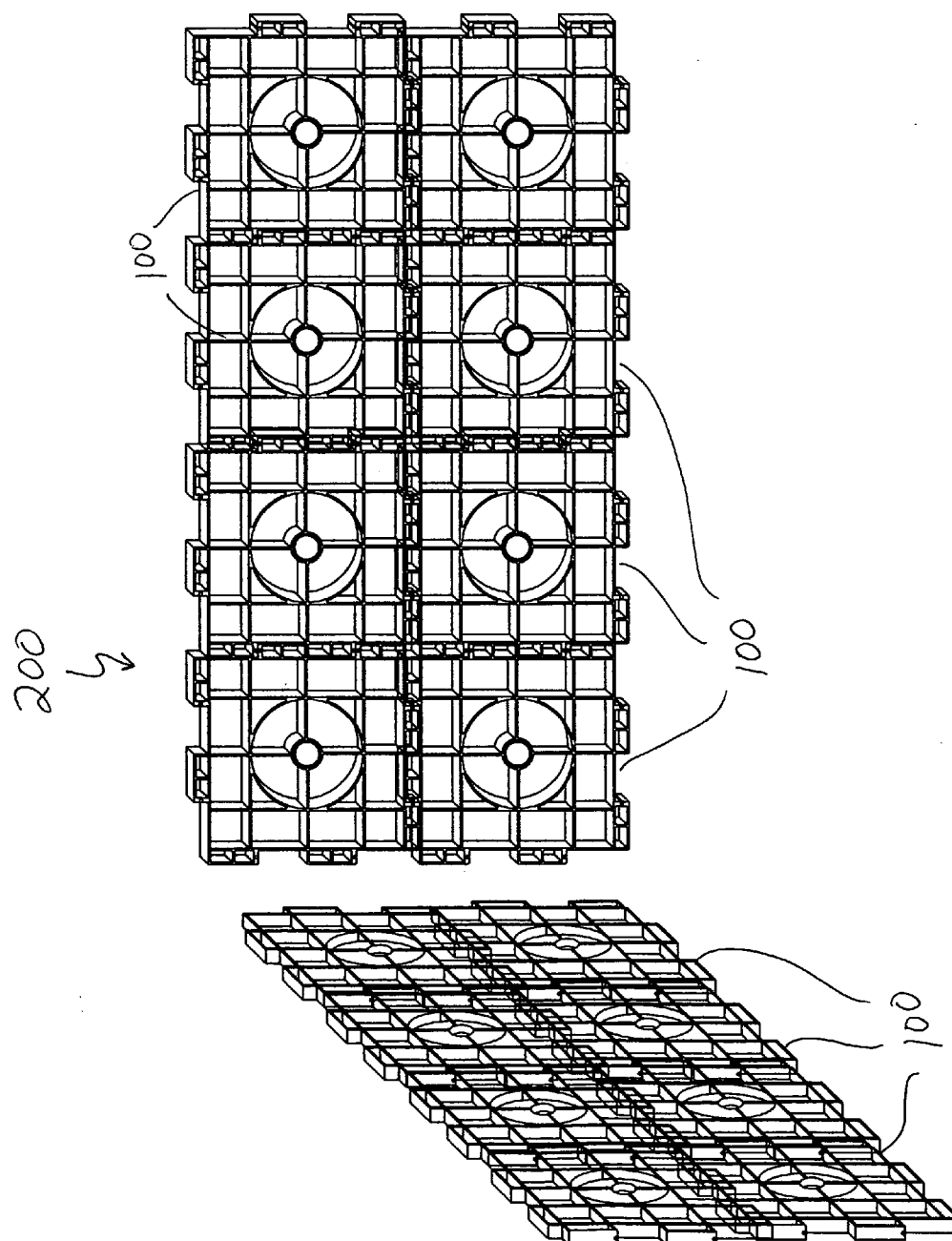


FIG. 6





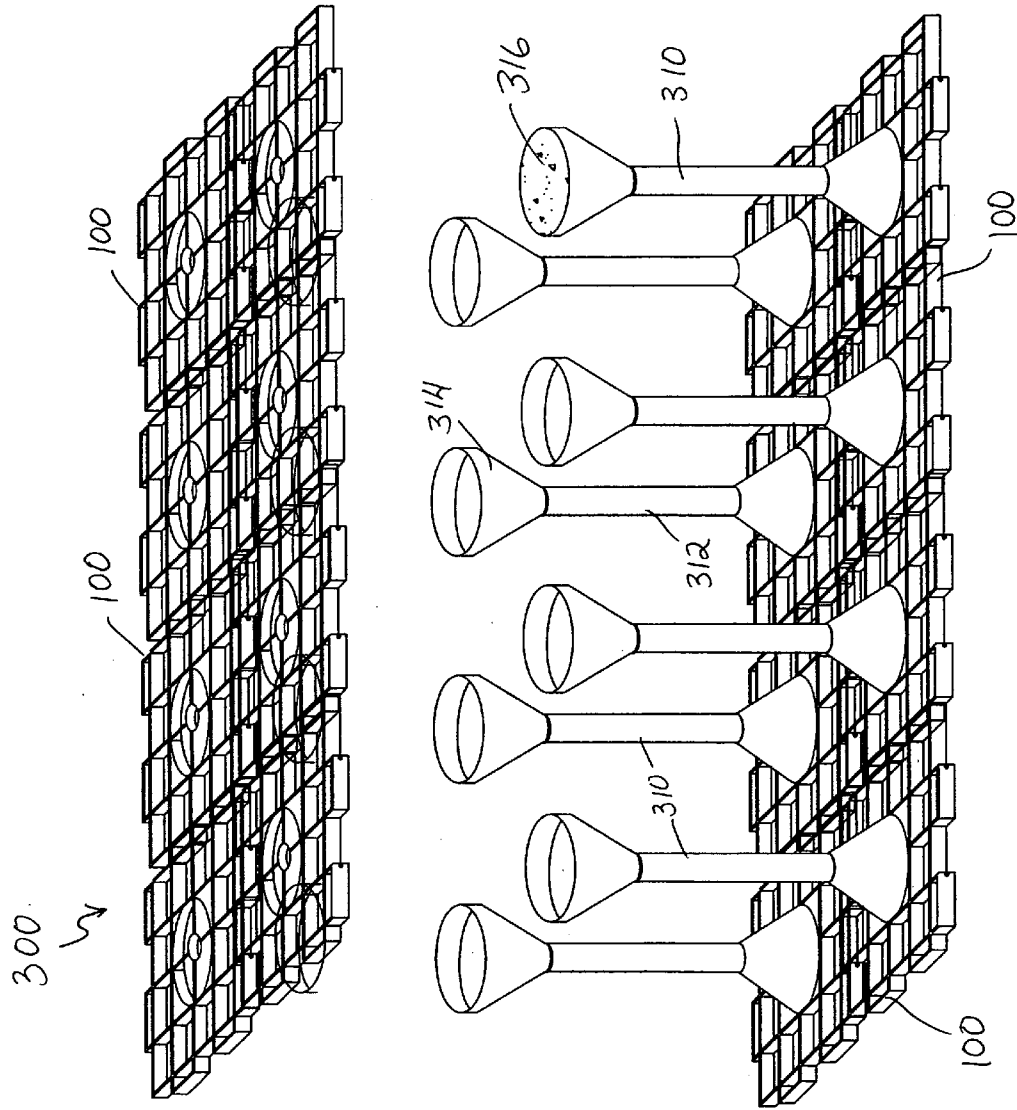
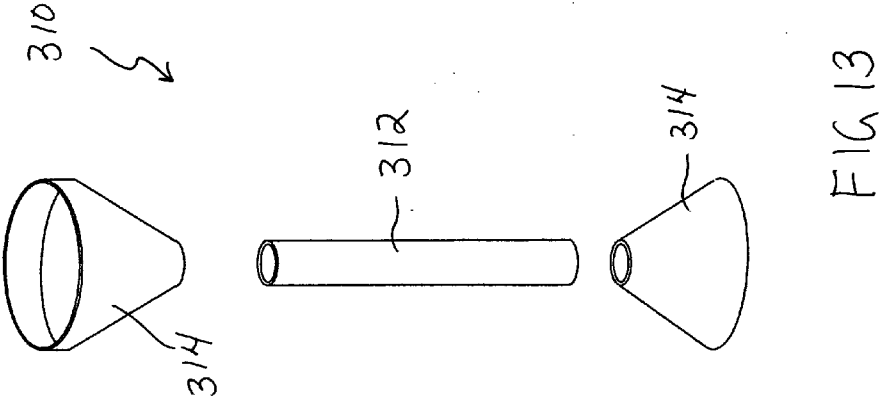
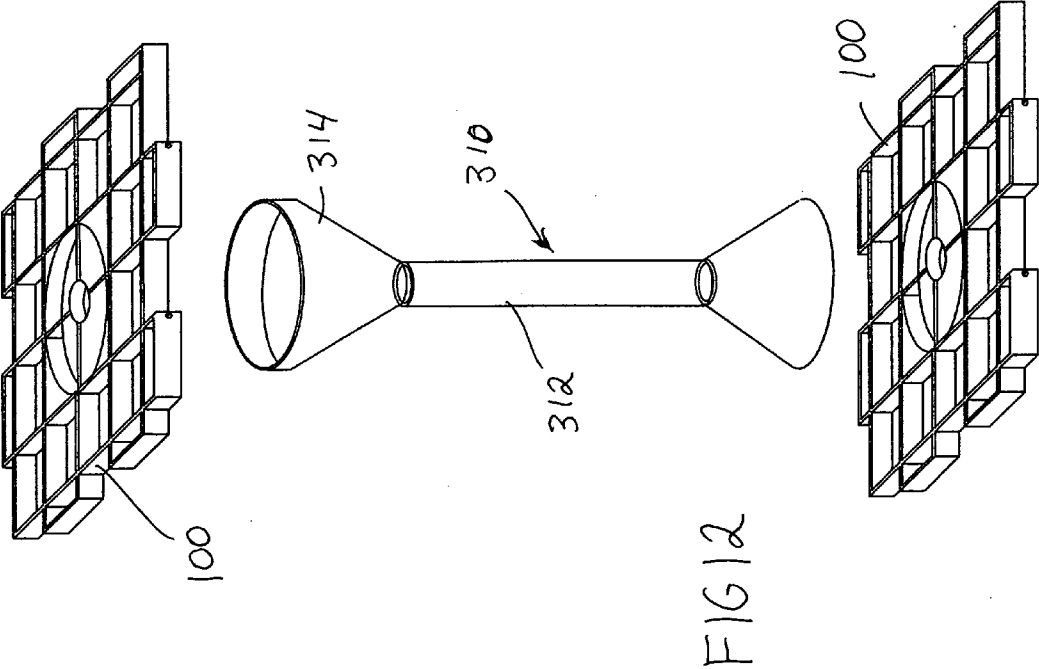
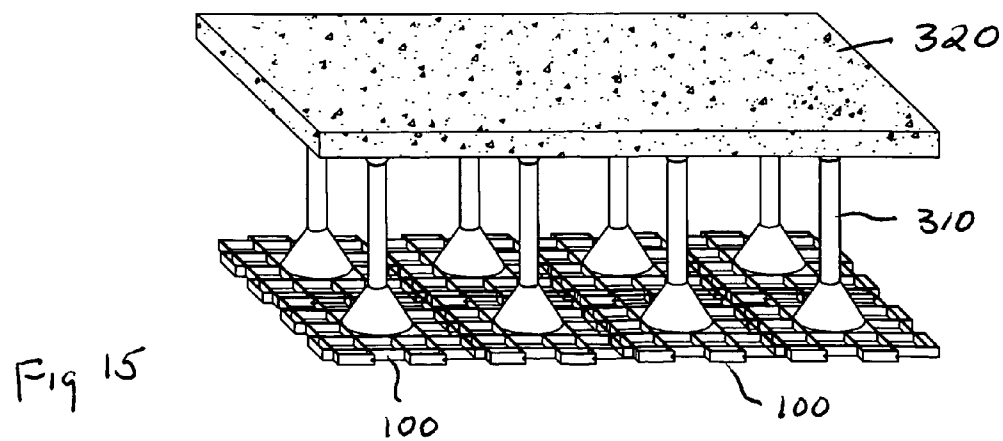
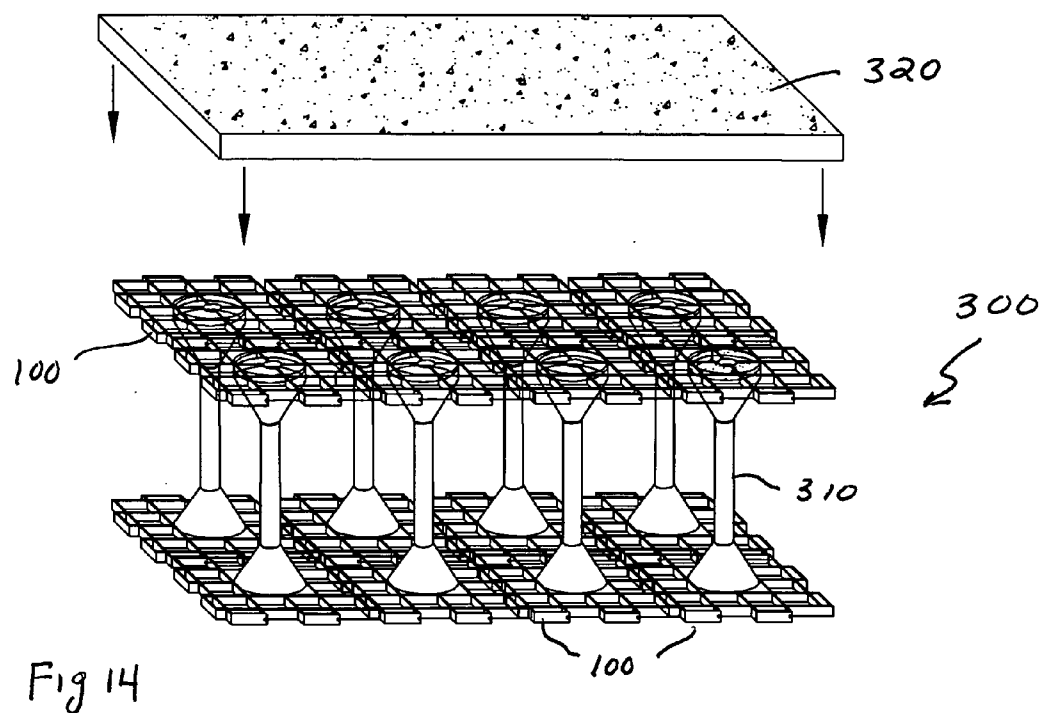


FIG 11





WATER RETENTION/DETENTION STRUCTURE FORMED FROM IDENTICAL PANELS

REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to U.S. Provisional Patent Application No. 61/081,460 filed December Jul. 17, 2008 and U.S. patent application Ser. No. 12/505,233 filed Jul. 17, 2009, both entitled "Water Retention/Detention Structure Formed from Identical Panels" which is incorporated by reference in its entirety as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] Improperly managed storm runoff water flows from impervious surfaces picking up pollutants, and washes them into rivers and streams. In addition storm water run-off causes flooding and erosion, destroys habitat, and contributes to storm sewer overflows. Storm water retention and detention basins can be constructed underground with reclaimed water released slowly into rivers and streams or retained on site for irrigation purposes. Properly installed underground retention structures can provide for debris and pollutant removal. Underground retention structures can also be used for the storage of rainwater and/or grey water, for subsequent use as sustainable irrigation. These underground structures can be used to free up valuable space on site for parking lots, play grounds, parks, gardens and other amenities.

[0003] Conventional retention/detention systems most often include an array of heavy and cumbersome concrete structures that are extremely expensive to transport and install. Other water detention/retention structures consist of a multitude of small molded plastic parts that are labor intensive and often difficult to assemble due to the large number of different parts in the system. These systems have little or no access inside the structure for maintenance, and debris removal. Still others of these systems consist of an assemblage of large pipes or arched structures that require large quantities of expensive gravel in their installation and have very limited access for maintenance.

[0004] Examples of prior art systems are disclosed in U.S. Pat. Nos. 6,095,718 to Bohnhoff and 6,648,549 to Urriola and EP 1 416 099 A2 to Ramella et al.

[0005] Other prior art of interest cited in the referenced applications is US patent application 2006/0250052 to Davis et al, not related water storage and retention systems. Davis et al discloses a modular furniture assembly using identical panels with connector tabs to join adjacent panels as seen in FIG. 3C of the reference. This connection structure only permits the connection of adjacent panels at a ninety degree angle because of the angular orientation of the connector tabs. Therefore the teaching is limited to the creation of a square or box like structure.

SUMMARY OF THE INVENTION

[0006] The present invention provides a simple, modular, straight forward approach to a construction assembly for joining assembly panels together in a variety of different configurations for use with water retention/detention systems. In a broader context, the panels of the present invention that are particularly suitable for a water retention/detention system, may be used for a wide variety of different building and structural uses.

[0007] The panels are identical in size and shape and are structured to interconnect in a variety of different configurations and sizes. The panels are further defined by being able to connect in an in-line configuration or at ninety degrees to each other to form a cubic and/or rectangular structural shaped framework with a hollow interior. These structural shapes may be used for a wide variety of structural and/or engineering applications, particularly where an on-site location requires specific sizes and shapes to accomplish the intended purpose.

[0008] In the preferred embodiments, the panels are substantially square when viewed in elevation. The simplicity of the invention provides for a unique structure where six identical panels can be assembled to form a perfect hollow cube. Likewise, the panels can be assembled to form a connected double, hollow cube, a triple, hollow cube and many other geometrical configurations as preferred. Thus a wide variety of cubic and rectangular shapes and combinations thereof can be constructed in accordance with the site needs. The simplicity of the design prevails since multiple copies of only a single panel design is used thereby eliminating confusion with the use of different multiple parts and their assembly. The panels are relatively light weight, compact and can be palletized to facilitate easy and inexpensive transportation.

[0009] The interior sections of the structures made with the panels may be hollow and a wide variety of structures are possible using the panels as an outer support shell. After the formation of the specified number of cubes or assembled panels is complete, the exterior of the facility may be finished with an appropriate outer covering including such things as side walls, a roof, geogrid, and/or a geotextile depending upon the intended use. The present panel structure provides a simple, modular, straight forward approach to the assembly of a structural configuration.

[0010] The panel structure of the present invention is particularly applicable to form a composite water retention/detention structure of the type disclosed in the referenced prior applications. Water retention/detention structures are particularly useful for use with athletic facilities, playgrounds and parking lots and as replacement for detention ponds on construction sites among many other similar outdoor sites. A water retention/detention structure, formed with a gang of panels in accordance with the techniques of the present invention is often used in heavy load environments such as a parking lot or storage facility. In these heavy load environments a reinforced concrete support system is formed between at least upper and lower levels of interconnected panels of the water detention/retention structure to support the heavy weight on the ground surface that may be experienced from vehicular traffic, for example.

[0011] An object of the present disclosure is to provide a building panel that is capable of producing a variety of different size and shaped structures.

[0012] Another object of the present disclosure is to provide a building panel capable of being connected with other identical panels in multiple angular configurations.

[0013] Another object of the present disclosure is to provide a simple, modular, straight forward approach to the assembly of a water retention/detention structure to retain and/or detain, storm water runoff and/or grey water.

[0014] Still another object is to provide a water detention/retention structure capable of withstanding heavy surface loads.

[0015] These and other objects will become apparent with reference to the following drawings and specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Many aspects of the present disclosure can be better understood with reference to the following drawings and specification. 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.

[0017] FIG. 1 is a perspective view of a first embodiment of a building panel in accordance with the present invention.

[0018] FIG. 2 is a front perspective view of another building panel used to form a building structure assembly of the present invention.

[0019] FIG. 3 is a front elevational view of the FIG. 2 panel.

[0020] FIG. 4 is an end elevational view of the FIG. 2 panel.

[0021] FIG. 5 is a rear elevational view of the FIG. 2 panel.

[0022] FIG. 6 is a view of a detail of FIG. 2 and a connector used therewith.

[0023] FIG. 7 is a view of two panels connected in a ninety degree relationship.

[0024] FIG. 8 is a view of two panels connected in line.

[0025] FIG. 9 is a partially exploded view of three panels connected at opposite 90 degree angles.

[0026] FIG. 10 is a perspective exploded view of a water retention/detention system of the present invention.

[0027] FIG. 11 is a perspective, exploded view of another water retention/detention system of the present invention.

[0028] FIG. 12 is a perspective, exploded view of a detail of FIG. 11.

[0029] FIG. 13 is a perspective, exploded view of another detail of FIG. 11.

[0030] FIG. 14 is an exploded, perspective view of another embodiment of a water detention/retention system in accordance with the present invention.

[0031] FIG. 15 is a non-exploded view of FIG. 14.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] Disclosed herein are various embodiments of building panel structures and water detention/retention assemblies made therefrom. Reference will now be made in detail to the description of the embodiments as illustrated in the drawings, wherein like reference numbers indicate like parts throughout the several views.

[0033] FIG. 1, illustrates a building panel 10 in accordance with the present invention. The panel 10 includes a front surface 12 and a rear surface (not shown) that is a mirror image of the front surface. The panel surface 12 is planar with side walls 14 around the periphery of the panel 10. Each side wall 14 has at least two connector tabs 16 and connector openings 18 between the tabs 16. The connector openings 18 are the same size as the tabs 16. On each side wall 14, a first one of the connector tabs 16a is located at the end of the side wall 14. A second connector tab 16b is located in a spaced relationship from the first tab 16a between the ends of the side wall 14, the space between the two connector tabs 16 defining a connector opening 18. The front to rear width of each connector tab 16 is identical to the width between the front surface 12 of the panel and the corresponding rear surface. Similarly the height of the connector tabs 16 that is, the

distance that each tab 16 extends from the side wall 14 is identical to the width of the tab 16 presenting a square shaped cross section. In this embodiment, the panel 10 is solid and typically is made of plastic or wood but may also be made of other materials such as metal, fiberglass ceramic and/or other suitable materials. Because the panel 10 is solid, it can have greater utility when used as a load bearing surface and the like.

[0034] FIG. 2 through FIG. 6 illustrate another panel 100, having a similar overall shape but that is formed with flow through openings thereby being particularly adapted for use with various structural configurations such as water retention/detention systems of the type shown and described hereinbelow. The panel 100 is formed in a square configuration when viewed in front and rear elevation as seen in FIGS. 3 and 5, with a front surface 106, rear surface 108 and four equally sized side walls 110 disposed at ninety degrees to each other whereby opposed walls 110 are substantially parallel and define the peripheral edges of the panel 100. The panel 100 includes connector tabs 112, located on the side walls 110 described hereafter. A grid like array of support ribs 114 are attached internally from the side walls 110 and are configured in a ninety degree relationship each to the adjoining others to maximize strength and rigidity. Likewise a circular support 116 with a central opening 118 is centrally located and forms an integral part of the panel 100. The spaces between the walls 110 and the support ribs 114 and the circular support 116 form openings 120 that permit free flow of air, water and/or other fluid or solid material that may come in contact with the panel 100 when it is installed at a site location. It will be appreciated that the openings 120 may take a variety of different shapes other than round or square to accommodate free flow of fluid and material therethrough and are not limited to the specific grid structures shown in the drawings. In addition, if more structural integrity is needed, the openings may be fewer in number or smaller depending upon the particular site requirements. The openings 120 likewise may be larger depending upon the on-site system requirements.

[0035] The peripheral design of the panel 110 is the same as the panel 10 described above. Each side wall 110 of the panel 100 is identical in length and is formed with connector tabs 112 that extend outward from the side walls 110. In the embodiment shown, the length of each of the connector tabs 112 is approximately one quarter of the length of the side wall 110. The tabs 112 are staggered, with one tab 112 being located on the end of the side wall 110 and a second tab 112 spaced therefrom on the side wall 110 forming a connector opening 122 between the tabs 112 having a length that is the same as the length of the tabs 112 themselves. The width or thickness of each tab 112 is the same as the width of the panel between the front surface 106 and rear surface 108. The distance the connector tab 112 extends from the side wall 110 is the same as the thickness thus, in cross section, each connector tab 112 is square. Also each tab 112 and the connector opening 122 are the same length along the side wall 110. Each of the four side walls 110 of the panel 100 have identical arrangements of tabs 112 on all four side walls 110 whereby the configuration of the panel 100 is the same no matter what direction it is rotated or positioned; that is when a panel is rotated 90, 180 or 270 degrees, the location of the side walls 110 and tabs 112 are in substantially identical arrangements.

[0036] In an upright, frontal position, the left side of the panel 100 is formed with a tab 112 adjacent the upper edge of the panel wall 110 whereas the right side of the panel is

formed with a tab **112** adjacent a lower edge of the panel. Although the tabs **112** and the side wall space between the tabs **112** are shown to be identical, it will be appreciated that the number of tabs **112** and the spacing between tabs **112** may vary so long as all four side walls **110** have the same offsetting tab and opening arrangement.

[0037] Referring to FIG. 6, each of the connector tabs **112** of the total of eight tabs **112** formed on the side walls **110** of the panel **100** is provided with additional openings **124** to accommodate fluid flow. Each connector tab **112** also includes connection slots **126** on an inner end wall **130** of the tab **112** for connecting adjacent panels **100** in a variety of configurations as described below. A first slot **126a** is vertically located on the tab **112** and a second slot **126b** is disposed at a ninety degree angle to the first slot **126a**. Each slot **126** is designed and shaped to accommodate a suitable, barbell shaped fastener **128** to connect tabs **112** of adjacent panels **100** when the panels **100** are interconnected to form an assembly gang of panels **100**.

[0038] The structure of the slots **126a** and **126b**, being disposed at a ninety degree angle, allows a connection between adjacent panels **100** at least in three different angular configurations. For example the slot arrangement allows a first panel **100** to connect to an adjacent panel **100** at a ninety degree to the front **106** of the panel **100** or to connect at a 270 degree angle to the rear **108** of the panel using the first slot **126a**. The arrangement also permits the connection of adjacent panels **100** in an in-line configuration using the second slot **126b**.

[0039] Whereas the fasteners **128** are described as being barbell shaped, other suitable shapes are equally applicable such as keystone shapes or the like. In addition, the fasteners may take the form of, but are not limited to, screws, bolts, nuts, staples and rivets. In some other embodiments fasteners may not be needed where a friction fit is sufficient to keep the panels **100** connected.

[0040] The width of the walls **110** and supports **114** and **116** of the panel **100**, as well as the thickness of the material forming the same, create a rigid structure with sufficient strength that may be adequate for the intended purpose. The flow through characteristics of the panel **100** provides an ideal structure for forming water retention/detention assembly of the type described hereinbelow and in the cross referenced applications cited above.

[0041] Preferably the panels **100** are made of molded, plastic although it will be appreciated other materials are equally applicable when formed into the disclosed panel structural design. For example, the panels may be made of many materials or combinations of materials, including but not limited to, steel, iron, aluminum, ceramic, polyethylene, polypropylene, polystyrene, other metals and metal alloys, plastic, wood, foam, rubber, concrete, cement, ceramic and resin reinforced composites.

[0042] FIG. 7 illustrates a pair of panels **100** connected in a ninety degree relationship. Because the tabs **112** are square in cross section, and are identically positioned in an offset arrangement with tabs **112** on an adjoining panel **100**, the connection forms a ninety degree corner between the panels **100** without protruding edges.

[0043] FIG. 8 illustrates two identical panels **100** connected in a side to side, in-line, relationship. In this configuration, the connector tabs **112** on the left frontal side of a first panel **100** are disposed in-line with the openings **122** on the right frontal side of an identical adjoining panel **100**.

[0044] FIG. 9 illustrates the interconnection of three identical panels **100**. A central panel **100a** is shown connected to a second identical panel **100b** disposed in a ninety degree relationship and connected to a third identical panel **100c** disposed in a ninety degree relationship in a direction opposite to the panel **100b**. This connection is made possible because the connector tabs **116** and connector openings **122** are the same length and the tabs **112** have the same cross-sectional, square configuration.

[0045] All the connections of adjacent panels **100** may be coupled or fastened together using a fastener **128** located in adjacent connection slots **126** on the inner end walls of the tabs **112**, as shown in FIG. 6. The fastener **128** and the corresponding slot **126** have the same shape allowing adjacent panels **100** to be coupled together. In this way movement between the panels **100** is restricted and the panels have structural integrity.

[0046] Referring now to FIG. 10, an exploded, partial view of an embodiment of a water retention/detention assembly **200** is illustrated having gangs of panels **100**, connected together using a connection structure of the type described hereinabove. In this figure, a substantially square or rectangular shaped water detention/retention structure **200** is partially shown to include only an end and side of the assembly with the area between the panels **100** being open for fluid and material retention.

[0047] It will be appreciated that similar mirror image arrangements of gangs of panels **100** are used to form additional sides and ends of the water detention/retention assembly **200**, the exact configuration of the assembly depending upon the location site.

[0048] FIG. 11 illustrates an exploded view of another water retention/detention structure **300** that is used in heavy load environments such as a parking lot where heavy vehicles traverse the pavement surface above the underground structure **300**. In this embodiment the water retention/detention structure **300** is formed with a plurality of panels **100** in a rectangular configuration. Only the upper and lower gangs of panels **100** are shown, it being appreciated additional panels can be used to complete the structure. It will be appreciated that the lower gang of panels **100** lies on a prepared ground surface normally formed level with compacted stone, gravel or similar material. In this embodiment, internal support members **310** are positioned in of the structure **300** between the upper and lower horizontal arrays of panels **100** thereby defining an open space that may be accessible for repair and maintenance. As seen in FIGS. 12 and 13, the support members **310** include a central support column **312** and end caps **314** that are typically a rigid plastic shell that may or not be filled with concrete **316** to suit on site loading conditions. The support members **310** allow the structure **300** to be positioned below ground while accommodating substantial weight such as might be experienced with a heavy load environment.

[0049] When substantial support is required, the support members **310** are filled with concrete **316** after being vertically located between the upper and lower gangs of panels. Since the panels **100** and the support members **310** are hollow, the concrete spills through all the way to the prepared ground sub-surface at the bottom and through the upper gang of panels **100** at the top. Thus heavy loads on the concrete paving surface are transferred directly through the support members **310** to the compacted sub-surface. This structure creates a rigid, strong, concrete support system that does not depend upon the plastic panels for the required support.

[0050] Referring to FIGS. 14 and 15, the water retention/detention structure 300, formed of multiple panels 100 and support members 310, described above, further includes an additional ground based support such as a preformed or in site concrete slab 320, or the like, for such applications as parking lots or other high weight applications. This arrangement of support members 310 permit additional load bearing ability while maintaining the structural integrity of the water detention/retention system 300, particularly at a sub-surface site. It should be understood that although support members 310 are depicted in a vertical arrangement, the support members may be orientated in other directions; for example, in a horizontal direction which may provide additional support for side panels 100. The support member 310 may be made of many materials, including but not limited to the materials listed above. Although depicted as round, in other embodiments the support member may be square or rectangular in shape. Other supports may include structural, beams, such as I or H beams, or preformed concrete with a variety of cross sectional configurations.

[0051] Because the panels 100 are substantially identical, the assembly of panels, when rotated 90, 180 or 270 degrees, will be in a substantially identical arrangement. Therefore, once formed, a water retention/detention assembly may be placed or arranged without regard to orientation or location of any particular side or panel 100.

[0052] In other embodiments multiple assemblies may be created, using a selected number of identical panels. Multiple panels may be formed into cubes and assembled in-line to form a horizontal configuration for installation, for example, in a continuous trench like site application. By assembling additional cubes, each formed with substantially like panels 100, larger assemblies may be formed.

[0053] In still other embodiments the materials of one assembly may differ from or be the same as the material of another assembly.

1. A system for retaining and detaining water, comprising:
a plurality of substantially identical panels arranged adjacent to each other to form an assembly with a hollow interior, said panels characterized by
a front and back surface; said front and back planar surface being spaced to define the width of said panels;
four sides of substantially similar length which define edges of the panels, said sides being disposed at ninety degrees relative to each adjacent side; and
connector tabs extending laterally in substantially identical arrangement from each of four sides of said panels;
the tabs of at least one panel communicating with the tabs of at least one other panel for the alignment of panels; said panel characterized by a plurality of connector tabs extending from each of said side surfaces and a plurality of connector openings at each of said side surfaces; said tabs and said openings being defined by having essentially the same length whereby said tab fits within said opening; said tabs and said opening being further defined by a square cross section.

2. The system of claim 1, wherein the panels further include fluid flow openings between said front and back surfaces.

3. The system of claim 2 being further defined by support ribs between said side walls forming said openings.

4. The system of claim 1 further including locking connectors for each locking connector tab of said panels for connection of adjacent panels in a connected relationship.

5. The system of claim 4 wherein said locking connectors are further defined as a shaped slot and correspondingly shaped fastener.

6. The system of claim 5 wherein said shaped slot is formed on an end wall of said connector tab.

7. The system of claim 6 wherein said shaped slot is further defined as a first opening in a first direction and a second opening in a second direction at a ninety degree angle to said first opening.

8. The system of claim 7 wherein said fastener is shaped to engage said first and said second opening of said shaped slot of said locking connectors in accordance with the orientation of the adjacent panels being connected.

9. The system of claim 1 being further defined by at least a gang of interlocking panels on a first level and a second gang of interlocking panels on a second level.

10. The system of claim 9, further comprising support members between said first and said second levels of interlocking panels.

11. The system of claim 10 wherein said support members are hollow to accommodate flow of a reinforcing material.

12. The system of claim 11 wherein said reinforcing material is concrete.

13. The system of claim 9 further including a ground surface covering.

14. The system of claim 13 wherein said ground covering is reinforced concrete.

15. A building panel comprising a front surface, a rear surface, and side surfaces; a first thickness defining the distance between said front and said rear surfaces; said panel characterized by a plurality of connector tabs extending from each of said side surfaces and a plurality of connector openings at each of said side surfaces; said tabs and said openings being defined by having essentially the same length whereby said tab fits within said opening; said tabs and said opening being further defined by a square cross section.

16. The system of claim 15 further including locking connectors for each locking connector tab of said panels for connection of adjacent panels in a connected relationship.

17. The system of claim 16 wherein said locking connectors are further defined as a shaped slot and correspondingly shaped fastener.

18. The system of claim 16 wherein said shaped slot is formed on an end wall of said connector tab.

19. The system of claim 18 wherein said shaped slot is further defined as a first opening in a first direction and a second opening in a second direction at a ninety degree angle to said first opening.

20. The system of claim 19 wherein said fastener is shaped to engage said first and said second opening of said shaped slot of said locking connectors in accordance with the orientation of the adjacent panels being connected.

* * * * *