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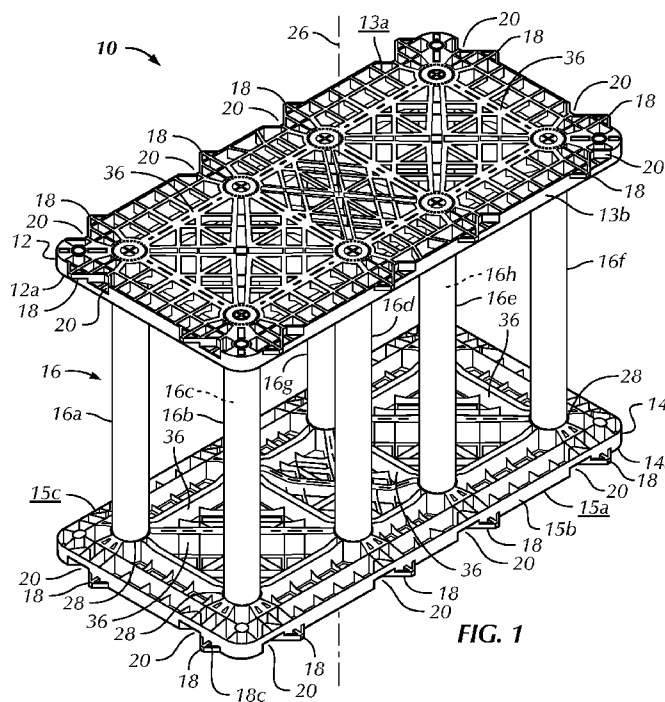
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(54) Title: STORM WATER DRAIN TANK MODULES AND ASSEMBLY



(57) Abstract: A storm water drain tank module for assembly into a storm tank for storage of storm water includes a top platen, a bottom platen and a support spacer. The top platen has an upper surface and a top platen peripheral edge. The bottom platen has a bottom surface and a bottom platen peripheral edge. The support spacer is attached to the top and bottom platens to space the top platen relative to the bottom platen. A plurality of tabs and a plurality of slots are defined proximate the top and bottom platen peripheral edges, respectively. Each of the plurality of tabs extends outwardly away from the top and bottom platen peripheral edges, respectively, and each of the plurality of slots extends into the top and bottom platen peripheral edge. The plurality of slots is open in a lateral direction.

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TITLE OF THE INVENTION

Storm Water Drain Tank Modules and Assembly

CROSS-REFERENCE TO RELATED APPLICATIONS

5 [0001] The present application claims the benefit of U.S. Provisional Patent Application No. 62/815,639 filed on March 8, 2019 and titled “Storm Water Drain Tank Modules and Assembly” the entire contents of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

10 [0002] Box structure systems or storm tanks create an underground void space for the collection of storm water. Once directed into the system, the water may be released into the surrounding soil, piped elsewhere, or stored. In order to maintain this void space, the system must resist pressures acting on its exterior from the surrounding soil and is preferably easily assembled and aligned. An effective storm water system, therefore, is able to reliably resist both lateral soil pressures acting on the sides of the system, and vertical soil pressures acting on the system’s top to maintain the storage
15 area for the storm water runoff. Vertical alignment provides continuity across lateral structural members to maintain compressive lateral strength in a buried condition.

[0003] A box structure system or storm tank may be constructed of separate structures (modules), which are arranged or connected to form a larger structure or assembly. Typically, these modules are positioned next to each other to form a layer of modules, a water drain tank assembly or
20 a storm tank that is preferably buried in the ground, for example, beneath or adjacent a parking lot, housing development or other area where flash water runoff may occur during a heavy rainstorm or event. In some installations, multiple layers of modules are installed, where a second layer of modules is stacked onto the first. A prior art water drain tank or storm water tank and assembly is shown and described in U.S. Patent No. 7,591,610, titled, “Water Drain Tank or Channel Module,”
25 which describes a water drain tank or channel module with stacked water-permeable lattice members or modules that are wrapped with a permeable geotextile material and buried at an appropriate location in the ground.

[0004] It is desirable to design, construct and deploy a storm tank assembly, comprised of a box structure or water drain tank structure and assembly, which is able to function in the challenging
30 environment of a buried storm tank. It is also desirable to construct a storm tank assembly that is stackable and resists the structural loads encountered by the storm tank assembly when buried

underground. A first row of assembled storm water drain tank modules or box structures preferably creates a generally flat or planar upper surface to facilitate stacking of a second row of assembled storm water drain tank modules or box structures. The preferred storm tank assembly facilitates efficient and simple installation and withstands the normal operating environment of the water drain tank or storm water tank system and assembly.

BRIEF SUMMARY OF THE INVENTION

[0005] Briefly stated, the preferred invention is directed to a storm water drain tank module for assembly into a storm water drain tank or storm tank assembly for storage of storm water. The storm water drain tank module includes a top platen, a bottom platen and a support spacer. The top platen has an upper surface and a top platen peripheral edge. The bottom platen has a bottom surface and a bottom platen peripheral edge. A plurality of column sockets is defined in the top and bottom platens. The support spacer is comprised of a plurality of columns. The plurality of columns is attached to adjoining ones of the plurality of column sockets to space the upper platen relative to the lower platen. A plurality of tabs and a plurality of slots are defined proximate the top and bottom platen peripheral edges, respectively. Each of the plurality of tabs extend outwardly away from the top and bottom platen peripheral edges, respectively, and each of the plurality of slots extends into the top and bottom platen peripheral edges. The plurality of slots is open in a lateral direction.

[0006] In another aspect, the preferred invention is directed to a storm water drain tank assembly for storage of storm water runoff. The storm water drain tank assembly includes a first tank module including a first top platen, a first bottom platen and a first plurality of columns. The first top platen includes a first peripheral edge, a first plurality of tabs positioned at the first peripheral edge and a first plurality of slots positioned at the first peripheral edge. The first plurality of tabs includes a first tab and the first plurality of slots including a first slot. A second tank module includes a second top platen including a second peripheral edge. A second plurality of tabs is positioned at the second peripheral edge and a second plurality of slots is positioned at the second peripheral edge. The second plurality of tabs includes a second tab and the second plurality of slots includes a second slot. The first tab is positioned in the second slot and the second tab is positioned in the first slot in an assembled configuration, wherein the first peripheral edge is position adjacent the second peripheral edge.

[0007] In a further aspect, the preferred invention is directed to a storm water drain tank assembly for storage of storm water runoff. The storm water tank assembly includes a first module

with a first top platen, a first bottom platen and a first plurality of columns. The first top platen includes a first peripheral edge and a first pin hole therethrough. The storm water drain tank assembly also includes a second module having a second bottom platen with a second peripheral edge and a second pin hole, wherein the first peripheral edge is vertically aligned with the second peripheral edge and the first pin hole is aligned with the second pin hole in an assembled configuration. The storm water tank includes an alignment pin having an insertion end, a top end and a lip positioned at the top end. The alignment pin tapers from an insertion end diameter at the insertion end to a top end diameter at the top end. The insertion end diameter is smaller than the top end diameter. The alignment pin is positioned in the first and second pin holes in the assembled configuration. The first top platen also includes a first top platen surface and the second bottom platen includes a second bottom platen surface. The first top platen surface is positioned adjacent the second bottom platen surface in the assembled configuration. The alignment pin aligns the first top platen and the second bottom platen and, therefore, the first plurality of columns of the first module and a second plurality of columns of the second module such that column sockets of the first top platen and the second bottom platen are aligned in the assembled configuration. In the assembled configuration, accordingly, pairs of the first and second plurality of columns are aligned for efficient transfer of loads through the assembly and into the surrounding ground. In a shear condition, the pin maintains alignment, transferring load from the first or second platen to the other of the first or second platen, respectively, across the first and second modules or parts and across the plane between the first and second modules.

[0008] In an alternative aspect, the preferred invention is directed to a storm water drain tank module for assembly into a storm water drain tank for storage of storm water. The storm water drain tank module includes a top platen, a bottom platen and a support spacer. The top platen has an upper surface and a top platen peripheral edge. The bottom platen has a bottom surface and a bottom platen peripheral edge. The support spacer is attached to the top and bottom platens to space the top platen relative to the bottom platen generally in a parallel orientation. A plurality of tabs and a plurality of slots are defined proximate the top and bottom platen peripheral edges, respectively. Each of the plurality of tabs extends outwardly away from the top and bottom platen peripheral edges, respectively, and each of the plurality of slots extends into the top and bottom platen peripheral edges, respectively.

[0009] In a further aspect, the preferred invention is directed to a storm water drain tank assembly for storage of storm water runoff. The storm water drain tank assembly includes a first module having a first top platen, a first bottom platen and a first support spacer and a second module

including a second top platen, a second bottom platen and a second support spacer. A first plurality of tabs extends laterally outwardly from the first top platen, the first bottom platen or the first support spacer and a first plurality of slots extends laterally inwardly into the first top platen, the first bottom platen or the first support spacer. The first plurality of tabs includes a first tab and the first plurality of slots including a first slot. A second plurality of tabs extends laterally outwardly from the second top platen, the second bottom platen or the second support spacer and a second plurality of slots extends laterally inwardly into the second top platen, the second bottom platen or the second support spacer. The second plurality of tabs includes a second tab and the second plurality of slots includes a second slot. The first tab is positioned in the second slot and the second tab is positioned in the second slot in an assembled configuration.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0010] The foregoing summary, as well as the following detailed description of the preferred embodiment of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings an embodiment which is presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0011] Fig. 1 is a top perspective view of a storm water drain tank module in accordance with a preferred embodiment of the present invention;

[0012] Fig. 2 is a top plan view of the storm water drain tank module of Fig. 1;

[0013] Fig. 3 is a side elevational view of the storm water drain tank module of Fig. 1;

[0014] Fig. 4 is a front elevational view of the storm water drain tank module of Fig. 1;

[0015] Fig. 5 is a top plan view of corners of four storm water drain tank modules of Fig. 1, wherein three of the storm water drain tank modules are positioned in an assembled configuration and a fourth storm water drain tank module is being positioned for assembly;

[0016] Fig. 6 is a top plan view of the corners of the four storm water drain tank modules of Fig. 5, wherein the fourth storm water drain tank module is further positioned for assembly;

[0017] Fig. 7 is a top plan view of the corners of the four storm water drain tank modules of Fig. 5, wherein the four storm water drain tank modules are positioned in an assembled configuration;

[0018] Fig. 7B is a cross-sectional view of top platens of third and fourth storm water drain tank modules of the assembly of Fig. 7, taken along line 7B-7B of Fig. 7;

[0019] Fig. 8 is a top plan view of the corner of the fourth storm water drain tank module of Fig. 5;

[0020] Fig. 8B is a cross-sectional view of a top platen of the fourth storm water drain tank module of Fig. 5, taken along line 8C-8C of Fig. 8;

[0021] Fig. 9 is a magnified top plan view of a portion of a top platen of a first storm water drain tank module of Fig. 5, a bottom platen of a fifth storm water drain tank module positioned on top of the top platen of the first storm water drain tank module and an alignment pin, taken from within shape 9 of Fig. 5;

[0022] Fig. 9A is a cross-sectional view of the top and bottom platens and alignment pin of Fig. 9, taken along line 9A-9A of Fig. 9;

[0023] Fig. 10 is a side elevational view of the portion of the top platen of the first storm water drain tank module of Fig. 9, the bottom platen of the upper storm water drain tank module of Fig. 9 and the alignment pin, wherein the alignment pin is positioned for insertion into assembly holes of the top and bottom platens;

[0024] Fig. 11 is a side elevational view of the portion of the top platen and the bottom platen of Fig. 10, wherein the alignment pin is installed in pin holes of the top and bottom platens.

DETAILED DESCRIPTION OF THE INVENTION

[0025] Certain terminology is used in the following description for convenience only and is not limiting. Unless specifically set forth herein, the terms “a”, “an” and “the” are not limited to one element but instead should be read as meaning “at least one”. The words “right,” “left,” “lower,” and “upper” designate directions in the drawings to which reference is made. The words “inwardly” or “distally” and “outwardly” or “proximally” refer to directions toward and away from, respectively, the geometric center or orientation of the water drain tank modules and assemblies and related parts thereof. The terminology includes the above-listed words, derivatives thereof and words of similar import.

[0026] It should also be understood that the terms “about,” “approximately,” “generally,” “substantially” and like terms, used herein when referring to a dimension or characteristic of a component of the invention, indicate that the described dimension/characteristic is not a strict boundary or parameter and does not exclude minor variations therefrom that are functionally the same or similar, as would be understood by one having ordinary skill in the art. At a minimum, such references that include a numerical parameter would include variations that, using mathematical and industrial principles accepted in the art (e.g., rounding, measurement or other systematic errors, manufacturing tolerances, etc.), would not vary the least significant digit.

[0027] Referring to Figs. 1-11, the preferred invention is directed to a storm water drain tank module, generally designated 10, that includes two (2) platens, including a top platen 12 and a bottom platen 14, and a structural support spacer 16. The support spacer 16 is attached to the top and bottom platens 12, 14 to space the top platen 12 relative to the bottom platen 14, preferably with the top and bottom platens 12, 14 oriented generally parallel relative to each other. The structural support spacer 16 provides structural support to carry load and space the top platen 12 relative to the bottom platen 14. In the preferred embodiment, the support spacer 16 is comprised of a plurality of columns, more preferably eight (8) columns, including first, second, third, fourth, fifth, sixth, seventh and eighth columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h. The support spacer 16 is not limited to being comprised of the eight columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h and may be comprised of nearly any structure that is designed and configured to space the top platen 12 from the bottom platen 14, carry loads to and between the top and bottom platens 12, 14 and withstand the normal operating conditions of the support spacer 16. The support spacer 16, for example, may be comprised of peripheral walls (not shown) that extend between top and bottom platen peripheral edges 13b, 15b, panels (not shown) that are attached between the top and bottom platens 12, 14, integrally molded structures (not shown) that space the top platen 12 from the bottom platen 14 and other similar structural supports that space the top platen 12 from the bottom platen 14. The support spacer 16 also preferably provides open space between the top and bottom platens 12, 14 so that water, drain fluid and other materials may be positioned between and contained within a space between the top and bottom platens 12, 14 during use, as is described in greater detail below.

[0028] The storm water drain tank modules 10 are preferably utilized in an assembly of pluralities of the storm water drain tank modules 10 to define a storm tank (not shown) for storage of storm water. The storm tank is typically assembled in a pit and substantially buried in soil or other ground supporting material beneath or adjacent to an area, such as a parking lot or housing development, where storm water runoff is desirable to control or manage. The support spacer 16 spaces the top platen 12 from the bottom platen 14 and provides structural support for the storm water drain tank module 10. The storm water drain tank module 10 is not limited to the eight columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h comprising the support spacer 16 of the preferred embodiment and may include less or more columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, which generally transfer compression loads, or other structures that space the top platen 12 from the bottom platen 14, as was described above. In an alternative preferred embodiment, the storm water drain tank module 10 may, for example, include three columns 16a, 16b, 16c attached between the top and bottom platens 12, 14, four (4) columns 16a, 16b, 16f, 16h positioned generally at corners of

the preferably rectangular shaped top and bottom platens 12, 14 or columns 16a, 16b, 16f, 16h for each corner of variously shaped top and bottom platens 12, 14, such as eight columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h for top and bottom platens 12, 14 having an octagonal shape (not shown). The storm water drain tank module 10 preferably includes at least four columns 16a, 16b, 16f, 16h for supporting the preferred rectangular shaped platens 12, 14 positioned near the corners of the platens 12, 14 or may alternatively include six columns 16a, 16b, 16c, 16d, 16f, 16h with four of the columns 16a, 16b, 16f, 16h positioned near corners of the rectangular shaped platens 12, 14 and two columns 16c, 16d mounted near a midline of the platens 12, 14. The number of columns 16a, 16b, 16c, 16d, 16f, 16h for each module 10 may be driven by the size, shape and configuration of the top and bottom platens 12, 14 or other design considerations.

[0029] The top platen 12 has an upper surface 13a and a top platen peripheral edge 13b. The top platen 12 also has a lower surface 13c spaced from the upper surface 13a that faces the bottom platen 14 in an assembled configuration (Figs. 1, 3 and 4). The upper surface 13a is preferably planar and the preferred lower surface 13c has some curvature or chamfers inwardly from the top platen peripheral edge 13b. The top and bottom platens 12, 14 preferably have relief holes 34 therethrough that permit water or other fluid to flow through the top and bottom platens 12, 14, generally perpendicularly relative to the top surface 13a and to limit the weight of the top and bottom platens 12, 14. The top and bottom platens 12, 14 are not limited to having the relief holes 34 therethrough, to having the planar top surface 13a or the non-planar lower surface 13c and may be otherwise designed and configured to perform the preferred functions of the top and bottom platens 12, 14, such as transmitting loads into the support spacer 16 and into adjacent soil or support structures and to otherwise create structural support and spacing for the storm water tank. The bottom platen 14 preferably has a bottom surface 15a, a bottom platen peripheral edge 15b and an upward surface 15c, wherein the bottom surface 15a faces away from the support spacer 16 and the upward surface 15c faces toward the support spacer 16 in the assembled configuration. The bottom surface 15a, similar to the upper surface 13a, is preferably planar within the bottom platen peripheral edge 15b and the preferred upward surface 15c, similar to the lower surface 13c, is non-planar having some curvature or chamfers inwardly from the bottom platen peripheral edge 15b, generally to preserve material and reduce weight of the platens 12, 14. The lower surface 13c of the top platen 12 and the upward surface 15c of the bottom platen 14 are not limited to being non-planar and may be generally planar or have alternative shapes and configurations that are able to withstand the normal operating conditions of the platens 12, 14 and perform the preferred functions of the platens 12, 14.

[0030] The top and bottom platens 12, 14 preferably have the same or similar size, shape and configuration, with the bottom platen 14 being substantially the same as the top platen 12, but attached to the support spacer 16 such that the bottom platen 14 is positioned below the top platen 12 in the assembled configuration. The top platen 12 may, accordingly, be utilized as the bottom
5 platen 14 by overturning the storm water drain tank module 10. In the assembled configuration, the upper surface 13a of the top platen 12 and the bottom surface 15a of the bottom platen 14 are preferably oriented generally parallel relative to each other to facilitate stacking of pluralities of modules 10, as is described in greater detail below. Certain of the features of the top and bottom platens 12, 14 are generically described herein, as the top and bottom platens 12, 14 have generally
10 the same or similar features, with the top platen 12 being substantially the same as the bottom platen 14 in size, shape, design and configuration. The top and bottom platens 12, 14 of the preferred embodiment are substantially symmetrical in the assembled configuration and provide for proper alignment of the slots 20 and tabs 18 in the assembled configuration. The design and configuration of the assembled modules 10 that form a storm tank for storing water runoff with the engaged tabs
15 18 and slots 20 generally prevents the soil structure under the assembly from destabilizing the assembly or the storm tank. Individual modules 10 in the storm tanks generally do not move downwardly or otherwise relative to other modules 10 because of the engagement of the slots 20 and the tabs 18 between the modules 10. The assembly of modules 10 or the storm tank, thereby stabilizes the soil upon which the storm tank is mounted so that the assembly of modules 10 is
20 consistently supported by the underlying soil.

[0031] The top and bottom platens 12, 14 and the support spacer 16 are preferably constructed of a generally stiff and strong polymeric material, such polypropylene (“PP”) or polyvinyl chloride (“PVC”), most preferably the platens 12, 14 are constructed of the PP material and the preferred
25 columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h are constructed of the PVC material, but the platens 12, 14 and columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h are not so limited and may be constructed of nearly any relatively stiff and strong structural material that is able to take on the general size and shape of the platens 12, 14 and the support spacer 16, withstand the normal operating conditions of the platens 12, 14 and the support spacer 16 and perform the typical functions of the platens 12, 14 and the support spacer 16, as is described in further detail herein. The storm water drain tank
30 module 10 preferably includes multiple or a plurality of storm water drain tank module 10, such as first, second, third, fourth and fifth modules 10a, 10b, 10c, 10d, 10e, that are assembled together into a storm tank or storm water tank assembly that is installed, wrapped in a synthetic, permeable sheeting, fitted with side panels at sides of the assembly and buried to create a permeable tank for

storm water runoff. The side panels and synthetic wrap or surrounding fabric/membrane 77 are partially depicted in Fig. 3, but generally surround the assembled modules 10, at least at sides of the modules 10 in the assembled and buried configurations. Each of the modules 10, 10a, 10b, 10c, 10d, 10e, as well as the platens 12, 14, defines a longitudinal axis 22, a lateral axis 24 and a vertical axis 26. The storm water tank assemblies may include nearly any number of storm water drain tank modules 10 assembled in side-by-side and stacked arrangements, generally based on volume requirements for the storm tank and related design considerations. The assembled storm water drain tank modules 10 may also include side panels (not shown) that mount to sides of the outermost storm water drain tank modules 10 in the assembly to transfer loads from surrounding soil and a surrounding fabric/membrane to the structure and to limit and prevent surrounding soil from entering into the storm tank, along with the preferred surrounding fabric/membrane during use, but the side panels and the surrounding fabric/membrane are not required for operation of the storm water drain tank modules 10.

[0032] The first module 10a preferably includes a first top platen 12a, a first bottom platen 14a and the support spacer 16, which is comprised of a first plurality of columns 16, 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h in the preferred embodiment. The first top platen 12a includes the top platen or first peripheral edge 13a, a first plurality of tabs 18 positioned at the first peripheral edge 13a and a first plurality of slots 20 positioned at the first peripheral edge 13a. The first plurality of tabs 18 includes a first tab 18 and the first plurality of slots 20 includes a first slot 20. In the preferred embodiment, the first plurality of tabs 18 includes twelve (12) tabs 18 extending from the first peripheral edge 13a and the first plurality of slots 20 includes twelve (12) slots 20 extending into the first peripheral edge 13a. The preferred first top platen 12a and each of the top and bottom platens 12, 14 of the preferred embodiment include twelve tabs 18 and twelve slots 20 with two tabs 18 and slots 20 on each of the front and rear ends of the platens 12, 14 and four tabs 18 and slots 20 on each of the side or long ends of the platens 12, 14. The platens 12, 14 are not limited to including the twelve tabs 18 and slots 20 or to the particular arrangement of tabs 18 and slots 20 of the preferred embodiment and may have less or additional tabs 18 and slots 20, depending on designer preferences and storm water tank assembly requirements.

[0033] The storm water tank assembly also includes the second module 10b having a second top platen 12b with a second peripheral edge 13b, a second plurality of tabs 18 positioned at the second peripheral edge 13b and a second plurality of slots 20 positioned at the second peripheral edge 13b. The second plurality of tabs 18 includes a second tab 18 and the second plurality of slots 20 includes a second slot 20. The first tab 18 of the first top platen or first platen 12a is positioned in the second

slot 20 of the second top platen or second platen 12b and the second tab 18 of the second top platen or the second platen 12b is positioned in the first slot 20 of the first top platen or first platen 12a in the assembled configuration (Figs. 5-7). In the assembled configuration, the first peripheral edge 13b of the first top platen 12a is positioned adjacent the second peripheral edge 13a of the second top platen or second platen 12b. The third, fourth and fifth modules 10c, 10d, 10e also include third, fourth and fifth top platens 12c, 12d, each with the plurality of tabs 18 and slots 20 at the respective peripheral edges 13b. In addition, the first and second pluralities of tabs 18 and slots 20 are not limited to being connected to the top and bottom platens 12, 14 and may be connected to the support spacer 16, as long as the connecting tabs 18 and slots 20 are engaged in the assembled configuration to maintain alignment and positioning of the storm water drain tank modules 10 relative to each other in the assembled configuration. In the preferred embodiment, each of the plurality of tabs 18 is integrally formed with its associated top or bottom platen 12a, 12b, such as by injection molding, machining or otherwise integrally forming the tabs 18 with the platens 12. The tabs 18 are not so limited and may be separately formed and attached to the platens 12 or otherwise designed and configured to perform the functions of the tabs 18, withstand the normal operating conditions of the tabs 18 and take on the general size and shape of the tabs 18.

[0034] During a storm tank installation, the storm water drain tank modules 10 are placed adjacent to each other, so that the respective tabs 18 and slots 20 on adjacent top and bottom platens 12, 14 nest or engage with each other, which aligns the adjacent storm water drain tank modules 10, such as the first, second, third and fourth modules 10a, 10b, 10c, 10d, wherein the matching tabs 18 and slots 20 of the first, second, third and fourth top platens 12a, 12b, 12c, 12d nest or engage with each other in the assembled configuration (Figs. 5-7). The tabs 18 and slots 20 include the plurality of tabs 18 and the plurality of slots 20 defined proximate the top platen peripheral edges 13b and the bottom platen peripheral edges 15b of the respective modules 10, 10a, 10b, 10c, 10d, 10e. Each of the plurality of tabs 18 extends outwardly away from the top and bottom platen peripheral edges 13b, 15b, respectively. In addition, each of the plurality of slots 20 extends into the top and bottom platen peripheral edges 13b, 15b. In the preferred embodiment, the tabs 18 and slots 20 are positioned in pairs adjacent to each other, but are not so limited and may be spaced from each other or otherwise arranged. In the preferred embodiment, the first tab 18 and the first slot 20 of the first top platen 12a are positioned adjacent to each other and the second tab 18 and the second slot 20 of the second top platen 12b are positioned adjacent to each other, thereby defining pairs of slots 18 and tabs 20 on the platens 12. The first, second and third modules 10a, 10b, 10c may be moved generally horizontally, substantially along the longitudinal or lateral axes 22, 24, respectively, to

assemble the pairs of tabs 18 and slots 20 (Figs. 5-7). Once the first, second and third modules 10a, 10b, 10c are assembled, the fourth module 10d preferably moves laterally and longitudinally relative to the first, second and third modules 10a, 10b, 10c to engage the adjoining tabs 18 and slots 20 of the fourth module 10d to the slots 20 and tabs 18 of the first and third module 10a, 10c (Figs. 5-7).

5 The movement of the fourth module 10d relative to the first and third module 10a, 10c is at least partially guided by sliding engagement between tab legs 19a, 19b of the tabs 18 and slot legs 21a, 21b of the slots 20 (Figs. 5-8). This generally horizontal movement of the fourth module 10d generally horizontally to engage the already assembled first, second and third modules 10a, 10b, 10c generally eliminates or reduces any required vertical movement of the fourth module 10d to assemble to or engage the first, second and third modules 10a, 10b, 10c to define an assembly of the first, second, third and fourth module 10a, 10b, 10c, 10d.

[0035] In the preferred embodiment, the tabs 18 and the slots 20 are generally identified and described generically, as each of the tabs 18 and slots 20 are substantially the same, except for their positioning on the top and bottom platen peripheral edges 13b, 15b, although the tabs 18 and slots
15 20 are not so limited. The tabs 18 each preferably have a substantially trapezoid shape extending away from the top and bottom platen peripheral edges 13b, 15b and adjacent the upper and bottom surfaces 13a, 15a, respectively. The tabs 18 each preferably have a pair of tab legs 19a, 19b (Fig. 8) extending outwardly from the top and bottom platen peripheral edges 13b, 15b proximate the upper surface 13a of the top platen 12 and proximate the bottom surface 15a of the bottom platen 14,
20 respectively. The tab legs 19a, 19b taper in a generally linear fashion from the peripheral edges 13b, 15b outwardly, but are not so limited and may have an arcuate or other taper, as long as the tab legs 19a, 19b taper from a larger width at the peripheral edges 13b, 15b to a narrower width spaced from the peripheral edges 13b, 15b. The tab legs 19a, 19b extend from the top and bottom platen peripheral edges 13b, 15b, which extend substantially parallel to the longitudinal axis 22 or the
25 lateral axis 24, at a tab angle Θ . In the preferred embodiment, the tab angle Θ is approximately forty-five degrees (45°), but is not so limited and may extend at other angles relative to the top and bottom platen peripheral edges 13b, 15b, such as approximately thirty to sixty degrees ($30-60^\circ$). The forty-five degree (45°) tab angle Θ , however, is preferred to facilitate the angular engagement or assembly of the adjacent storm water drain tank modules 10, as is described in greater detail
30 below. The tabs 18 preferably have a blunt nose or tip 25a spaced from the peripheral edges 13b, 15b to define the trapezoid shape that mates with the trapezoid shaped slots 20, although the tabs 18 and slots 20 are not limited to having trapezoid shapes and may have nearly any shape that facilitates engagement between the tabs 18 and slots 20, such as triangular or other shapes that

facilitate slidable engagement and positioning of the tabs 18 within the slots 20 in the preferred embodiment. For example, the tabs 18 and slots 20 may be comprised of a pin (not shown) extending from the support spacer 16 that engages a hole or recess (not shown) in the support spacer 16 of an adjacent module to engage the adjacent storm water drain tank modules 10 relative to each other in the assembled configuration. The tabs 18 and slots 20 preferably maintain alignment of the top and bottom platens 12, 14 of the adjacent storm water drain tank modules 10 in the assembled configuration to facilitate load transfer between the top and bottom platens 12, 14, respectively, of adjacently assembled storm water drain tank modules 10.

[0036] In the preferred embodiment, the slots 20 each also have the trapezoidal shape that extends into the top and bottom peripheral edges 13b, 15b with a blunt or flattened bottom at its inwardly most portion relative to the top and bottom platens 12, 14. Each of the slots 20 has a pair of slot legs 21a, 21b extending inwardly from the top and bottom platen peripheral edges 13b, 15b proximate the top and bottom surfaces 13a, 15a at a slot angle Δ . The preferred slot angle is approximately forty-five degrees (45°), but is not so limited and may be in a range of approximately thirty to sixty degrees ($30-60^\circ$) and preferably is arranged and configured to match with mating tabs 18 on adjacent platens 12, 14 in the assembled configuration. The slots 20 are not limited to having the trapezoidal shape and may have alternate shapes that are able to mate with the tabs 18, such as triangular or other shapes that are able to withstand the normal operating conditions of the slots 20 and perform the preferred functions of the slots 20, as is generally described herein. The slots 20 are preferably open in a lateral outward direction from the top and bottom platens 12, 14, respectively, which is substantially perpendicular to the longitudinal axis 26 and at least between where the pair of slot legs 21a, 21b that join the top and bottom platen peripheral edges 13b, 15b, respectively. The opening at the edge of the slots 20 at the peripheral edges 13b, 15b facilitates sliding of the tabs 18 into the slots 20 from the lateral direction, as is described in greater detail below.

[0037] The mouth or opening 23a of each of the slots 20 that is defined generally at the peripheral edges 13b, 15b preferably has a mouth width W_M that is greater than a width of any other portion of the slots 20 between the peripheral edges 13b, 15b and bottom or butt ends 23b of the slots 20. The slots 20, therefore, have their widest portion at the mouth 23a, which is comprised of the mouth width W_M , to facilitate insertion of the tabs 18, generally laterally and/or longitudinally into the slots 20. The slots 20 and, specifically, the slot legs 21a, 21b, taper inwardly from the mouth 23a to the bottom or butt ends 23b of the slots 20 opposite the mouth 23a. The slot legs 21a, 21b have a generally straight taper in the preferred embodiment, but are not so limited and may have

arcuate or other configurations, as long as the slot legs 21a, 21b preferably taper in size from the larger mouth 23a at peripheral edges 13b, 15b to the smaller or narrower butt ends 23b.

[0038] In the assembled configuration, tips 25a of the tabs 18 are positioned adjacent the bottom or butt ends 23b of the slots 20 of mating tabs 18 and slots 20, respectively. In the preferred embodiment, a base of the tabs 18 defines a base width W_B measured proximate the peripheral edges 13b, 15b that is substantially the same and may be slightly smaller than the mouth width W_M . The tabs 18 taper from the base width W_B near the peripheral edges 13b, 15b toward the tips 25a such that the greatest width of the tabs 18 is at the base width W_B and the smallest width is at the tips 25a. The tapers of the tabs 18 and the slots 20 facilitate positioning of the tabs 18 into the slots 20 in the assembled configuration with the tips 25a of the tabs 18 positioned proximate the butt ends 23b of the slots 20, the base width W_B generally accommodated by the mouth width W_M and bottom surfaces 27 of the slots 20 positioned adjacent or in facing engagement with the lower surfaces 18c of the tabs 18. In the preferred embodiment, the mouth and base widths W_M , W_B are approximately one-half to twelve inches ($\frac{1}{2}$ - 12"), but are not so limited and may have larger or smaller sizes based on design considerations, sizes of the modules 10, expected loading, expected operating environments and other relevant design factors. In the preferred embodiment, the butt ends 23b are generally flat or blunt, but are not so limited and may come to a point such that the slots 20 have a generally triangular shape. In such a configuration with generally triangularly-shaped slots 20, additional relief is provided between the tips 25a of the tabs 18 and the butt ends 23b in the assembled configuration to accommodate debris that may be present during assembly.

[0039] The engagement or positioning of the lower surfaces 18c of the tabs 18 relative to the bottom surfaces 27 of the slots 20 of the opposing top and bottom platens 12a, 12b in the assembled configuration of multiple modules 10, such as the first, second, third and fourth modules 10a, 10b, 10c, 10d, generally engages the multiple modules 10 together and limits or prevents vertical movement of the modules 10 relative to each other along the vertical axis 26. There is, however, preferably a space between the lower surfaces 18c of the tabs 18 and the bottom surfaces 27 of the slots 27 in the assembled configuration to facilitate assembly, provide for limited movement along the vertical axis 26 and to accommodate foreign objects that may be encountered in the operating environment, as is further described herein. In addition, in the assembled configuration, the respective upper and bottom surfaces 13a, 15a of assembled and adjacent modules 10, such as the first, second, third and fourth modules 10a, 10b, 10c, 10d, are generally coplanar with each other to facilitate positioning of the assembled modules 10 on a flat support or ground surface and stacking of additional rows of the modules 10 on a first or lower row of modules 10. The tabs 18 are also

preferably tapered from a smallest thickness at the tips 25a to a greater thickness at their base to facilitate assembly and provide some forgiveness in the assembly by reducing potential interference of the tabs 18 with the peripheral edges 13b, 15b with the lower profile or reduced thickness tips 25a of the tabs 18.

5 **[0040]** The preferred tabs 18 also define a tab depth D_x measured from the base of the tabs 18 at the peripheral edges 13b, 15b to the tips 25a and the slots 20 define a slot depth D_s measured from the butt ends 23b to the peripheral edges 13b, 15b, generally parallel to the longitudinal or lateral axes 22, 24, respectively. The tab depth D_x and the slot depth D_s are preferably, substantially the same with the slot depth D_s being slightly greater than the tab depth D_x to accommodate insertion of
10 the tabs 18 into the slots 20 in the assembled configuration. In the preferred embodiment, the tab and slot depths D_x , D_s are preferably approximately one-quarter to four inches ($\frac{1}{4}$ - 4") depending on the size of the modules, designer preferences, operating environment and other relevant factors.

[0041] In the preferred embodiment, each of the platens 12, 14 includes two slots 20 and tabs 18 on each peripheral edge 13b, 15b, thereby including at least eight (8) tabs 18 and eight (8) slots 20 in
15 the preferred rectangular shaped platens 12, 14, although the platens 12, 14 are not so limited and may include less or more tabs 18 and slots 20, depending on designer preferences and configurations. In the preferred embodiment, each of the platens 12, 14 includes twelve (12) tabs 18 and twelve (12) slots 20, with two pairs of tabs 18 and slots 20 at ends of the platens 12, 14 and four pairs of tabs 18 and slots 20 on each of the long peripheral edges 13b, 15b of the platens 12, 14. The
20 slots 20 are also preferably open through the upper and bottom surfaces 13a, 15a, respectively, and form bottom surfaces 27 that define slot void or the slots 20 in combination with the slot legs 21a, 21b. The bottom surfaces 27 and the slot legs 21a, 21b generally set the boundaries or define the slots 20. The mating tabs 18 are positioned within the slot voids or slots 20, respectively, in the assembled configuration with the tab legs 19a, 19b positioned in facing engagement or adjacent to
25 the slot legs 21a, 21b and the bottom surfaces 27 of the slots 20 in facing engagement or adjacent to lower surfaces 18c of the tabs 18 in the assembled configuration. The positioning of the legs 19a, 19b and the slot legs 21a, 21b in facing engagement or adjacent to each other limits lateral and longitudinal movement (along the longitudinal axis 22 and lateral axis 24) of the adjacent platens 12, 14 relative to each other and positioning of the bottom surfaces 27 of the slots 20 and the lower
30 surfaces 18c of the tabs 18 in facing engagement or adjacent to each other limits vertical movement (along the vertical axis 26) of the adjacent platens 12, 14 relative to each other in the assembled configuration.

[0042] Once buried, the installation is subjected to loading from the surrounding soil. To resist the vertical loading from the soil directly above the top platens 12 of the storm water drain tank modules 10 in the assembled storm tank, the top platens 12 accept the load from the soil and transfer it to the support spacer 16. The load is at least partially transferred through the top platens 12 directly to the support spacer 16 by support beams 36, which will be described in greater detail below, that extend directly between adjacent column sockets 28 of the preferred embodiment of the platens 12, 14. The support spacer 16, which is comprised of the eight columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h in the preferred embodiment, then transfers the load into the bottom platens 14, which sends the load to the soil below, also preferably directly away from the sockets 28 by the support beams 36. To resist the lateral loading from the soil surrounding the perimeter of the storm tank, side panels and peripheral edges 13b, 15b of the top and bottom platens 12, 14 accept the load and transfer it to both the top and bottom platens 12, 14 and, potentially, to the support spacer 16 if the support spacer 16 is in contact with or connected to the side panels. The lateral load is transferred to adjacent storm water drain tank modules 10 and their top and bottom platens 12, 14 and, eventually, into the surrounding soil within which the storm water drain tank modules 10 are buried. The support spacer 16 assists in maintaining the spacing between the top and bottom platens 12, 14 and alignment of the adjacent top and bottom platens 12, 14 is preferably maintained by engagement of the slots 20 and tabs 18.

[0043] In the assembled configuration, lateral loads may be substantially transferred directly across top the and bottom platens 12, 14, respectively, of the adjacent storm water drain tank modules 10. For the lateral compression load transferred to the support spacer 16, the top and bottom platens 12, 14 receive the load at column sockets 28 into which the columns 16 are installed in both the top and bottom platens 12, 14 in the preferred embodiment, so that the lateral compressive load is preferably resisted through the compression of the top and bottom platens 12, 14 (neglecting frictional forces). Vertical alignment of adjacent top platens 12 and bottom platens 14 or alignment of the mating top and bottom platen peripheral edges 13b, 15b is preferred for the storm tank to properly resist compressive lateral loading. The top and bottom platens 12, 14 preferably include a plurality of the column sockets 28 defined and opening at the bottom surface 13c. The plurality of columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h are attached to adjoining ones of the plurality of sockets 28 to space the top and bottom platens 12, 14 relative to each other. Ends of the columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h are positioned in the column sockets 28 to separate and top and bottom platens 12, 14, preferably positioning the top platen 12 in a relatively parallel orientation relative to the bottom platen 14 in the assembled configuration. As was

described above, the preferred storm water drain tank modules 10 are not limited to including the eight (8) columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h of the preferred embodiment and may include other structures that space the top and bottom platens 12, 14 and provide space between the top and bottom platens 12, 14 for storage of fluid and other materials, preferably storm water.

5 **[0044]** In the preferred embodiment, the top and bottom platens 12, 14 include at least three (3) support beams 36 extending therefrom to adjacent column sockets 28. For example, each of the corner column sockets 28 includes a support beam 36 extending to an adjacent corner socket 28 generally in a direction parallel to the lateral axis 24, a support beam 36 extending to an adjacent middle socket 28 generally in a direction parallel to the longitudinal axis 22 and a support beam 36
10 extending to a diagonal middle socket 28 generally extending at an acute angle relative to the longitudinal and lateral axes 22, 28. The support beams 36 provide direct load paths for transferring loads from, to and between the columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h or into the columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h from the platens 12, 14 and the soil within which the storm tank is buried. The support beams 36 also resist lateral compression from loads applied to the
15 platens 12, 14 from the columns 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, the optional side panels and other storm water drain tank modules 10 in the assembly. The platens 12, 14 are not limited to including the support beams 36, but the support beams 36 are preferred for load transfer and stiffness and rigidity of the platens 12, 14 and the storm water drain tank modules 10.

[0045] Some installations of the storm water drain tank modules 10 include multiple vertical
20 layers of storm water drain tank modules 10 with the storm water drain tank modules 10 stacked on each other, generally in rows of assembled storm water drain tank modules 10. To limit lateral motion of an upper assembly, row or layer of the storm water drain tank modules 10 relative to a lower assembly, row or layer of storm water drain tank modules 10, alignment pins 30 are placed in pin holes 32. The pin holes 32 of the bottom platens 14 of the upper assembly, row or layer of storm
25 water drain tank modules 10 and the pin holes 32 of the top platen 12 of the lower assembly, row or layer of storm water drain tank modules 10 are aligned and the alignment pins 30 are positioned in the aligned pin holes 32. As a non-limiting example and referring to Figs. 9-11, a first top platen 12a of the first module 10a is shown positioned relative to a fifth bottom platen 14d of a fifth module 10e, which is aligned and stacked onto the first module 10a. In this configuration, the top
30 platen peripheral edge 13b of the first top platen 12a is aligned with the bottom platen peripheral edge 15b of the fifth bottom platen 14d. The pin holes 32 of the first top platen 12a and the fifth bottom platen 14d are aligned parallel to the vertical axis 26 and the alignment pin 30 is inserted into the pin holes 32 to laterally secure the first top platen 12a relative to the fifth bottom platen 14e

and the first module 10a relative to the fifth module 10e. The alignment pins 30 positioned in the pin holes 32 also provide continuity in load transfer from column 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h to column 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h in a stacked configuration.

[0046] The tabs and slots 18, 20 are preferably incorporated into each of the top and bottom platens 12, 14 along the peripheral edges 13b, 15b of the top and bottom platens 12, 14 or around the perimeter of the top and bottom platens 12, 14. During installation, the tabs 18 on each platen 12, 14 nest into the slots 20 on adjacent platens 12, 14, thereby aligning the platens 12, 14 laterally relatively to each other or along the longitudinal and lateral axes 22, 24, respectively. The tabs 18 and slots 20 have a generally trapezoid shape extending from or into, respectively, the peripheral edges 13b, 15b of the platens 12, 14 and are preferably angled at approximately forty-five degrees (45°) relative to the longitudinal and lateral axes 22, 24, respectively, thereby allowing the tabs 18 on front, rear and side peripheral edges 13b, 15b of the adjacent platens 12, 14 to be aligned simultaneously in one angled motion (see Figs. 5-7).

[0047] Once aligned, the engaged slots 20 and tabs 18 resist excessive vertical misalignment between adjacent platens 12, 14 through contact between bottom faces 18a of the tabs 18 and top faces 20a of slots 20 on the adjacent platens 12, 14 (see Fig. 7B). Since proper vertical alignment of adjacent top and bottom platens 12, 14 is preferred for the assembled storm tank to resist compressive lateral loading and generally for efficient load transfer in the assembly, the addition of the tabs 18 and slots 20 is beneficial for the assembled storm tank and the assembled storm water drain tank modules 10 by improving the reliability of the storm tank when subjected to lateral loading. In addition, the engagement of the slots 20 and tabs 18 align the support beams 18 of adjacent platens 12, 14 and the peripheral edges 13b, 15b, as well as limiting vertical misalignment between adjacent top and bottom platens 12, 14 to limit movement of the platens 12, 14 past each other in the vertical direction in the assembled configuration. The engaged slots 20 and tabs 18 also align the peripheral edges 13b, 15b to transfer lateral load and maintain continuity across the storm water drain tank modules 10 in the assembled configuration to take advantage of the platens 12, 14 so they efficiently resist lateral compression. The generally V-shape or polygonal-shape of the tabs 18 and slots 20, with a mouth 23a at the peripheral edges 13b, 14b of the slots 20 being open, facilitate insertion or sliding of the tabs 18 into the slots 20, which is particularly desirable for assembly of the fourth module 10d into the first, second and third modules 10a, 10b, 10c in the assembled configuration (Figs. 5-7). The generally V-shape or polygonal-shape of the tabs 18 and slots 20, when nested, align the peripheral edges 13b, 15b of the adjacent platens 12, 14. The tabs 18 are preferably slidable into or engageable with the slots 20 by moving the tabs 18 laterally into

the slots 20 through the opening between the legs 21a, 21b of the slots 20, as opposed to vertical sliding, which is difficult for alignment purposes.

[0048] Referring to Figs. 7-8B, a space or gap is defined between the bottom faces 18a of the tabs 18 and the top faces 20a of the slots 20 in the assembled configuration (Fig. 7B). The gap facilitates assembly of the modules 10 into the storm tank, provides tolerance for the assembly and provides space for displacement of foreign objects out of the way of the tabs 18 when inserted into the slots 20. The environments where the storm tanks, which are comprised of pluralities of the modules 10, are assembled can be dusty and dirty and subject to encroachment of foreign objects, such as rocks and soil, onto the modules during assembly. The space or gap between the bottom faces 18a of the tabs 18 and the top faces 20a of the slots 20 provides space for urging these foreign objects out of the way of the tabs 18 during insertion and assembly of the tabs 18 into the slots 20. The slots 20 also preferably have windows through the bottom surfaces 27 that open into an inner space of the modules 10 between the top and bottom platens 12, 14 where rocks, mud, soil and dirt may be urged out of the way of the tabs 18 during assembly. The tabs 18 also include top faces 18b that is substantially coplanar with the upper surface 13a in the preferred embodiment, but may also taper from a larger thickness to a smaller thickness at the tip 25a in an alternative preferred embodiment, shown in dashed linetype in Fig. 8B. The alternative preferred taper of the top faces 18b provides relief for assembly of the modules 10 and facilitates movement or space for foreign objects that may impede assembly.

[0049] Referring to Figs. 1-11, for installations that include the upper and lower layers of storm water drain tank modules 10, stacking features are incorporated into the platens 12, 14 to limit the relative lateral motion or movement along the longitudinal and lateral axes 22, 24 of vertically stacked storm water drain tank modules 10, such as the first module 10a and the fifth module 10e (Figs. 9-11), relative to each other. Specifically, the top and bottom platens 12, 14 include the pin holes 32 that are preferably positioned proximate each of the four (4) corners of the top and bottom platens 12, 14 and the alignment pin 30. The pin holes 32 on the platens 12, 14 are preferably enclosed by a cylindrical face 32a and are spaced so that the pin holes on the bottom platen 14 align with the pin holes 32 in the top platen 12 in the assembled configuration, such as the alignment of the pin hole 32 in the top platen 12a of the first module 10a and the pin hole 32 in the bottom platen 14e of the fifth module 10e, which is shown in Figs 9-11. Once the pin holes 32 are aligned, the alignment pin 30 is placed or dropped into the holes 32, limiting relative lateral movement or movement along the longitudinal and lateral axes 22, 24 of the storm water drain tank modules 10, 10a, 10e relative to each other and aligning the platens 12, 14 and the columns 16a, 16b, 16c, 16d,

16e, 16f, 16g, 16h. The alignment pins 30 preferably have a tapered configuration from an insertion end 30a to a top end 30b to facilitate alignment of the alignment pins 30 in the aligned pin holes 32 during installation and assembly. The alignment pins 30 also preferably include a lip 30c at the top end 30b that is larger than the pin holes 32 to stop the alignment pins 30 from being inserted too far into or through the pin holes 32 and to provide a feature for engagement by a tool for removal of the alignment pins 30 from the pin holes 32. The alignment pins 30 taper from the insertion end 30a, which has an insertion diameter D_I , to the top end 30b, which has a top end diameter D_T , wherein the insertion diameter D_I is less than the top end diameter D_T .

[0050] Certain prior stacking feature designs for existing storm tank modules required placement of alignment pins in the top platen of the first layer of modules before adding a second layer of assembled modules by placing the second modules on top of the first modules with a downward motion to engage the pins. Since the tabs 18 and slots 20 of the preferred top and bottom platens 12, 14 may be interlocked through a lateral sliding motion (see Figs. 5-7) and are preferably not assembled using a downward or vertical motion, because the tabs 18 would interfere with peripheral edges of the adjacent top or bottom platens 12, 14, the alignment pins 30 and pin holes 32 enable installation of the alignment pins 30 after the tabs 18 are aligned in the slots 20 in the assembled configuration. Additionally, since the lip 30c on the top end 30b of each alignment pin 30 prevents the pin 30 from falling fully through the pin hole 32, the pins 30 may either be inserted into the bottom platen 14 of the upper layer of storm water drain tank modules 10 in a stacked configuration prior to performing the sliding action to interlock the tabs 18 and slots 20 or after the alignment has already occurred. For example, the alignment pins 30 may be partially inserted into each of the four (4) pin holes 32 in the fifth bottom platen 14e of the fifth module 10e, the fifth module 10e may be arranged such that its tabs 18 and slots 20 engage adjacent storm water drain tank modules 10 on the upper layer of storm water drain tank modules 10 and the partially inserted alignment pins 30 may be urged downwardly into the aligned pin holes 32 of the first top platen 12a of the first module 10e until the lip 30c is positioned adjacent rims 32b of the pin holes 32 of the fifth bottom platen 14e. When the lip 30c is engaged with or near an upward surface 15c of the fifth module 10e, the insertion end 30a is preferably positioned adjacent a lower surface 13c of the first module 10a, as is shown in Fig. 9A, but is not so limited and may be otherwise sized and configured, as long as the pin 30 laterally supports the engaged modules 10a, 10e.

[0051] In the preferred embodiment, aligning of the planes of adjacent top and bottom platens 12, 14 is preferred to resist lateral compression from soil on the side panels in contact with the walls of the excavation in a buried condition. Other prior art box structures that have intermediate walls

suffer from misalignment between upper and lower surfaces of adjacent boxes or lateral compression displacement varies between layers causing misalignment vertically. The difference is that if the box structures include intermediate walls, the adjacent intermediate walls are point loaded by the misaligned horizontal plane. Since the walls are designed for interface with the soil, the misalignment generates a point load on the mid vertical span of the side panels and failure may occur. The load is still translated to the top and bottom planes in a box structure to resist soil pressures across an installation through horizontal planes.

[0052] It will be appreciated by those skilled in the art that changes could be made to the embodiment described above without departing from the broad inventive concept thereof. It is understood, therefore, that this invention is not limited to the particular embodiment disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the present disclosure.

CLAIMS

I/We claim:

1. A storm water drain tank module for assembly into a storm tank for storage of storm water, the tank module comprising:

5 a top platen having an upper surface and a top platen peripheral edge;
a bottom platen having a bottom surface and a bottom platen peripheral edge;
a support spacer attached to the top and bottom platens to space the top platen relative to the bottom platen; and

10 a plurality of tabs and a plurality of slots defined proximate the top and bottom platen peripheral edges, respectively, each of the plurality of tabs extending outwardly away from the top and bottom platen peripheral edges, respectively and each of the plurality of slots extending into the top and bottom platen peripheral edges, the plurality of slots being open in a lateral direction.

2. The storm water drain tank module of claim 1, wherein each of the plurality of slots has a slot mouth defining a slot width proximate the top and bottom platen peripheral edges, respectively,
15 the plurality of slots tapering inwardly toward butt ends, respectively, such that the slot width is greater than a width of any other portion of the plurality of slots.

3. The storm water drain tank module of claim 1, wherein each of the plurality of tabs has a substantially trapezoid shape.

4. The storm water drain tank module of claim 3, wherein each of the plurality of tabs
20 includes a pair of tab legs, the pair of tab legs extending outwardly from the top and bottom platen peripheral edges proximate one of the upper and lower surfaces at a tab angle.

5. The storm water drain tank module of claim 4, wherein the tab angle is approximately forty-five degrees (45°).

6. The storm water drain tank module of claim 1, wherein each of the plurality of slots has a
25 substantially trapezoid shape.

7. The storm water drain tank module of claim 6, wherein each of the plurality of slots includes a pair of slot legs, the pair of slot legs extending inwardly from the top and bottom platen peripheral edges proximate one of the top and bottom surfaces at a slot angle.

8. The storm water drain tank module of claim 7, wherein the slot angle is approximately forty-five degrees (45°).

9. The storm water drain tank module of claim 1, wherein each of the plurality of slots has a substantially triangular shape and each of the plurality of tabs has a substantially triangular shape.

5 10. The storm water drain tank module of claim 1, wherein the plurality of tabs includes at least eight tabs and the plurality of slots includes at least eight slots.

11. The storm water drain tank module of claim 10, wherein the plurality of tabs includes twelve tabs and the plurality of slots includes twelve slots.

10 12. The storm water drain tank module of claim 1, wherein the plurality of tabs and the plurality of slots includes a first tab and a first slot, the first tab positioned adjacent the first slot, the first tab integrally formed with one of the top platen and the bottom platen.

13. The storm water drain tank module of claim 1, wherein the support spacer is comprised of a plurality of columns, the top and bottom platens include a plurality of column sockets, adjoining ones of the plurality of column sockets configured to accept opposing ends of the plurality of
15 columns to attach the plurality of columns to the top and bottom platens, the top platen and the bottom platen being constructed of a polypropylene material.

14. The storm water drain tank module of claim 13, wherein the plurality of columns includes at least four columns.

15. The storm water drain tank module of claim 14, wherein the plurality of columns
20 includes eight columns.

16. The storm water drain tank module of claim 1, wherein the support spacer is constructed of a polyvinyl chloride material.

17. A storm water drain tank module assembly for storage of storm water runoff, the storm water tank assembly comprising:

25 a first module including a first top platen, a first bottom platen and a first support spacer, a first plurality of tabs extending laterally outwardly from one of the first top platen, the first bottom platen and the first support spacer and a first plurality of slots extending laterally inwardly into one

of the first top platen, the first bottom platen and the first support spacer, the first plurality of tabs including a first tab and the first plurality of slots including a first slot; and

a second module including a second top platen, a second bottom platen and a second support spacer, a second plurality of tabs extending laterally outwardly from one of the second top platen, the second bottom platen and the second support spacer and a second plurality of slots extending laterally inwardly into one of the second top platen, the second bottom platen and the second support spacer, the second plurality of tabs including a second tab and the second plurality of slots including a second slot, the first tab positioned in the second slot and the second tab positioned in the second slot in an assembled configuration.

18. The storm water drain tank module assembly of claim 17, wherein the first tab and first slot are positioned adjacent to each other and the second tab and second slot are positioned adjacent to each other.

19. The storm water drain tank module assembly of claim 17, further comprising:

a third module including a third bottom platen, the third bottom platen including a third peripheral edge and a third pin hole, the third bottom platen defining a third bottom surface, the first top platen including a first pin hole, the first top platen defining a first top surface, the first top platen surface positioned adjacent the third bottom surface and the first pin hole aligned with the third pin hole in the assembled configuration.

20. The storm water drain tank module assembly of claim 19, further comprising:

an alignment pin including an insertion end, a top end and a lip positioned at the top end, the alignment pin tapering from an insertion end diameter at the insertion end to a top end diameter at the top end, the insertion end diameter being smaller than the top end diameter, the alignment pin positioned in the first and third pin holes in the assembled configuration.

21. The storm water drain tank module assembly of claim 20, wherein the third pin hole includes a rim opposite the bottom surface, the lip positioned adjacent the rim in the assembled configuration.

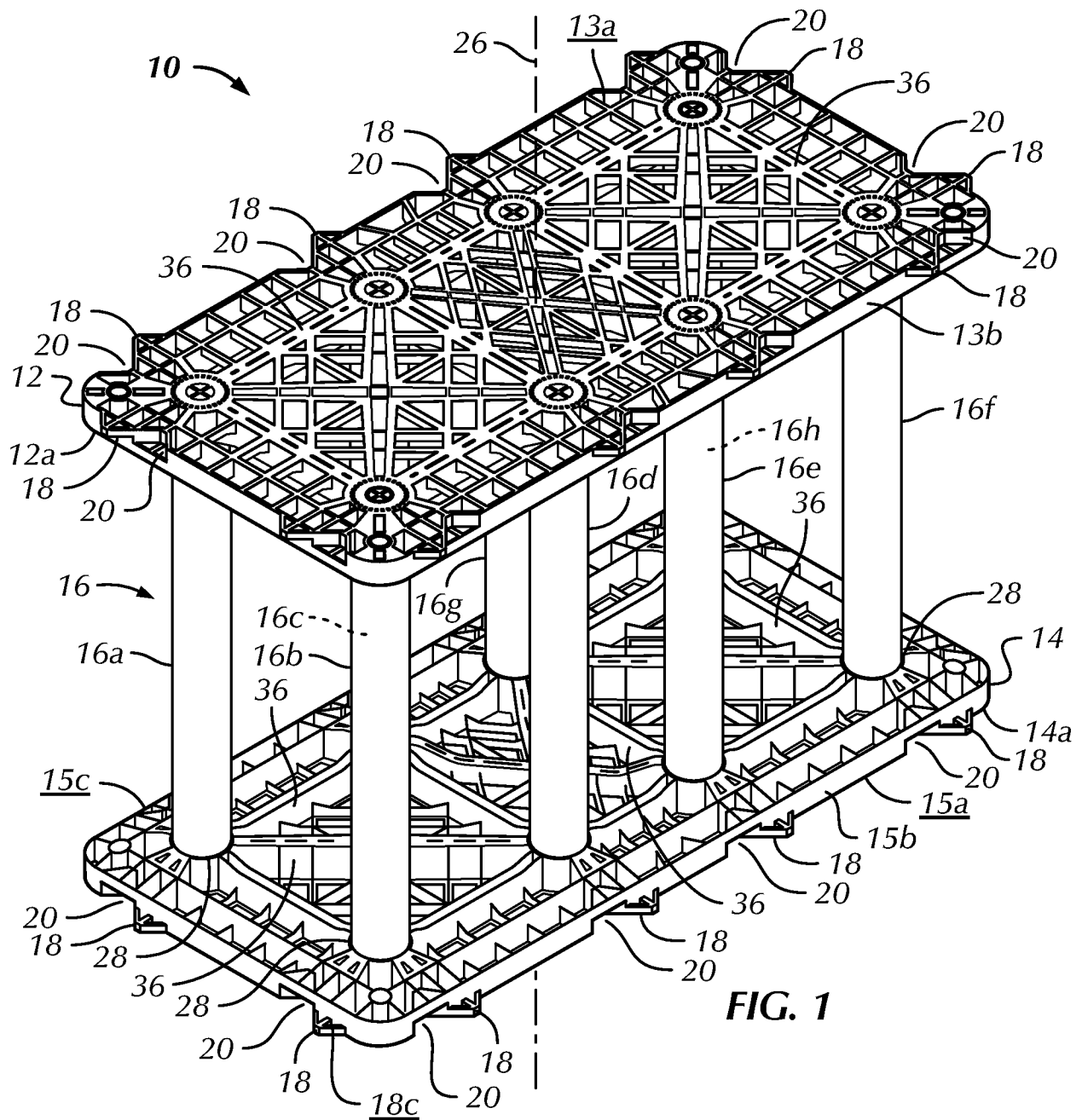
22. The storm water drain tank module assembly of claim 17, wherein the first plurality of tabs is comprised of twelve tabs and the first plurality of slots is comprised of twelve slots.

23. The storm water drain tank module assembly of claim 17, wherein the first top platen includes a first peripheral edge and the second top platen includes a second peripheral edge, the first peripheral edge is position adjacent the second peripheral edge in the assembled configuration, the first plurality of tabs and the first plurality of slots positioned at the first peripheral edge, the second
5 plurality of tabs and the second plurality of slots positioned at the second peripheral edge.

24. The storm water drain tank module assembly of claim 17, further comprising:

an alignment pin including an insertion end and a top end, the alignment pin tapering from an insertion end diameter at the insertion end to a top end diameter at the top end, the insertion end diameter being smaller than the top end diameter, the alignment pin connecting the first module to
10 the second module in the assembled configuration.

1/12



2/12

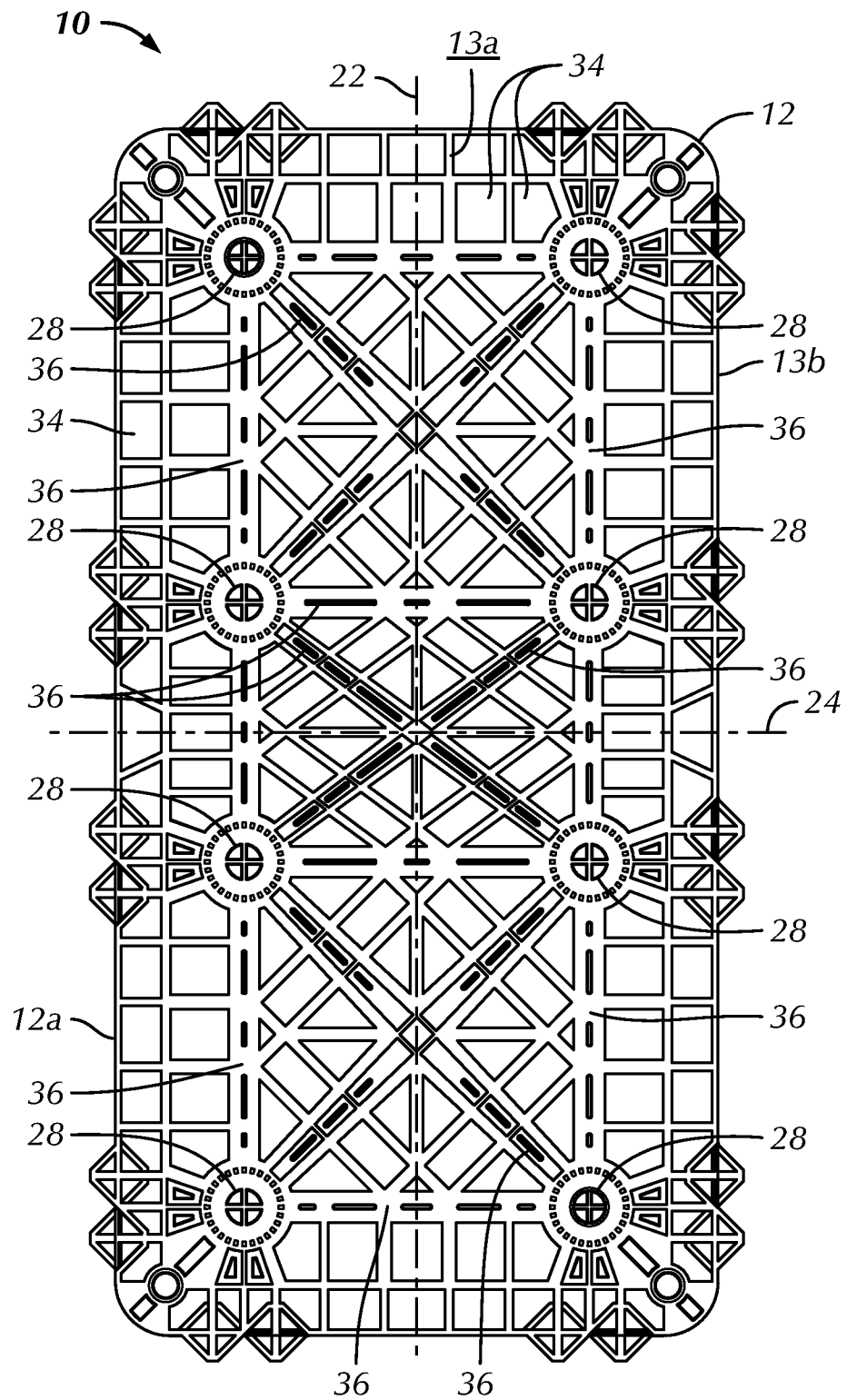


FIG. 2

3/12

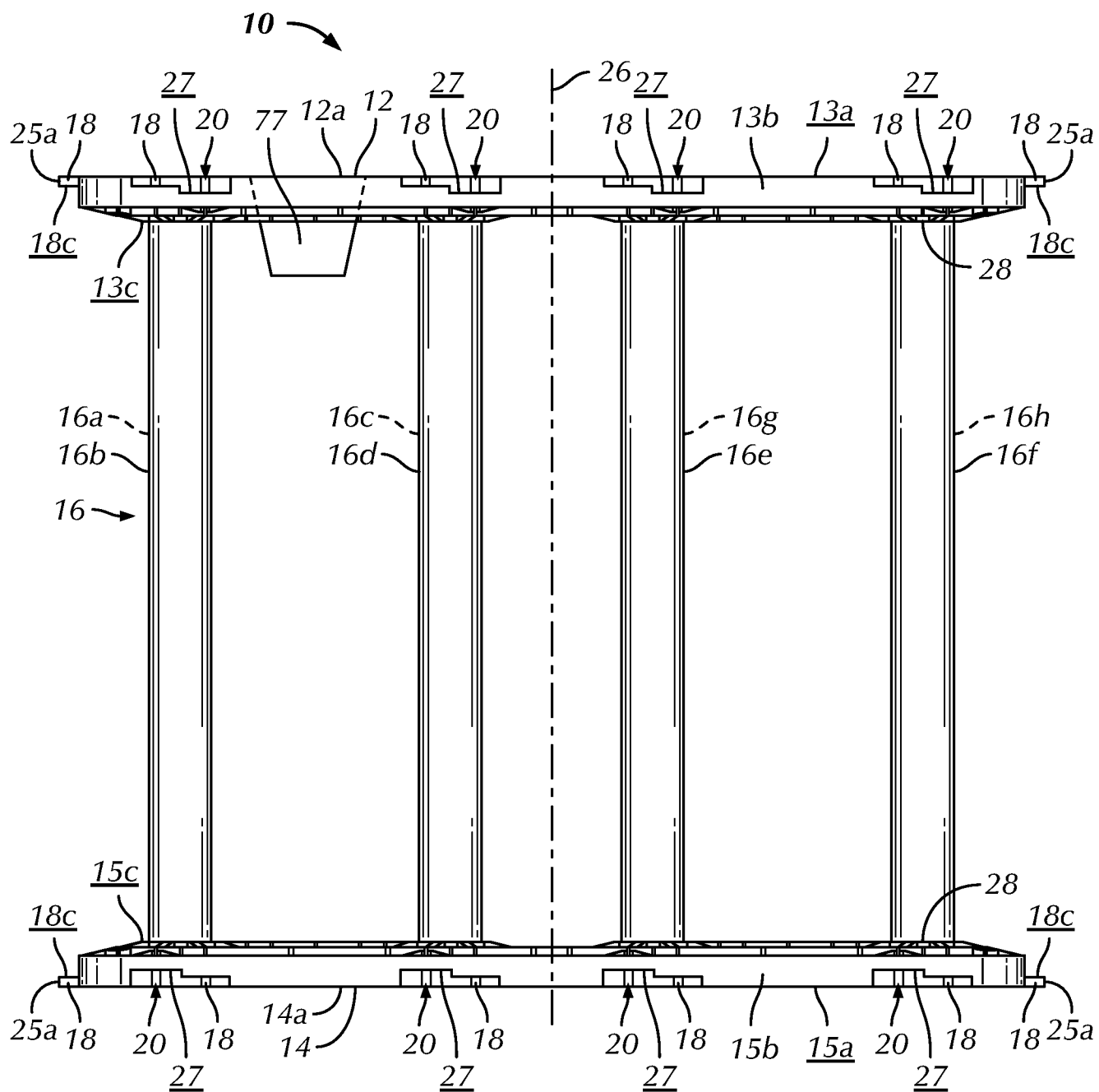


FIG. 3

4/12

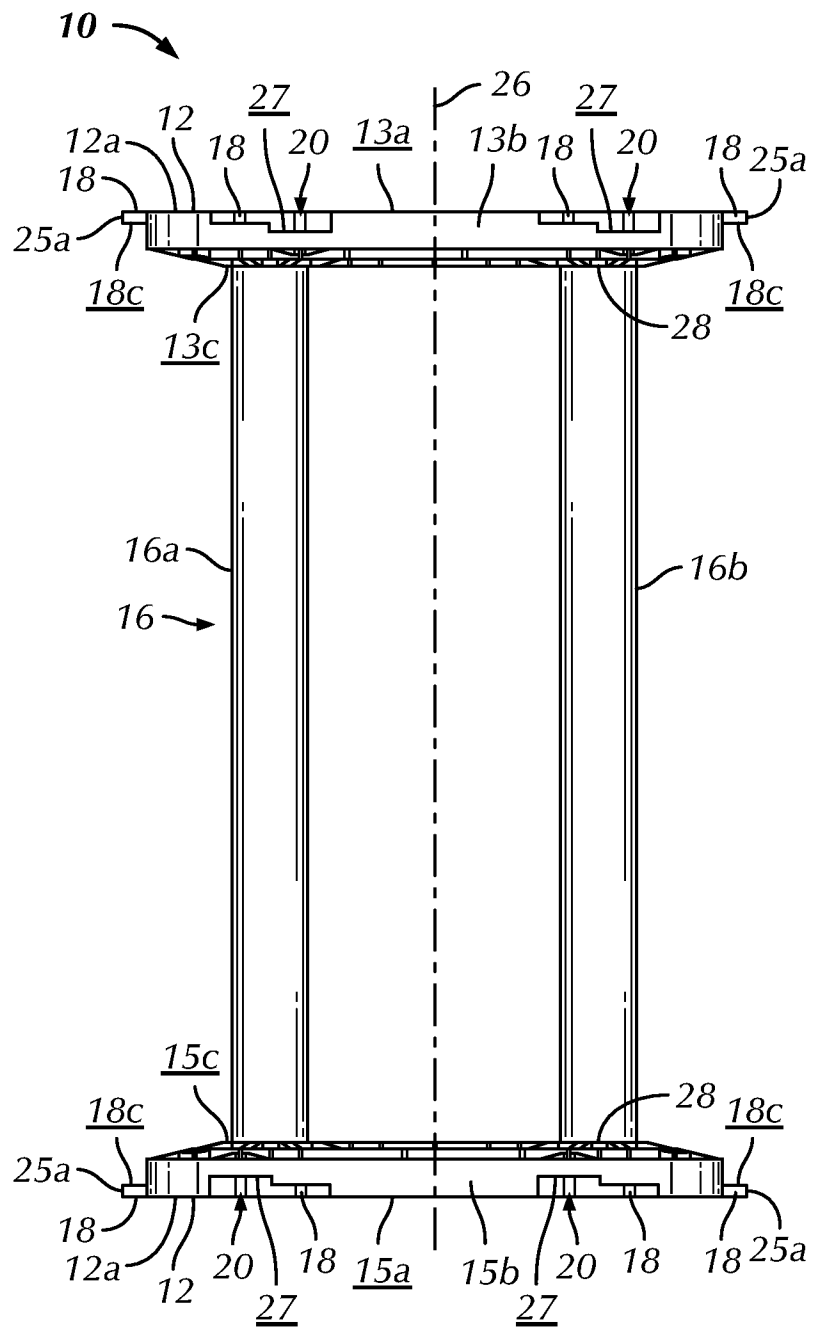


FIG. 4

5/12

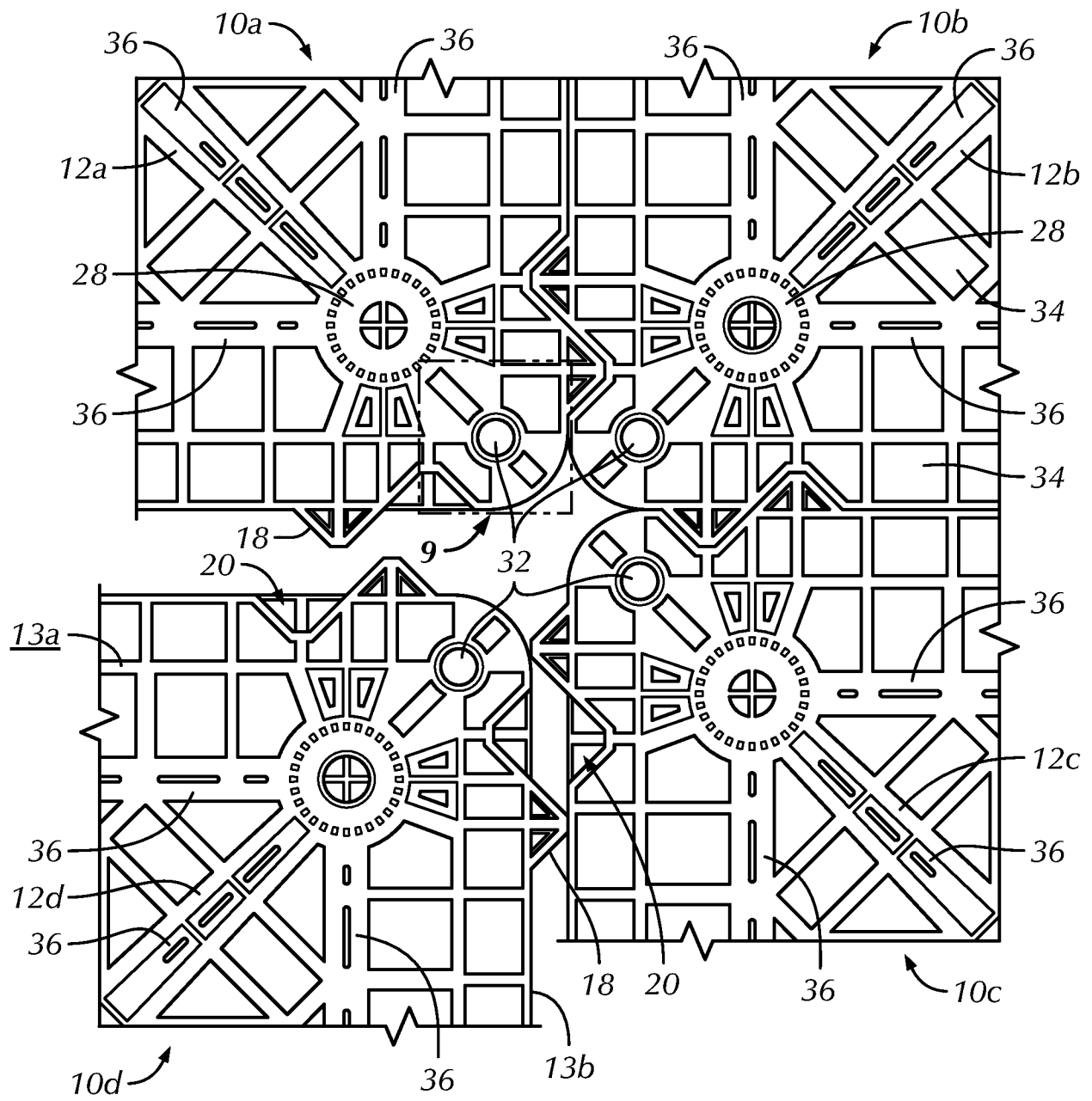


FIG. 5

6/12

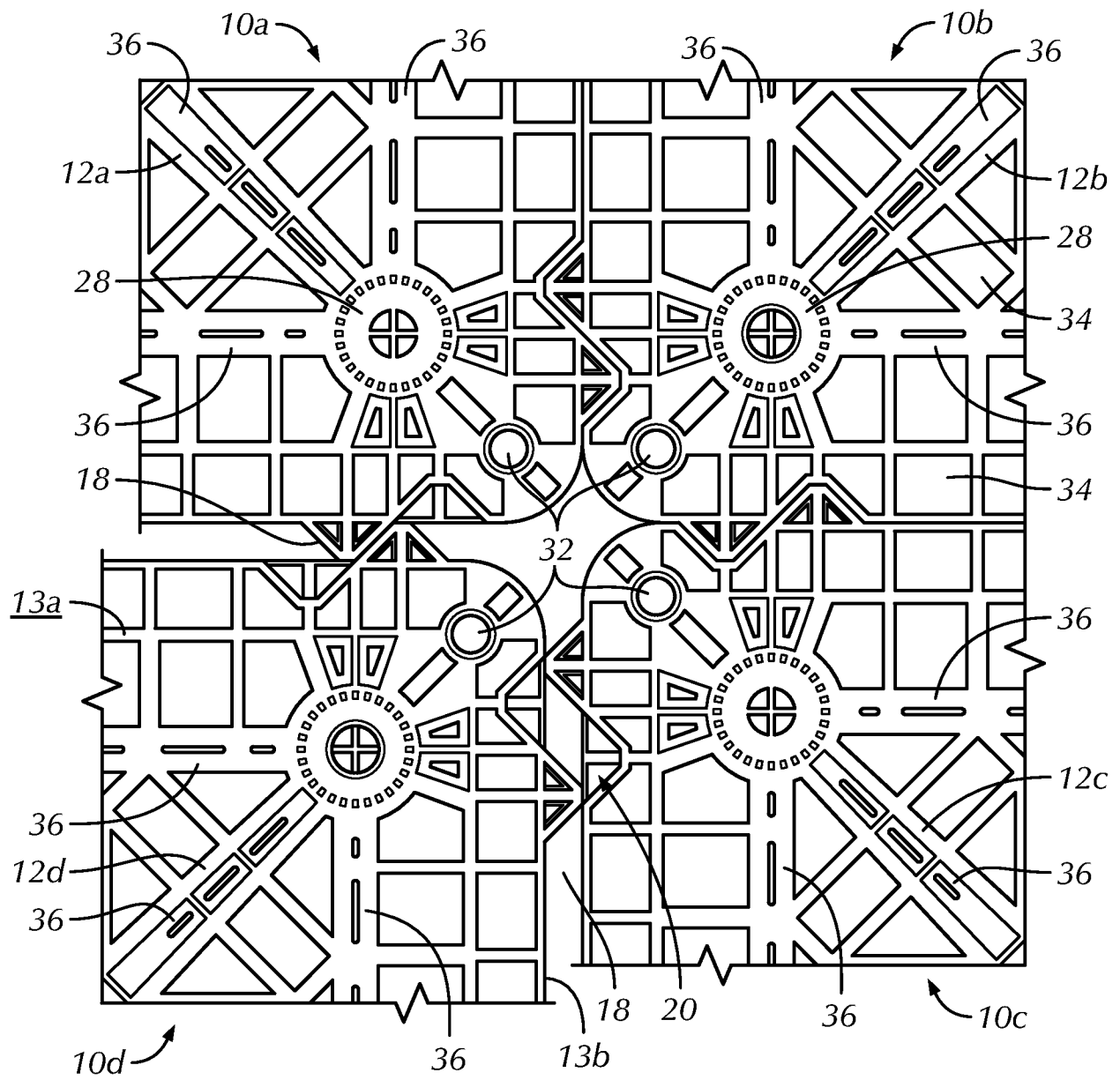


FIG. 6

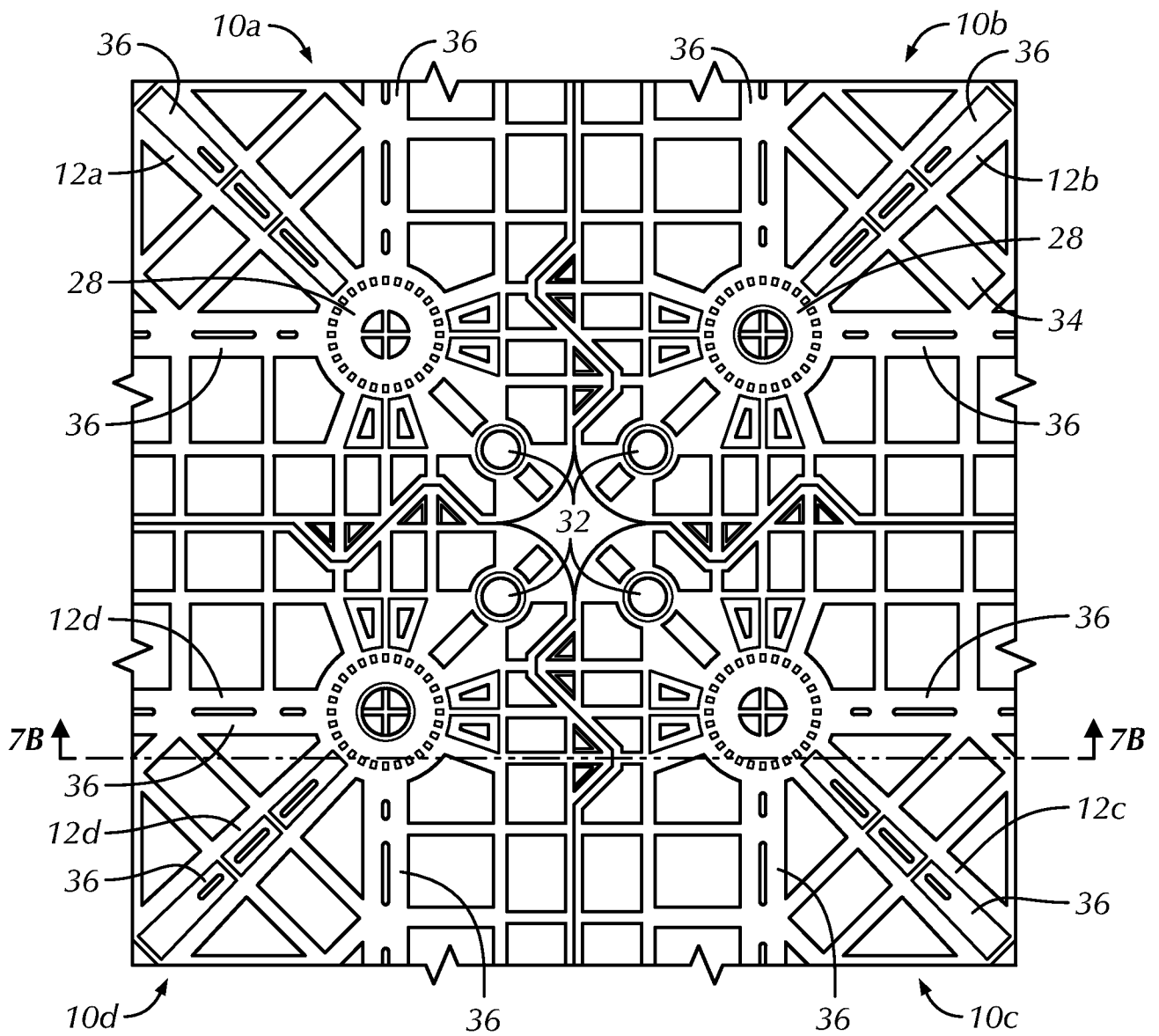


FIG. 7

8/12

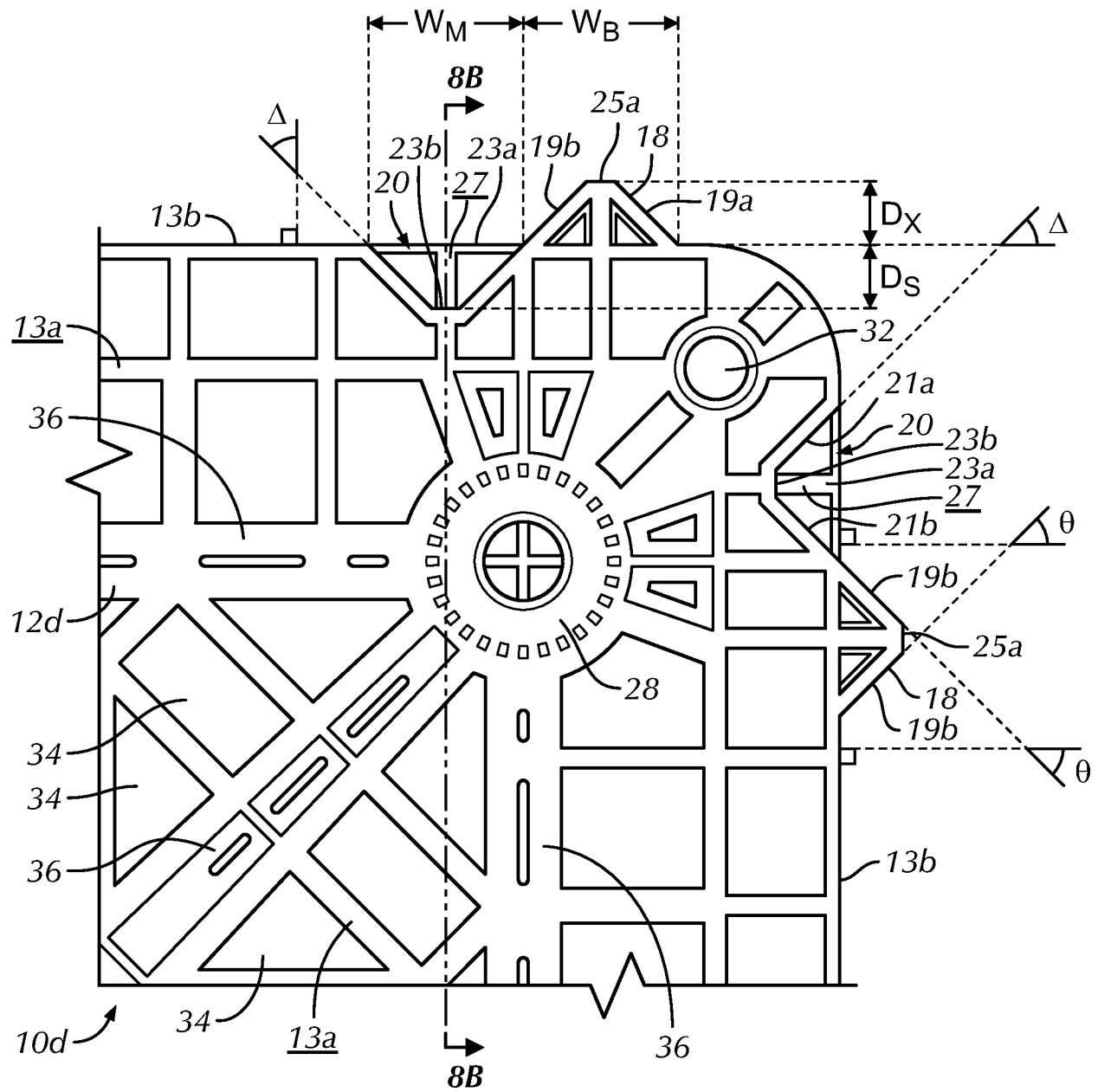


FIG. 8

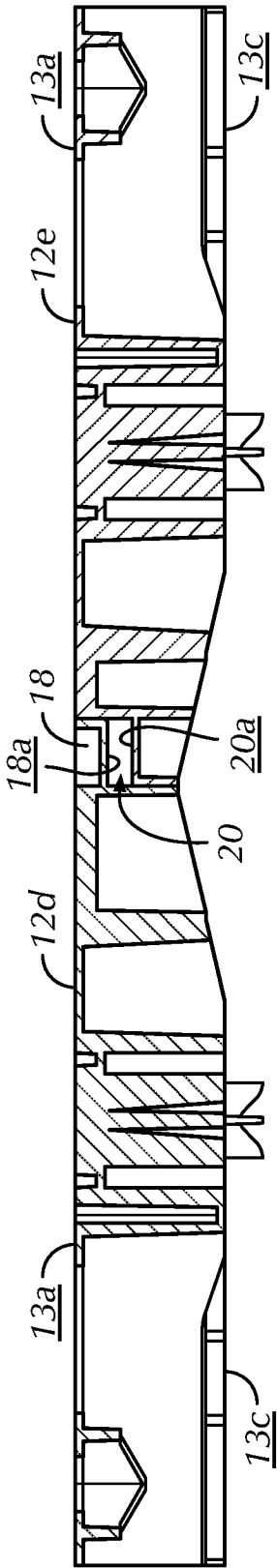


FIG. 7B

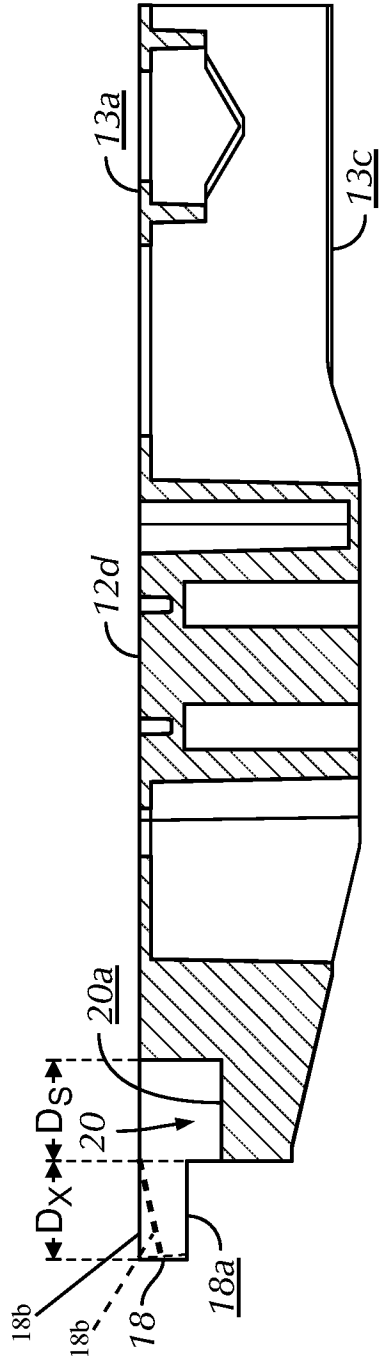


FIG. 8B

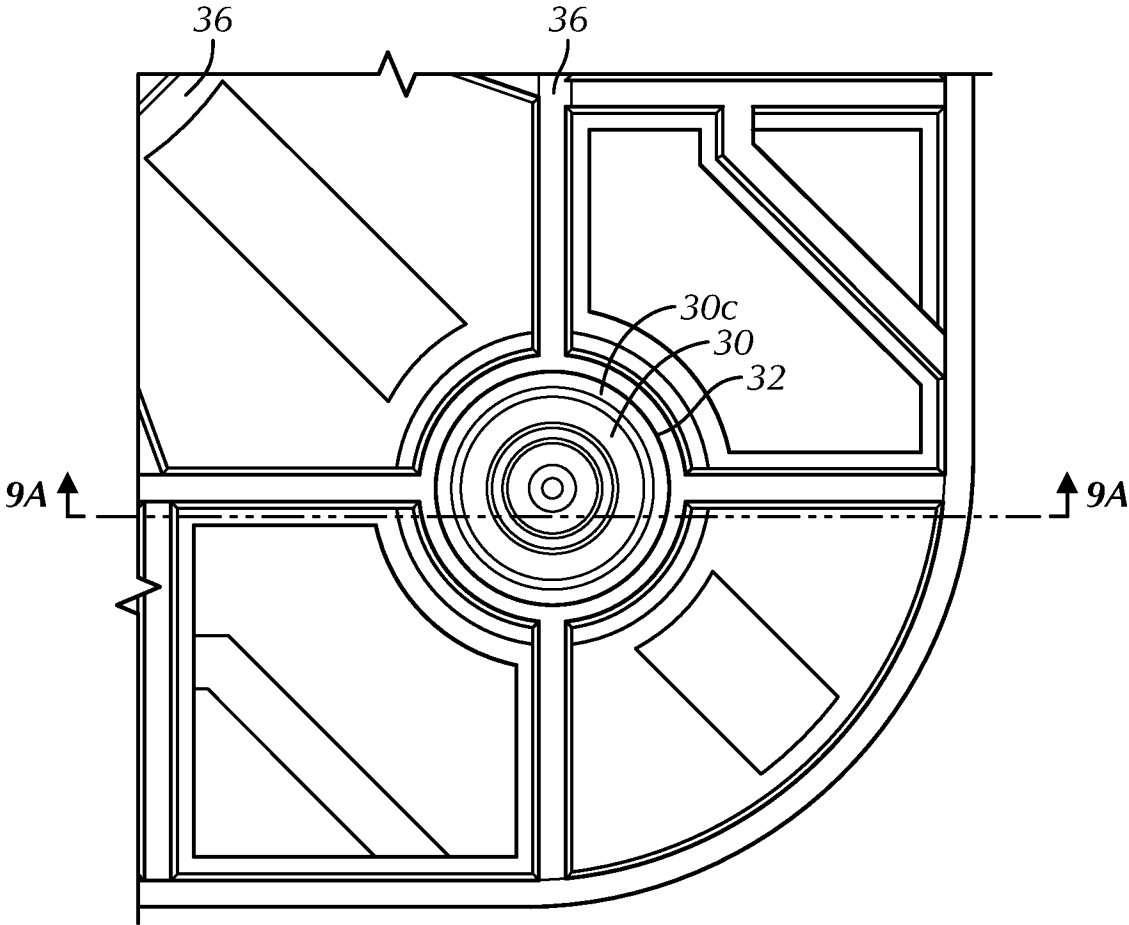


FIG. 9

11/12

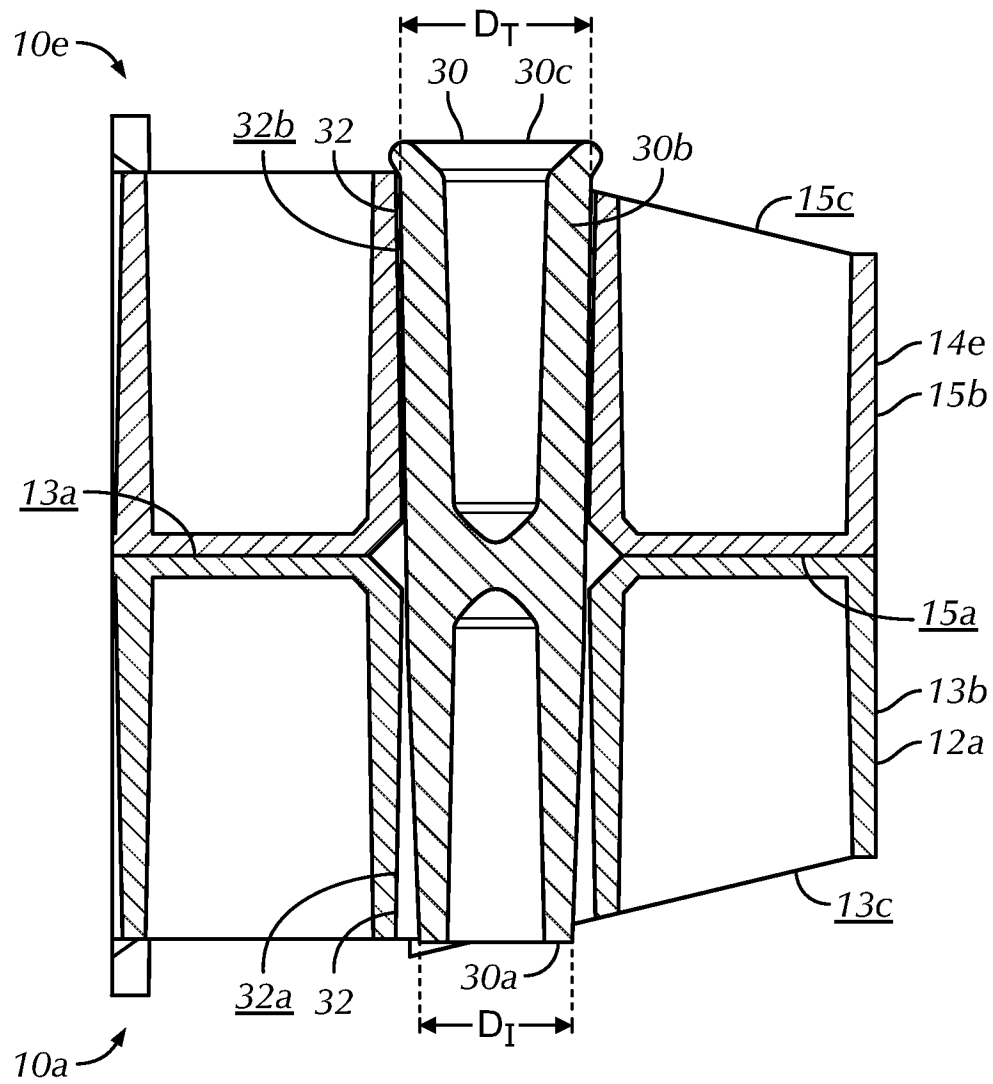
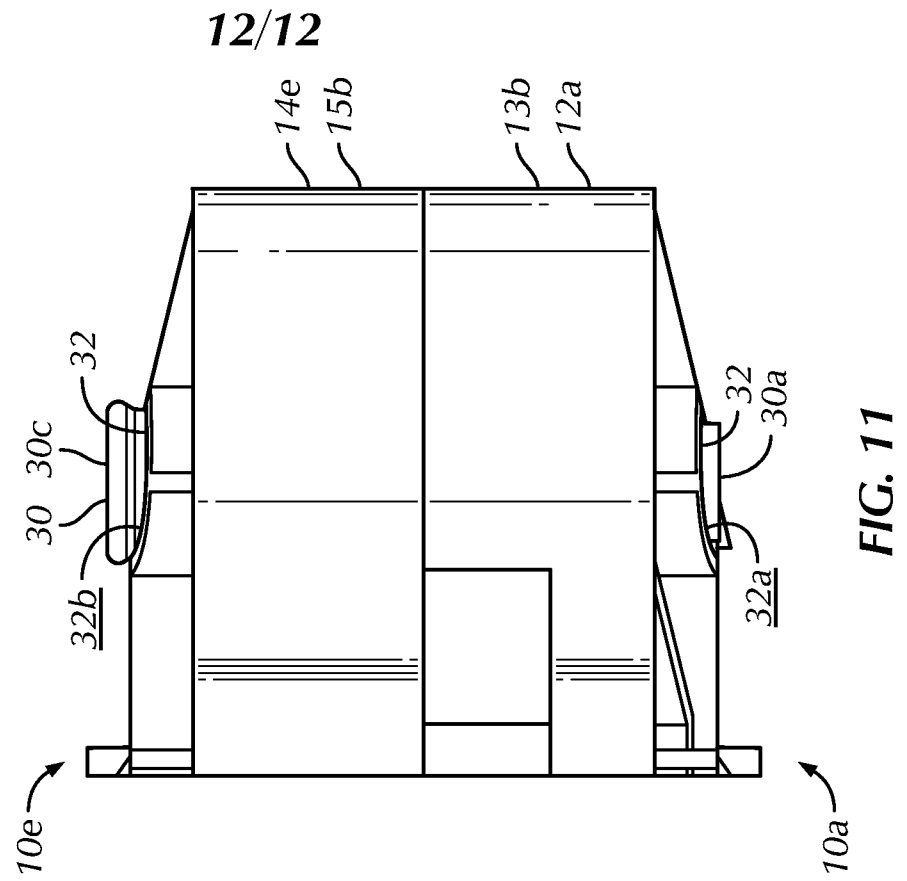
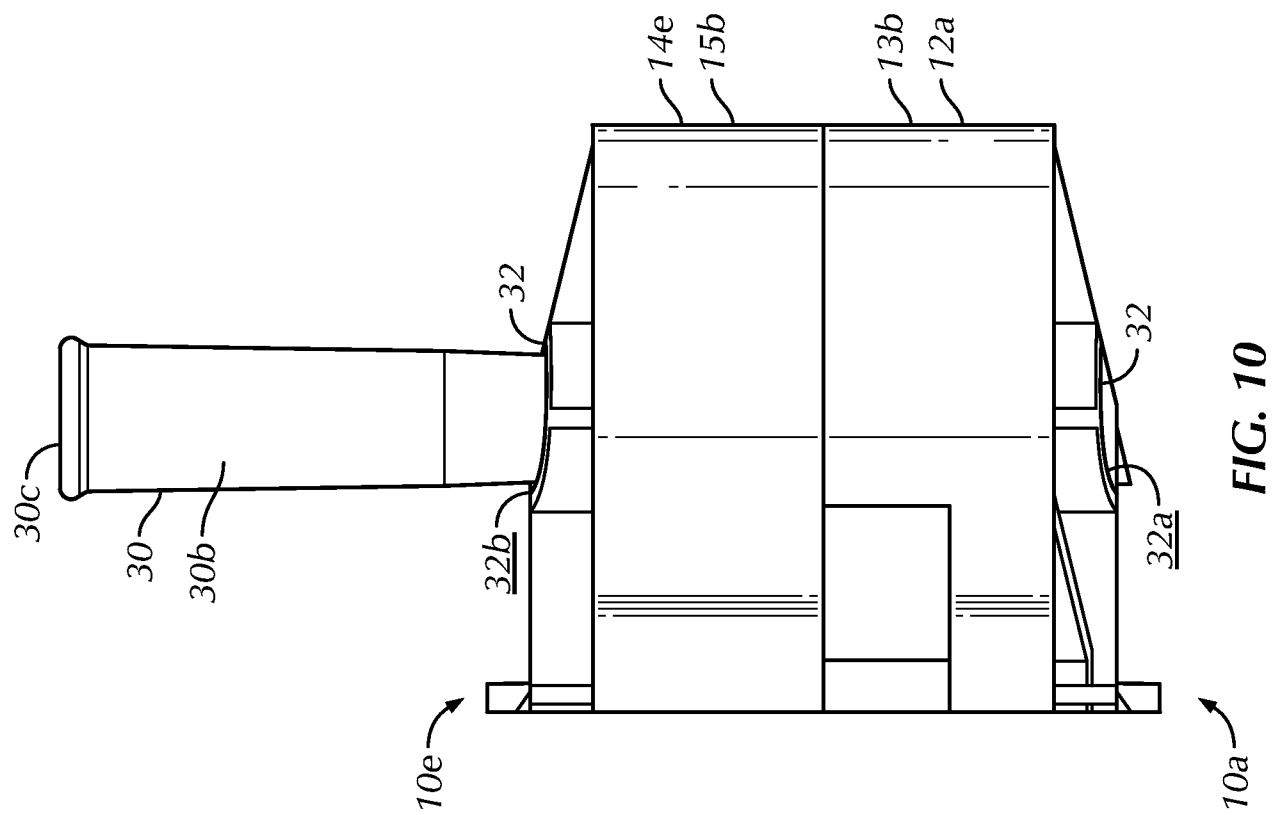


FIG. 9A



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2019/047860

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - E03F 1/00; E03B 3/03; E03F 5/12 (2019.01)

CPC - E03F 1/005; E03B 3/03; E03F 1/002; E03F 5/12 (2019.08)

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)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 210/170.03; 405/36; 405/39; 405/43 (keyword delimited)

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/0292259 A1 (WAVIN B.V.) 12 October 2017 (12.10.2017) entire document	1-18, 22, 23
A	US 6,112,894 A (KIKUCHI et al) 05 September 2000 (05.09.2000) entire document	1-24
A	US 2011/0097151 A1 (LEE et al) 28 April 2011 (28.04.2011) entire document	1-24
A	US 2008/0166182 A1 (SMITH et al) 10 July 2008 (10.07.2008) entire document	1-24

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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"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

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"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

09 October 2019

Date of mailing of the international search report

29 OCT 2019

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