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Cohen(10) **Pub. No.: US 2020/0040595 A1**(43) **Pub. Date: Feb. 6, 2020**(54) **MODULAR POOL****Publication Classification**(71) Applicant: **Galit Cohen**, Ramat Hasharon (IL)(51) **Int. Cl.**
E04H 4/00 (2006.01)(72) Inventor: **Galit Cohen**, Ramat Hasharon (IL)(52) **U.S. Cl.**
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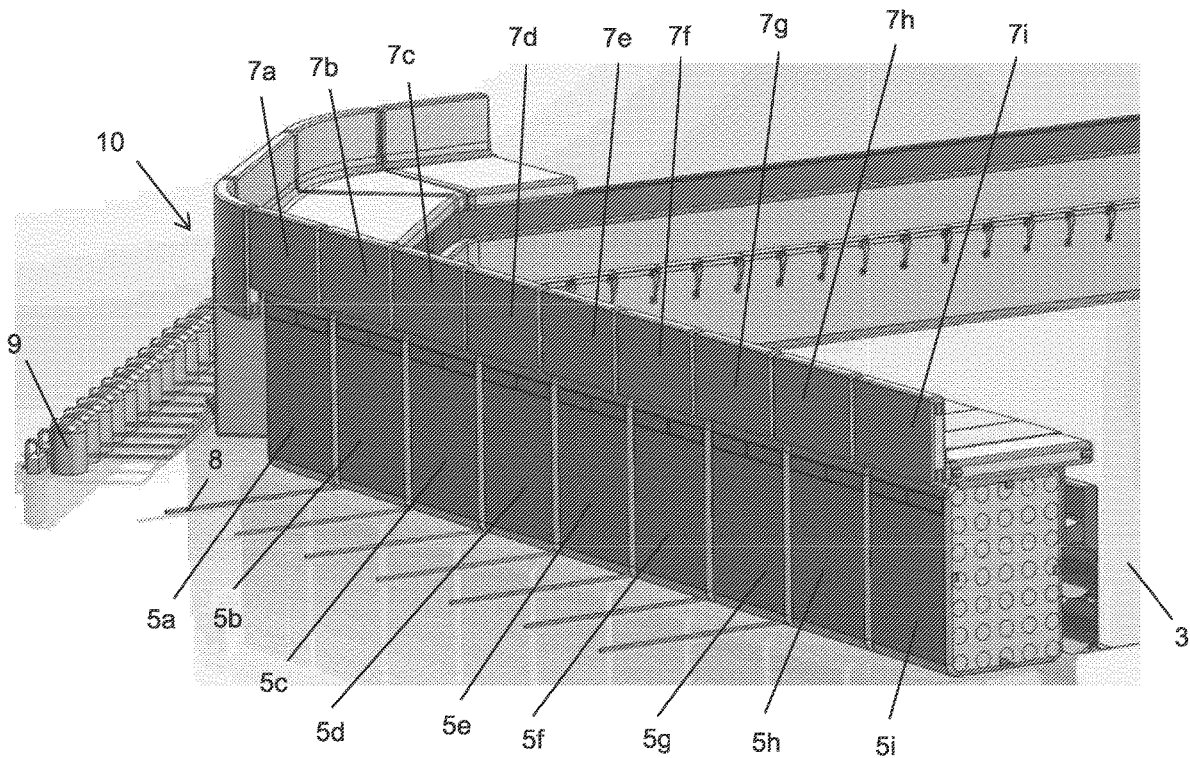
§ 371 (c)(1),

(2) Date: **Oct. 3, 2019**(57) **ABSTRACT**

An above-ground modular pool which is unsupported by an embankment has a plurality of interconnected and inflatable water-exposed units entirely made of reinforced composite polymeric material, and a plurality of floor panels each of which is connected to one or more of the water-exposed units, such that each of the plurality of water-exposed units is of sufficient structural strength to withstand the hydraulic pressure applied thereto by a body of water received in the pool.

(30) **Foreign Application Priority Data**

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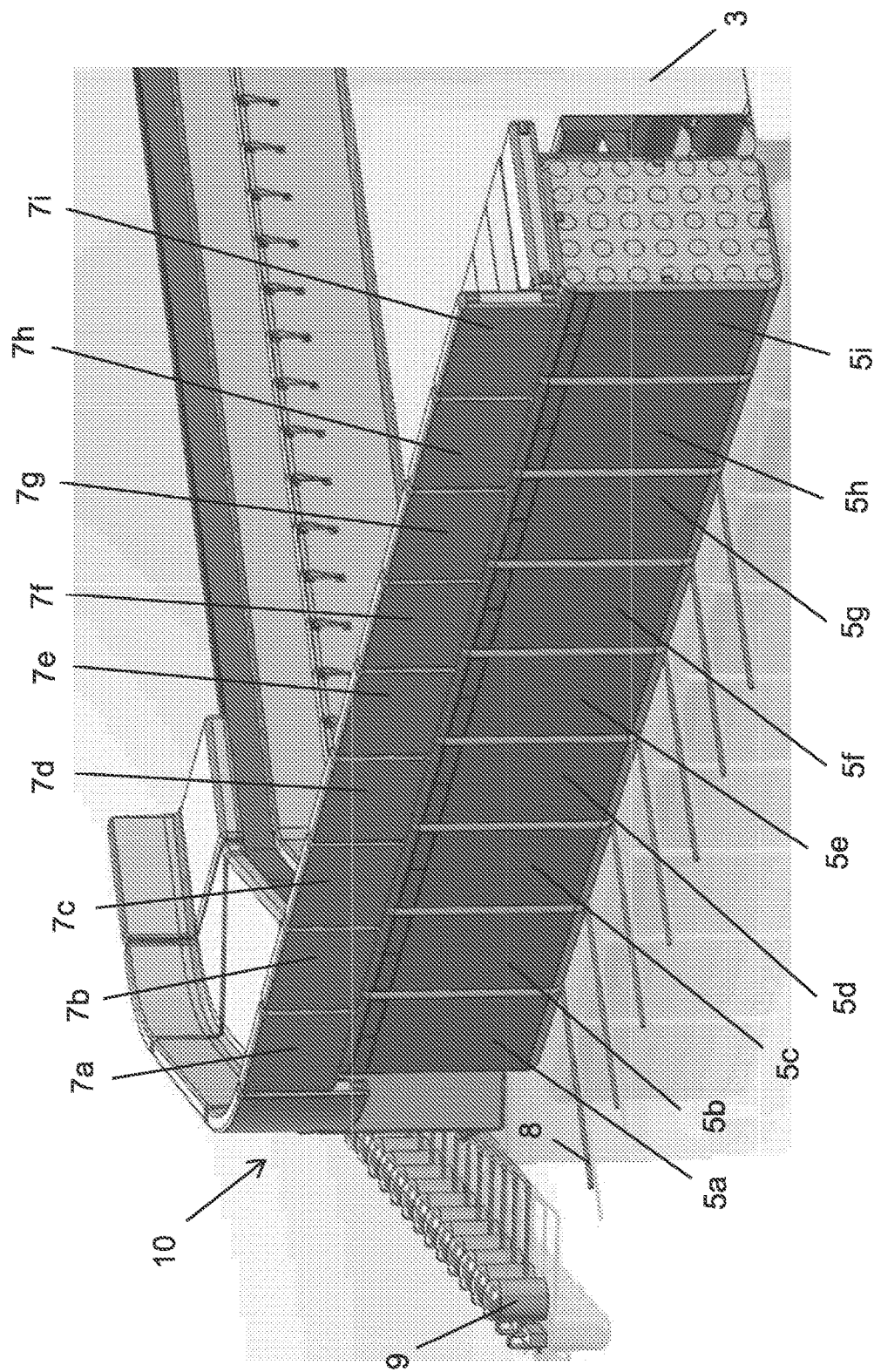


Fig. 1

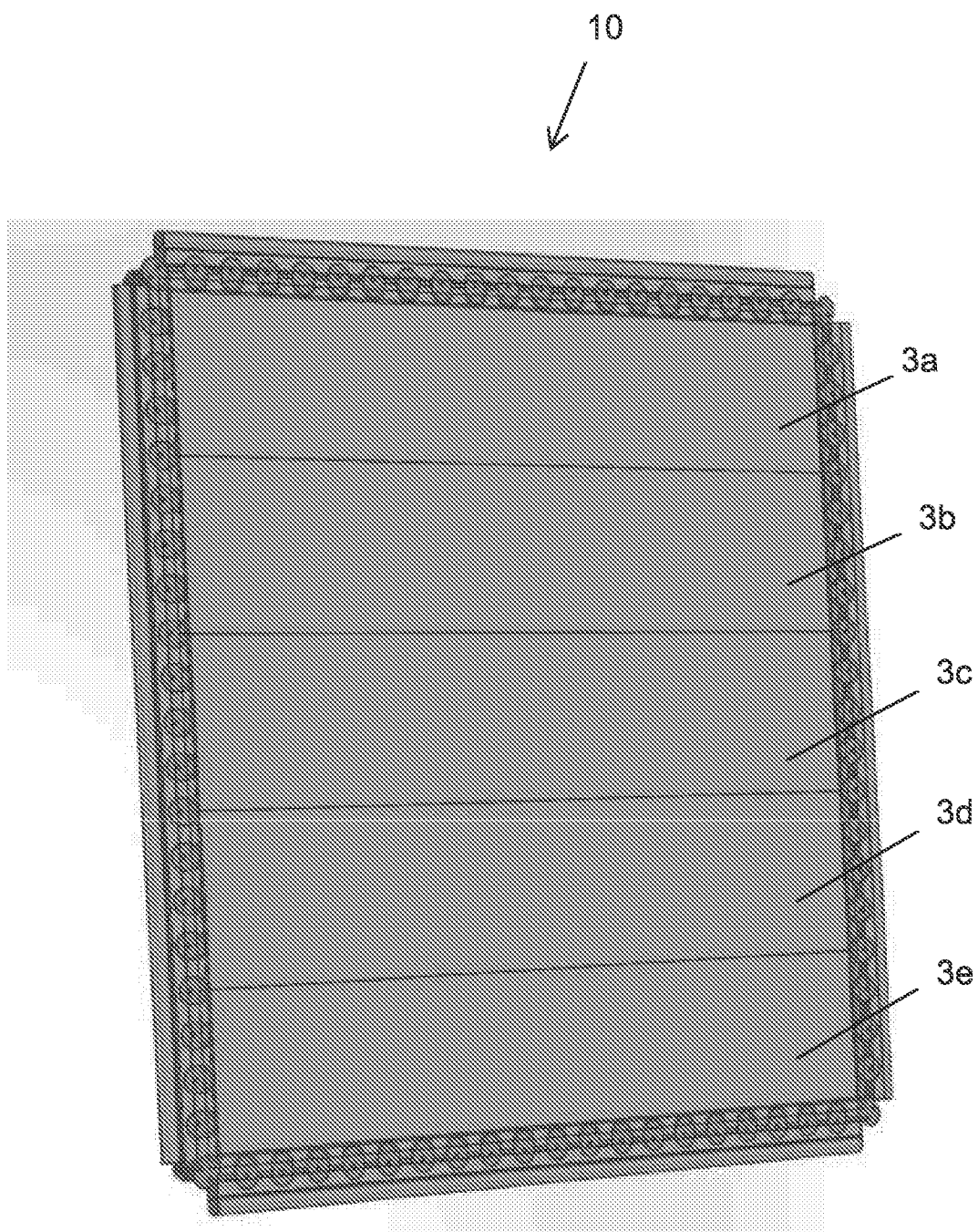


Fig. 2

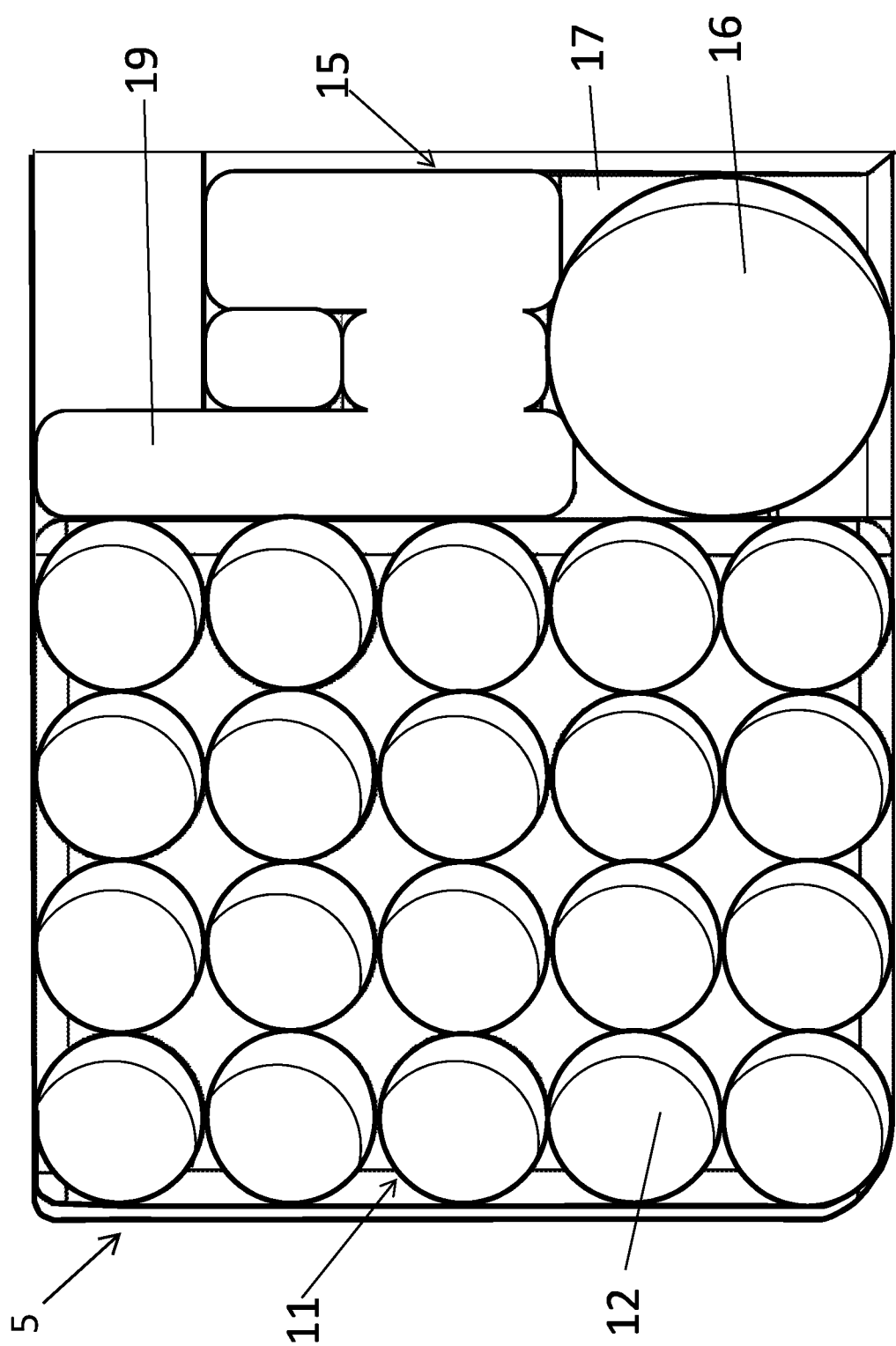


FIG. 3

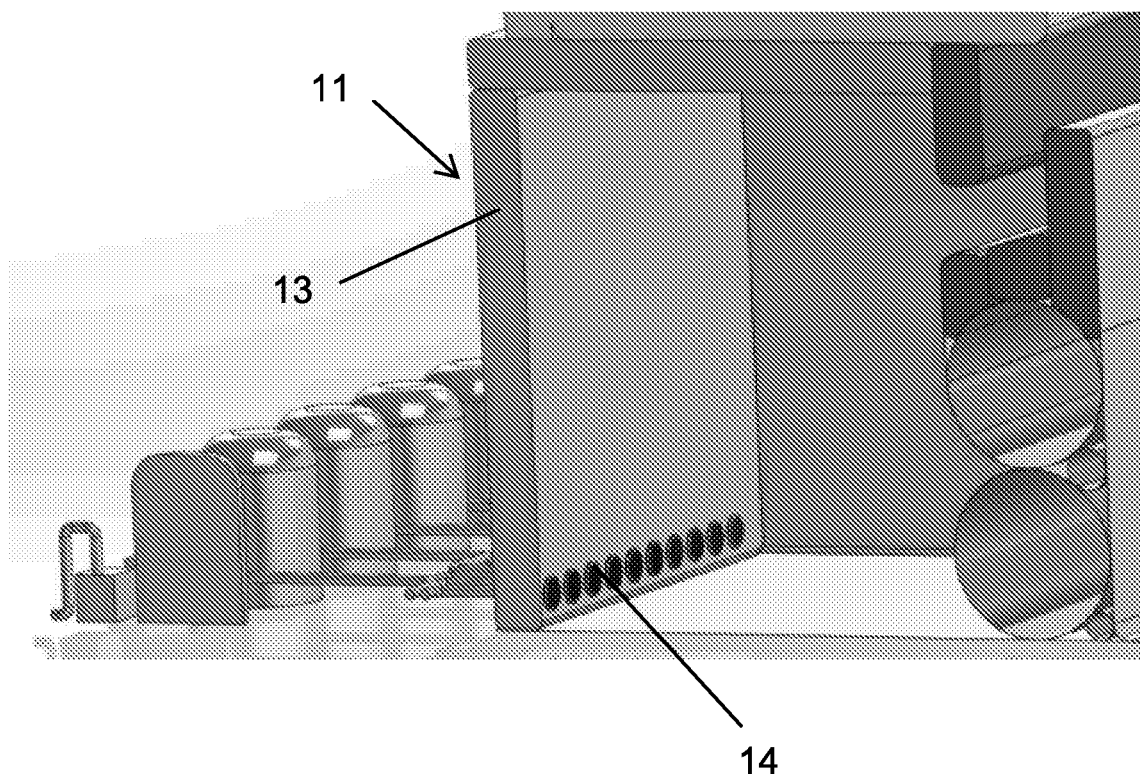


Fig. 4

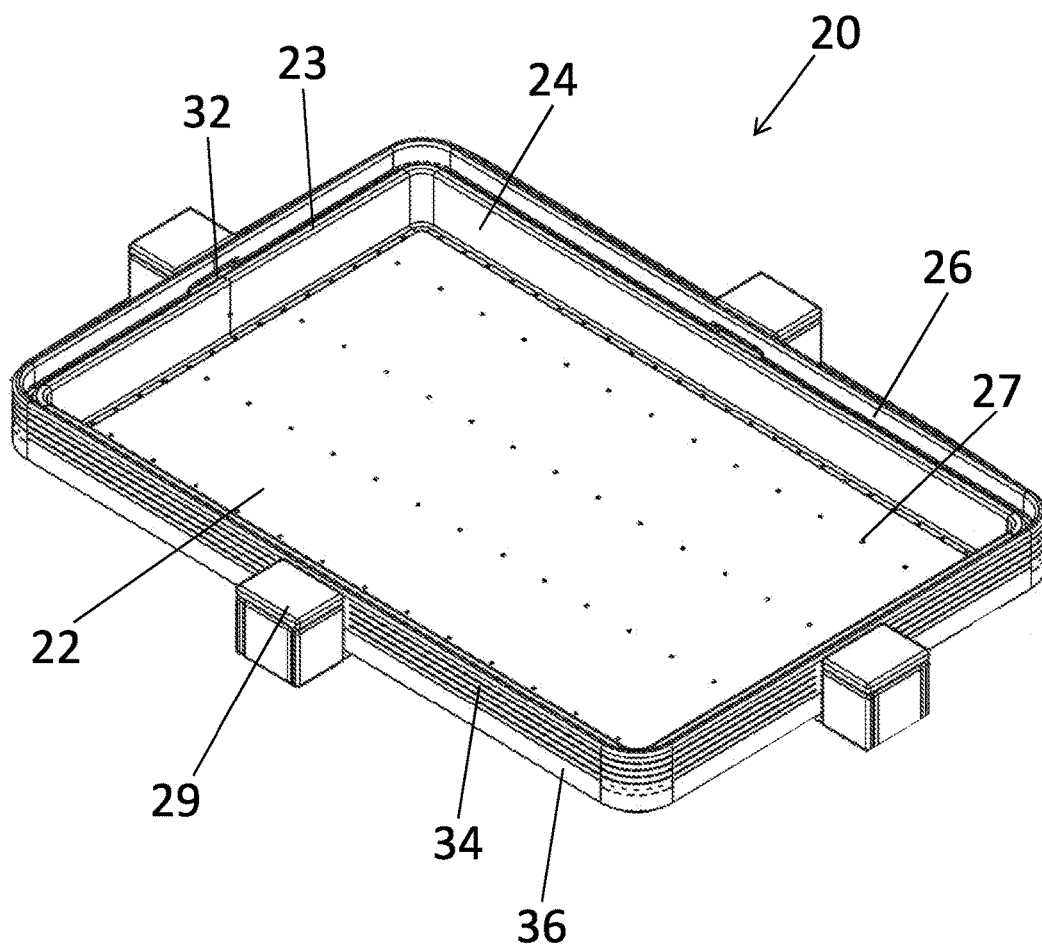


FIG. 5

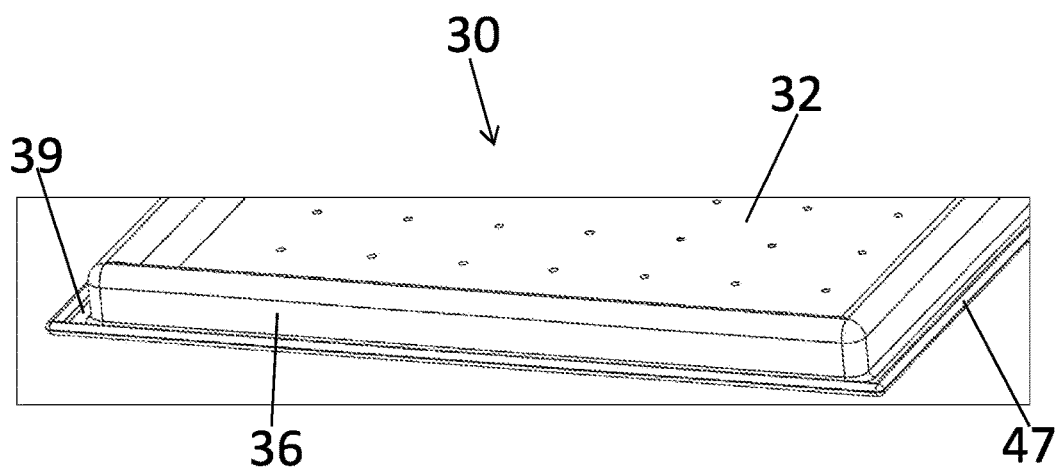


FIG. 6

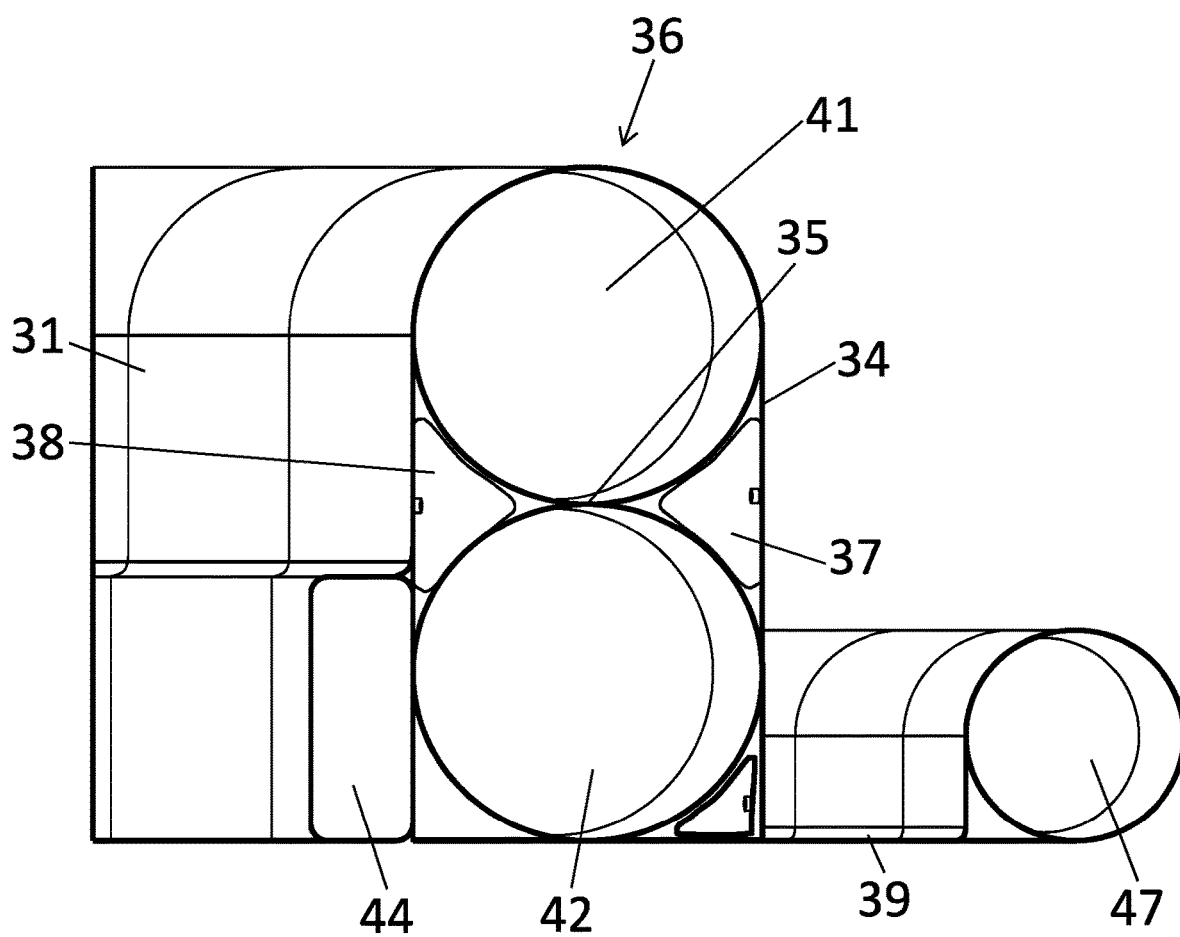


FIG. 7

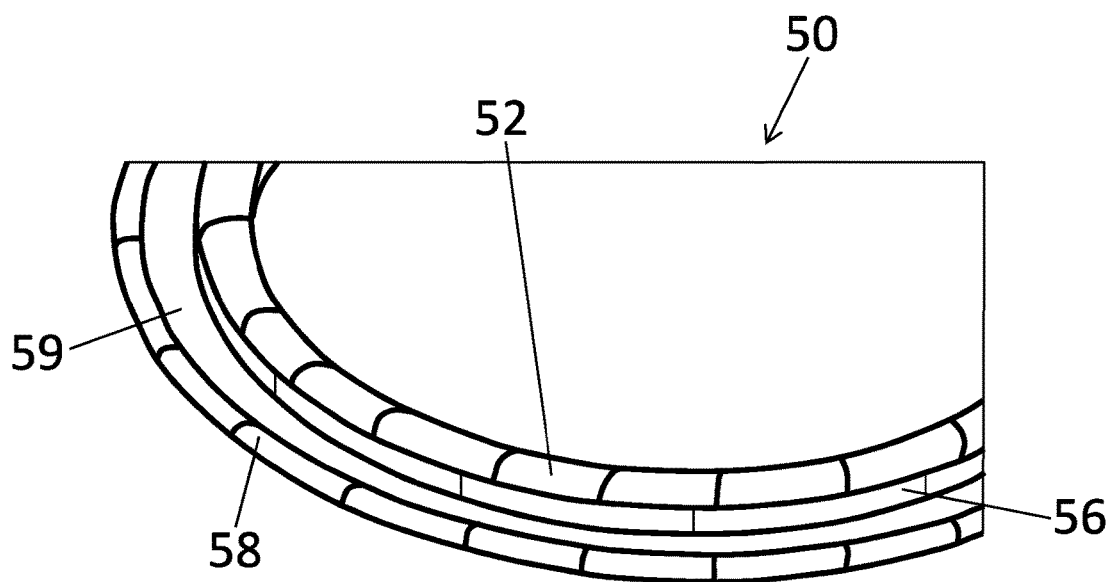


FIG. 8

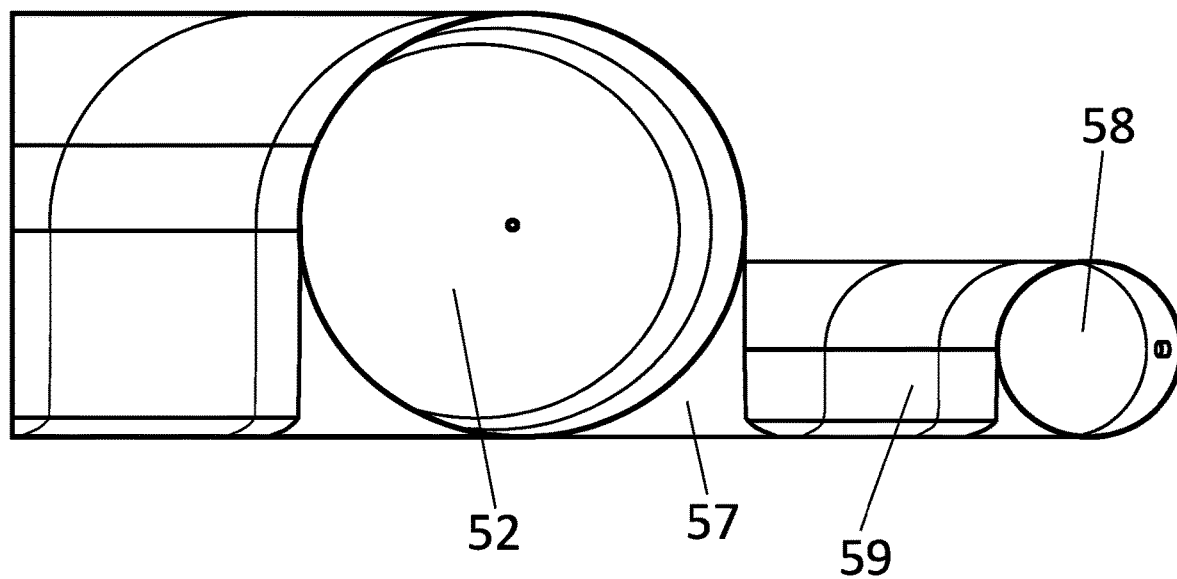


FIG. 9

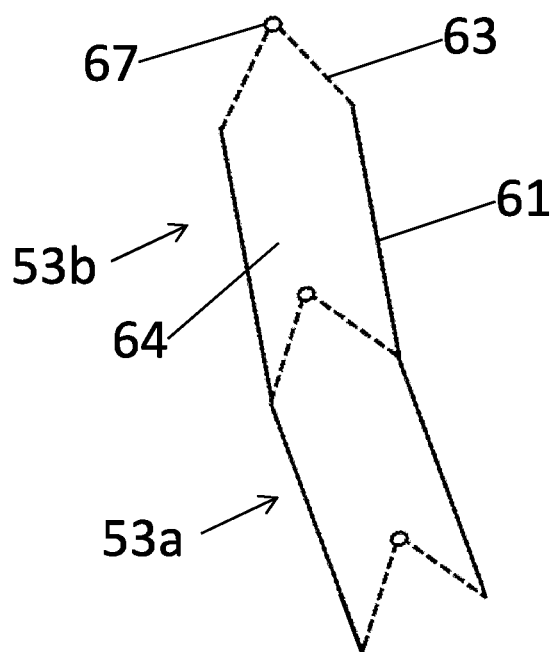


FIG. 10

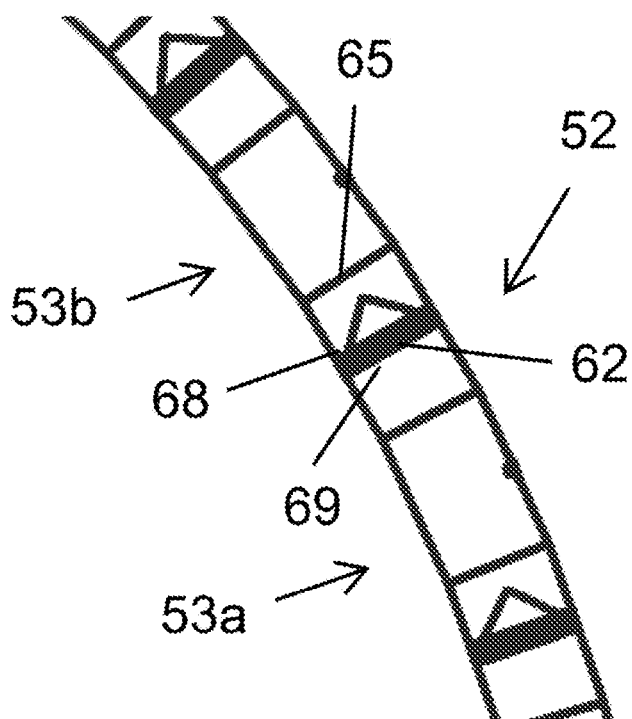


FIG. 11

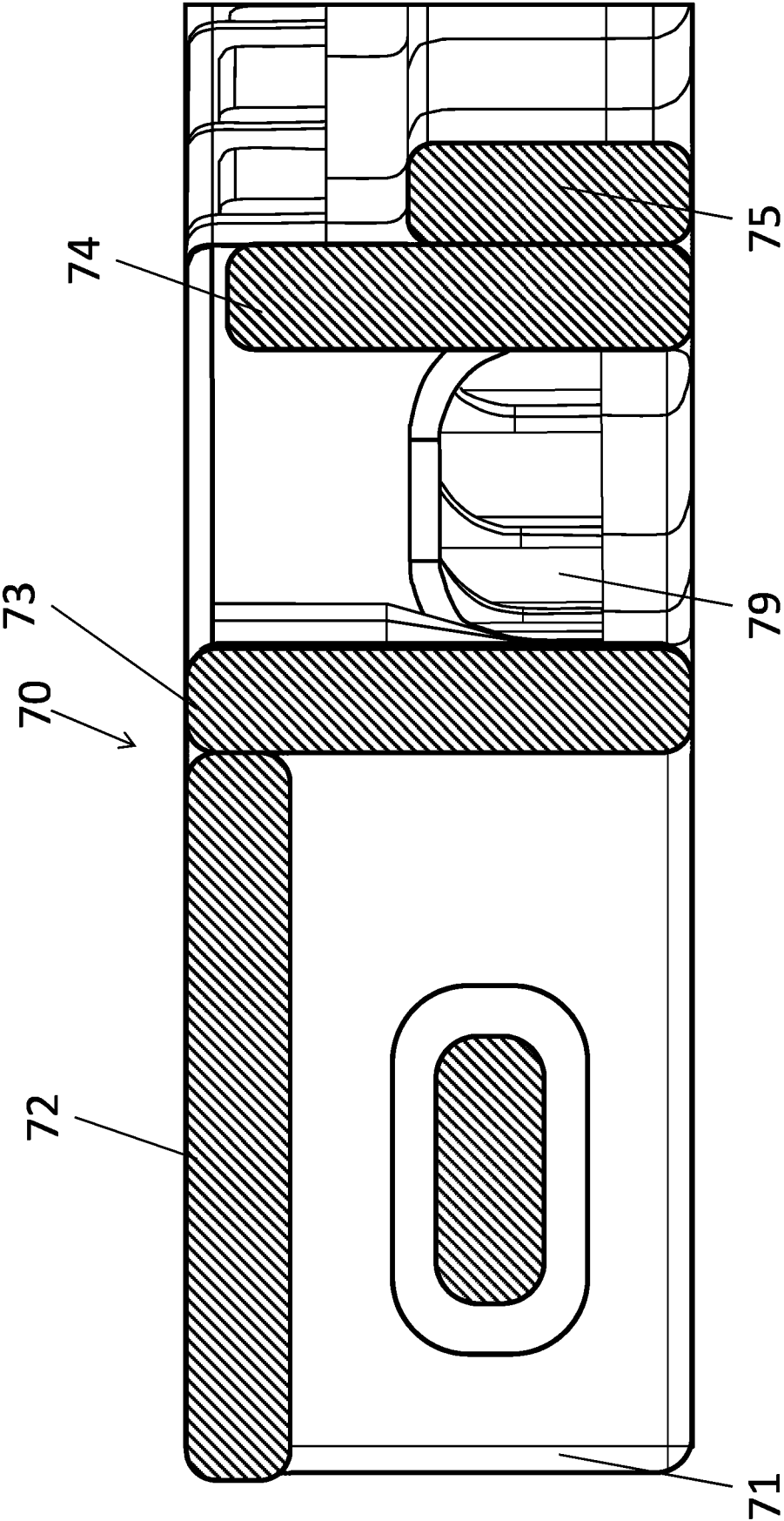


FIG. 12

MODULAR POOL

FIELD OF THE INVENTION

[0001] The present invention relates to the field of water reservoirs. More particularly, the invention relates to a structurally strong, composite and inflatable modular pool that can be economically and speedily assembled.

BACKGROUND OF THE INVENTION

[0002] Many modular swimming pools are known from the prior art, including WO 2016/092099, CN 204435975, WO 2014/099628, US 2005/0086732, U.S. Pat. No. 5,652,972 and GB2261164. These prior art pools, which have a circular or polygonal configuration, either comprise combinable prefabricated sections or dedicated construction elements for strengthening the modular elements, and therefore occupy a sizable volume when being stored and generally require a time consuming assembly operation.

[0003] It would be desirable to provide an inflatable modular swimming pool that can be compactly stored and speedily assembled to define a customized water volume received therewithin. However, the structural strength of a prior art inflatable pool is low, and therefore the prior art inflatable pool can safely receive only a limited volume of water, generally limited to a water depth of 1.5 m. Even at a water depth of 1.5 m, the prior art modular elements become deformed, such as curving or bulging outwardly. The deformation of a prior art inflatable pool is prone to a structural failure, which would be life threatening to bathers located within the pool at the time of the structural failure.

[0004] It is an object of the present invention to provide an inflatable and structurally strong modular pool that can define customized dimensions.

[0005] Other objects and advantages of the invention will become apparent as the description proceeds.

SUMMARY OF THE INVENTION

[0006] The present invention provides an above-ground modular pool which is unsupported by an embankment, comprising a plurality of interconnected and inflatable water-exposed units entirely made of reinforced composite polymeric material, and a plurality of floor panels each of which is connected to one or more of said water-exposed units, such that each of said plurality of water-exposed units is of sufficient structural strength to withstand the hydraulic pressure applied thereto by a body of water received in said pool.

[0007] Each of the water-exposed units preferably comprises an airtight section.

[0008] In one embodiment, the airtight section comprises a plurality of inflatable cells integrated in a membrane, said airtight section adapted to substantially evenly distribute pressure of air inflated therewithin.

[0009] In one aspect, each of the water-exposed units further comprises an energy-absorbing section that is connected to the airtight section and that is exposed to waves propagating in the body of water or to hydraulic pressure of the body of water.

[0010] In one embodiment, the airtight section is a hollow segment of a pressure-equalizing member. The hollow segment has a main body configured with an open proximal end and a closed distal end with the exception of an opening within which is fitted with a unidirectional flow control

device that is adapted to open when exposed to a predetermined triggering pressure level within a segment interior, an initial air pressure within said segment interior being retainable upon connection of said main body to the main body of an additional hollow segment adjacent thereto and pressurized air developed within said segment interior being dischargeable to an interior of said additional segment.

[0011] In one aspect, each of the water-exposed units comprises one or more releasable connectors by which adjacent water-exposed units are connectable together.

[0012] In one aspect, a sufficient number of water-exposed units may be serially and horizontally connected together to define an Olympic-sized swimming pool.

[0013] In one aspect, a sufficient number of water-exposed units are vertically connected together to define a pool having a depth of at least 2 m, for example a water depth of up to 10 m.

[0014] It will be appreciated that the pool length is not limited at all, and can assume a length of 500 m, or more.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] In the drawings:

[0016] FIG. 1 is a perspective, partially sectional view of an assembled pool, according to one embodiment of the present invention;

[0017] FIG. 2 is a bottom view of the pool of FIG. 1;

[0018] FIG. 3 is a vertical section at a slight perspective view through a water-exposed unit used in conjunction with the pool of FIG. 1;

[0019] FIG. 4 is a perspective view from the side of the water-exposed unit of FIG. 3, shown without the honeycomb-like section;

[0020] FIG. 5 is a perspective from the top of an assembled rectilinear pool, according to another embodiment of the invention;

[0021] FIG. 6 is a perspective from the top of a portion of a rectilinear pool, according to another embodiment of the invention;

[0022] FIG. 7 is a perspective view from the side of a vertical section through the peripheral wall and overflow pool of the pool of FIG. 6, when viewed from the interior of the pool;

[0023] FIG. 8 is a perspective from the top of a portion of a circular pool;

[0024] FIG. 9 is a perspective view from the side of a vertical section through the peripheral wall and overflow pool of the pool of FIG. 8, when viewed from the interior of the pool;

[0025] FIG. 10 schematically illustrates the structure of two interconnected and independently movable segments of a pressure-equalizing tubular member from above;

[0026] FIG. 11 schematically illustrates from above a plurality of the segments of FIG. 10, showing a portion of a pressure-equalizing tubular member that they define; and

[0027] FIG. 12 is a cross sectional view of a pool according to another embodiment of the invention along a plane intersecting both an inner and outer side thereof.

DETAILED DESCRIPTION OF THE INVENTION

[0028] The present invention is an inflatable and structurally strong above-ground modular pool. Although the accompanying drawings illustrate a swimming pool, it will

be appreciated that the invention is similarly applicable to any other type of pool or liquid reservoir including, but not limited to, a pond, a fire sprinkler reservoir, and a water treatment reservoir.

[0029] The costs for constructing a prior art water reservoir are considerable, and generally include metallic or concrete support elements that often require experienced workers for fabrication and assembly, and generally also the costs for constructing an earthen embankment around the reservoir.

[0030] The modular pool of the present invention obviates these costs by the use of inflatable units entirely made of reinforced composite polymeric material, such as polyurethane and PVC. As the pool lacks metallic or concrete support elements, maintenance costs are also reduced, and longevity is significantly increased. All is needed to construct the pool is the interconnection of adjacent units such as by releasable connectors to define a continuous wall of customized shape and dimensions, the inflation of the units, and the deployment of a continuous water contacting liner interfacing with all of the units.

[0031] The Applicant is unaware of any inflatable modular pool made entirely of reinforced composite polymeric material that is of sufficient structural strength to withstand the hydraulic pressure applied thereto by the liquid received in a pool having a water depth of at least 2 m without having to be supported from the outside by an earthen embankment, for example an Olympic-size swimming pool, or even a depth of up to 10 m.

[0032] When it is desired to change the dimensions of the pool after the water has been discharged, one or more connectors are released and a desired number of units are added and connected to the existing structure, and then a customized interfacing liner is deployed. The releasable connectors may be used not only to connect together adjacent lengthwise or widthwise inflatable units in order to customize the surface area of the pool, but also to connect together vertically adjacent inflatable units in order to customize the depth of the liquid contained within the pool.

[0033] Even though each unit is inflatable, the rigidity of a wall comprising one or more units is surprisingly high and similar to that of concrete, to assist a swimmer upon contacting the wall with one's foot, for example a swimmer desiring to change a swimming direction or a backstroke swimmer at the start of a swimming action.

[0034] The components of the pool may be compactly stored following separation and deflation of each of the units.

[0035] The reinforced composite polymeric material may be made, in one embodiment, from a drop stitch fabric matrix. Drop stitch fabric matrices are produced by weaving yarns, such as polyester, Kevlar and other polymeric fibers, between two or more fabric sheet layers, such as made of PVC, which are spaced a specific distance apart from one another. A typical drop stitch fabric matrix may include a large number, e.g. on the order of thousands, of vertical fibers of uniform length.

[0036] The yarns may be woven in a straight line along the continuous direction axis so as to be in line with the warp yarns. After being pulled through a fabric layer, they may be wrapped over and under multiple weft yarns following next to the adjacent warp yarn in the pattern. The drop stitch yarns may be patterned to form evenly spaced rows. In this fashion, the yarns are ensured of not unraveling, while the

matrix has a density for example of at least 50 threads per square inch and a thickness ranging from 2-30 inches. Once the matrix is woven together, an airtight coating or laminate is bonded to the fabric sheet layers. The drop stitch fabric matrix is thus, when inflated to a relatively high pressure, imparted with good resistance to flexing.

[0037] FIG. 1 illustrates a perspective, partially sectional view of an assembled pool 10, according to one embodiment of the present invention. Pool 10 comprises a plurality of interconnected and inflatable rectilinear water-exposed units, e.g. units 5*a-i*, a plurality of interconnected deck members, e.g. members 7*a-i*, which may be interconnected to a corresponding water-exposed unit, a plurality of floor panels 3 connected to one or more water-exposed units, and a plurality of compressors 9 for inflating corresponding water-exposed units via corresponding conduits 8. Pool 10 may also comprise anchor elements that facilitate stabilization on loose underlying support material, such as earth or sand.

[0038] Adjacent water-exposed units may be releasably connected to each other. An exemplary releasable connector is the Dual Lock™ fastener manufactured by 3M™, which comprises a mushroom-shaped stem that audibly snaps together to form a secure attachment with an adjacent piece. Both the stem and the adjacent piece may be adhered to a substrate of adjacent inflatable units.

[0039] FIG. 2 illustrates a bottom view of pool 10, showing a plurality of floor panels, e.g. floor panels 3*a-e*.

[0040] Water is advantageously added to pool 10 from below the floor panels in accordance with international standards, for example Israeli Standard 6701 enacted in August, 2008.

[0041] Each of the floor panels may be configured with a plurality of spaced small-diameter apertures 27 (FIG. 5), which are formed throughout the floor panel material, generally having a thickness ranging from 4-10 cm. A nozzle from which is issued a high-pressure spray is fitted at the bottom of a corresponding aperture, so as not to injure a bather when the pool constitutes a swimming pool. A conduit extends horizontally from each nozzle to a pump.

[0042] An exemplary structure of a water-exposed unit 5 is illustrated in FIG. 3. Unit 5 comprises an inflatable and airtight, honeycomb-like section 11 comprising a plurality of cells 12 integrated in a membrane for enhanced structural strength when inflated. Each cell 12 may be interconnected with one or more adjacent cells as shown, or alternatively may be isolated from an adjacent cell as shown in FIG. 1. This cellular configuration serves to evenly distribute the high pressure of the inflated air. Section 11 may be bounded at one or more surfaces thereof by a reinforcing plate. Tests conducted by the Applicant revealed that the strength of each section 11 is as much as 700 kg/m², and may be as great as 1000-1500 kg/m².

[0043] Internally to section 11, i.e. in the direction of the water, is located energy-absorbing section 15 for dampening the wave energy of any waves that propagate through the body of water located within the pool. Energy-absorbing section 15 comprises one or more tubular elements 16 integrated to a lower water liner 17 that is softer than the reinforcing plate of section 11 and that is exposed to low-amplitude waves or to hydraulic pressure. Liner 17 is connected to, or integrally formed with an upper L-shaped dissipating element 19. The spacing between the two legs of L-shaped dissipating element 19 provides sufficient resil-

iciency that causes the spacing between the two legs to become reduced when the force of a wave is applied to dissipating element 19 or is transmitted through water liner 17, and to thereby dissipate the wave energy.

[0044] As shown in FIG. 4, a reinforcing plate 13 of section 11 may be configured with a plurality of ports 14 through which the inflation air flows into the various cells.

[0045] The configuration of the honeycomb-like section and of each layer thereof is preferably changed in response to the selected use, for example the dimensions of the pool and whether the inflatable unit is connected vertically or horizontally to an adjacent unit.

EXAMPLE 1

[0046] The honeycomb-like section of an inflatable unit was made of 11 layers having a net thickness of 20 cm. The outermost and innermost layers were both made of 5-mm thick anti-skid pads made of ethylene-vinyl acetate (EVA) foam having a density of 20-190 kg/m³. Adjacent to each anti-skid pad was a set of 3 layers made of PVC material, with a combined thickness of 0.6-1.2 mm. Adjacent to a first PVC layer was a corresponding base PVC fabric having a thickness of 1.2 mm and made of PVC yarns and yarns of other materials. A plurality of polyester filaments extending between the two base PVC fabrics to define the cells had a length ranging from 5-20 cm, and the spacing between adjacent filaments ranged from 2-10 mm.

[0047] The honeycomb-like section was inflated to a pressure of 9-12 psia and has a tensile strength of 80-150 kg/cm.

[0048] FIGS. 5-10 illustrate another embodiment of the invention wherein the modular pool comprises an airtight, pressure-equalizing tubular member that provides each of its walls with sufficient structural strength to withstand the hydraulic pressure associated with a body of water having a depth of at least 2 m. The tubular member is fabricated from a plurality of interconnected and independently movable airtight segments that impart the pool with modularity. One or more segments locally deform after being subjected to the energy associated with an impact to the wall of the pool, causing their interior pressure to temporarily rise. The higher-pressure air is discharged to an adjacent segment until all segments attain a uniform pressure and a uniform shape.

[0049] An assembled rectilinear pool 20 is illustrated in FIG. 5. Pool 20 comprises floor panel 22, an inner liner 24 connected to, and projecting upwardly from the periphery of floor panel 22 to define the dimensions of the pool, a peripheral wall 26 spaced outwardly from, and having similar dimensions as, liner 24, and a plurality of overflow tanks 29, e.g. four, which are positioned outwardly from peripheral wall 26. Liner 24 interfaces with all water-exposed segment units that are disposed at a given side of the pool.

[0050] Floor panel 22 may be made of a single panel as shown, or alternatively may be made of a plurality of interconnected panels as shown in FIG. 2. Each of the floor panels may be inflatable, or alternatively may be non-inflatable, and configured with small-diameter apertures 27 to facilitate water inflow from below.

[0051] Peripheral wall 26, which is also connected to floor panel 22, protrudes upwardly from the upper edge 23 of liner 24. An aperture 32 through which water overflowing the liner 24 is discharged to a corresponding overflow tank 29 is formed at selected regions of an upper section 34 of

peripheral wall 26. Aperture 32 may also be formed to a certain extent in lower section 36 of peripheral wall 26, which is an outer liner adapted to conceal and to be connected to a pressure equalizing tubular member located between liner 24 and peripheral wall 26. The longitudinal axis of the tubular member is substantially parallel to liner 24.

[0052] The rectilinear pool 30 illustrated in FIG. 6 is configured with an overflow pool 39 that is contiguous with, and spaced outwardly from, the entire peripheral wall 36. Overflow pool 39 is made of material that is continuous with the outer liner of peripheral wall 36 and connected to a tubular member 47 defining the depth of water within overflow pool 39, for example having a diameter of 0.5 m. Tubular member 47 may be a pressure equalizing segmented member.

[0053] As shown in FIG. 7, peripheral wall 36, as well as each interconnectable water-exposed unit defining the peripheral wall, comprises a segment of each of two contiguous and connected tubular pressure-equalizing tubular members 41 and 42, member 42 being located directly below member 41. Each of tubular members 41 and 42 may be defined by a considerably larger diameter than tubular member 42, e.g. 1 m, to define a correspondingly large peripheral wall height, for example one that is suitable to retain a body of water having a depth of 2 m. A stabilizing element 37 having a triangular cross section is connected to the two tubular members 41 and 42, such that its apex is positioned proximate to the longitudinal interconnection region 35 between members 41 and 42 and its long side is connected to inner liner 34. Another similarly shaped stabilizing element 38 is connected to outer liner 31. Liners 31 and 34 are also made of composite materials, although they generally have a different construction than the tubular members.

[0054] It will be appreciated that the peripheral wall may be defined by more than two vertically spaced tubular elements to increase its height.

[0055] Peripheral wall 36 may be configured with an integrated step for supporting a swimmer who is desirous of resting. The upper surface of the step is preferably located 1.2 m below the water surface in accordance with safety standards. A wall of prior art inflatable pools heretofore has been unable to be provided with a step capable of supporting a swimmer.

[0056] The step may be made of an inflatable rectilinear block 44 of limited length which is connected to the side of a corresponding tubular member segment. Block 44 is made of suitable construction that supports inflation to a sufficiently high pressure that provides rigidity similar to, or even greater than, lower tubular member 42. The upper surface of block 44 is connected to, and covered by, outer liner 31. Adjacent blocks 44 may be connected to each other.

[0057] It will be appreciated that pool 10 of FIG. 1 may also be configured with an integrated step for supporting a swimmer who is desirous of resting.

[0058] The circular pool 50 illustrated in FIGS. 8 and 9 is configured with an overflow pool 59 that is contiguous with, and spaced outwardly from, the entire peripheral wall 56. As circular peripheral wall 56 is configured with only one tubular member 52, pool 50 may be used as a wading pool due to the limited depth of the body of water that is able to be collected within the volume delimited by tubular member 52. Tubular member 52 is concentric to outer tubular mem-

ber 58, which is of a smaller diameter than tubular member 52 and to which material constituting overflow pool 59 and continuous with outer liner 57 is connected.

[0059] FIGS. 10 and 11 schematically illustrate a plurality of interconnected and independently movable segments defining circular pressure-equalizing tubular member 52, in order to demonstrate the principles of this embodiment of the invention.

[0060] Each of the plurality of segments, for example the illustrated segments 53a and 53b, is made of a composite-material membrane and is configured with a conical shape. The conical configuration is characterized by a tubular main body 61 that narrows at its distal tip 63 to a small-diameter opening to which air within the segment interior 64 is urged to flow. A one-way valve 67 is fitted in the opening to allow only unidirectional flow of pressurized air when exposed to a predetermined triggering pressure level.

[0061] Main body 61 of segment 53b is carefully positioned and connected with respect to main body 61 of segment 53a to define a suitable angular relation therebetween that produces the circular configuration of tubular member 52. Main body 61 may also have a flexible intermediate element 65 that helps the segment to conform to a desired shape.

[0062] The interior 64 of segment 53b is converted to a pressure vessel when the proximal end 68 of its main body 61 is connected by hermetically sealed and pressure resistant connection 62 to distal end 69 of the main body 61 of segment 53a, or to any other suitable region thereof. This pressure vessel arrangement ensures that the initial pressure achieved by interior 64 after rigidizing-facilitating inflation air is introduced through an air valve of tubular member 52 will be subsequently retained, yet allows pressurized air developed within the interior 64 of segment 53b to be discharged to the interior of segment 53a. The presence of connection 62 and one-way valve 67 prevents any backflow of pressurized air into segment 53b. Likewise the same type of interconnection exists for other pairs of adjacent segments.

[0063] Thus when segment 53b becomes impacted, its interior pressure temporarily rises above the initial pressure, for example due to a reduced volume of interior 64. One-way valve 67 is consequently opened, allowing pressurized air to be discharged from segment 53b to segment 53a until the pressure within the interior of segment 53b is reduced below the predetermined triggering pressure level. Since the pressure within segment 53a is consequently increased, pressurized air will be discharged from segment 53a to the segment adjacent thereto, and likewise pressurized air will be serially discharged to all segments of circular tubular member 52 until the pressure within each segment interior becomes equalized.

[0064] This same pressure-equalizing response occurs also in tubular members 41 and 42 of FIG. 7.

[0065] A pressure-equalizing member may also be fabricated from a plurality of interconnected hollow segments of a different shape, although the conical shape has some advantages in terms of ease in manufacturing.

[0066] All connections described herein may be welded connections effected in conjunction with a first composite-material sheet placed in juxtaposition with a second composite-material sheet to produce a seam or other reinforcement means therebetween. The welded connection may be released by a suitable application of heat or by other means

well known to those skilled in the art, to allow the dimensions of the pool to be changed. Alternatively, adjacent segments may be releasably connected by other means such as by hook and loop fasteners.

[0067] FIG. 12 illustrates a pool 70 constructed with a plurality of drop stitch fabric matrices 71-75, for reinforcing pressure-equalizing member 79, such as illustrated on both an inner and outer side of pressure-equalizing member 79.

[0068] It will be appreciated that the number and location of the drop stitch fabric matrices can be varied, depending on the size of the pool and on the magnitude of the applied hydraulic pressure. Also, a matrix need not be uniformly positioned at a given segment of the pool, but rather may be localized at a given position desired to increase reinforcement thereat.

EXAMPLE 2

[0069] A tubular pressure-equalizing member having a diameter of 0.8 m was fabricated from a plurality of interconnected conical segments made of PVC, and had a strength of 1.6-1.7 t/m².

[0070] While some embodiments of the invention have been described by way of illustration, it will be apparent that the invention can be carried out with many modifications, variations and adaptations, and with the use of numerous equivalents or alternative solutions that are within the scope of persons skilled in the art, without exceeding the scope of the claims.

1. An above-ground modular pool which is unsupported by an embankment, comprising a plurality of interconnected and inflatable water-exposed units entirely made of reinforced composite polymeric material, and a plurality of floor panels each of which is connected to one or more of said water-exposed units, such that each of said plurality of water-exposed units is of sufficient structural strength to withstand the hydraulic pressure applied thereto by a body of water received in said pool.

2. The modular pool according to claim 1, wherein each of the water-exposed units comprises an airtight section.

3. The modular pool according to claim 2, wherein the airtight section comprises a plurality of inflatable cells integrated in a membrane, the airtight section adapted to substantially evenly distribute pressure of air inflated there-within.

4. The modular pool according to claim 3, wherein each of the water-exposed units further comprises an energy-absorbing section that is connected to the airtight section and that is exposed to waves propagating in the body of water or to hydraulic pressure of the body of water.

5. The modular pool according to claim 2, wherein the airtight section is a hollow segment of a pressure-equalizing member.

6. The modular pool according to claim 5, wherein the hollow segment has a main body configured with an open proximal end and a closed distal end with the exception of an opening within which is fitted with a unidirectional flow control device that is adapted to open when exposed to a predetermined triggering pressure level within a segment interior, an initial air pressure within said segment interior being retainable upon connection of said main body to the main body of an additional hollow segment adjacent thereto and pressurized air developed within said segment interior being dischargeable to an interior of said additional segment.

7. The modular pool according to claim 1, wherein each of the water-exposed units comprises one or more releasable connectors by which adjacent water-exposed units are connectable together.

8. The modular pool according to claim 7, wherein a sufficient number of water-exposed units are serially and horizontally connected together to define an Olympic-sized swimming pool.

9. The modular pool according to claim 7, wherein a sufficient number of water-exposed units are vertically connected together to define a pool having a water depth of at least 2 m.

10. The modular pool according to claim 9, wherein a sufficient number of water-exposed units are vertically connected together to define a pool having a water depth of up to 10 m.

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