

(19)



(11)

EP 1 733 964 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
26.05.2010 Bulletin 2010/21

(51) Int Cl.:
B63B 35/34 (2006.01)

(21) Application number: **06012393.2**

(22) Date of filing: **16.06.2006**

(54) **Float module**

Auftriebsmodul

Module de flottaison

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

(30) Priority: **17.06.2005 IT MI20051147**

(43) Date of publication of application:
20.12.2006 Bulletin 2006/51

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**WO-A-99/14110 DE-A1- 10 151 079
US-A- 3 073 271 US-A- 5 743 205
US-A- 6 021 730**

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Description

[0001] The present invention relates to a floating unit according to the characteristics of the preamble of independent claim 1 and consists of composite modular structures, which float and are removable, in variable shapes and sizes, and can be positioned on areas of water to create floating surfaces for various types of activities or public events. In particular, the floating structures according to the present invention can be used as accessible areas by tradespeople who run cafés, restaurants, dance halls etc. positioned on the banks of rivers, or the shores of lakes or beaches, in order to extend their available space at specific times of the year, for use as platforms for bathing activities and, primarily, as wharfs for mooring small or medium pleasure boats.

[0002] In the following parts of the present description, reference will be made to the use of the said floating structures as wharfs in tourist ports for the mooring of small or medium boats. It is however obvious that their usage as mooring wharfs is only one of the uses of the floating structure of the present invention.

[0003] Wharfs for the mooring of boats in tourist ports are basically classed into two types: fixed and floating wharfs. Fixed wharfs are firmly anchored to the bed of the river/lake/sea to form a rigid structure, which is generally obtained by means of reinforced concrete poles on which the pedestrian areas of the wharf are then fixed.

[0004] Such structures are particularly expensive. Due to their intrinsic structure they offer no flexibility and cannot be adapted to the changing needs which may arise in tourist areas during the course of year. Furthermore, the use of fixed wharfs is practically excluded in tourist ports in which the water level may vary considerably, creating a difference in height between the wharf and the boat which makes it difficult to get on and off boats.

[0005] In order to get round these difficulties, floating wharfs have been proposed and produced, which generally consist of boxes of reinforced concrete which are anchored to the bank/shore by means mobile gangway sections.

[0006] Although these floating wharfs offer far greater flexibility of use than fixed wharfs and are not affected by even significant differences in the water level, their dimensions and weight are so great that their installation and dismantling, warehousing and disposal make them very expensive, with regard to transportation, time necessary for construction and installation, and the necessary paper work to obtain permission for their use. Their lack of flexibility also makes it difficult to comply with the ever-changing needs which arise in a tourist infrastructure.

[0007] In addition, there are substantial problems linked with disposing of such wharfs at the end of their usable lifetime, due both to their structure in concrete and also to the fact that they use highly polluting substances, such as expanded resins, particularly polystyrene, to guarantee buoyancy.

[0008] Floating wharfs employing bell-shaped floating elements open at the immersed bottom are described in US-A-5, 743, 205, that is considered to represent the closest prior art to the novel solution found by the present applicant.

[0009] US-A-6, 021, 730 discloses sealed-drum-shaped floating units with inner parts that ensure buoyancy even in case the drum shell is punctured or develops a leak.

[0010] In the previous Italian patent number 1.284.069 (Inflatable floating supports) in the name of the present Applicant, a floating wharf is described, consisting of inflatable modular floating units with a surface area measuring up to 20 sq.mts. Unfortunately, although the solution described in the above-mentioned patent proved to be perfectly safe and reliable, it is not well accepted by users, if installed in particularly hostile surroundings, as in the case of floating wharfs anchored to beds of rivers/lakes/sea which are rocky and/or in moderate sea conditions, such as along rocky coastlines.

[0011] The Applicant has now found that all these difficulties could be minimised, if not eliminated, by means of a floating wharf consisting of an assembly of one or more floating supports, each support consisting of one floating, self-adjusting unit and connected to a suitable platform for the pedestrian area of the wharf - as the said unit would at least have a modular structure to ensure ease of assembly, dismantling, transportation and storage.

[0012] One embodiment of the present invention consists of a modular floating unit which can be easily installed over an area of water, to support a platform which can be used, for example, as a wharf for the mooring of small boats, and can be quickly dismantled for storage in reduced spaces or disposed of as ordinary waste at the end of its usable lifetime. In this regard, one specific advantage of the present invention lies in the fact that the above modular unit, as well as any complex construction which is created with the said units, uses only materials which can be recycled (metal, plastic and wood) or are environmentally friendly (air, water, sand), with regard to both the structure itself and its operation. A second advantageous embodiment of the present invention is a modular unit which can be used to create a floating support as defined above, that can be easily used in conjunction with similar units in order to modify the geometric structure of the mooring area of the floating wharf.

[0013] A further advantage of the present invention is a procedure which allows the quick and economic production of floating supports, as defined above, for use as wharfs for the mooring of small boats.

[0014] An additional advantage of the present invention concerns the production of a floating support for use as a mooring wharf which, in the event of violent storms or stormy seas, can be easily removed and then reassembled.

[0015] A further advantage of the present invention is a self-adjusting floating structure which can be adapted

according to the conditions of use.

[0016] According to the present invention, the said floating structure contains modular floating units made in a substantially rigid material, which cannot be perforated accidentally.

[0017] In yet another advantageous embodiment, the present invention proposes a floating unit for modular assembly which is easy to handle and store in a limited space when not in use, in spite of being substantially rigid.

[0018] Furthermore, the present invention concerns a floating support composed of a modular floating unit, fitted with devices which allow it to be solidly connected to other modular floating units and/or the bank or shore and covered with a platform, the top surface of which forms of a pedestrian area.

[0019] The modular floating unit has preferably small dimensions to allow easy handling and transportation. It is an advantage if the pedestrian area of a single floating support varies between one to just a few square meters. The pedestrian area may be made with any material which can bear the weight of people and equipment, and is resistant to physical damage and the effects of chemical agents in the surrounding environment. The choice of the size of the units will depend not only on the ease of handling and transportation, but also reduced storage space requirements. It may be constructed in metal, wood, synthetic materials or stone.

[0020] The present invention can be better understood from the following description of the particular production methods, which do not limit the framework of the invention itself, with reference to the enclosed diagrams, in which:

- diagram 1 represents a frontal section of a modular unit according to the invention in its first implementation method
- diagram 2 represents a frontal section of the modular unit of diagram 1, according to a variation of construction which involves a fluid-tight membrane as the base wall of the said unit;
- diagram 3 represents a frontal section of a modular unit according to the invention in a preferred implementation method
- diagram 4 shows a straight section view of the modular unit of diagram 3, complete with installation components;
- diagram 5 is a plan view of the pedestrian area of a wharf according to the invention, created by connecting a plurality of floating supports;
- diagram 6 is an exploded prospective view of the modular unit of diagram 3 with a corresponding type of platform;
- diagram 7a represents a detail of a first device for connecting the modular units together;
- diagram 7b represents a detail of a second device for connecting the modular units together;
- diagram 8 represents a plurality of modular floating units stacked together for storage of the said units.

[0021] In the diagrams, analogous units are indicated with identical number references.

[0022] In agreement with the present invention, the modular unit (diagram 1) which forms the basic floating unit of the structure according to the invention, is a hollow, substantially rigid body 1, with a truncated pyramid shape, in which the larger base is missing and the projection of the apex of the pyramid falls within the base of the latter. In the following part of the description, the inner volume 2 of the said truncated pyramid will be also defined as a chamber.

[0023] The geometric regularity of the pyramid and the number of sides are not essential for the purposes of manufacturing the present invention. The said pyramid could, for example, have circular bases, which define a truncated cone. The floating chamber consists substantially of portion 2 of the said hollow pyramid, which is truncated, immersed in liquid 3 with the greater base at the bottom, enclosing a volume of fluid, preferably a gas, even more preferably air, with a specific weight lower than that of the liquid in which the pyramid is immersed.

[0024] The lower wall of the floating chamber 2 is formed by the surface of liquid 3. In the case of pyramids which are immersed in water, the air bubble which remains inside the chamber 2 after immersion, is sufficient to guarantee buoyancy of the pyramid. Overturning of the pyramid is prevented by the fact that the pyramid is hooked, by means of standard devices 5, in a substantially solid way as will be seen, both to a platform 6 and to adjacent modular units.

[0025] The lower wall of the chamber, which may be moved by varying the quantity of liquid inside the chamber, makes it possible to modify the free inner volume of the chamber. This wall may be made, not only by means of the surface of the liquid in which the said pyramid is immersed, as said above, but also (diagram 2) with a shaped, flexible membrane 7, which is water-tight, elastic and solidly attached to the inner walls of the truncated pyramid to which it is appropriately attached.

[0026] In the particular implementation method here described and represented in the enclosed diagrams, the base of the pyramid is substantially square with a pyramid trunk height comparable to the side of the larger base, and in particular, with a preferred size which varies between 50 cm and 150 cm.

[0027] Dimensions may be modified according to the materials used, the characteristics of the pedestrian area of the platform and also the weight which the wharf has to bear.

[0028] In a preferred implementation method of the invention, the truncated pyramid 1 is solidly connected (diagram 3) to a second, homologous truncated pyramid 8, which contains pyramid 1, whose smaller base substantially corresponds to the larger base of pyramid 1, solidly connected to the said pyramid by means of a fluid-tight connection between the two said bases (respectively the larger and smaller base), which runs along the entire perimeter of the said bases.

[0029] The depth of the second pyramid 8 is basically comparable to the height of the first pyramid 1: in a particular implementation method of the invention the larger base of the outer pyramid 8 is substantially coplanar with the smaller base of the inner pyramid. The resulting structure is illustrated in diagram 3, whilst diagram 4 shows a straight section of this. As appears in diagram 4, the section comprises two V-shapes, which are symmetrically positioned in relation to the axis of the pyramids and connected to each other at the bottom.

[0030] Preferably, on the outside of the second pyramid, in correspondence with the larger base, an edge is present 9, which has the function of allowing the adjacent modular units to be coupled together, by means of a rigid or semi-elastic joint.

[0031] This edge, which preferably runs around the entire perimeter of the outer pyramid, allows the adjacent modular units to be coupled together, either directly or by means of a preferably semi-elastic joint 10, such as those shown in diagrams 7a and 7b.

[0032] For the purpose of carrying out the above coupling, the said edge (diagram 6) comprises a number of holes 11 in which bolts 12 can be placed and fixed with nuts 13. Alternatively, a different solution (not illustrated) in agreement with the present invention calls for attaching the bolts solidly to the edge, for example by welding or shrouding.

[0033] For the purpose of allowing a certain elasticity of the connection between the assembled modular units, the joints contain bearings 14, placed between pairs of edges which are joined together, in flexible material, mechanically resistant to the stress caused by the weight placed on the wharf and/or the wave motion of the area of water, on which the said wharf is floating, and chemically resistant to the aggression of environmental agents, such as the salinity of the water.

[0034] Such bearings are preferably made with elastometric materials in which natural and/or synthetic fibres are shrouded.

[0035] Diagram 7a shows a type of joint between two modular units placed side-by-side, comprising a double-C vertical girder 15, with the lower wing connected to edge 9 of the said modular units 8, by means of the interposition of the bearing 14, and with the upper wing connected to the platform of the wharf, possibly by means of the interposition of another bearing.

[0036] In diagram 7b, a variation of construction of the said joints is illustrated, which requires that the edge 9 of the modular unit no longer lies parallel but perpendicular in relation to the larger base of pyramid 8. In this construction method, the platform is connected to the pair of modular units by means of a T-shaped girder 16, which is positioned with the wing connected to the said platform. Any person skilled in the art will not have any difficulty in producing other devices for connecting the modular units to each other and for connecting the platforms of the wharf to the modular units, independently from the connection between the said modular units. Sim-

ilarly, he/she will easily be able to prearrange other connecting devices 5 for the construction method of the modular unit illustrated in diagram 1.

[0037] Preferably, platform 6 should substantially have the same surface area as modular unit 8. However, the pedestrian area of the wharf comprises a plurality of platforms which might not correspond to the number of modular units used: in this case, several platforms will be directly connected with each other, but not with corresponding modular units. Diagram 5 illustrates, with a top view, a portion of the wharf made with six platforms (a1, a2, b1, b2, c1, c2) assembled together, of which only platforms a1, a2, c1 and c2 are connected with corresponding modular floating units.

[0038] Standard types of safety devices for people, such as side panels, hand rails, and railing may be anchored, in the standard way, to the pedestrian area of the wharf, likewise other devices for boats, such as camels which protrude outwards from the pedestrian area, bollards, cleats, turrets housing sockets for access to the electricity or water supply etc.

[0039] According to one embodiment of the present invention, each modular floating unit, is connected to a control device 21, and regulated by a control panel, not illustrated, which regulates the pressure of the fluid in the floating chamber of the modular units, which are connected to the said devices. The control devices of the single modular units can be connected to an overall control system for the entire structure (i.e. wharf).

[0040] This overall control system can intervene both on each single modular floating unit and, at the same time, on a group of units, if they are connected together, to create, for example, a wharf.

[0041] The volume control of the said fluid can be achieved, for example, by a set of valves 17, respectively inlet and outlet; preferably, the control of the opening/closing of the valves should be regulated with the technique used in the semiconductor memories, with just two parameters which address the lines (a, b, c) and the columns (1, 2,) of the ideal matrix which identifies the floating wharf.

[0042] A first parameter addresses the line and enables all the valves of that line to work and a second parameter addresses the column and enables all the valves of that column to work, whilst the two parameters command only the modular unit which is placed at the point in which the chosen column crosses with the chosen line, and therefore enables the unit to be commanded.

[0043] The control devices can be connected to the control panel using both conventional physical methods and also remotely, for example by means of radio signals.

[0044] The overall control system can be used to modify the overall buoyancy of the entire wharf or parts thereof, in the event of certain circumstances, such as a heavy loads, in which case greater pressure is provided, or the mooring of small boats, with the subsequent need to sink the structure to a greater extent, reducing the quantity of fluid in the chamber. The buoyancy control of the floating

structure, at different points distributed over the structure itself, allows it to stay balanced, keeping it perfectly level and horizontal even in the case of a localised load applied far from the centre of mass of the structure itself. In the latter case, any conventional floating structure would in fact be thrown off balance and would assume a slanted position in relation to the water surface, whilst by acting on the different buoyancy forces of the single modules or groups of modules, the structure can be re-balanced regardless of the position or entity of the load.

[0045] The characteristic of being able to modify at will the height of the floating unit above the water level, resolves the problem of the current architectural barriers related to pleasure boating.

[0046] Persons with physical handicaps experience in fact great difficulty in overcoming the differences in height, which can be considerable, between the wharf itself and the side of a boat moored to the wharf. By modifying the waterline of the modular floating unit, it is possible to reduce or eliminate such differences in height, making it possible for even less fortunate people to get on and off boats easily.

[0047] For this purpose, according to a further variation of the invention proposed, the cavity 19 between the two truncated pyramids 1 and 8, is used as a stabilising element of the overall structure.

[0048] It is in fact possible to insert further valves 18 into the said cavity area: once open, these allow the cavity itself to be flooded. This, if appropriately balanced by the pressure control of the inner chamber, guarantees greater stability of the structure. The valves also allow the said cavity to be emptied, thus restoring or modifying the previous level of buoyancy.

[0049] It is alternatively possible to obtain the same, yet permanent stabilising effect, by using conformant material, i.e. a material which adapts its shape perfectly to that of the container which holds it (for example sand) and which, in many cases, has the additional advantage of being available in the location in which it is used. In addition it can be eliminated at the same time the wharf is dismantled. As an alternative, solidifiable materials such as self-expanding foams can also be used. Preferably, all the materials used in the structure according to the invention should be environmentally friendly, i.e. materials which can be disposed of without creating environmental pollution problems of any nature.

[0050] It is evident that the cavity 19 between the outermost truncated pyramid 8 and the innermost truncated pyramid 1, creates a useful service area, in which it is possible to place the above control devices, as well as valves, wires and tubes which serve to determine the behaviour of each single modular floating unit.

[0051] The said cavity may also form a further floating chamber, which can be created by sealing with a fluid-tight closure device the larger base of the truncated pyramid 8 (for example a rigid plate welded along the edges of the said base.)

[0052] The maintenance of the devices which are

housed in the said cavity can be easily carried out by removing a tile 20, which is duly fitted to the said closure device, using a method similar to that used for elevated flooring for areas used as data centres. In diagram 6, the said closure device consists of the corresponding platform of the modular unit, assembled with the said unit by means of such devices as a gasket placed between edge 9 and platform 6, which ensure fluid-tightness. Preferably, the said platform comprises a continuous surface, even when this is not assembled with the modular unit with fluid-tight devices, with the purpose of preventing either rain water or water from waves which might flood the wharf, from penetrating the above cavity and causing uncontrolled variations of the buoyancy of the wharf.

[0053] It is also evident that, because of the particular structure of the modular units, if they have to be stored out of use (for example surplus units which are not required or for storage during the Winter season), they can be easily stacked together by using a method similar to that used by public establishments such as cafés, restaurants, theatres or religious buildings, for storing unused chairs, as shown in diagram 8.

[0054] The same storage method is also possible with the pedestrian area of the wharf, which is made up of a plurality of platforms 6, i.e. a plurality of modules similar to large tiles which can be easily stacked together.

Claims

1. A floating unit adapted to be partially submerged for sustaining walkable structures including one or more platforms assembled together, comprising a substantially rigid hollow body (1) with devices (5) for fixing it to the sustained platform, having a truncated conical or pyramidal shape with base open at the bottom with projection of the apex of the truncated cone or pyramid falling within the area of the open base, the hollow body cavity constituting a floating chamber (2) of variable volume filled with a gaseous fluid trapped therein, closed at the bottom by the surface of the liquid (3) in which the hollow body (1) is immersed, **characterised in that** inlet and outlet valve means (17) are present through a top wall of the floating unit for releasing from or injecting gaseous fluid in said floating chamber (2) to vary its volume for regulating buoyancy of the single floating unit.
2. The floating unit of claim 1, further comprising a fluid impermeable and flexible membrane (7) having a perimetral edge sealingly connected to the inner surfaces of the walls of the floating chamber of variable volume, preventing direct contact of the liquid (3) with the gaseous fluid trapped in the floating chamber (2).
3. The floating unit according to claim 1, **characterised in that** the adjustable quantity of gaseous fluid in the

floating chamber (2) modifies the immersion level of the load bearing floating unit (1) in the liquid (3).

4. The floating unit according to claim 1, **characterised in that** said valve means (17) are coupled to a control system of the buoyant level and/or horizontality of a wharf sustained by a plurality of said floating units fixed to the wharf at points spaced from one another. 5
5. The floating unit according to claim 4, **characterised in that** said control system regulates the buoyancy adjusting valves (17) of each floating unit (1) independently from the other units. 10
6. The floating unit according to claim 1, **characterised in that** to said hollow body (1) is associated a second or outer hollow body (8) having an upside-down truncated conical or pyramidal shape open at the bottom, that completely accommodates inside it the truncated conical or pyramidal body (1), the bottom edge of the second body (8) being joined to the bottom edge of the first hollow body (1) in a fluid-tight manner for defining between the two bodies an ancillary float control cavity (19) surrounding the primary floating chamber (2) of variable volume. 20 25
7. The floating unit according to claim 6, **characterised in that** said ancillary cavity (19) is filled with a conformant filling material belonging to the group composed of solidifiable expanded foams sand and granular materials. 30
8. The floating unit according to claim 6, wherein the lower edges of the two hollow bodies are joined together not in a fluid-tight manner and said ancillary cavity (19) is fluid tight at the top and constitutes an ancillary floating chamber of variable volume, open at the bottom 35
9. The floating unit according to claim 8, wherein said ancillary floating chamber of variable volume open at the bottom has inlet and outlet valve means (8) for releasing from or injecting gaseous fluid in said cavity (19). 40
10. The floating unit according to claim 6 or 8, **characterised in that** the top surface of the said second truncated pyramid (8) constitutes a platform (6) of a multi-platform wharf. 45
11. The floating unit according to claim 1, **characterised in that** its shape allows it to be stacked together with other similar modular units in such a way that each unit (1) can be partially introduced inside the floating chamber (2) of another unit. 50
12. A floating structure comprising a plurality of platforms (6) linked together, wherein at least one of the plat-

forms has at least a floating unit (1) according to any one of the preceding claims attached to it.

13. A floating structure comprising at least one modular unit (1) according to any one of the preceding claims, **characterised in that** it is composed of recyclable materials belonging to the group composed of metals, plastics and wood, and environmentally friendly materials belonging to the group composed of air, water and sand.

Patentansprüche

1. Schwimmereinheit, die eingerichtet ist, teilweise untergetaucht zu werden, um begehbare Strukturen zu unterstützen, die eine oder mehrere Plattformen umfassen, die zusammengebaut sind, die einen im wesentlichen steifen Hohlkörper (1) mit Vorrichtungen (5) aufweist, um ihn an der unterstützten Plattform zu befestigen, die eine stumpfe Kegel- oder Pyramidenform mit einer am Boden offenen Basis aufweist, wobei ein Vorsprung des Scheitels des stumpfen Kegels oder der Pyramide in den Bereich der offenen Basis fällt, wobei der Hohlkörperhohlraum eine Schwimmkammer (2) mit variablem Volumen bildet, die mit einem darin eingeschlossenen gasförmigen Fluid gefüllt ist, die am Boden durch die Oberfläche der Flüssigkeit (3) verschlossen ist, in die der Hohlkörper (1) eingetaucht ist, **dadurch gekennzeichnet, daß** Einlaß- und Auslaßventilmittel (17) durch eine obere Wand der Schwimmereinheit vorhanden sind, um das gasförmige Fluid in der Schwimmkammer (2) aus ihr abzublasen oder in sie einzublasen, um ihr Volumen zum Regeln des Auftriebs der einzelnen Schwimmereinheit zu verändern.
2. Schwimmereinheit nach Anspruch 1, die ferner eine fluidundurchlässige und flexible Membran (7) aufweist, die eine Umfangskante aufweist, die abdichtend mit den Innenflächen der Wände der Schwimmkammer mit variablem Volumen verbunden ist, die einen direkten Kontakt der Flüssigkeit (3) mit dem in der Schwimmkammer (2) eingeschlossenen gasförmigen Fluid verhindert.
3. Schwimmereinheit nach Anspruch 1, **dadurch gekennzeichnet, daß** die einstellbare Menge des gasförmigen Fluids in der Schwimmkammer (2) den Eintauchpegel der lasttragenden Schwimmereinheit (1) in der Flüssigkeit (3) modifiziert.
4. Schwimmereinheit nach Anspruch 1, **dadurch gekennzeichnet, daß** die Ventilmittel (17) mit einem Steuersystem des Auftriebspegels und/oder der Horizontalität eines Kais gekoppelt sind, der durch mehrere der Schwimmereinheiten unterstützt wird, die am Kai an voneinander beabstandeten Punkten befe-

stigt sind.

5. Schwimmereinheit nach Anspruch 4, **dadurch gekennzeichnet, daß** das Steuersystem die Auftriebs-einstellventile (17) jeder Schwimmereinheit (1) unab-
hängig von den anderen Einheiten regelt.
6. Schwimmereinheit nach Anspruch 1, **dadurch ge-
kennzeichnet, daß** mit dem Hohlkörper (1) ein zwei-
ter oder äußerer Hohlkörper (8) verbunden ist, der
eine kopfstehende, am Boden offene stumpfe Kegel-
oder Pyramidenform aufweist, die den stumpfen Kegel-
oder Pyramidenkörper (1) vollständig in sich auf-
nimmt, wobei die Bodenkante des zweiten Körpers
(8) mit der Bodenkante des ersten Hohlkörpers (1)
in einer fluiddichten Weise verbunden ist, um zwi-
schen den beiden Körpern einen Zusatzschwimm-
steuerhohlraum (19) zu definieren, der die Haupt-
schwimmkammer (2) mit variablen Volumen umgibt.
7. Schwimmereinheit nach Anspruch 6, **dadurch ge-
kennzeichnet, daß** der Zusatzhohlraum (19) mit ei-
nem Füllmaterial mit Formanpassungsvermögen
gefüllt ist, das zu der Gruppe gehört, die aus verfe-
stigten expandierten Schäumen, Sand und körni-
gen Materialien besteht.
8. Schwimmereinheit nach Anspruch 6, wobei die Unter-
kanten der beiden Hohlkörper nicht in einer fluiddich-
ten Weise miteinander verbunden sind und der Zu-
satzhohlraum (19) am Oberteil fluiddicht ist und eine
Zusatzschwimmkammer mit variablem Volumen bil-
det, die am Boden offen ist.
9. Schwimmereinheit nach Anspruch 8, wobei die am Bo-
den offene Zusatzschwimmkammer mit variablem
Volumen Einlaß- und Auslaßventilmittel (8) aufweist,
um gasförmiges Fluid im Hohlraum (19) abzublasen
oder in ihn einzublasen.
10. Schwimmereinheit nach Anspruch 6 oder 8, **dadurch
gekennzeichnet, daß** die Oberseite der zweiten
stumpfen Pyramide (8) eine Plattform (6) eines
Mehrplattformkais bildet.
11. Schwimmereinheit nach Anspruch 1, **dadurch ge-
kennzeichnet, daß** es ihre Form ermöglicht, daß
sie mit anderen ähnlichen modularen Einheiten in
einer solchen Weise aufeinander gestapelt werden
kann, daß jede Einheit (1) teilweise in die Schwimm-
kammer (2) einer anderen Einheit eingeführt werden
kann.
12. Schwimmmanordnung, die mehrere Plattformen (6)
aufweist, die miteinander verbunden sind, wobei
mindestens eine der Plattformen mindestens eine
Schwimmereinheit (1) nach einem der vorhergehen-
den Ansprüche aufweist, die an ihr angebracht ist.

13. Schwimmmanordnung, die mindestens eine modulare
Einheit (1) nach einem der vorhergehenden Ansprü-
che aufweist, **dadurch gekennzeichnet, daß** sie
aus wiederverwertbaren Materialien, die zu der
Gruppe gehören, die aus Metallen, Kunststoffen und
Holz besteht, und umweltfreundlichen Materialien
besteht, die zu der Gruppe gehören, die aus Luft,
Wasser und Sand besteht.

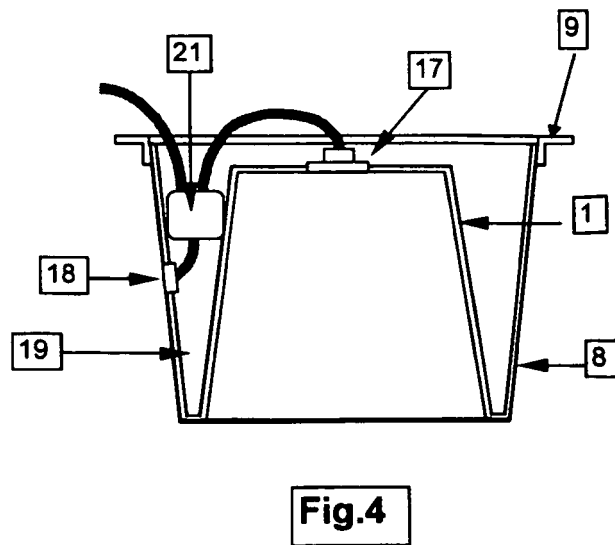
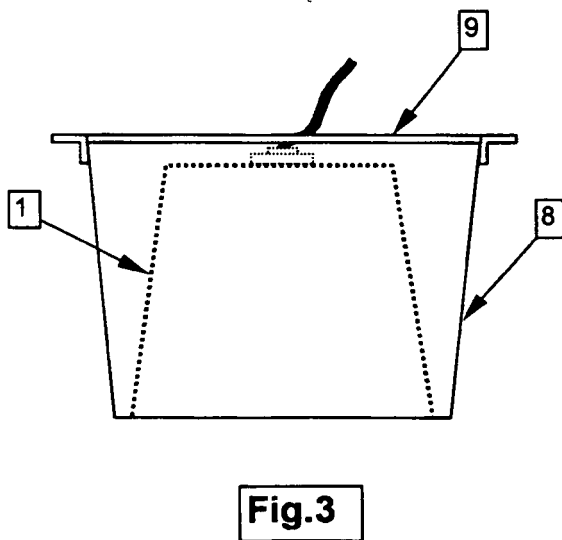
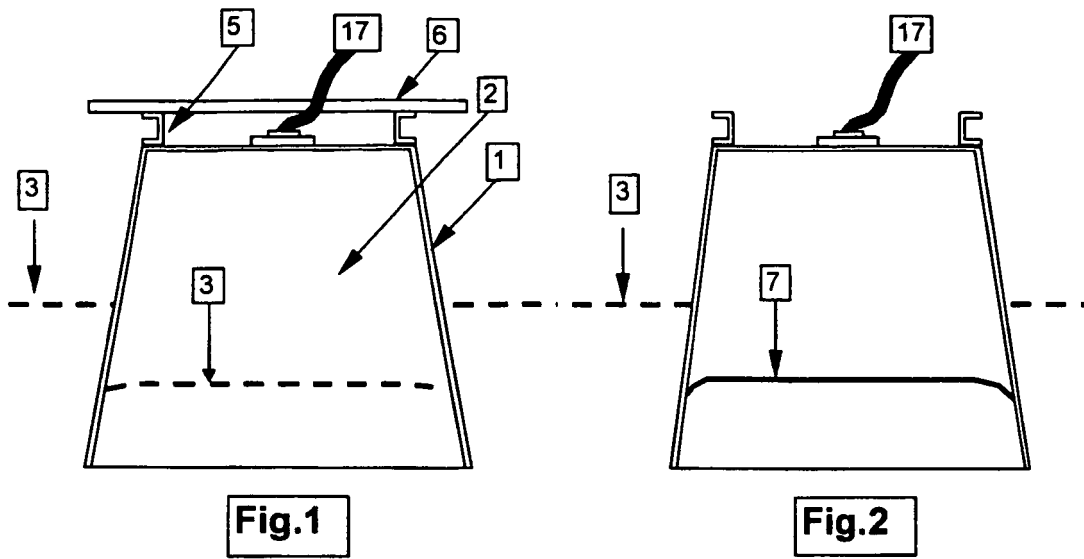
Revendications

1. Module de flottaison adapté à être submergé partiel-
lement pour soutenir des structures piétonnières
comprenant une ou plusieurs plateformes assem-
blées entre elles, comprenant un corps creux (1)
sensiblement rigide avec des dispositifs (5) pour le
fixer à la plateforme soutenue, ayant une forme co-
nique ou pyramidale tronquée avec une base ouver-
te en bas avec une projection du sommet du cône
tronqué ou de la pyramide tronquée tombant dans
la zone de la base ouverte, la cavité du corps creux
constituant une chambre de flottaison (2) à volume
variable, remplie d'un fluide gazeux piégé à l'inté-
rieur, fermée en bas par la surface du liquide (3)
dans lequel le corps creux (1) est immergé, **carac-
térisé en ce que** des moyens de vannes d'entrée
et de sortie (17) sont présents à travers une paroi
supérieure du module de flottaison pour libérer ou
injecter un fluide gazeux dans la chambre de flottai-
son (2) pour faire varier son volume pour réguler la
flottabilité du module de flottaison individuel.
2. Module de flottaison selon la revendication 1, com-
prenant en outre une membrane (7) imperméable
aux fluides et flexible, ayant un bord périphérique
relié de façon étanche aux surfaces intérieures des
parois de la chambre de flottaison à volume variable,
empêchant un contact direct du liquide (3) avec le
fluide gazeux piégé dans la chambre de flottaison
(2).
3. Module de flottaison selon la revendication 1, **carac-
térisé en ce que** la quantité réglable de fluide ga-
zeux dans la chambre de flottaison (2) modifie le
niveau d'immersion du module de flottaison (1) por-
tant une charge dans le liquide (3).
4. Module de flottaison selon la revendication 1, **carac-
térisé en ce que** les moyens de vanne (17) sont
couplés à un système de commande du niveau de
flottaison et/ou de l'horizontalité d'un quai soutenu
par une pluralité desdits modules de flottaison fixés
au quai en des points espacés entre eux.
5. Module de flottaison selon la revendication 4, **carac-
térisé en ce que** le système de commande régule
les vannes de réglage de flottaison (17) de chaque

module de flottaison (1) indépendamment des autres modules.

tiques et de bois, et de matériaux respectant l'environnement appartenant au groupe composé de l'air, de l'eau et du sable.

6. Module de flottaison selon la revendication 1, **caractérisé en ce qu'**au corps creux (1) est associé un second corps creux (8), ou corps creux extérieur, ayant une forme conique ou pyramidale tronquée renversée ouverte en bas, qui loge complètement à l'intérieur le corps conique ou pyramidal tronqué (1), le bord du bas du second corps (8) étant joint au bord du bas du premier corps creux (1) de façon étanche aux fluides pour définir entre les deux corps une cavité auxiliaire de contrôle de flottaison (19) entourant la chambre de flottaison principale (2) à volume variable. 5
10
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7. Module de flottaison selon la revendication 6, **caractérisé en ce que** la cavité auxiliaire (19) est remplie d'un matériau de remplissage à conformation appartenant au groupe composé de mousses expansées solidifiables, de sable ou de matériaux granuleux. 20
8. Module de flottaison selon la revendication 6, dans lequel les bords inférieurs des deux corps creux sont joints entre eux d'une façon non étanche aux fluides et la cavité auxiliaire (19) est étanche aux fluides en haut et constitue une chambre de flottaison auxiliaire à volume variable, ouverte en bas. 25
9. Module de flottaison selon la revendication 8, dans lequel la chambre de flottaison auxiliaire à volume variable ouverte en bas comporte des moyens de vannes d'entrée et de sortie (8) pour libérer ou injecter un fluide gazeux dans la cavité (19). 30
35
10. Module de flottaison selon la revendication 6 ou 8, **caractérisé en ce que** la surface du haut de la seconde pyramide tronquée (8) constitue une plateforme (6) d'un quai à plateformes multiples. 40
11. Module de flottaison selon la revendication 1, **caractérisé en ce que** sa forme lui permet d'être stocké avec d'autres modules individuels similaires, de telle sorte que chaque module (1) peut être introduit partiellement dans la chambre de flottaison (2) d'un autre module. 45
12. Structure de flottaison comprenant une pluralité de plateformes (6) reliées entre elles, dans laquelle au moins une des plateformes comporte au moins un module de flottaison (1) selon l'une quelconque des revendications précédentes, attaché à celle-ci. 50
13. Structure de flottaison comprenant au moins un module modulaire (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**elle est composée de matériaux recyclables appartenant au groupe composé de métaux, de plas-



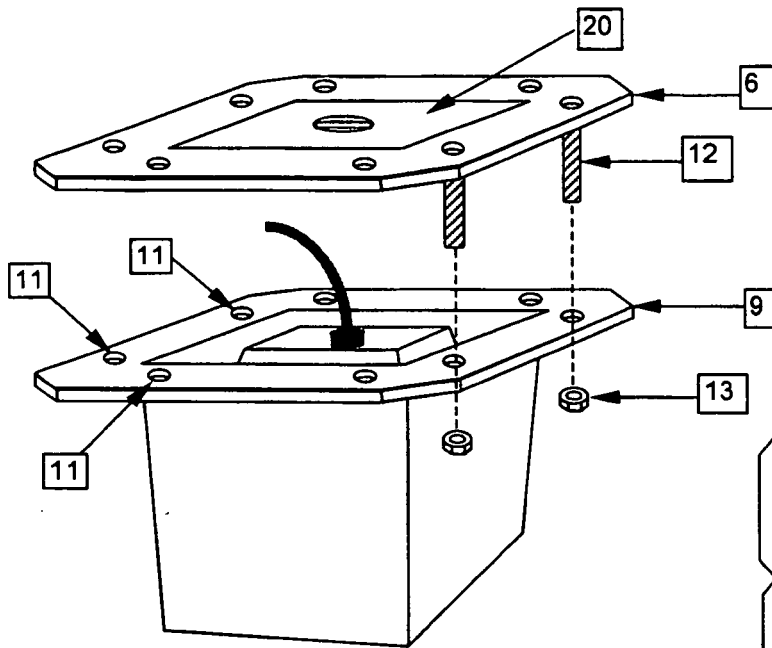


Fig. 6

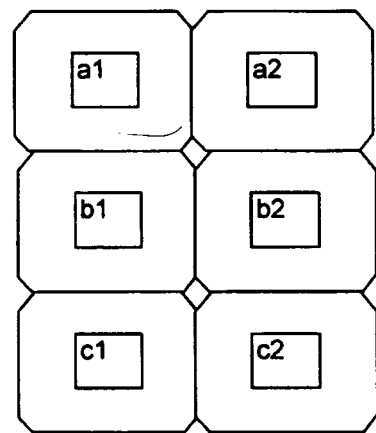


Fig. 5

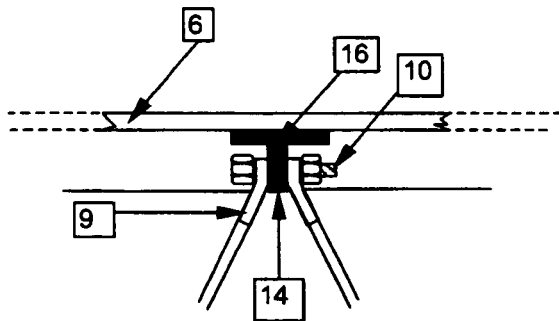


Fig. 7b

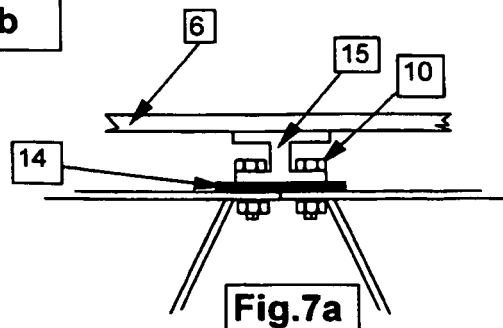


Fig. 7a

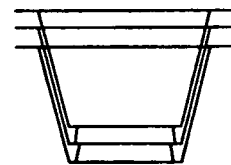


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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