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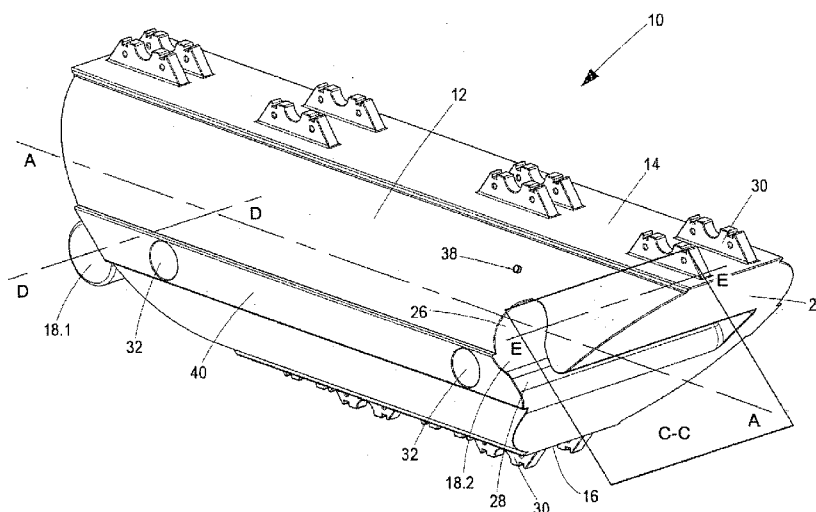


Figure 1

(57) Abstract: A buoyant element (10) includes an elongate buoyant body (12) that defines a major side (14), a minor side (16) that is parallel to the major side (14), axial ends (20) connecting the major side (14) and the minor side (16) at an angle of substantially 45 degrees from the orthogonal spanning the major side (14) and the minor side (16) and means (18) for connecting adjacent buoyant elements (10) together. The length of the major side (14) is twice the length of the minor side (16).

Buoyant element

BACKGROUND

The present invention relates to a buoyant element. More specifically, the present invention relates to a buoyant element with integral male and female connectors for axially connecting adjacent elements together either linearly or orthogonally.

Various buoyant elements are known. For example:

US4,409,921 "Floating inspection platform" and US4,798,169 "Plant for fish farming in the open sea" describe hexagonal structures comprising a series of floating elements with sides angled at 60°;

US7,182,034 "Offshore floating dock" illustrates trapezoidal elements with sides angled at 15° from the orthogonal spanning the parallel sides;

US6,381,792 "Modular foam floating bridge" illustrates trapezoidal elements with sides angled at 35° from the orthogonal spanning the parallel sides. Furthermore, according to the description at column 3, line 21: "[the plane of each end piece has] *an acute angle on the order of 30° and 60° ...*"; and

EP1,280,695 "Temporary floatation stabilization device and method" illustrates trapezoidal pontoons with ends angled at 45° such that, if connected end-to-end, the pontoons would form a square.

It is an object of the present invention is to provide a buoyant element that is modular, homogeneous and includes integral means for connecting adjacent buoyant elements together.

SUMMARY OF THE INVENTION

According a preferred embodiment of the present invention, a buoyant element includes:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 45° from the orthogonal spanning the major and minor sides;
and

means for connecting adjacent buoyant elements together,

wherein the length of the major side is twice the length of the minor side.

Typically, the elongate buoyant body is in cross section: (i) a square; (ii) a rectangle; (iii) a circle; or (iv) two half-circles connected by linear sections.

Generally, the connecting means connect axial ends of adjacent buoyant elements together.

Preferably, the connecting means comprises: (i) an integral male connector at one axial end; and (ii) an integral female connector at the other axial end, each connector being sized and shaped such that the male connector can be slidably received and captured within a female connector on an adjacent buoyant element to connect buoyant elements together.

Typically, the male connector includes a neck extending from the axial end and an enlarged head at its free end.

Generally, the male connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the neck and head; and (ii) extends midway between the major and minor sides, and the plane extending through the male connector is orthogonal to the plane defined by the axial end.

Typically, the female connector comprises a cavity with a constriction at its opening.

Generally, the female connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the constriction and cavity; and (ii) extends midway between the major and minor sides, and the plane extending through the female connector is orthogonal to the plane defined by the axial end.

Typically, the cavity is open at one end and extends through the centre of the elongate buoyant body, equidistant from the major and minor sides.

Preferably, the major and minor sides are both located on a line running through the longitudinal axis of the elongate buoyant body, and the longitudinal axis of the cavity is orthogonal to the line on which the major and minor sides are located.

Typically, the cross-sectional profile of the cavity is constant along its length.

Generally, the male connector is elongate, and the longitudinal axis of the male connector is parallel to the longitudinal axis of the cavity.

Conveniently, the connector means are puzzle-shaped.

Preferably, each axial end is substantially planar such that, when connected to each other, adjacent buoyant elements are in facial contact along their axial ends.

Optionally, the buoyant element further includes at least one tab extending from each of the major and minor sides.

Typically, each tab defines an aperture therethrough. And, each aperture is between 15mm and 20mm in diameter.

Optionally, each of the minor and major sides includes four parallel, axially extending series of tabs. Preferably, the width of each tab is 30mm and the inner parallel series of tabs are spaced to define a 45mm gap therebetween, whereas the outer parallel series of tabs are spaced to define a 120mm gap therebetween. The tabs in each series of tabs may be spaced from each other to define gaps between neighbouring tabs that

correspond to the length of a tab. Furthermore, the tabs in the inner series of tabs may be aligned. Similarly, the tabs in the outer series of tabs may be aligned. Preferably, (i) the tabs in the inner series of tabs; and (ii) the tabs in the outer series of tabs, are staggered.

When buoyant elements are arranged with the minor side of a first buoyant element adjacent the major side of a second buoyant element, the series of tabs on the minor side of the first buoyant element may locate between the series of tabs on the major side of the second buoyant element.

Conveniently, a bolt extends between the tabs on the first and second buoyant elements to connect them together.

Optionally, the elongate buoyant body defines a pair of bores extending radially through the elongate body, orthogonal to the line on which the major and minor sides are located.

Typically, the longitudinal axes of the bores are spaced the same distance as the length of the minor side.

Generally, the bores have a diameter between 50mm and 110mm and a pipe extends through each bore.

Optionally, the buoyant element further includes opposed ridges extending axially along the peripheral wall midway between the major and minor sides.

Preferably, each ridge defines a pair of parallel lateral sides to facilitate securing of a clamp on the ridge.

Generally, the buoyant element is homogeneous.

According to a second embodiment of the present invention, a buoyant element includes:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 30° from the orthogonal spanning the major and minor sides; and

means for connecting adjacent buoyant elements together,

wherein the length of the major side is three times the length of the minor side.

According to a second aspect of the invention, there is provided a method of making a buoyant element according to the preferred or second embodiments of the invention, the method including the steps:

inserting a pipe into a mould;

charging the mould with a plastics material; and

rotomolding the buoyant element within the mould from the plastics material, and incorporating the pipe into the buoyant element such that the pipe extends through each bore.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of examples only, with reference to the accompanying drawings in which:

Figure 1 is a first perspective view of a buoyant element according to a preferred embodiment of the present invention;

Figure 2 is a second perspective view of the buoyant element in Figure 1;

Figure 3 is a top view of the buoyant element in Figure 1;

Figure 4 is a side view of the buoyant element in Figure 1 showing the female connector;

- Figure 5** is an end view of the buoyant element in Figure 1 with plates secured to the tabs;
- Figure 6** is a perspective view of four buoyant elements in Figure 1 attached to each other and a pipe framework extending through the bores to support a submerged pump;
- Figure 7** is a first perspective view of a buoyant element according to a second embodiment of the invention; and
- Figure 8** is a second perspective view of the buoyant element in Figure 7.

DESCRIPTION OF A PREFERRED EMBODIMENT

With reference to Figures 1 to 6 of the drawings, a buoyant element 10 according to a preferred embodiment of the invention includes an elongate, buoyant body 12, a major side 14, a minor side 16 and means 18 for connecting adjacent buoyant elements 10 together.

The above parts 12, 14, 16 and 18 of the buoyant element 10 are homogeneous and formed integrally from polyethylene, a polymer based compound, resin, polyurethane, PET, Styrene or polypropylene during a casting, roto-moulding or blow moulding process.

The body 12 could, in cross section, be a square, rectangle or circle. The figures 1 to 6 show a body 12 comprising, in cross section two half-circles connected by linear sections. To ensure buoyancy, the body 12 is either hollow or filled with a polyurethane foam (or a similar closed-cell low-density material or foaming compound). Longitudinal axis A-A extends through the body 12.

Major and minor sides 14 and 16 extend axially along the radial peripheral wall of the body 12. The sides 14 and 16 are parallel to each other and to the longitudinal axis A-A.

The length of the major side 14 is twice that of the minor side 16.

With particular reference to Figure 4, planar axial ends 20 close the axial ends of the body 12, and are inclined at substantially 45° (i.e. between 42° and 48°) to the orthogonal

spanning the major and minor sides 14 and 16. The body 12 is in the form of a symmetrical trapezoid with parallel major and minor sides 14 and 16 and axial ends 20 extending therefrom at 45°.

Turning to Figures 2 and 4, puzzle-shaped connecting means 18 for connecting axial ends 20 of adjacent buoyant elements 10 together comprises an integral male connector 18.1 and an integral female connector 18.2. The male connector 18.1 includes a neck 22 that extends from the axial end 20 and terminates at its free end in an enlarged head 24. Plane B-B: (i) runs from the axial end 20 along the centre of the neck 22 and head 24; and (ii) extends from the axial end 20 midway between the major and minor sides 14 and 16. The male connector 18.1 is symmetrical about plane B-B. And, plane B-B is orthogonal to the planar axial end 20.

With reference to Figures 1 and 4, the female connector 18.2 comprises a cavity 26 defined by the axial end 20 with a constriction 28 at its opening. Plane C-C: (i) runs from the axial end 20 along the centre of the constriction 28 and cavity 26; and (ii) extends midway between the major and minor sides 14 and 16. The female connector 18.2 is symmetrical about plane C-C. And, plane C-C is orthogonal to the planar axial end 20. The cavity 26 extends along the axial end 20 and is open at one axial end - extending through an aperture defined by the radial peripheral wall of the body 12. The male connector 18.1 is also elongate, with its longitudinal axis D-D extending parallel to the longitudinal axis of the cavity 26 E-E.

The male and female connectors 18.1 and 18.2 are sized and shaped such that the male connector 18.1 of one buoyant element 10 can be received within the female connector 18.2 of a second buoyant element 10 via the aperture defined by the radial peripheral wall of the body 12 and slid axially along the cavity 26 (i.e. along E-E) – the head 24 being captured within the cavity 26 while the neck 22 extends through the passage 28.

The shape and arrangement of the connecting means 18 is an improvement over existing linking systems using pins, as its puzzle-shape distributes stress over a larger area than would be the case if a locking pin (as described in prior art systems) were used to connect adjacent pontoons together. By distributing stresses, the risk of fatigue failure of the connecting means 18 is reduced. Furthermore, the closed axial wall of the cavity 26 limits relative movement of the male and female connectors 18.1 and 18.2 in one direction without the need to insert a locking pin.

With reference to Figure 6, it will be appreciated that when the axial ends 20 of buoyant elements 10 are connected to each other, the planar sections of the axial ends 20 are in facial contact. This arrangement provides a rigid connection with little "play".

Each of the major and minor sides 14 and 16 includes four parallel series of tabs 30 extending axially along the body. The width of each tab is 30mm and the inner parallel series of tabs 30 are spaced to define a 45mm gap therebetween, whereas the outer parallel series of tabs 30 are spaced to define a 120mm gap therebetween. On the minor side 16, the tabs 30 in each series of tabs 30 are spaced from each other to define gaps between neighbouring tabs that correspond to the length of a tab.

On the major side 14, each tab 30 in the inner series of tabs is aligned with a tab 30 on the minor side 16, i.e. the paired tabs 30 are located orthogonal to the same point on the axis A-A. Similarly, on the major side 14, each tab 30 in the outer series of tabs is aligned with a tab 30 on the minor side 16, but the tabs 30 on the outer series of tabs 30 are staggered relative to the tabs 30 in the inner series of tabs 30.

In this arrangement, it will be appreciated that, should two buoyant elements 10 be arranged with the minor side 16 of a first buoyant element 10 adjacent the major side 14 of a second buoyant element 10, the parallel lines of tabs 30 on the minor side 16 of the first buoyant element 10 locates between the parallel lines of tabs 30 on the major side 14 of the second buoyant element 10. A bolt (not shown) inserted through the apertures in the overlapping tabs 30 secures the adjacent buoyant elements 10 together. A stringer (not shown) could also be located between the inner parallel lines of tabs 30 on the minor and major sides 16 to transfer forces between the tabs 30 and bolts.

Alternatively, with reference to Figure 5, the inner parallel lines of tabs 30 could be used to secure boards or plates 31 to the buoyant element 10 to act as a keel for a barge pontoon.

The body 12 also defines a pair of 50mm to 110mm internal diameter bores 32 extending radially therethrough in a direction orthogonal to the line spanning the major and minor sides 14. The longitudinal axes of the bores 32 are spaced the same distance as the length of the minor side 16. Referring to Figure 6, a pipe framework 34 for supporting a submerged pump 36 can be secured to the buoyant elements 10 by extending the ends of the pipe framework 34 through the bores 32.

The buoyant element 10 also includes a valve 38 for controlling the inflow and/or outflow of air and/or water into / from the body 12, thereby to vary buoyancy of each buoyant element 10 independently.

A pair of opposed ridges 40 extend axially along the peripheral wall midway between the major and minor sides 14 and 16. Each ridge 40 defines a pair of parallel lateral sides to facilitate securing of a clamp (not shown) on the ridge 40.

It will be appreciated that when four buoyant elements 10 are connected to each other, they provide a rigid structure suitable as a floating support, whether for a submerged pump, a deck or a fish farm plant. Alternatively, the buoyant elements 10 could be connected such that the elements 10 extend linearly. This configuration is specifically suited for use as modular pontoons for barges. Furthermore, since the major side 14 of each buoyant element 10 is generally less than 2.4m, and the buoyant element typically weighs between 24kg and 100kg, they can easily be transported and assembled by manual labour without the need for cranes.

Although the Figure 6 shows the submerged pump 36 rigidly suspended by a solid pipe, it will be appreciated that the submerged pump 36 is preferably suspended by a chain.

According to a second embodiment of a buoyant element 110 shown in Figures 7 and 8, the buoyant element 110 is similar to the buoyant element 10 according to the preferred embodiment of the invention. However, the length of the major side 114 is three times that of the minor side 116. And, the planar axial ends 120 are inclined at substantially 30° (i.e. between 27° and 33°) to the orthogonal spanning the major and minor sides 114 and 116. The body 112 is in the form of a symmetrical trapezoid with parallel major and minor sides 114 and 116 and axial ends 120 extending therefrom at 30°.

This buoyant element 110 is particularly suited to being arranged in a triangular formation.

According to a second aspect of the present invention, a method of making a buoyant element 10 or 110 according to either the preferred or the second embodiments of the invention includes the steps of:

inserting a pipe into a mould;

charging the mould with a plastics material; and
rotomolding the buoyant element within the mould from the plastics material, and
incorporating the pipe into the buoyant element 10 or 110 such that the pipe extends
through each bore 32 or 132.

CLAIMS

1. A buoyant element including:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 45° from the orthogonal spanning the major and minor sides;
and

means for connecting adjacent buoyant elements together,

wherein the length of the major side is twice the length of the minor side.

2. A buoyant element according to claim 1, wherein the elongate buoyant body is in cross section: (i) a square; (ii) a rectangle; (iii) a circle; or (iv) two half-circles connected by linear sections.
3. A buoyant element according to claim 2, wherein the connecting means connect axial ends of adjacent buoyant elements together.
4. A buoyant element according to claim 3, wherein the connecting means comprises: (i) an integral male connector at one axial end; and (ii) an integral female connector at the other axial end, each connector being sized and shaped such that the male connector can be slidably received and captured within a female connector on an adjacent buoyant element to connect buoyant elements together.
5. A buoyant element according to claim 4, wherein the male connector includes a neck extending from the axial end and an enlarged head at its free end.
6. A buoyant element according to claim 5, wherein the male connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the neck and head; and (ii) extends midway between the major and minor sides.

7. A buoyant element according to claim 6, wherein the plane extending through the male connector is orthogonal to the plane defined by the axial end.
8. A buoyant element according to claim 7, wherein the female connector comprises a cavity with a constriction at its opening.
9. A buoyant element according to claim 8, wherein the female connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the constriction and cavity; and (ii) extends midway between the major and minor sides.
10. A buoyant element according to claim 9, wherein the plane extending through the female connector is orthogonal to the plane defined by the axial end.
11. A buoyant element according to claim 10, wherein the cavity is open at one end and extends through the centre of the elongate buoyant body, equidistant from the major and minor sides.
12. A buoyant element according to claim 11, wherein the major and minor sides are both located on a line running through the longitudinal axis of the elongate buoyant body.
13. A buoyant element according to claim 12, wherein the longitudinal axis of the cavity is orthogonal to the line on which the major and minor sides are located.
14. A buoyant element according to claim 13, wherein the cross-sectional profile of the cavity is constant along its length.
15. A buoyant element according to claim 14, wherein the male connector is elongate.
16. A buoyant element according to claim 15, wherein the longitudinal axis of the male connector is parallel to the longitudinal axis of the cavity.
17. A buoyant element according to claim 16, wherein the connecting means are puzzle-shaped.

18. A buoyant element according to claim 17, wherein each axial end is substantially planar such that, when connected to each other, adjacent buoyant elements are in facial contact along their axial ends.
19. A buoyant element according to claim 18, further including at least one tab extending from each of the major and minor sides.
20. A buoyant element according claim 19, wherein each tab defines an aperture therethrough.
21. A buoyant element according to claim 20, wherein each aperture is between 15mm and 20mm in diameter.
22. A buoyant element according to claim 21, wherein each of the minor and major sides includes four parallel, axially extending series of tabs.
23. A buoyant element according to claim 22, wherein the width of each tab is 30mm.
24. A buoyant element according to claim 23, wherein the inner parallel series of tabs are spaced to define a 45mm gap therebetween.
25. A buoyant element according to claim 24, wherein the outer parallel series of tabs are spaced to define a 120mm gap therebetween.
26. A buoyant element according to claim 25, wherein the tabs in each series of tabs are spaced from each other to define gaps between neighbouring tabs that correspond to the length of a tab.
27. A buoyant element according to claim 26, wherein the tabs in the inner series of tabs are aligned.
28. A buoyant element according to claim 27, wherein the tabs in the outer series of tabs are aligned.
29. A buoyant element according to claim 28, wherein: (i) the tabs in the inner series of tabs; and (ii) the tabs in the outer series of tabs, are staggered.

30. A buoyant element according to claim 29, wherein, when buoyant elements are arranged with the minor side of a first buoyant element adjacent the major side of a second buoyant element, the series of tabs on the minor side of the first buoyant element locates between the series of tabs on the major side of the second buoyant element.
31. A buoyant element according to claim 30, wherein a bolt extends between the tabs on the first and second buoyant elements to connect them together.
32. A buoyant element according to claim 31, wherein the elongate buoyant body defines a pair of bores extending radially through the elongate body, orthogonal to the line on which the major and minor sides are located.
33. A buoyant element according to claim 32, wherein the longitudinal axes of the bores are spaced the same distance as the length of the minor side.
34. A buoyant element according to claim 33, wherein the bores have a diameter between 50mm and 110mm.
35. A buoyant element according to claim 34, wherein a pipe extends through each bore.
36. A buoyant element according to claim 35, further including opposed ridges extending axially along the peripheral wall midway between the major and minor sides.
37. A buoyant element according to claim 36, wherein each ridge defines a pair of parallel lateral sides to facilitate securing of a clamp on the ridge.
38. A buoyant element according to claim 37, wherein the buoyant element is homogeneous.
39. A buoyant element including:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 30° from the orthogonal spanning the major and minor sides; and

means for connecting adjacent buoyant elements together,

wherein the length of the major side is three times the length of the minor side.

40. A buoyant element according to claim 39, wherein the elongate buoyant body defines a pair of bores extending radially through the elongate body, orthogonal to the line on which the major and minor sides are located.
41. A buoyant element according to claim 40, wherein the longitudinal axes of the bores are spaced the same distance as the length of the minor side.
42. A buoyant element according to claim 41, wherein the bores have a diameter between 50mm and 110mm.
43. A buoyant element according to claim 42, wherein a pipe extends through each bore.
44. A method of making a buoyant element according to claim 35 or claim 43, the method including the steps of:

inserting a pipe into a mould;

charging the mould with a plastics material; and

rotomolding the buoyant element within the mould from the plastics material, and incorporating the pipe into the buoyant element such that the pipe extends through each bore.

AMENDED CLAIMS

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1. A buoyant element including:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 45° from the orthogonal spanning the major and minor sides; and

means for connecting adjacent buoyant elements together, the connecting means comprising: (i) an integral male connector at one axial end; and (ii) an integral female connector at the other axial end, each connector being sized and shaped such that the male connector can be slidably received and captured within a female connector on an adjacent buoyant element to connect buoyant elements together.

2. A buoyant element according to claim 1, wherein the elongate buoyant body is in cross section: (i) a square; (ii) a rectangle; (iii) a circle; or (iv) two half-circles connected by linear sections.
3. A buoyant element according to claim 2, wherein the connecting means connect axial ends of adjacent buoyant elements together.
4. A buoyant element according to claim 3, wherein the male connector includes a neck extending from the axial end and an enlarged head at its free end.
5. A buoyant element according to claim 4, wherein the male connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the neck and head; and (ii) extends midway between the major and minor sides.

6. A buoyant element according to claim 5, wherein the plane extending through the male connector is orthogonal to the plane defined by the axial end.
7. A buoyant element according to claim 6, wherein the female connector comprises a cavity with a constriction at its opening.
8. A buoyant element according to claim 7, wherein the female connector is symmetrical about a plane that: (i) runs from the axial end along the centre of the constriction and cavity; and (ii) extends midway between the major and minor sides.
9. A buoyant element according to claim 8, wherein the plane extending through the female connector is orthogonal to the plane defined by the axial end.
10. A buoyant element according to claim 9, wherein the cavity is open at one end and extends through the centre of the elongate buoyant body, equidistant from the major and minor sides.
11. A buoyant element according to claim 10, wherein the cross-sectional profile of the cavity is constant along its length.
12. A buoyant element according to claim 11, wherein the male connector is elongate.
13. A buoyant element according to claim 12, wherein the longitudinal axis of the male connector is parallel to the longitudinal axis of the cavity.
14. A buoyant element according to claim 13, wherein the connecting means are puzzle-shaped.
15. A buoyant element according to claim 14, wherein each axial end is substantially planar such that, when connected to each other, adjacent buoyant elements are in facial contact along their axial ends.
16. A buoyant element according to claim 15, further including at least one tab extending from each of the major and minor sides.
17. A buoyant element according claim 16, wherein each tab defines an aperture therethrough.

18. A buoyant element according to claim 17, wherein each aperture is between 15mm and 20mm in diameter.
19. A buoyant element according to claim 18, wherein each of the minor and major sides includes four parallel, axially extending series of tabs.
20. A buoyant element according to claim 19, wherein the width of each tab is 30mm.
21. A buoyant element according to claim 20, wherein the inner parallel series of tabs are spaced to define a 45mm gap therebetween.
22. A buoyant element according to claim 21, wherein the outer parallel series of tabs are spaced to define a 120mm gap therebetween.
23. A buoyant element according to claim 22, wherein the tabs in each series of tabs are spaced from each other to define gaps between neighbouring tabs that correspond to the length of a tab.
24. A buoyant element according to claim 23, wherein the tabs in the inner series of tabs are aligned.
25. A buoyant element according to claim 24, wherein the tabs in the outer series of tabs are aligned.
26. A buoyant element according to claim 25, wherein: (i) the tabs in the inner series of tabs; and (ii) the tabs in the outer series of tabs, are staggered.
27. A buoyant element according to claim 26, wherein, when buoyant elements are arranged with the minor side of a first buoyant element adjacent the major side of a second buoyant element, the series of tabs on the minor side of the first buoyant element locates between the series of tabs on the major side of the second buoyant element.
28. A buoyant element according to claim 27, wherein a bolt extends between the tabs on the first and second buoyant elements to connect them together.

29. A buoyant element according to claim 28, wherein the elongate buoyant body defines a pair of bores extending radially through the elongate body, orthogonal to the line on which the major and minor sides are located.
30. A buoyant element according to claim 29, wherein the longitudinal axes of the bores are spaced the same distance as the length of the minor side.
31. A buoyant element according to claim 30, wherein the bores have a diameter between 50mm and 110mm.
32. A buoyant element according to claim 31, wherein a pipe extends through each bore.
33. A buoyant element according to claim 32, further including opposed ridges extending axially along the peripheral wall midway between the major and minor sides.
34. A buoyant element according to claim 33, wherein each ridge defines a pair of parallel lateral sides to facilitate securing of a clamp on the ridge.
35. A buoyant element according to claim 34, wherein the buoyant element is homogeneous.
36. A buoyant element including:

an elongate buoyant body that defines:

a major side;

a minor side that is parallel to the major side;

axial ends connecting the major and minor sides at an angle of substantially 60° from the orthogonal spanning the major and minor sides;
and

means for connecting adjacent buoyant elements together, the connecting means comprising: (i) an integral male connector at one axial end; and (ii)

an integral female connector at the other axial end, each connector being sized and shaped such that the male connector can be slidably received and captured within a female connector on an adjacent buoyant element to connect buoyant elements together.

37. A buoyant element according to claim 36, wherein the elongate buoyant body defines a pair of bores extending radially through the elongate body, orthogonal to the line on which the major and minor sides are located.
38. A buoyant element according to claim 37, wherein the longitudinal axes of the bores are spaced the same distance as the length of the minor side.
39. A buoyant element according to claim 38, wherein the bores have a diameter between 50mm and 110mm.
40. A buoyant element according to claim 39, wherein a pipe extends through each bore.

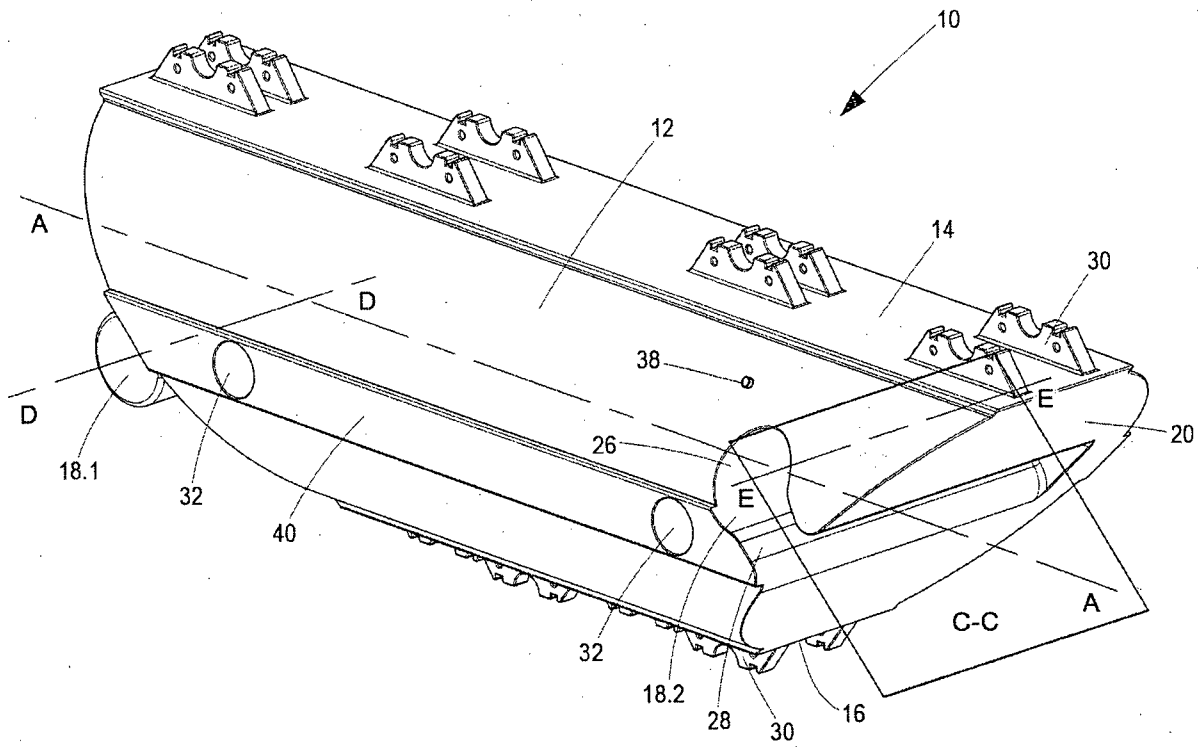


Figure 1

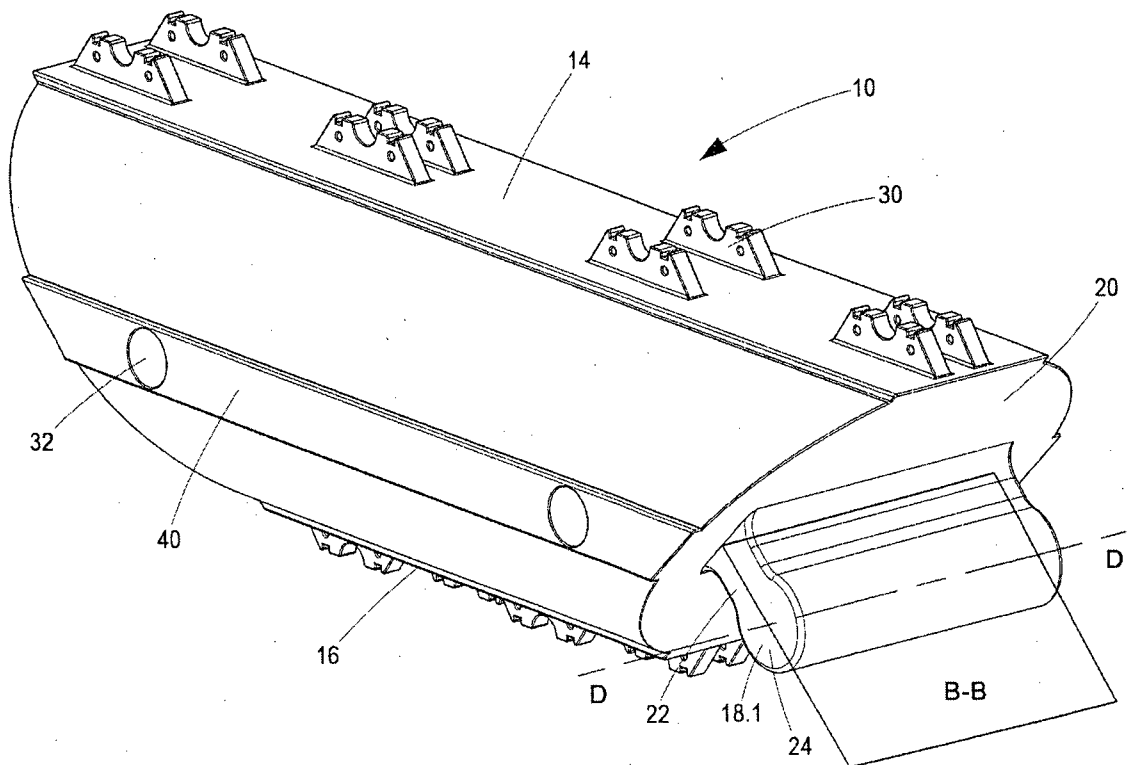


Figure 2

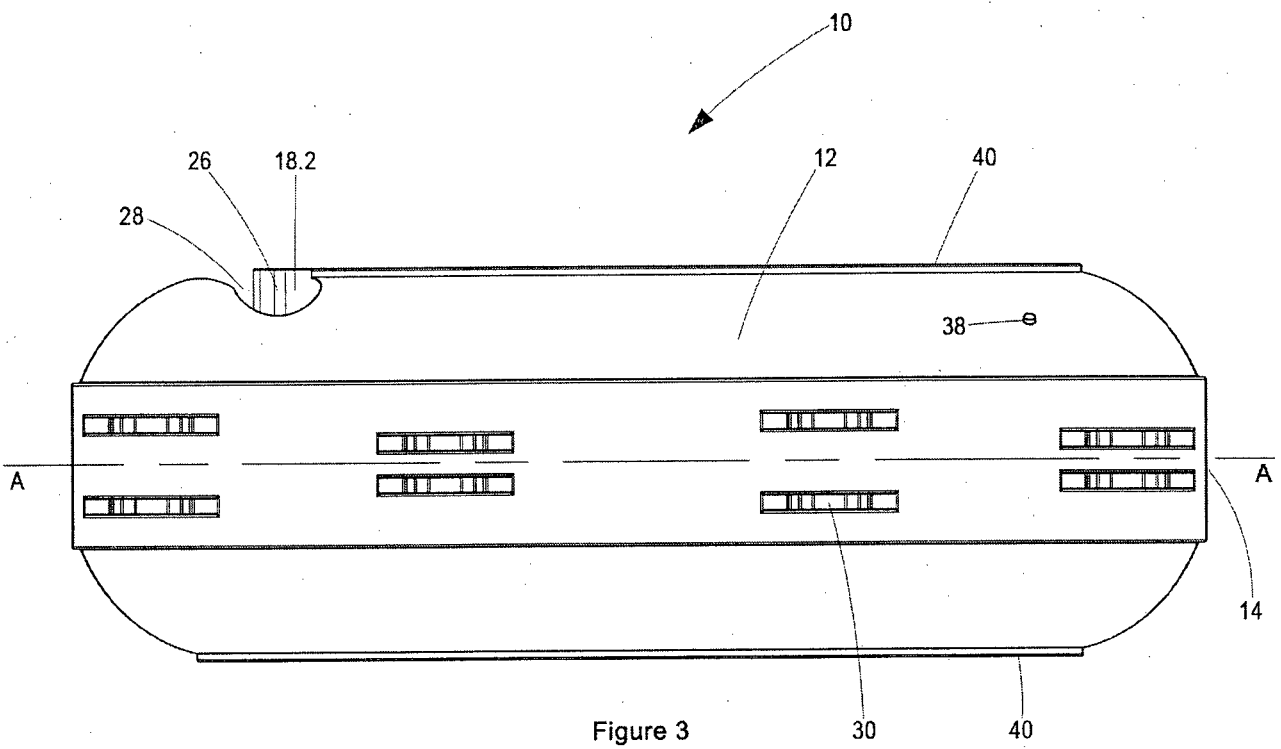


Figure 3

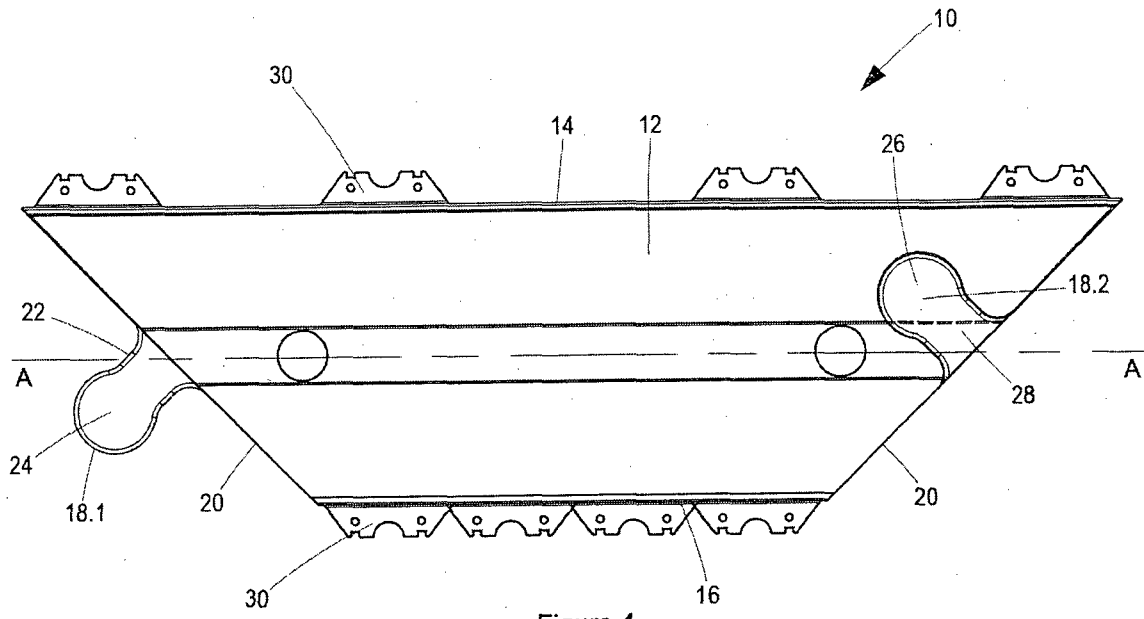


Figure 4

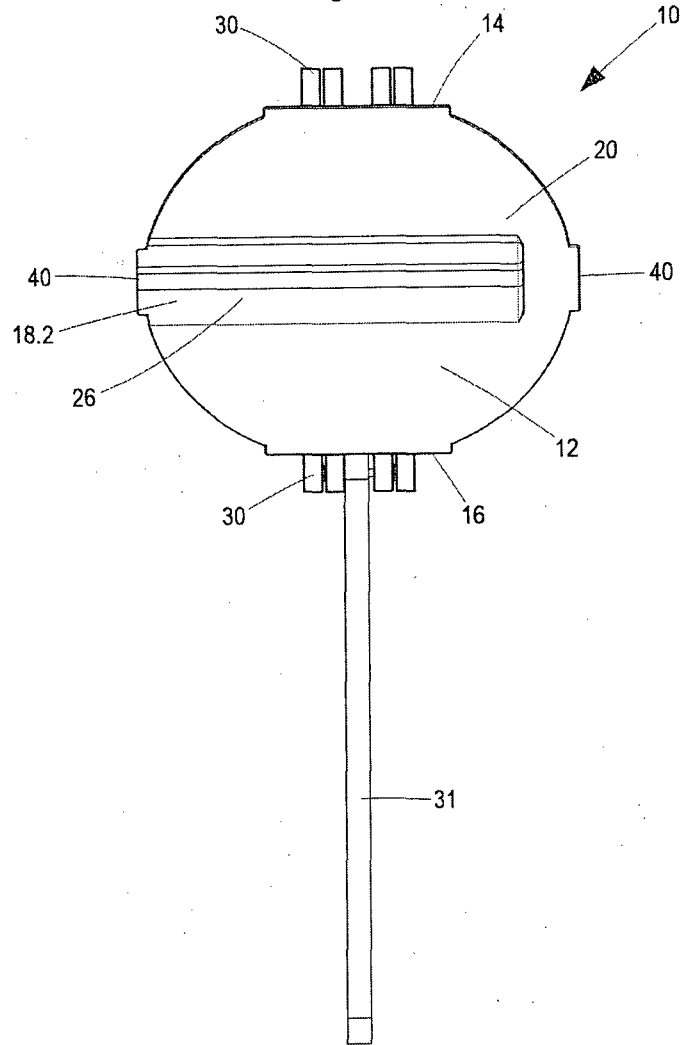


Figure 5

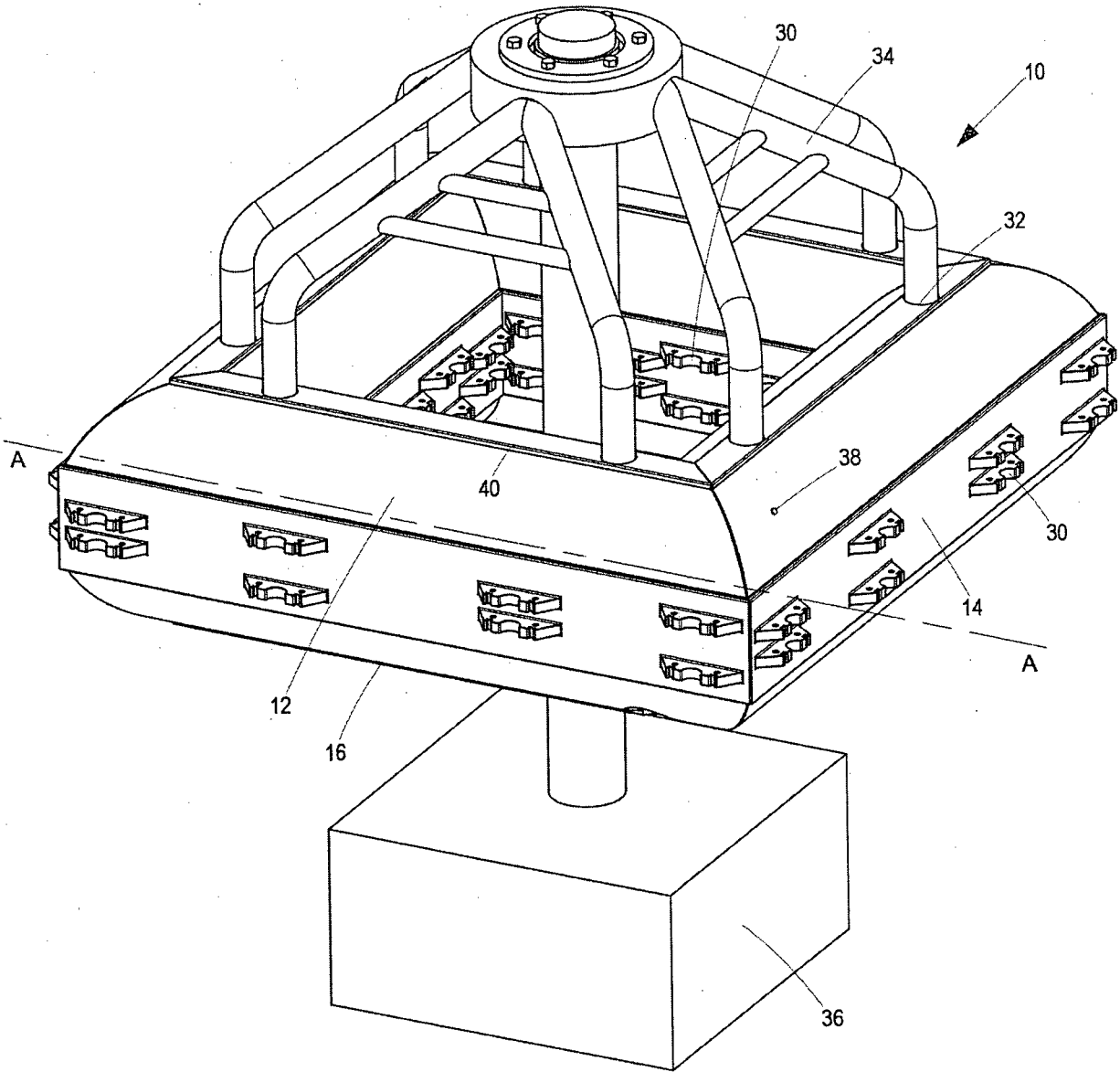


Figure 6

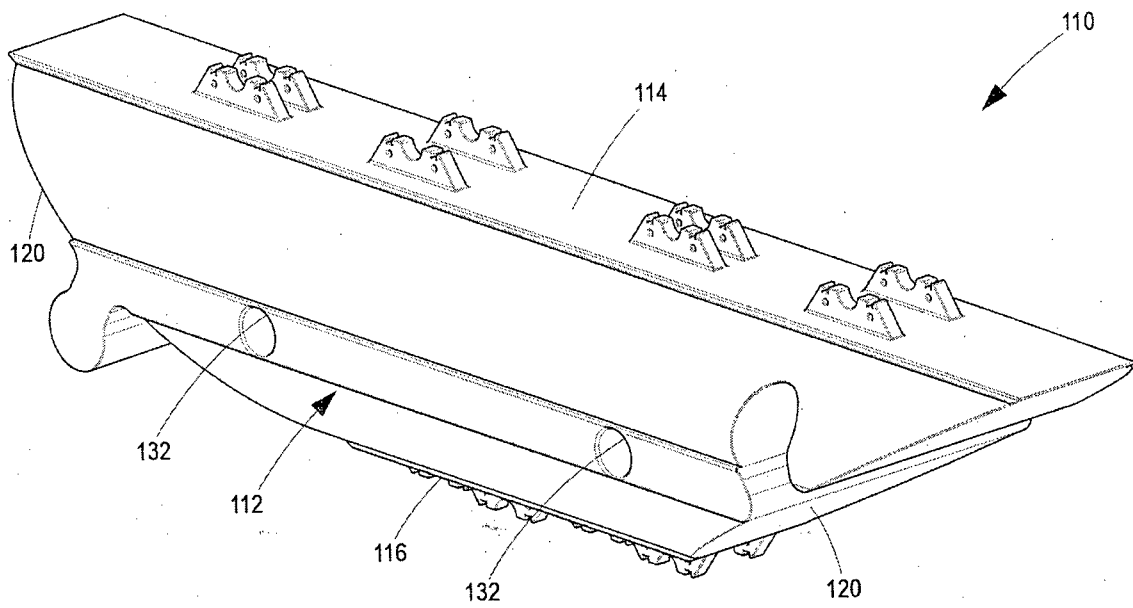


Figure 7

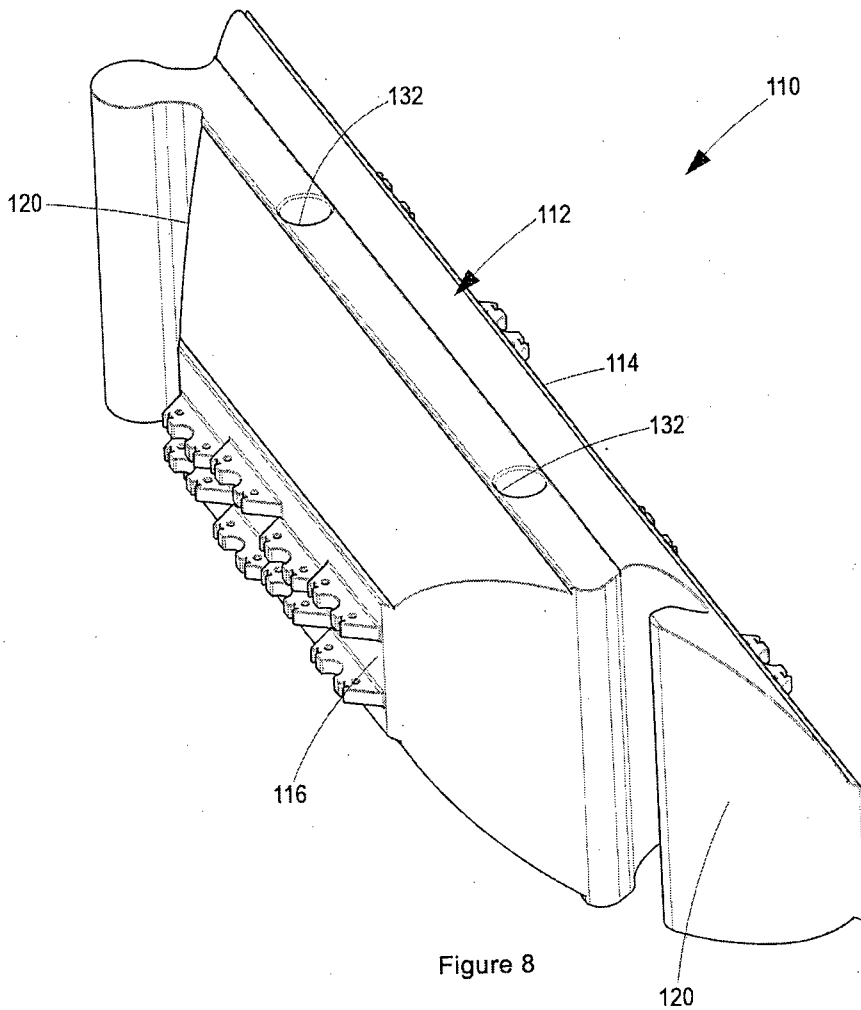


Figure 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT / ZA 2013/000085

A. CLASSIFICATION OF SUBJECT MATTER IPC: B63B 35/38 (2006.01); B29C 39/08 (2006.01) 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) B63B, B29C 39/08 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, FULLTEXT		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6381792 B1 (WOODFIN) 07 May 2002 (07.05.2002) Fig. 1, column 1 lines 21-28, column 3 lines 19-27, claim 1	1-3, 39
X	CN 102616341 A (INTELLIGENT NETWORK) 01 August 2012 (01.08.2012) Fig. 1-4, 6	1-3, 39
A	DE 1809928 A1 (LICENTIA GMBH) 11 June 1970 (11.06.1970) Fig. 1, 2, 4, 5, pages 8, 9	1-4
X	US 2012227653 A1 (WIDMER) 13 September 2012 (13.09.2012) Abstract	44
X	CN 2061926 U (SU GUOHUA) 12 September 1990 (12.09.1990) Fig., abstract	44
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance		"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
"E" earlier application or patent but published on or after the international filing date		"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		"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
"O" document referring to an oral disclosure, use, exhibition or other means		"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 29 January 2014 (29.01.2014)	Date of mailing of the international search report 03 February 2014 (03.02.2014)	
Name and mailing address of the ISA/AT Austrian Patent Office Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24-535	Authorized officer EHRENDORFER K. Telephone No. +43 / 1 / 534 24-367	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT / ZA 2013/000085

Patent document cited in search report			Patent family member(s)			Publication date
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CN	A	102616341	CN	A	102616341	2012-08-01
DE	A1	1809928	DE	A1	1809928	1970-06-11
US	A1	2012227653	US	A1	2012227653	2012-09-13
CN	U	2061926	CN	U	2061926	1990-09-12