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(71) Applicant: **Soletanche Freyssinet**
92500 Rueil-Malmaison (FR)

(72) Inventors:
- **LEBON, Jean-Daniel**
  78100 Saint Germain en Laye (FR)
- **LAURENT, Eric**
  91790 Boissy Sous Saint Yon (FR)

(74) Representative: **Nony**
11 rue Saint-Georges
75009 Paris (FR)

(54) FLOATABLE STRUCTURE AND METHOD OF MAKING SAME

(57) The present invention relates to a floatable structure (1), in particular a floatable platform (1), comprising:

- At least two separate hulls (10) each having a longitudinal axis (X), each hull comprising along the longitudinal axis a succession of hollow concrete segments (20).

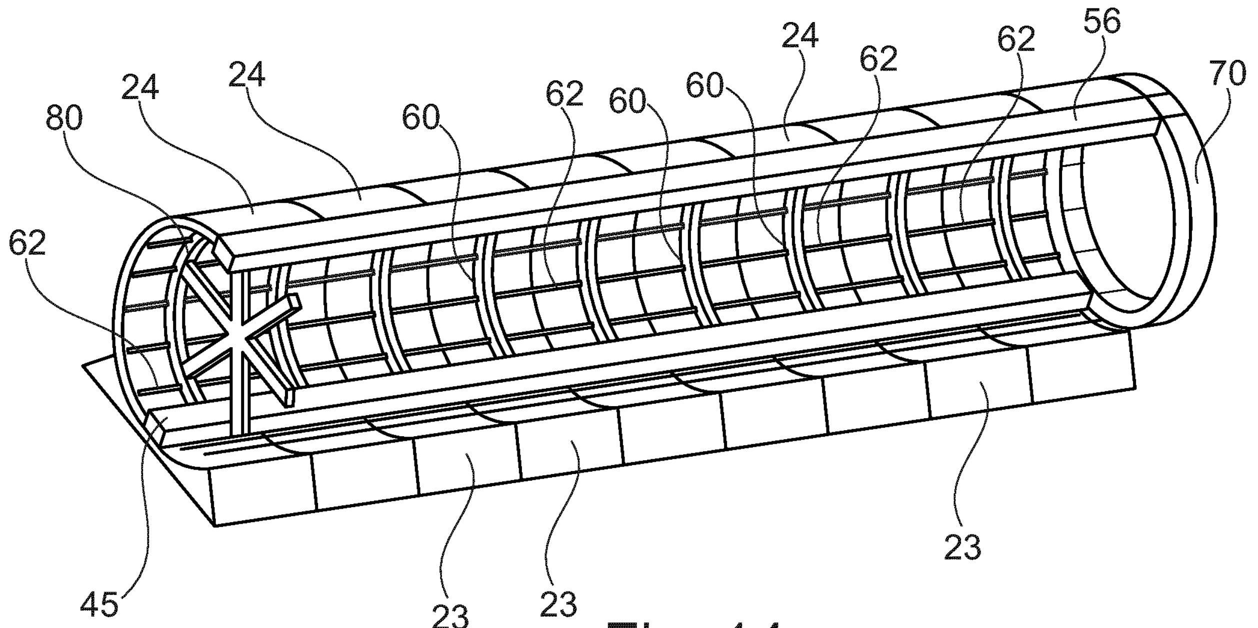

Fig. 14

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Description

[0001] The present invention relates to a floatable structure such as a floatable platform and a method of making same.

[0002] Marine floatable platforms for carrying various loads and made of reinforced concrete are known.

[0003] Some platforms of substantially parallelepipedal shape are made by casting concrete in a drydock. Such method offers no flexibility and the preparation of the drydock is quite time expensive.

[0004] It is also known to make floatable structures by assembling smaller elements of substantially parallelepipedal shape. These elements are relatively complex to make and heavy and difficult to manipulate if the dimensions of the platform are large.

[0005] US 3828708 discloses a pre-stressed concrete barge in which the hull is constructed from a plurality of modules which are longitudinally prestressed by tendons that are post-tensioned. Since the modules are cast as full-transverse cross-sectional elements, any change of the barge width requires the development of new cross-sectional elements. Furthermore, the elements become cumbersome and very heavy to manipulate if the barge is to have large dimensions.

[0006] There thus remains a need to facilitate the making of floatable structures suited for different applications and the invention aims at satisfying this need.

[0007] Exemplary embodiments of the invention relate to a floatable structure comprising at least two separate hulls each having a longitudinal axis, each hull comprising along the longitudinal axis a succession of hollow concrete segments.

[0008] The terms "separate hulls" mean that the hulls are adjacent but distant from each other and do not possess a partitioning wall in common. The hulls can thus be made independently of each other if one desires so. The longitudinal axes of the hulls are preferably parallel.

[0009] A floatable structure according to the invention is modular and easy to adapt to the load by varying the number of hulls and the number of segments of each hull. Each hull forms a hollow tubular body that provides buoyancy to the structure. Furthermore, as the hulls can be made separately, the segments do not extend along the full transverse cross section of the structure and remain easier to make than elements extending along the full transverse cross section of the structure as in some of the prior art discussed above. The invention thus renders easier to make structures of large dimensions, with hulls of height or diameter of 5m or more for example.

[0010] The length and/or width of the floatable structure may be greater than 20m or 50m.

[0011] The floatable structure preferably comprises a plurality of junction elements spaced along the longitudinal axis, each junction element connecting the two hulls together.

[0012] The junction elements act like spacers and make the hulls behave like a monolithic body.

[0013] Each junction element is preferably a cross beam element, i.e. comprises at least two beams that cross. This reduces weight while offering good mechanical stability to connect the hulls.

[0014] Each junction element preferably is made of concrete, preferably reinforced concrete, and comprises a pre-stressing layout. The junction element may comprise at least one passage for at least one tendon that is tensioned once the junction element is assembled to adjacent concrete segments of the hulls. Preferably, the junction element comprises a plurality of passages for a plurality of tendons that are tensioned once the junction element is assembled to the concrete segments of the hulls. The prestressing of the junction elements improves the resistance of the assembly and helps obtain a monolithic behavior.

[0015] Each junction element may connect each hull at two separate upper and lower locations. The upper location is preferably situated above mid-height of the segment, while the lower location is preferably situated below the mid-height of the segment.

[0016] Each junction element may comprise top and lower horizontal beams and diagonal beams connecting the top and lower horizontal beams. These beams preferably each comprise a pre-stressing layout and they all may integrate sheaths or ducts for the introduction of tendons.

[0017] Each junction element may be a one-piece element. In a variant, it may comprise at least two preformed assembled parts.

[0018] Each hollow segment preferably comprises two preformed elements that are connected. These elements are preferably half ring elements, preferably left and right elements but in a variant could be top and bottom elements. These elements can easily be made by an industrial plant in large numbers even for large structures. Each element may be a half ring element, but the cross-sectional profile of the elements may be other than semicircular, depending for example on hydrodynamic considerations. Preferably the elements are symmetrical, but if required by some hydrodynamic or other considerations, they may be dissymmetric.

[0019] The height of the left or right element may range from 4 to 32 m, and its width (i.e. dimension along the longitudinal axis of the hull) may range from 1 to 10 m. The outer radius of curvature of the half ring element may range from 2 to 16 m.

[0020] Preferably, most if not all of the left and right elements are identical or symmetrical. Preferably they are made of reinforced concrete, with rebar reinforcement cages.

[0021] The left and right elements have preferably matched cast transversal joints. They preferably comprise female and male complementary shear keys that contribute to properly position one element in contact with the adjacent one during the assembly operation, and this also increases shear resistance of each joint.

[0022] The interface between two consecutive left or right elements may be filled with a polymeric binder such as an epoxy-based resin.

[0023] Each hull may comprise at least one cast in situ longitudinal beam, preferably one lower and one top cast in situ beams. These beams are preferably made of pre-stressed reinforced concrete and provide more stiffness to the hulls. The beams may comprise rebar and may be pre-stressed with longitudinal tendons internal to the beams, that are post-tensioned after the concrete has set. The top longitudinal beam may also serve to connect the corresponding hull to a top slab, e.g. the deck of the platform. The longitudinal beams extend in gaps between the left and right elements. The elements of the segments preferably have rebar extending within the longitudinal beam(s).

[0024] Each hollow segment may comprise at least one pre-slab for casting the at least one cast in situ longitudinal beam, especially the top longitudinal beam.

[0025] Each hull comprises post-tensioned tendons extending from one longitudinal end of the hull to the opposite longitudinal end. These tendons apply an axial load to the segments.

[0026] Each hull is closed at opposite longitudinal ends, preferably with bulkheads.

[0027] Each hollow segment is preferably connected to a respective cradle, preferably by bolting. The cradle is useful when assembling the left and right elements of each hull as it maintains the elements in a predefined position, preferably vertical, and offers some wind resistance until the assembly is completed. Preferably, each cradle comprises a shoulder against which an end of the element abuts, which helps block the element in a given position. The cradles may be removed or not once the hulls are completed or when the platform has reached the launch site. The cradles may be configured to play an hydrodynamic role, for example to dampen structure oscillations in the sea, in which case the cradles remain advantageously permanently fixed on the corresponding hulls.

[0028] Each hollow segment may comprise at least one stiffening rib. This rib extends preferably along the left and right elements. The rib may be provided with openings for guiding tensioning tendons used for pre-stressing the hull.

[0029] Each hull may comprise at least one internal reinforcement member, such as a brace, diaphragm or ties, in particular radial ties. This reinforcement member may help prevent ovalization of the hull because of localized external load. The brace may have a star configuration and bear on stiffening ribs of the left and right elements.

[0030] The invention also provides a method for the construction of a floatable structure such as the one defined above, comprising at least two separate hulls, the method comprising assembling pre-formed concrete elements on respective cradles to form at least two adjacent segments successions, preferably left and right pre-formed elements.

[0031] The method may comprise installing junction elements between the at least two adjacent segments successions.

[0032] The method may further comprise casting in situ at least one longitudinal beam along each succession of segments, preferably a top longitudinal beam, more preferably a top longitudinal beam and a lower longitudinal beam.

[0033] Each pre-formed concrete element is preferably cast horizontally in a U configuration with the concavity of the U oriented upwards, then pivoted vertically by a quarter of turn ready for installing on the cradle, the transverse faces of the pre-formed concrete elements preferably being match cast on a long bench.

[0034] Preferably, the top and lower longitudinal beams are provided each with rebar and with sheaths or ducts for post-tensioned tendons.

[0035] The method may comprise installing pre-stressing tendons along the succession of segments. These tendons may be internal to wall of the segments or external to the wall of the segments. The tendons may go through ribs protruding on the internal surface of the hulls.

[0036] The method may comprise installing bulkheads at the ends of each succession of segments.

[0037] The method may comprise making a top structure such as a top slab, to which the hulls are connected, preferably with rebar extending within the concrete of the top slab and within the concrete of the hull, preferably the concrete of the top longitudinal beam.

[0038] The method may comprise installing pre-slabs on the hull segments before pouring the concrete to form the top longitudinal beam.

[0039] Preferably, the top slab is made of preformed pre-slabs which are submitted to pre-stressing as an axial load is applied to the hull hollow segments thanks to the tendons cited above.

[0040] The method may comprise pre-stressing the hulls by applying an axial load to the segments using post-tensioned tendons.

[0041] The method may comprise prestressing the junction elements. The method may comprise pouring or injecting in situ joint at the interface between the junction element and the adjacent segments and prestressing the junction element once the joint has hardened, the junction element preferably being a cross beam element. Preferably, inflatable seals are used at the interface of the junction element with the segments to define a volume where grout or other filler is poured or injected.

[0042] The drawings illustrate exemplary and non-limiting embodiments of the present invention. In the drawings:

- Figure 1 is perspective schematic view of a floatable platform according to the invention,
- Figures 2A to 2J illustrate various steps of making of the platform of figure 1,
- Figure 3 shows detail A of figure 2D,
- Figure 4 shows detail B of figure 2E,

- Figure 5 shows detail C of Figure 2H,
- Figure 6 shows detail D of Figure 2J,
- Figure 7 is a front view of the floatable body,
- Figure 8 is a front view of a half ring element,
- Figure 9 is a front view of the half ring element assembled to the cradle,
- Figure 10 shows detail E of Figure 9,
- Figure 11 shows detail F of Figure 9,
- Figure 12 is a front view of a cross beam element,
- Figure 13 is a front view of an internal brace,
- Figure 14 is a partial perspective view of a hull of the floatable body,
- Figure 15 is a perspective view in isolation of a half ring element,
- Figure 16 is a perspective view in isolation of a cradle,
- Figure 17 is a perspective view in isolation of a cross-beam element,
- Figure 18 is a perspective view in isolation of a slab element,
- Figure 19 is a perspective view in isolation of a bulkhead,
- Figure 20 is a view analogous to Figure 1 of a variant embodiment of the platform, and
- Figure 21 illustrates in a partial and schematic manner the interlocking of shear keys at the interface of two consecutive half ring elements.

[0043] The floatable structure 1 shown in Figure 1 is a platform comprising a top structure such as a top slab 2 and a floatable body 3 supporting the top slab 2.

[0044] The floatable body 3 comprises two hulls 10 each extending along a longitudinal axis X, the longitudinal axes of the hulls 10 being parallel in the example shown.

[0045] Each hull 10 comprises a succession of hollow segments 20 extending along the longitudinal axis X, and each hull is closed by bulkheads 70 at its longitudinal ends.

[0046] Each hollow segment 20 is in the example shown a ring segment of substantially circular outline, attached to a respective cradle 23.

[0047] Further structural details of the floatable platform 1 will become apparent when reading the description below of a method of making the platform 1, with reference to Figures 2A to 2K.

[0048] To manufacture a hull 10, one starts to position a few cradles 23 in line on a construction slab (not apparent) as shown in Figure 2A. The cradles 23 are laid on a supporting structure lying above ground level at the assembly zone, as the completed platform will need to be transported to a launch site by any appropriate transportation equipment such as a tracked trolley or Self-Propelled Modular Transporter (SPMT) or similar equipment.

[0049] The cradles 23 are laid one next to the other with some axial spacing to allow the necessary movement of the adjacent ring segments 20 when they are assembled longitudinally. Any remaining gap between adjacent cradles 23 after assembly of the ring segments 20 is completed may be filled with any appropriate filler such as concrete.

[0050] The half ring elements 24 are fixed on the cradles 23 using bolts (not shown), introduced into openings 25 of the cradles 23 as shown in Figures 9 and 11.

[0051] Each cradle 23 comprises a top concave surface of shape complementary to the elements 24, with a central boss 26 as shown in Figure 10. The boss 26 defines opposite shoulders 27 against which respective lower ends of corresponding half ring elements 24 abuts, thus blocking these in rotation.

[0052] Each half ring element 24 may be hoisted down onto the corresponding cradle 23, and the bolting of the element on this cradle preferably takes place before the element is detached from the hoist. The cooperation between the element 24 and the cradle 23 ensures the element 24 remains stable and withstands any transverse wind load that may occur on the construction site (if the assembly takes place outdoors).

[0053] Figure 2B shows left and right half ring elements 24 lying on a respective cradle 23.

[0054] Since the floatable body 3 comprises two hulls 10, two successions of segments 23 are assembled, as shown in Figure 2C, side by side.

[0055] Adjacent half ring elements 24 are preferably match cast and comprise on their axial end surfaces (i.e. faces transverse to longitudinal axis X) complementary male 24a and female 24b shear keys as shown in Figure 21.

[0056] The elements 24 may be cast in a U configuration as shown in Figure 8, with the concavity of the U facing upwards. The elements 24 may be cast along a long bench. During manufacture of the elements 24, the end of the formwork used to cast an element 24 may be vertical and be constituted by the end face of another element 24 previously cast. In this way the elements 24 are match cast, which allows to easily obtain interlocking shapes at the interface of adjacent elements.

[0057] After casting, the formwork is removed, and the elements may be pivoted about a quarter of a turn to reach a vertical configuration ready for installation on a respective cradle. This facilitates the handling of the elements and their installation on the cradles, as the elements may be heavy and bulky.

[0058] The contact surfaces of adjacent half ring elements 24 are coated with a binder 100 such as a polymer resin, e.g. an epoxy-based resin, before the elements 24 are brought together. Provisional longitudinal pre-stressing is advantageously applied to the elements 24 under assembly to ensure a good repartition of the binder at the interface of the elements 24 during polymerization of the binder and avoid any undesirable relative move of the elements 24.

[0059] Junction elements 30 are installed between the adjacent successions of ring segments 20 as shown in Figure 2D.

[0060] Each junction element 30 is preferably a cross beam element 30 comprising, as shown in Figure 12, a top beam 31 and a lower beam 32 connected by two diagonal beams 33 that cross in their middle. The beams 33 may be perpendicular to each other as in the shown example.

[0061] Top and lower beams 31 have ends 34 of a concave shape configured to substantially match the outer surface of the adjacent half ring elements 24.

[0062] The junction element 30 also comprises sheaths or ducts 36 extending internally along each beam 31, 32 or 33 for the introduction of tensioning tendons (not shown).

[0063] The junction elements 30 are preformed reinforced concrete elements that are installed using temporary stability components.

[0064] If the junction elements 30 are one-piece elements, they may be inserted horizontally between the hulls 10 with a corresponding trolley moving longitudinally between the hulls and erected once they reach their destination.

[0065] If the junction elements are made of multiple parts, some parts may be installed before the others. For example, if the junction element comprises a lower part and an upper part, the lower part is preferably installed before the corresponding half ring elements 24 are installed on their respective cradles 23.

[0066] The ends of the junction element 30 that are close to the half ring elements 24 may be provided with inflatable seals (not shown) that are inflated to fill the gap between the junction element and the adjacent half ring elements to define a cavity for pouring or injecting a joint such as grout. The use of inflatable seals avoids the need to access from above to the interface of the junction element with the half ring element. The presence of the inflatable seals may thus render the making of the joint easier.

[0067] The sheaths of the junction element may be extended into the segments. This operation may be achieved from the inside of the hull.

[0068] Once the joint has hardened at the interface of the junction element 30 with the adjacent half ring elements 24, the junction element 30 is ready for pre-stressing by post-tensioning corresponding tendons introduced in the sheaths or ducts.

[0069] The steps described above relating to the installation of the half ring elements 24 and junction elements 30 are repeated until the segment erection is complete for each hull 10, as shown in Figures 2E and 2F.

[0070] During the erection of segments 20, concrete pre-slabs 50 are inserted between the upper ends of the half ring elements 24, as shown in Figure 4.

[0071] Each half ring element 24 comprises for this purpose at its upper end a fallen edge 52, provided with a pre-slab bearing 53, as shown in Figure 8.

[0072] The pre-slabs 50 define, together with the fallen edges 52, a longitudinal channel 55 that acts as a formwork. The pre-slabs avoid the need to use other formwork tools.

[0073] The segment rings 20 define a longitudinal channel 40 at their base. The bottom of the channel 40 is defined by the cradles 23. The bottom end of each half ring element 24 comprises a raised edge 42. The channel 40 extends between these raised edges 42 and acts as a formwork.

[0074] The elements 24 preferably have rebar (not shown) extending in the channels 40 and 55 to improve the connection with the corresponding longitudinal beams that are cast in these channels.

[0075] Appropriate rebar is installed in the channels 40 and 55, together with longitudinal sheaths for tendons intended to provide pre-stressing.

[0076] A longitudinal lower beam 45 is cast in situ in the channel 40, as shown in Figures 2H and 5. A longitudinal top beam 56 is cast in situ in the channel 55, as shown in Figure 21.

[0077] Each half ring element 24 comprises a stiffening rib 60 extending along its inner surface along a median plane, between the raised edge 42 and the fallen edge 55, as can be seen in Figure 6.

[0078] This rib 60 may be provided with openings 61 for the installation of longitudinal sheaths along the internal surface of each hull 10, for the introduction of external post-tensioning tendons.

[0079] For these external post-tensioning tendons, the sheaths that are installed are preferably HDPE sheaths with electro-weldable sleeves at their ends to ensure good sealing of the sheaths.

[0080] Once the hulls are ready to be closed at their longitudinal ends, reinforced concrete bulkheads 70 are installed into the end ring segments 20, as shown in Figure 6.

[0081] The prestressing of the junction elements 30, typically made with internal post-tensioning tendons, occurs before the bulkheads 70 are installed. The tendons extending within the various beams of the junction elements 30 are tensioned. The tensioning of these tendons will cause the hulls 10 to behave like a monolithic structure.

[0082] The bulkheads 70 may be one-piece elements, as shown, or may be made of multiple parts if the weight of the bulkhead exceeds the capacity of the available hoisting equipment.

[0083] As for the interface of adjacent ring segments, the contact faces between the bulkhead and the adjacent ring segment are coated with a binder such as epoxy-based resin, after the continuity into the bulkheads 70 of the tendon sheaths extending within the longitudinal beams and through the ring segments stiffening ribs has been completed.

[0084] After bulkheads 70 are installed, the tendons are threaded in the corresponding longitudinal sheaths from outside the hull 10.

[0085] The top slab 2 is preferably assembled to the ring segments 20 after completion of the hulls 10 as shown in Figure 2K.

[0086] The top slab 2 may be made of pre-slabs and other preformed elements. The components of the top slab 2 are connected to the hulls by reinforced concrete connections.

[0087] The top slab 2 is intended to carry various equipment (for example hoisting equipment, accommodations, storage tanks, plant processing equipment...) depending the intended use.

[0088] Each hull 10 may comprise rebar (not shown) that extends within concrete parts of the top slab 2 that are cast in situ. This rebar may extend also into the concrete of the top longitudinal beam 56 of the hull.

[0089] The tendons extending within sheaths 62 and those (not shown) extending within the longitudinal beams 45 and 56 are tensioned to induce an axial load and corresponding pre-stressing into the succession of ring segments 20 and longitudinal beams 45 and 56.

[0090] The tensioning of the tendons is preferably coordinated with the making of the top slab 2 so that the tensioning of the tendons induces also some pre-stressing into the top slab 2.

[0091] After the tensioning of the tendons is completed, grout or other filler may be injected into the corresponding sheaths. In a variant, the filler is introduced before post-tensioning, by using unbounded prestressing tendons such as individually HDPE coated and greased strands.

[0092] If needed, one or more internal braces 80 or any other reinforcement member such as diaphragms or ties, are inserted in one or more ring segments 20 before bulkheads 70 are installed, as shown in Figure 14, to prevent ovalization due to localized loads on the top slab 2. The one or more internal reinforcement members 80 are fixed inside the hull at one or more axial positions where the external load is expected or at the location(s) of the junction element(s).

[0093] Each reinforcement member 80 may exhibit a star configuration, with radial beams 82 as shown in Figure 13. The beams 82 may be provided at their outer ends with flanges 84 for their fixation on corresponding ribs 60 by bolting or otherwise.

[0094] Once the structure 1 is fully equipped, it may be transferred to the launch site where it is put in water and the construction site may be re-used to make the next structure 1.

[0095] The invention is not limited to the example described above.

[0096] Various modifications may be brought to the structure 1.

[0097] The platform 1 is not limited to a given number of hulls 10 and may comprise three or more parallel hulls as shown in Figure 20.

[0098] At least two separate hulls may be positioned in succession in the longitudinal direction of the platform 1. The longitudinal axes of the hulls may not be parallel. For example, the platform comprises four or more hulls having longitudinal axes oriented in a diamond or star configuration. This may involve the use of junction elements of different shapes and sizes.

[0099] Each hull may be provided with extra components. For example, an inspection door may be provided in the upper part of each hull.

[0100] Each hull may be provided with a liner to help prevent ingress of water.

[0101] Each hull may be provided with at least one internal wall to define at least two sealed compartments in the hull and help render the latter unsinkable in case of damage.

[0102] Upright reinforced concrete beams may connect the top longitudinal beam to the lower longitudinal beam to improve mechanical resistance and withstanding of vertical loads. These upright beams may be preformed and installed in the segments before the longitudinal beams are cast. These upright beams may comprise rebar extending within the concrete of the longitudinal beams. The upright beams may comprise rebar that extends within the concrete of the top slab. The upright beams may be pre-stressed thanks to post-tensioned tendons extending therethrough and possibly also through the top slab 2.

[0103] Ends of the post-tensioned tendons may be anchored against surfaces of the hulls in various manners, with the use of anchoring plates or other anchoring components such as embedded anchor heads with trumpet shape if needed.

[0104] The tendons used in the construction of the hulls are preferably high tensile strength steel cables made of individual units called strands. The tendons used for pre-stressing the hulls 10 may be of the type T15.7 strands with fGUTS=1860MPa, with a 150mm^2 section area that is a 279 kN FGUTS (guaranteed ultimate tensile strength).

[0105] In case of unbounded tendons, when injecting cement grout or other filler in the cable sheath or duct before tensioning, the tendons are preferably individually sheathed with plastic material such as HDPE and lubricated (greased) within each individual sheath to insure unbounding with a low friction coefficient.

[0106] When required, the above-mentioned provisional tensioning may be achieved using bars (not shown) introduced into corresponding passages. These bars may have threaded ends to enable to couple bars one in line with the others to accommodate for the increase of length when the number of assembled segments become higher.

[0107] The left and right elements 24 and/or other concrete components of the hulls are preferably made of High-Performance Concrete (HPC). The concrete used for making these elements or components has a compressive strength of better than 30 MPa, preferably better than 60 MPa, and more preferably of 90 MPa or better.

[0108] Pre-stressing of the hull may also be achieved through internal tendons, extending within the thickness of the wall of the segments. In such case, left and right elements may be cast with corresponding sheaths, typically made of corrugated metallic ducts, and these ducts are connected in waterproof manner when the elements are assembled.

[0109] The left and right elements of the segments may be replaced by top and bottom elements or by any other elements dividing the segments in sectors, with same features as described above.

Claims

1. A floatable structure (1), in particular a floatable platform (1), comprising:

   - At least two separate hulls (10) each having a longitudinal axis (X), each hull comprising along the longitudinal axis a succession of hollow concrete segments (20).

2. The structure of claim 1, comprising a plurality of junction elements (30) spaced along the longitudinal axis (X), each junction element connecting the two hulls together the junction element(s) (30) preferably being cross-beam element(s).

3. The structure of claim 2, the or each cross-beam element comprising top (31) and lower (32) horizontal beams and diagonal beams (33) connecting the top and lower horizontal beams, these beams preferably comprising a pre-stressing layout

4. The structure of any one of claims 1 to 3, each hollow segment comprising two preformed elements (24) that are connected, preferably half ring elements, more preferably symmetrical half ring elements (24), even more preferably symmetrical left and right half ring elements (24) .

5. The structure of any one of claims 1 to 4, each hull (10) comprising at least one cast in situ longitudinal beam (45; 56), preferably one lower and one top cast in situ beams.

6. The structure of claim 5, each hollow segment (20) comprising at least one pre-slab (50) for casting the at least one cast in situ longitudinal beam.

7. The structure of any one of claims 1 to 5, each hull (10) comprising post-tensioned tendons extending from one longitudinal end of the hull to the opposite longitudinal end.

8. The structure of any one of claims 1 to 7, each hull (10) being closed by bulkheads (70) at opposite longitudinal ends of the hull.

9. The structure of any one of claims 1 to 8, each hollow segment (20) being connected to a respective cradle (23), preferably by bolting, each cradle (23) preferably comprising a shoulder (27) against which an end of the element (24) as defined in claim 4 abuts.

10. The structure of any one of claims 1 to 9, each hollow segment (20) comprising at least one stiffening rib (60).

11. The structure of any one of claims 1 to 10, each hull (10) comprising at least one internal reinforcement member (80), the internal reinforcement member (80) preferably bearing on the at least one stiffening rib (60).

12. A method for the construction of a floatable structure (1), in particular a floatable structure such as the one defined in any one of the preceding claims, the floatable structure (1) comprising at least two separate hulls (10), the method comprising:

    a)Assembling pre-formed concrete elements (24) on respective cradles (23) to form at least two adjacent segments successions, preferably left and right pre-formed concrete elements (24),
    b)installing junction elements (30) between the at least two adjacent segments successions,
    c)casting in situ at least one longitudinal beam (45; 56) along each succession of segments, preferably a top longitudinal beam, more preferably a top longitudinal beam (56) and a lower longitudinal beam (45).

13. The method of claim 12, comprising installing pre-slabs (50) on the segments before pouring concrete to form the top longitudinal beam (56).

14. The method of claim 12 or 13, comprising pouring in situ joint between the junction element (30) and the adjacent elements and prestressing the junction element (30) once the joint has hardened, the junction element (30) preferably being a cross beam element.

15. The method of any one of claims 12 to 14, each pre-formed concrete element (24) being cast horizontally in a U configuration with the concavity of the U oriented upwards, then pivoted vertically by a quarter of turn ready for installing on the cradle, the transverse faces of the pre-formed concrete elements (24) preferably being match cast on a long bench.

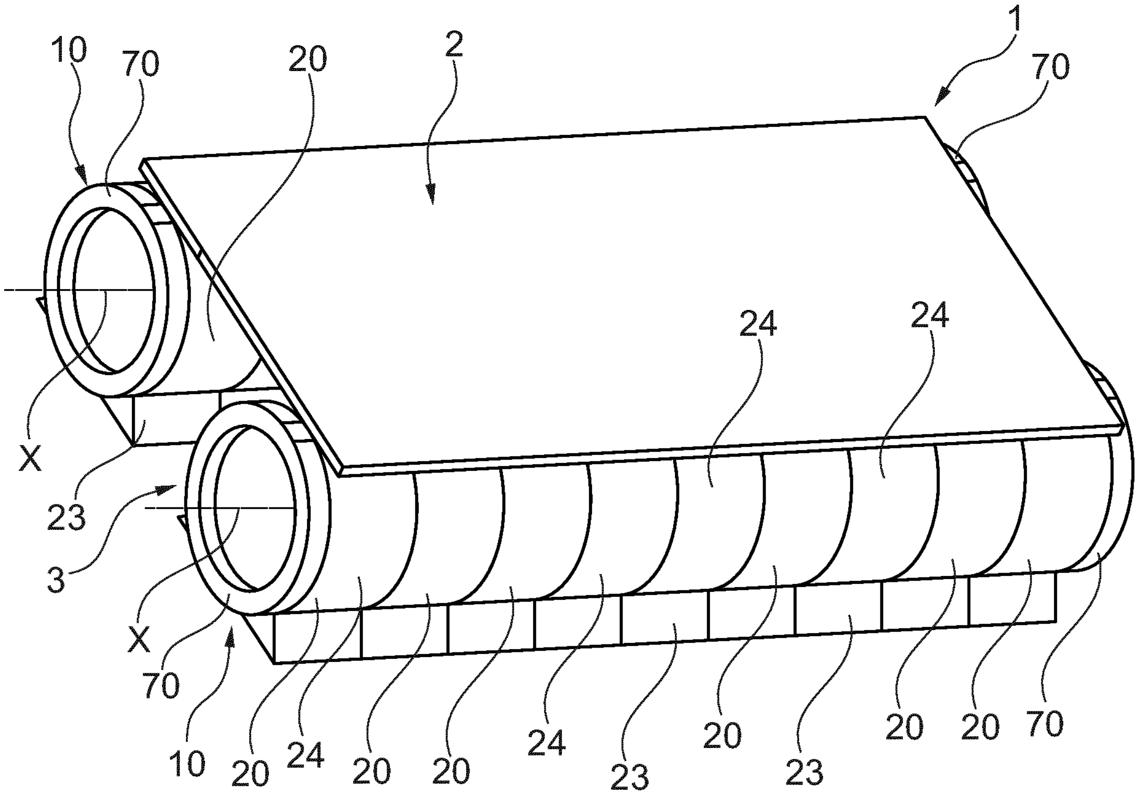
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Fig. 1

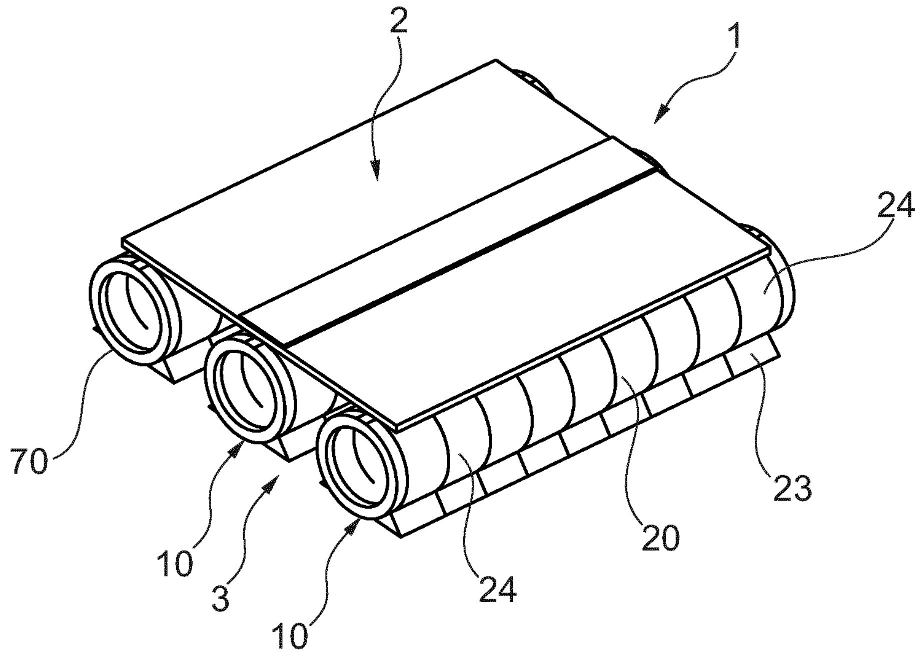
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Fig. 20

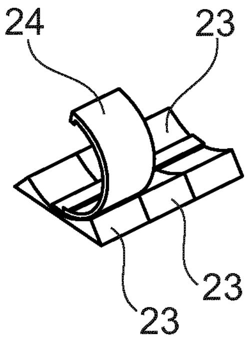


Fig. 2A

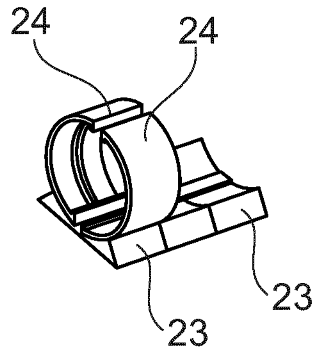
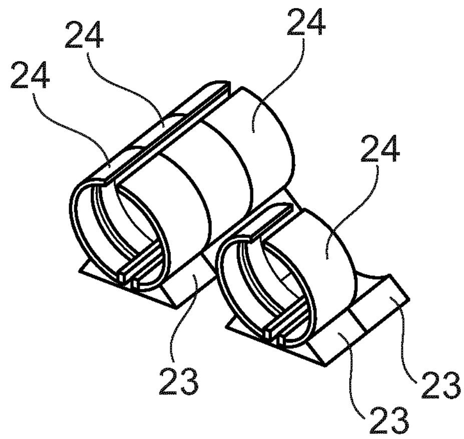


Fig. 2B



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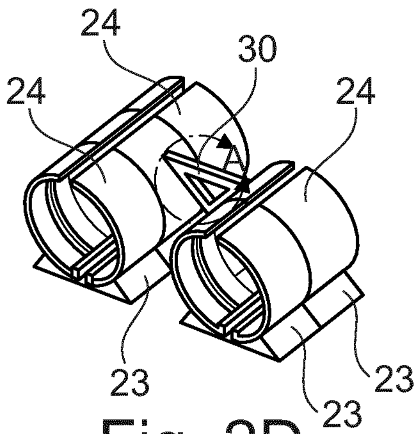

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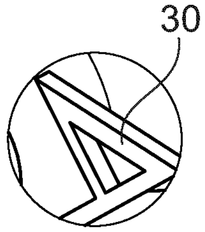

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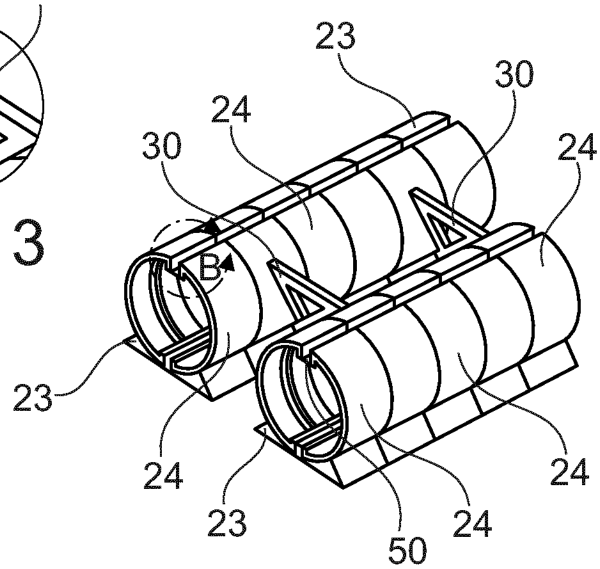
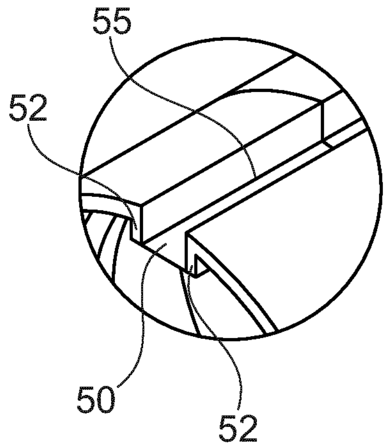


Fig. 2E



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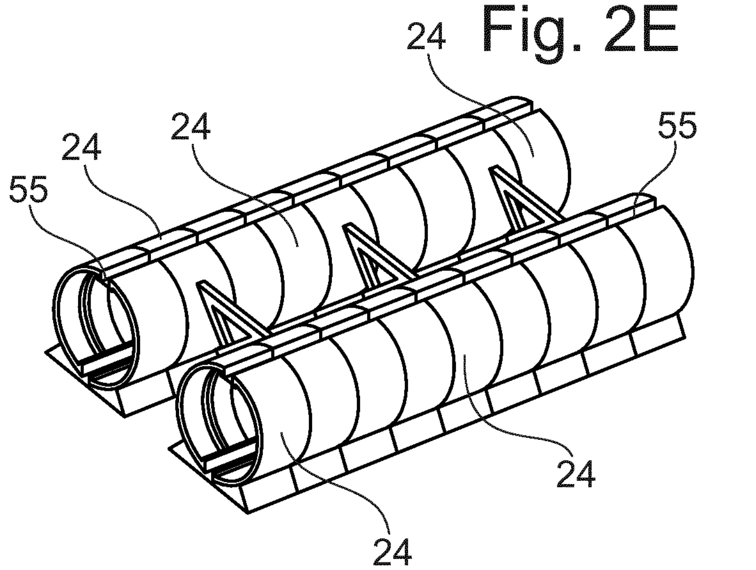


Fig. 2F

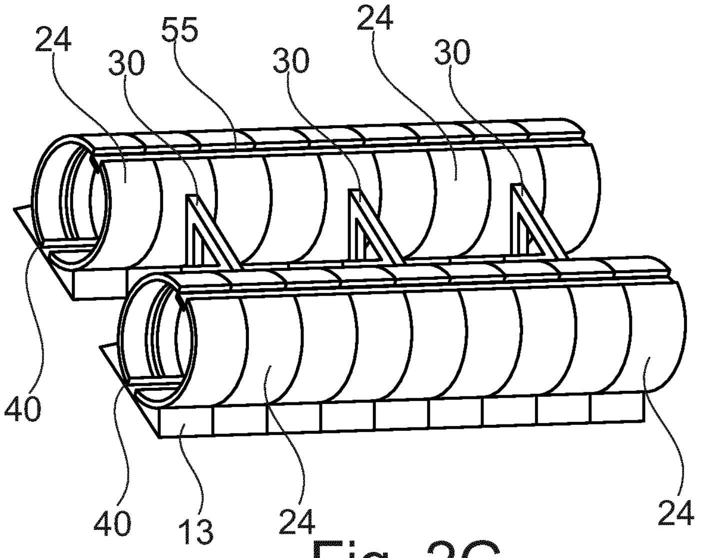
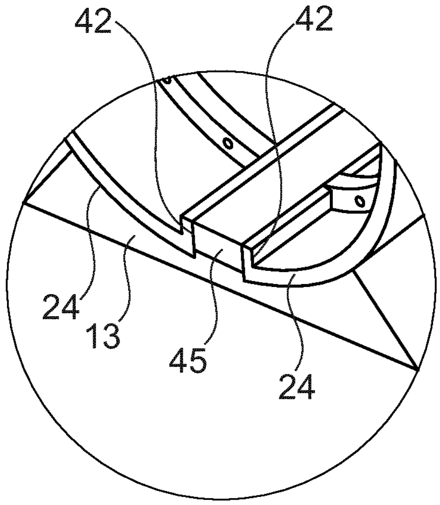


Fig. 2G



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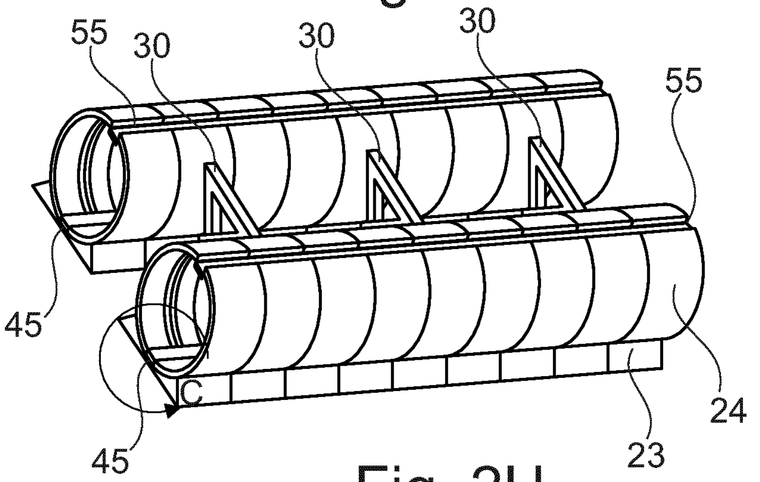


Fig. 2H

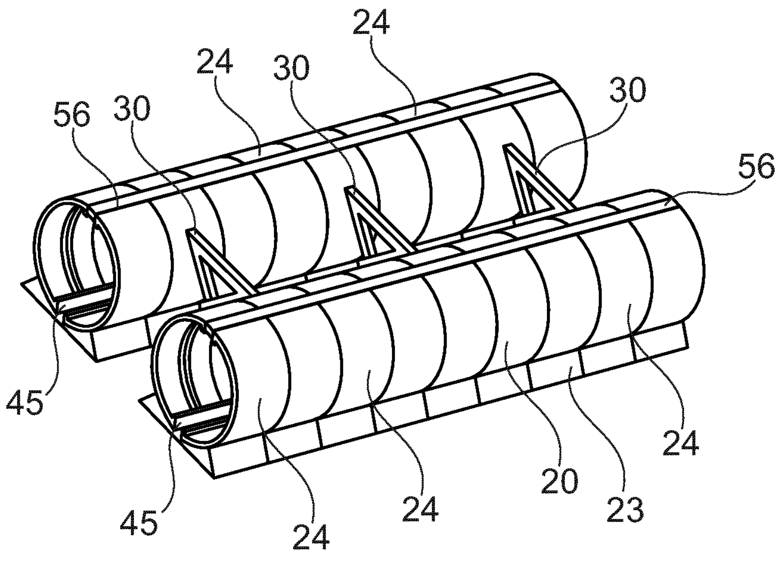
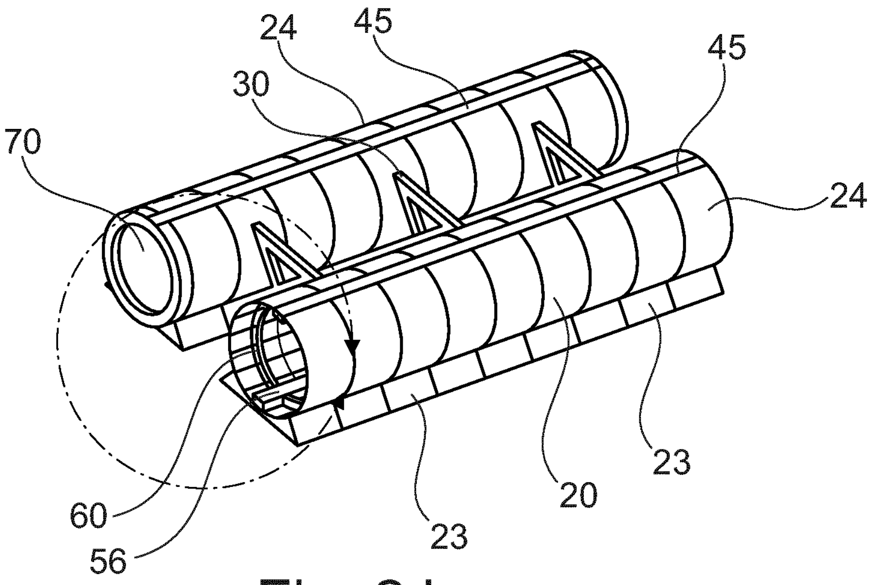


Fig. 2I



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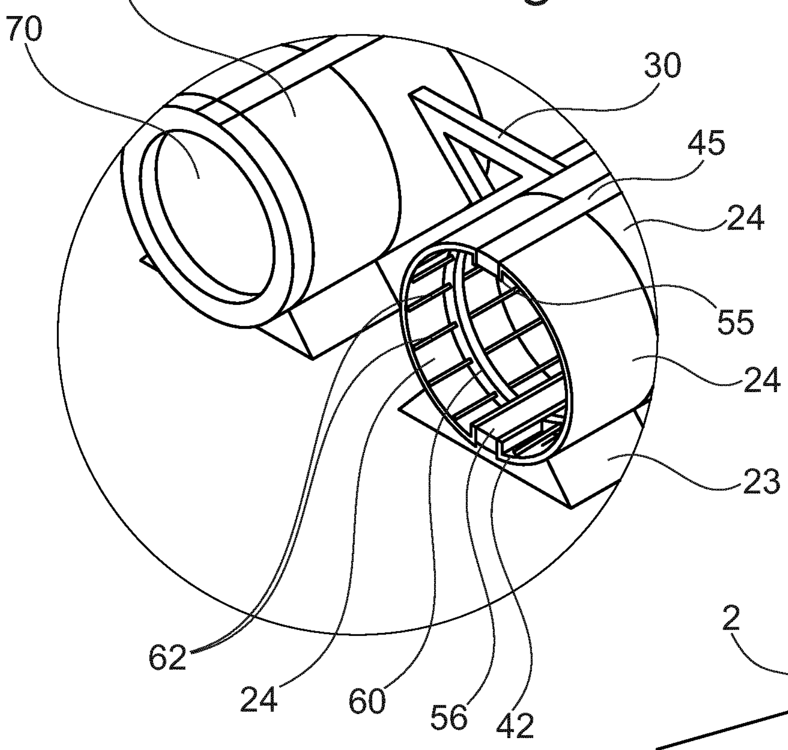

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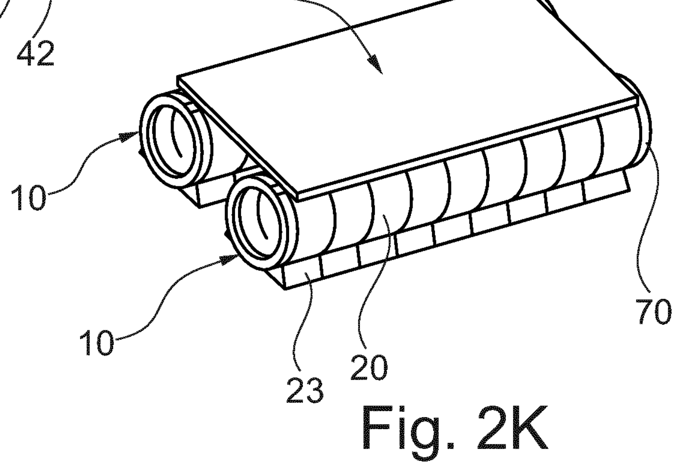
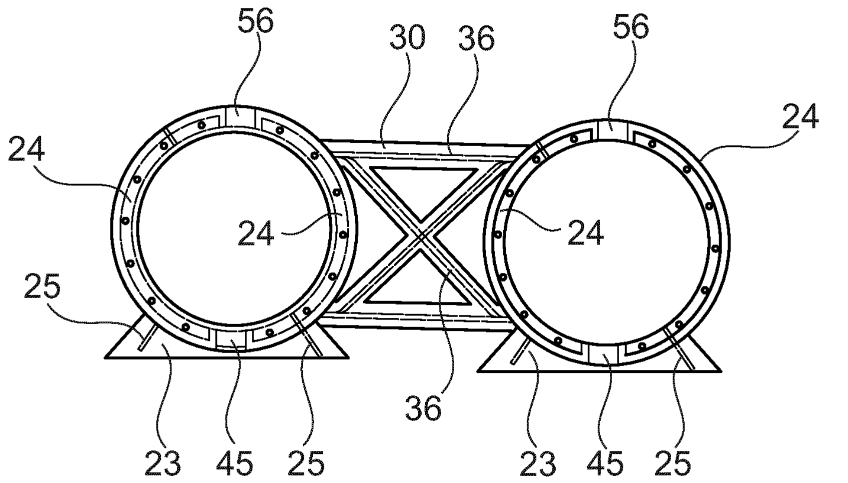


Fig. 2K



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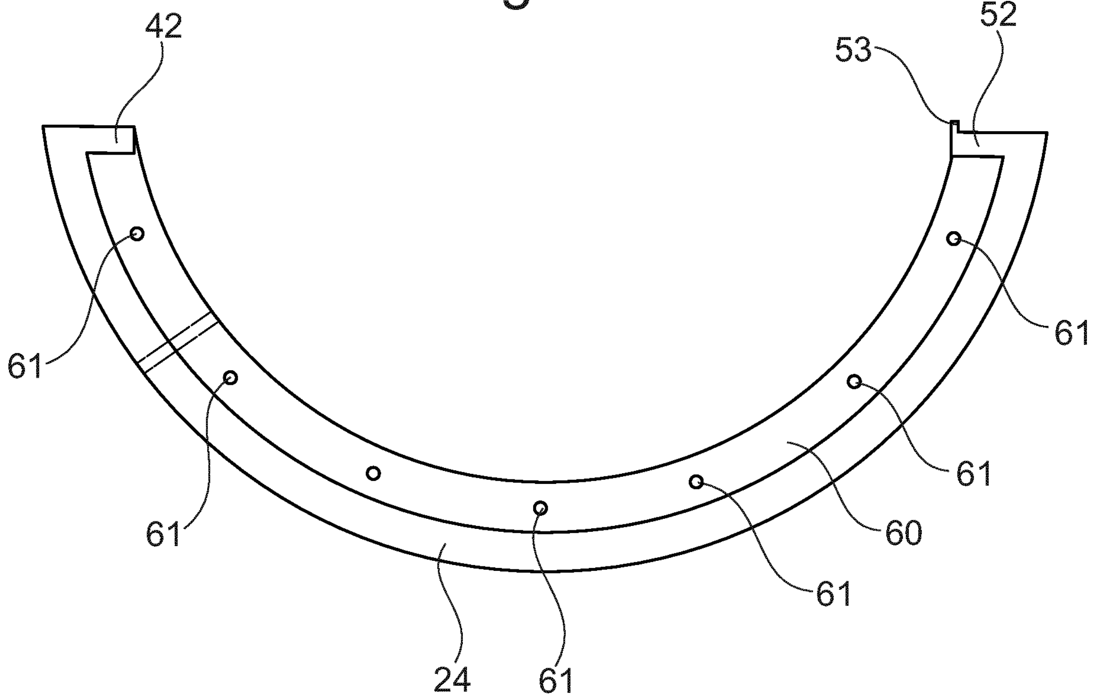

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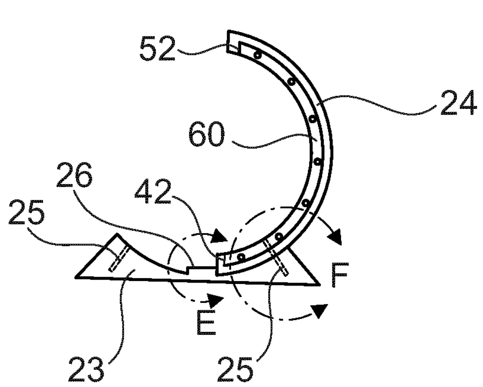

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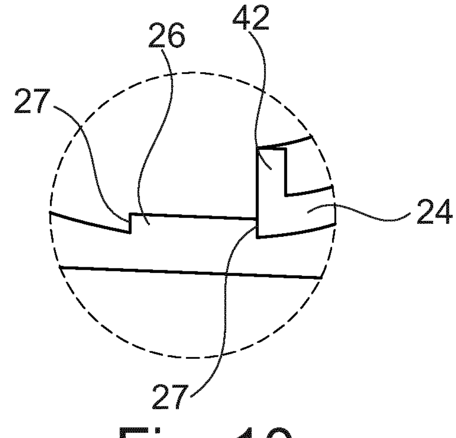

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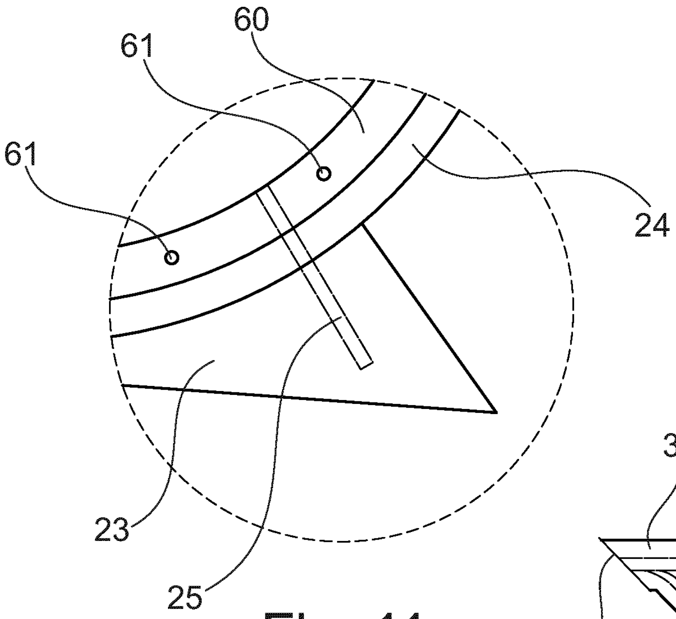

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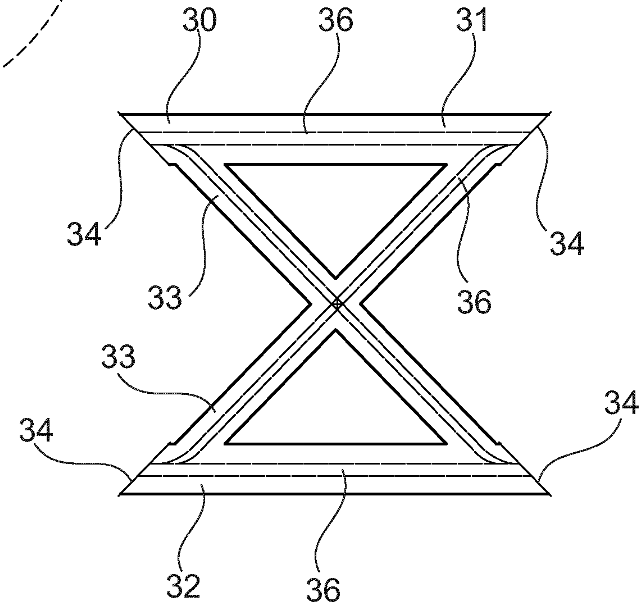

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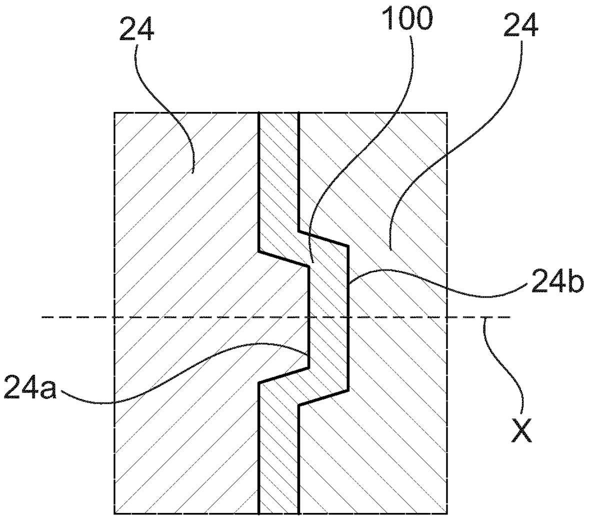


Fig. 21

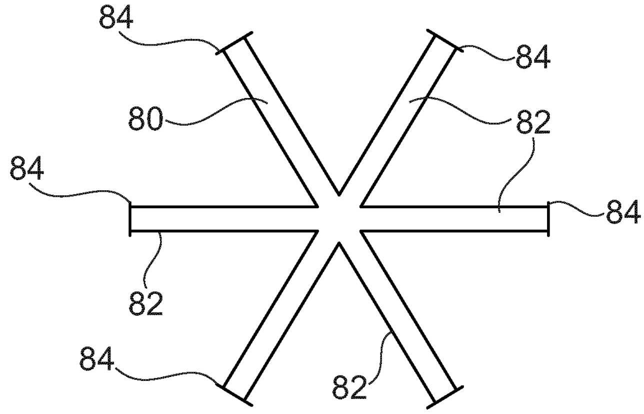


Fig. 13

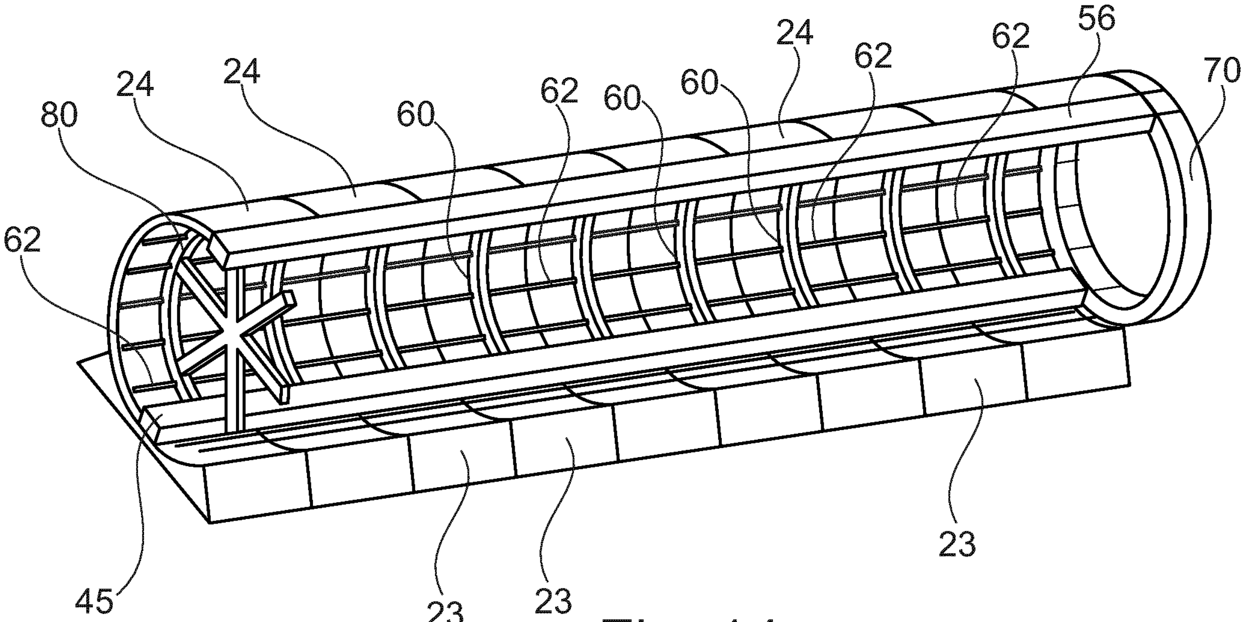


Fig. 14

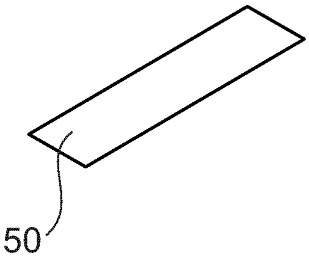
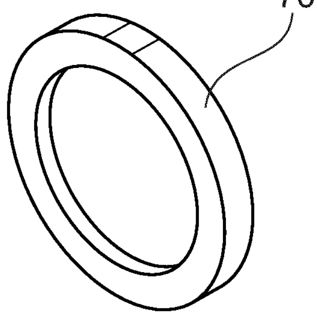


Fig. 18



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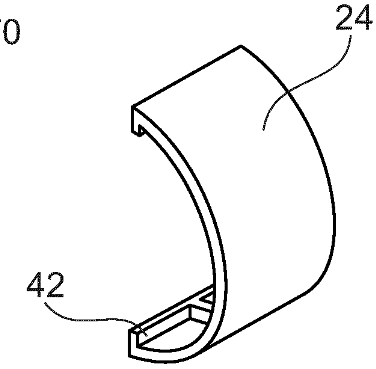

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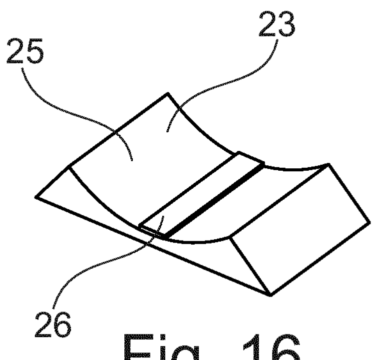

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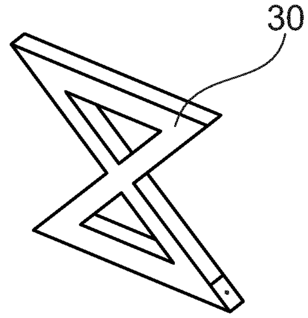

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 19 30 5410

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	FR 2 043 982 A5 (MARSEILLE GRANDS TRAVAUX) 19 February 1971 (1971-02-19) * page 1, line 1 - page 3, line 22 * * figure 1 *	1-5,8, 10,11 7	INV. B65D88/78 B63B35/34 B63B1/12 E04H7/20 ADD. B63B35/44
Y A	GB 1 232 097 A (J. H. POMEROY & CO. INC.) 19 May 1971 (1971-05-19) * page 2, left-hand column, line 33 - right-hand column, line 87 * * figure 4 *	7 1	
X A	DE 202 07 585 U1 (CLEMENT JUERGEN [DE]) 5 September 2002 (2002-09-05) * page 2, line 5 - line 50 * * figures 1, 4 *	12-15 5,6	
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A	US 3 280 525 A (CROWLEY FRANCIS X) 25 October 1966 (1966-10-25) * line 35, paragraph 2 - line 49 * * figure 1 *	6	E04H B63B B65D F17C

The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
The Hague	23 August 2019	Lindemann, Ruben

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