Oct. 3, 1967 A. ZIERMANN 3,344,764

FLOATING BODY

Filed May 3, 1965 2 Sheets-Sheet 1

FIG. 1

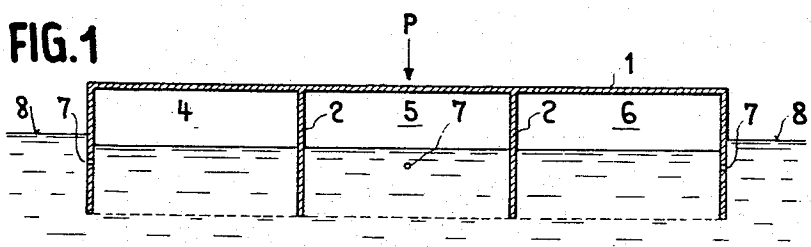


FIG. 2

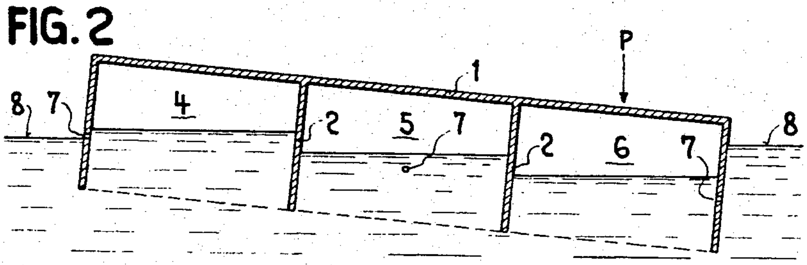
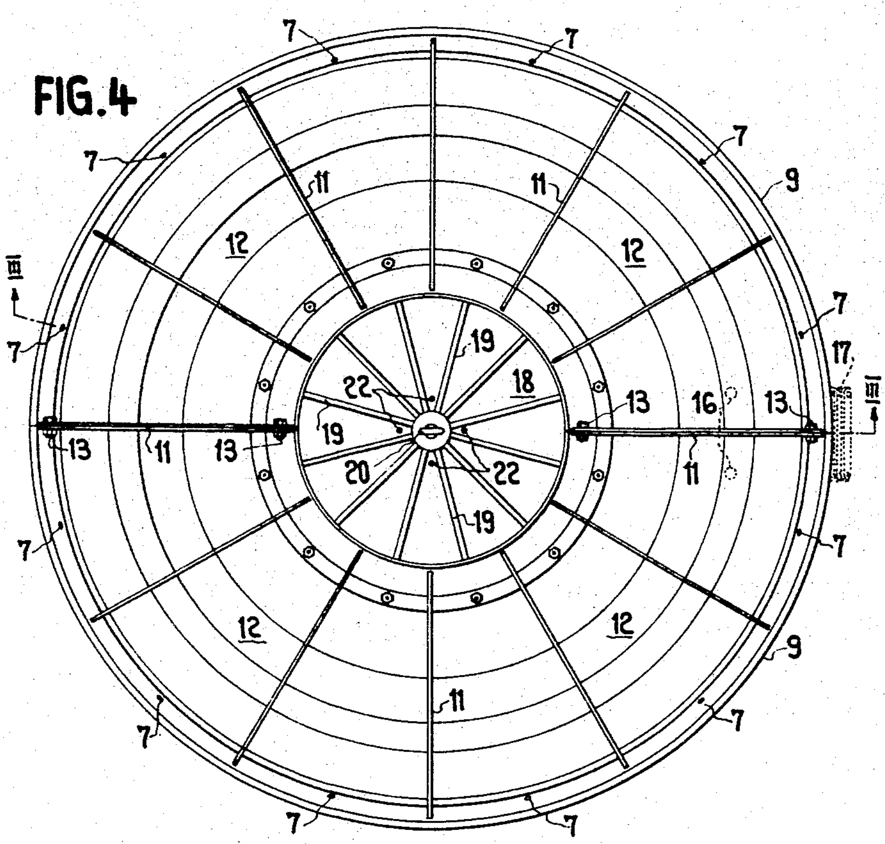


FIG. 4



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FLOATING BODY

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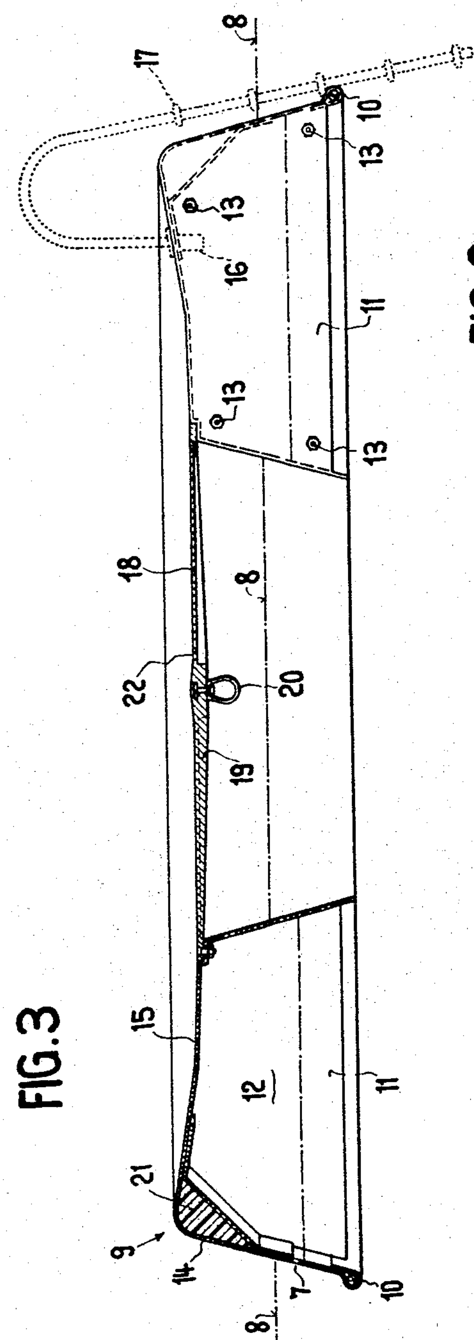

FIG.3

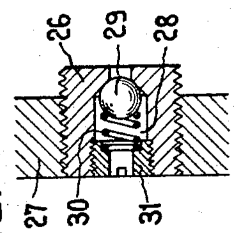

FIG.6

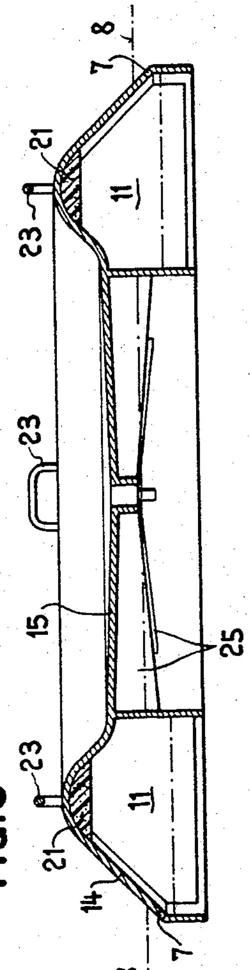

FIG.5

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FLOATING BODY
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9 Claims. (Cl. 114—121)

This invention relates to a floating body comprising a number of floating chambers open at their lower side and rigidly interconnected side by side. Floating bodies of this type are known and may serve as docks, floating platform for installations such as derricks, radar stations or the like. In many cases the chambers of the floating structure are interconnected by means of pipes, valves and compressors whereby it is possible to adjust the water level and consequently the buoyancy lift of each chamber to a desired value. However, it is obvious that the costs of such means for individually adjusting the buoyancy lift of the chambers are only justified for large-size floating structures carrying equipment of high value.

It is known to provide a floating platform with three floating chambers open at their lower end and filled with water to an appreciable extent, such floating chambers serving for stabilisation of the platform. However, it is hardly possible with three floating chambers in triangular arrangement to stablize the platform against tilting when asymmetrically loaded.

Generally speaking, the problem of obtaining a particularly high stability of a floating body such that tilting of the floating body under asymmetrical load is minimized has not been solved with prior floating structures, because such structures have been designed for carrying a load fixed to the structure in predetermined position. It is a first object of this invention to provide a floating body of particularly high tilting stability, that is, the floating body should tilt as little as possible when asymmetrically loaded. It is another object of this invention to obtain this tilting stability with particularly simple means, especially without the use of piping, compressors and the like, so that high stability may also be obtained in accordance with this invention for small units such as bathing rafts or the like. The floating body according to this invention broadly comprises a number of floating chambers open at their lower side and rigidly interconnected side by side, at least three chambers being disposed in symmetrical distribution relatively to at least one axis, and a flow connection of high flow resistance from a place above the rim of said opening of each chamber to the outside of the chamber. Under these circumstances the floating body will not only sink at the side where excessive load is applied but the body will tilt round its center so that the chamber or chambers symmetrically opposite the excessive load will rise. However, tilting in this manner is efficiently opposed by the rising chambers because underpressure may be produced in such chambers.

The invention will now be explained in more detail with reference to the attached drawings wherein

FIG. 1 is a longitudinal section of a first embodiment of the floating body with symmetrical load,

FIG. 2 shows the floating body of FIG. 1 with asymmetrical load,

FIGS. 3 and 4 shows a bathing raft according to this invention in section along line III—III in FIG. 4 and in bottom view respectively,

FIG. 5 shows a modified form of the bathing raft and

FIG. 6 shows a one-way valve in section.

The floating body schematically shown in FIGS. 1 and 2 has an oblong prismatic casing 1 subdivided into three

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chambers 4, 5 and 6 by means of separating walls 2. Each chamber has a small bore 7 in one of its outer walls whereby a connection of relatively high flow resistance is formed between the chamber and the outside.

The floating body of FIGS. 1 and 2 may be used as a pontoon. Since this pontoon is connected to a bridge in a manner not shown in the drawing, no particular stability of the pontoon in the direction of the longitudinal extension of the bridge is required. However, the pontoon should have a relatively high stability in the direction of its own longitudinal axis so that the pontoon and the bridge supported thereon will tilt sidewise as little as possible when the bridge is excessively charged on one side thereof. A particularly high stability in this direction is obtained with the floating body or pontoon shown in FIGS. 1 and 2 as follows:

When the floating body is lowered onto the water surface, it will slowly sink because the air enclosed in chambers 4, 5 and 6 gradually flows out of the chambers through the holes 7. Only when the water level in chambers 4, 5 and 6 has reached the level of openings 7 the air in such chambers is compressed when the casing 1 further sinks into the water, and the floating body will reach the position shown in FIG. 1 when loaded with the symmetrical load P. The floating body is horizontal and all chambers 4, 5 and 6 equally contribute to the buoyancy lift of the body. When the floating body is now asymmetrically loaded as shown in FIG. 2, the chamber 6 is immersed deeper and therefore produces additional buoyancy lift. The middle chamber 5 produces substantially the same buoyancy lift as before, when the same load is applied, because the body is tilted round a middle axis perpendicular to the longitudinal axis thereof. Chamber 4 is lifted so that its buoyancy lift is reduced and may change to load or negative buoyancy because the water level in chamber 4 may raise above the water level 8. Under these circumstances underpressure is produced in chamber 4 and since the opening 7 of this chamber is above the water level 8 air will be sucked into chamber 4. However, the openings 7 are so narrow that the exchange of fluid through them is relatively slow. Therefore, a relatively small exchange of air or water takes place through openings 7 when asymmetric load only occurs during relatively short periods. Under normal symmetrical load the conditions in chambers 4, 5 and 6 are reestablished, whereby fluid exchange through the openings 7 may occur. In order to obtain particularly high stability of the floating body, the holes 7 should be located at a substantial distance above the lower rim of chambers 4, 5 and 6 so that the floating body is first immersed relatively deeply before producing buoyancy lift. Under this condition it is impossible that the lower edge of any wall of chambers 4, 5 or 6, for instance the left-hand edge of the wall of chamber 4 (FIG. 2) is lifted above the water level 8 when the floating body is appreciably tilted by excessive asymmetrical load.

While the floating body shown in FIGS. 1 and 2 has only improved stability in the direction of its longitudinal axis, floating bodies having high stability in more than one direction are required for most purposes. Improved stability in more than one direction may be obtained by a ring arrangement of the chambers, for instance a circular or polygonal arrangement. Such a floating body serving as a bathing raft and having high stability in any direction is shown by way of example in FIGS. 3 and 4. The body comprises two semicircular parts 9 of plastic material of which the outer rim is reinforced by means of a tube 10. Each of the parts 9 is subdivided into segment-shaped chambers 12 by means of separating walls 11. Each of the chambers 12 has a narrow opening 7 in its outside wall. Adjacent end walls 11 of the parts 9 are assembled by means of bolts **13**. The so assembled parts **9** form an annular axially symmetrical floating body having a raised outer rim portion **14** and a cover portion **15** slightly inclined inwardly. Anchoring means **16** for a ladder **17** shown in broken lines are provided in the cover portion **15** of the body.

The central opening of the floating body is covered by a cover **18** having stiffening ribs **19**, this cover having a ring **20** for fixing an anchoring rope. Inserts **21** of plastic foam are fixed in the upper outer edges of the chambers, such inserts preventing sinking of the raft due to leakage of the chambers. The cover **18** has holes **22** preventing building up of overpressure below the cover and serving for draining water from the cover portion **15** of the raft.

The high stability of the raft shown in FIGS. 3 and 4 is obtained for the reasons explained above with reference to FIGS. 1 and 2. Whenever an excentric load occurs the raft sinks at the side of higher load whereas the chambers symmetrically opposite to the excentric load are lifted. Since the chambers are distributed practically symmetrically and regularly at the circumference of the raft, the same conditions occur independently of the direction of excentricity of the load, that is, the raft has similarly high stability in any direction.

Since the floating bodies described above are subjected to asymmetrical loads during short intervals only and alternatively in different directions, it is usually possible to reestablish the desired pressure conditions in all chambers by fluid exchange trough openings **7**. However, the floating body according to this invention may preferably be used for larger objects such as floating platforms of cranes, dredges or the like, where appreciable asymmetrical loads may occur in the same direction during long periods. In this case it may be necessary to provide one-way valves instead of simple apertures **7**, such one-way valves allowing an exchange of fluid only from the chambers outwardly but not in the opposite direction. Such a one-way valve is shown, by way of example in FIG. 6. The valve body **26** is screw-fixed in an aperture of an outer wall **27** of a chamber of the floating body. A valve ball **29** is located in the valve bore **28** and is urged against its seat by a pressure spring **30**, of which the other end engages a screw **31**. Due to such a one-way valve the floating body immediately returns to its original symmetrical position and condition from any tilted position for which underpressure may occur in some chambers, when the asymmetrical load is removed.

The floating body according to this invention has not only a particularly high tilting stability, but it is further very stable in that horizontal shifting thereof is opposed by high resistance and high inertia. This is of particular importance for the bathing raft shown in FIGS. 3 and 4 because climbing onto the raft is highly facilitated by the fact that the raft does not yield laterally. This high stability against lateral yielding is improved by the depth of immersion of the floating body because the water columns trapped in the chambers have to be accelerated laterally together with the floating body. Further, high resistance would be produced by turbulence at the lower edges of the partition walls **11** of the parts **9**.

This invention is not limited to any particular application of or material used for the floating body. While the bathing raft shown in FIGS. 3 and 4 is preferably made of plastic material, floating bodies of larger size may be made of light metal, steel, concrete or the like. Except for the purposes mentioned above, the floating body may be used for quays, aerodromes, inflatable boats, artificial islands, moles and the like.

Of course many modifications may be made without departing from the invention as claimed. Instead of chambers formed by separating walls in a hull of a floating body, separate chambers may be used mechanically interconnected by a platform or other structure.

Instead of being made of two interconnectable parts as shown in FIGS. 3 and 4, the bathing raft may be made in one piece as shown in FIG. 5, wherein corresponding parts are similarly designated as in FIGS. 3 and 4. Handles **23** are formed at the raised rim portion, and the upper surface of the raft may be provided with a non-skid sculpture. The cover portion **15** has a central hole **24** through which rain water is drained and into which a support for an anchoring hook may be inserted. The cover portion is reinforced by means of ribs **25**. From the inner edge of the raised rim portion a cylindrical wall extends downwardly and forms the inner wall of the chambers formed by the separating walls **12**.

What I claim is:

1. A floating body comprising a number of floating chambers open at their lower end and closed at their upper end, said chambers being rigidly interconnected side by side, at least three chambers being disposed in symmetrical distribution relatively to a vertical plane through the center point of the body, and a flow connection of high flow resistance from a place vertically spaced from said upper end and from the rim of said opening of each chamber to the outside of the chamber, an air cushion being formed in each chamber substantially between said place and said upper end when the floating body is positioned for use in water.

2. A floating body according to claim **1**, wherein said flow connection comprises a small aperture in the outer wall of each chamber at a distance above the rim of the lower opening of the chamber.

3. A floating body according to claim **1**, said flow connection comprising a one-way valve crossing the wall of each chamber at a distance above the rim of the opening of the chamber, such one-way valve allowing fluid flow from the chamber to the outside.

4. A floating body according to claim **1**, comprising a number of chambers in ring arrangement.

5. A floating body according to claim **4**, comprising a central chamber connected to the atmosphere encircled by a closed ring of said floating chambers.

6. A floating body according to claim **1**, comprising separate chambers interconnected by a mechanical structure.

7. A floating body according to claim **1**, comprising a substantially dish-shaped hull with a convexly upwardly curved rim portion, a ring of chambers being formed below the said hull by separating walls reaching below the water level.

8. A floating body according to claim **7**, the said ring of chambers having an inner cylindrical wall extending downwardly from the cover portion of the hull.

9. A floating body according to claim **1**, comprising elements of plastic foam near the upper end of the chambers.

References Cited

UNITED STATES PATENTS

1,341,677	6/1920	Roberts	114—43.5
2,858,790	11/1958	Russell	114—121
3,035,286	5/1962	Brill	9—11

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