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(54) **SHIP WITH VERTICAL DRAUGHT SYSTEM**

SCHIFF MIT VERTIKALEM TIEFGANGSYSTEM

NAVIRE ÉQUIPÉ D'UN SYSTÈME DE TIRAGE VERTICAL

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Description

umn consisting of vertical displacement elements along the length of the corresponding column.

Technical field

[0001] The present invention falls within the field of those structures intended for the underwater salvage of any kind of object and for transport and construction in marine environments.

Background

[0002] Existing structures currently employed for the underwater salvage of any kind of object and for transportation and construction in marine environments are regarded as limited, perhaps because they are difficult to manufacture or perhaps because their creators failed to adapt to new global market circumstances.

[0003] The document DE 203 08850 U1 disclosing a catamaran for ship salvage and oil platform disposal is considered the closest prior art.

Invention description

[0004] The present invention refers to a ship with a vertical draught system which comprises:

- Two compartmentalized hulls, one at each side of the ship, which may be submerged or made to refloat until the desired effect is achieved;
- four folding columns, two on each hull, one on the stem and the other on the prow of each hull, with an upper compartment for housing pressurised air;
- an upper superstructure attached to the ship, which comprises:

- two longitudinal beams spanning from column to column and from stem to prow;
- two telescopic crossbeams spanning from column to column and from starboard to port;

the ends of these beams being joined to the columns by means of a piece which wraps around each column consisting of vertical displacement elements along the length of the corresponding column;

- a lower superstructure, located under the upper superstructure, comprising:

- two fixed length longitudinal beams spanning from column to column and from stem to prow;
- four telescopic crossbeams spanning from column to column;
- an equipment for laterally hooking the object or vessel to be rescued, located on each lateral end and on the underside, facing the sea of the telescopic crossbars;

the ends of all the beams being joined to the columns by means of a piece which wraps around each col-

[0005] The upper superstructure comprises at least four winches on each longitudinal beam spanning from column to column and from prow to stem. One end of a draught cable is attached to each winch; the other end of the cable is attached to the lower superstructure and to the lateral hooking equipment of the object or vessel to be rescued thus enabling the lower superstructure to be lowered and raised to any point located below the ship together with the hooking equipment, depending on how much pulling force is required, without it being necessary for the boat and the upper superstructure to be lowered or raised.

[0006] The lower superstructure serves to guide the draught cables coming from the upper superstructure and just as importantly, to stop or block these cables mid ascent or descent by means of a cable blocker consisting of a hydraulic mechanical system to press longitudinally said cable in order to vary the position of the upper superstructure (withheld).

[0007] The articulated hydraulic arms have a free hooking end that can be modified by attaching specific tools, for mooring or hooking various vessels or objects.

[0008] The envisaged use of the vertical draught ship described is to carry out any type of work with minimal limitation in terms of direct vertical draught.

[0009] It may be used in underwater salvage work, of any kind of object, and for transport and construction work in marine environments, outperforming any existing vertical draught system currently available both on the surface as well as underwater. Some examples that can be cited are:

- the installation, placement and repair of pipes of any type or size at great depths;
- the construction of large, prefabricated ports, with all kinds of preinstalled harbouring facilities both currently needed and needed in the foreseeable future, such as fuel storage, rope warehouses, store rooms and cabins to let, cold storage, etc. All these elements, amongst others, would be constructed in specialised areas and would be transported for their installation in the appropriate place, thus eliminating the current elevated cost of this kind of operation;
- the fabrication and installation of large underwater tunnel structures, prefabricated and installed in the seabed or in mid-waters at the desired depth;
- recovery and rescue actions and manoeuvres for large vessels or floating artefacts run aground at the surface or at great depths;
- the loading and unloading of large container vessels without it being necessary for them to moor at the port;
- providing assistance and comprehensive repair service to, and rescuing all kinds of military boats and structures which, at certain times and given their

special status, pose danger to the population. These operations may be carried out in high seas or anywhere near the coast;

- the cleaning up of dangerous elements which may be found at the water's surface or in mid- waters from navigation zones, for example large trunks or containers tossed into the sea by violent storms and the lurching of the ships which score the oceans on a daily basis.

Brief description of the figures

[0010] Below is a brief description of a set of figures which aid a better understanding of the invention, and are expressly related to an embodiment of said invention which is presented as a non limiting example thereof.

Figure 1 is a front elevation of the ship.

Figure 2 is a side elevation of the ship.

Figure 3 is a front elevation of the ship in rescue position with the lower superstructure below the water's surface.

Figure 4 is a front elevation of the ship in rescue position with the lower superstructure above the water's surface.

[0011] In the abovementioned figures, a series of reference numbers appear, which correspond to the elements indicated below, but not by way of limitation:

1. - hull
2. - floating column of the prow
3. - floating column of the stern
4. - upper superstructure
5. - lower superstructure
6. - draught cable
7. - hydro-electronically operated equipment
8. - articulated hydraulic arm
9. - cable fasteners
10. - wrap piece around mobile junction for the crossbeams in the upper superstructure
11. - wrap piece around mobile junction for the crossbeams in the lower superstructure
12. - upper superstructure telescopic crossbeam spanning from port to starboard
13. - upper superstructure longitudinal beam spanning from the stern to the prow
14. - lower superstructure telescopic crossbeam spanning port to starboard in the
15. - lower superstructure longitudinal beam spanning from the stern to the prow
- 16.-ship

Detailed description of an embodiment

[0012] The ship 16 represented in Figures 1-4 has a vertical draught system, which comprises:

- two compartmentalized hulls 1,1', one at each side of the ship 16;
- two floating columns on each hull 1,1', one on the stem 2, 2' and the other on the prow 3, 3', which are compartmentalised and folding, with an upper compartment designed and constructed to house pressurized air and a vertical conical toothed rack with blunt point from top to bottom along the length of the side facing both the upper and lower superstructure;
- an upper superstructure 4 attached to the ship 16, which comprises:

- at least two fixed length longitudinal beams 13, 13' spanning from column to column and from prow to stern (see Figure 1) with at least four winches 9 per beam from which a draught cable 6 hangs for every mechanically operated winch;
- at least two telescopic crossbeams 12, 12' (variable in length) spanning from column to column and from port to starboard, see Figure 1;
- power generation equipment for cascading electrical and hydraulic energy to supply the machinery distributed around the ship;

the beams being attached in a moveable manner through their ends to columns 2, 2', 3, 3' by means of a wrap piece 10 around each column that comprises a plurality of wheels, adaptable to the shape of the conical toothed rack on the corresponding column with their rubbery side in order to avoid metal grazing and being hydraulically operated;

- a lower superstructure 5, which comprises:

- at least two fixed length longitudinal beams 15, 15' spanning from column to column and from prow to stern (see Figure 2) with at least four cable fasteners 9;
- at least four telescopic crossbeams 14, 14', 14", 14''' (variable in length), spanning from the prow to stem, starboard longitudinal beam to the prow to stem, port longitudinal beam, see Figures 1 and 2;
- equipment for laterally hooking the object or vessel to be rescued located on each lateral end and underside of the telescopic crossbeams, 14, 14', 14", 14''' , facing the sea,

the ends of all the beams being attached to the starboard longitudinal beam spanning from prow to stern and the port longitudinal beam spanning from prow to stern.

This lower superstructure may be longitudinally displaced across the floating columns by means of a draught cable from the upper superstructure. Once it is situated at the adequate point, this lower superstructure can be secured (blocked) to the floating columns through a hydraulic system on the blunt point conical toothed rack.

[0013] The lateral hooking equipment is attached to the draught cables 6 attached to the upper superstructure by winches or cable fasteners 9 which enables the hooking equipment coupled to the lower structure 5 to be lowered and raised to any point situated below the ship without it being necessary for the upper superstructure 4 and ship to be raised and lowered.

[0014] This hooking equipment comprises a plurality of articulated hydraulic arms 8 attached through one end to the hydroelectric operating equipment 7 that drives them.

[0015] The ship described operates as follows:

When the pulling capacity of the winches is insufficient, this ship opens out telescopically, increasing its beam by 35-40%, becoming very stable, and by opening out vertically the floating columns it increases its height by 150% in order to gradually immerse itself in a controlled manner whilst the main upper superstructure 4 is displaced across the floating columns to constantly maintain adequate positioning, always above surface level.

[0016] The main upper superstructure 4 is able to unfold in this way making use of its buoyancy, thus allowing the columns 2, 2', 3 and 3' to be displaced across the upper superstructure without resistance (this saves a lot of fuel).

[0017] The progressive, controlled immersion of the lower superstructure 5 entails the flooding of the hull compartments by means of a controlled siphon system. This system involves allowing the water to enter to just above the natural waterline of the hulls, from the bottom pipe. Whereby these pipes are full, a vacuum may occur or the interior of the deposits to be filled might be depressed slightly (from 100 to 200 g) when the water begins to enter. This will be controlled by electro valve on the upper portion of the piping which is above the waterline.

[0018] This ship model allows the hub to be cascade filled in a natural way, only having to create a slight vacuum or depression (-0.20 kg/ cm²) in the compartments via the floating towers to provoke said cascade flow through the siphons controlled by the electro valves.

[0019] Once correct positioning has been achieved for manoeuvre, a visual inspection will be carried out using the cameras located on the hydraulic hooking arms, without discarding the possibility of the ship having a mini-submarine.

[0020] Once hooked up, the cables 6, 6' are tensed, securing the object to the ship, thus eliminating unwanted movements. The air coming from the compartments build and designed to house compressed air in the upper part of the floating towers is then injected through pressure regulators which are always housed in the lower part of the deposits from which water is to be emptied.

[0021] These pressure regulator valves maintain the air pressure in each compartment which is never more than 2 kg/ cm² higher than the external air pressure, thus

avoiding the deformation of and breakages in these compartments.

[0022] Once the object or vessel rescued reaches the surface, as shown in Figure 4, water is bailed out and the rescue of possible shipwreck victims or the recovery of corpses can begin.

[0023] Any survivors found may receive medical attention in the ship itself or be transported quickly by medical helicopter or in the helicopter located on the ship.

Claims

1. Ship (16) with a vertical draught system for the rescue of objects or vessels, **characterised in that** it comprises:

- two compartmentalized hulls (1, 1'), one at each side of the ship (16),
- four folding columns (2, 2', 3, 3'), two on each hull (1, 1'), one on the stern (2, 2') and the other on the prow (3, 3') of each hull, located on each hull (1, 1') with an upper compartment for housing pressurised air;
- an upper superstructure (4) attached to the ship (16), which comprises:

- two fixed length, longitudinal beams (13, 13') spanning from column to column and from stem to prow;
- two telescopic crossbeams (12, 12') spanning from column to column and from starboard to port;

the ends of these beams (12, 12', 13, 13') being joined to the columns (2, 2', 3, 3') by means of a piece (10) which wraps around each column consisting of vertical displacement elements along the length of the corresponding column;

- a lower superstructure (5), located under the upper superstructure (4), comprising:

- two fixed length, longitudinal beams (15, 15') spanning from column to column and from stem to prow;
- four telescopic crossbeams (14, 14', 14", 14''') spanning from the prow to stern, starboard longitudinal beam, to the prow to stern, port longitudinal beam,
- an equipment for laterally hooking the object or vessel to be rescued, located on each lateral end and on the underside, facing the sea, of the telescopic crossbeams (14, 14', 14", 14''');;

the ends of all the longitudinal beams (15, 15') being joined to the columns (2, 2', 3, 3') by means of a piece (11) which wraps around each

column consisting of vertical displacement elements along the length of the corresponding column.

2. Ship with vertical draught according to claim 1 **characterised in that** the upper superstructure (4) comprises at least four winches (9) on each longitudinal beam (13, 13') spanning from column to column and from prow to stem, one of the ends of the draught cable (6) being attached to each winch, the other end of the cable fastened to the lower superstructure (5) and the equipment for laterally hooking the object or vessel * to be rescued. 5 10
3. Ship with vertical draught according to claim 2 **characterised in that** each equipment for laterally hooking the object or vessel to be rescued consists of a plurality of articulated hydraulic arms (8) attached through one end to the hydroelectric operating equipment which drives them attached to the telescopic crossbeams (14, 14', 14'', 14''') and the underside of the lower superstructure (5) facing the sea. 15 20
4. Ship with vertical draught according to the previous claims **characterised in that** each column (2, 2', 3, 3') comprises a conical toothed rack with blunt point along the length of the side facing the lower (5) and upper (4) superstructure and **in that** each wrap-around piece (10, 11) comprises a plurality of wheels which interconnect with the conical teeth of the rack on the corresponding column with the rubbery side in order to avoid metal grazing and being hydraulically operated. 25 30
5. Ship with vertical draught system according to the previous claims **characterised in that** the upper superstructure comprises a cascading electronic and hydraulic power generation equipment to supply the machinery distributed around the ship. 35 40
6. Ship with vertical draught system according to the previous claims **characterised in that** the hulls (1, 1') comprise a plurality of flood siphons in the compartments for submerging them. 45

Patentansprüche

1. Schiff (16) mit vertikalem Tiefgangsystem für die Rettung von Objekten oder Wasserfahrzeugen, **dadurch gekennzeichnet, dass** es Folgendes umfasst: 50
 - zwei aufgeteilte Rumpfe (1, 1'), einen an jeder Seite des Schiffes (16),
 - vier klappbare Säulen (2, 2', 3, 3'), zwei auf jedem Rumpf (1, 1'), eine auf dem Heck (2, 2') und die andere auf dem Bug (3, 3') von jedem

Rumpf, angeordnet auf jedem Rumpf (1, 1') mit einer oberen Kammer zur Aufnahme von Druckluft;

- einen oberen Überbau (4), welcher mit dem Schiff (16) gekoppelt ist, umfassend:

- zwei Längsträger mit fester Länge (13, 13'), welche sich von Säule zu Säule und von Heck zu Bug erstrecken;
- zwei teleskopische Querträger (12, 12'), welche sich von Säule zu Säule und vom Steuerbord zum Backbord erstrecken;

wobei die Enden dieser Träger (12, 12', 13, 13') mit den Säulen (2, 2', 3, 3') mittels eines Teils (10) verbunden sind, welches jede Säule umhüllt, bestehend aus vertikalen Verschiebungselementen entlang der Länge der entsprechenden Säule;

- einen unteren Überbau (5), angeordnet unter dem oberen Überbau (4), umfassend:

- zwei Längsträger mit fester Länge (15, 15'), welche sich von Säule zu Säule und von Heck zu Bug erstrecken;
- vier teleskopische Querträger (14, 14', 14'', 14'''), welche sich von Bug zu Heck erstrecken, einen Steuerbord-Längsträger, von Bug zu Heck, und einen Backbord-Längsträger,
- eine Vorrichtung zum seitlichen Festhaken des zu rettenden Objekts oder Wasserfahrzeugs, angeordnet auf jedem seitlichen Ende und auf der Unterseite, dem Meer zugewandt, der teleskopischen Querträger (14, 14', 14'', 14'''); 35

wobei die Enden aller Längsträger (15, 15') mit den Säulen (2, 2', 3, 3') mittels eines Teils (11) verbunden sind, welches jede Säule umhüllt, bestehend aus vertikalen Verschiebungselementen entlang der Länge der entsprechenden Säule.

2. Schiff mit vertikalem Tiefgang nach Anspruch 1, **dadurch gekennzeichnet, dass** der obere Überbau (4) mindestens vier Winden (9) auf jedem Längsträger (13, 13'), welcher sich von Säule zu Säule und von Bug zu Heck erstreckt, umfasst, wobei eines der Enden des Zugseils (6) mit jeder Winde gekoppelt ist, wobei das andere Ende des Seils an dem unteren Überbau (5) und der Vorrichtung zum seitlichen Festhaken des zu rettenden Objekts oder Wasserfahrzeugs befestigt ist. 45
3. Schiff mit vertikalem Tiefgang nach Anspruch 2, **dadurch gekennzeichnet, dass** jede Vorrichtung zum seitlichen Festhaken des zu rettenden Objekts oder Wasserfahrzeugs aus einer Vielzahl von gelenkigen

hydraulischen Armen (8) besteht, welche durch ein Ende mit der hydroelektrischen Operationsvorrichtung gekoppelt sind, welche dieselben betätigt, gekoppelt mit den teleskopischen Querträgern (14, 14', 14'', 14''') und der Unterseite des unteren, dem Meer zugewandten Überbaus (5).

4. Schiff mit vertikalem Tiefgang nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jede Säule (2, 2', 3, 3') eine konische Zahnstange mit stumpfer Spitze entlang der Länge der dem unteren (5) und dem oberen (4) Überbau zugewandten Seite umfasst, und dass jedes Umhüllungs-
teil (10, 11) eine Vielzahl von Rädern umfasst, welche mit den konischen Zähnen der Stange auf der entsprechenden Säule mit der gummiartigen Seite vermascht sind um eine Metallabschürfung zu verhindern und welche hydraulisch betätigt werden.
5. Schiff mit vertikalem Tiefgangssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der obere Überbau eine kaskadierende elektronische und hydraulische Energieerzeugungsvorrichtung zur Versorgung der um das Schiff herum verteilten Maschinen umfasst.
6. Schiff mit vertikalem Tiefgangssystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Rümpfe (1, 1') eine Vielzahl von Überflutungssiphons in den Kammern für das Untertauchen derselben umfassen.

Revendications

1. Bateau (16) avec un système de tirant d'eau vertical pour le sauvetage d'objets ou de vaisseaux, **caractérisé en ce qu'il** comprend :

- deux coques compartimentées (1,1'), une de chaque côté du bateau (16),
- quatre colonnes pliantes (2, 2', 3, 3'), une sur chaque coque (1, 1'), une sur la poupe (2, 2') et l'autre sur la proue (3, 3'), de chaque coque, situées sur chaque coque (1, 1') avec un compartiment supérieur pour loger de l'air pressurisé ;
- une superstructure supérieure (4) fixée au bateau (16), qui comprend :

deux poutres longitudinales à longueur fixe (13, 13') s'étendant de colonne à colonne et de poupe à proue ;
deux traverses télescopique (12, 12') s'étendant de colonne à colonne et de tribord à bâbord ;

les extrémités de ces poutres (12, 12', 13, 13')

étant reliées aux colonnes (2, 2', 3, 3') par le biais d'une pièce (10) qui enveloppe chaque colonne composée d'éléments de déplacement vertical le long de la longueur de la colonne correspondante ;

- une superstructure inférieure (5), située sous la superstructure supérieure (4) comprenant :

deux poutres longitudinales à longueur fixe (15, 15') s'étendant, de colonne à colonne et de proue à poupe ;
quatre traverses télescopique (14, 14', 14'', 14''') s'étendant de proue à poupe, une poutre de tribord longitudinale, de proue à poupe, et une poutre de bâbord longitudinale ;
un équipement pour accrocher latéralement l'objet ou le vaisseau à secourir, située à chaque extrémité latérale et sur le dessous, faisant face à la mer, des traverses télescopiques (14, 14', 14'', 14''') ;

les extrémités de toutes les poutres (15, 15'') étant reliées aux colonnes (2, 2', 3, 3') par le biais d'une pièce (11) qui enveloppe chaque colonne composée d'éléments de déplacement vertical le long de la longueur de la colonne correspondante.

2. Bateau avec système de tirant d'eau vertical selon la revendication 1, **caractérisé en ce que** la superstructure supérieure (4) comprend au moins quatre treuils (9) sur chaque poutre longitudinale (13, 13') s'étendant de colonne à colonne et de proue à poupe, une des extrémités du câble de tirant d'eau (6) étant fixée à chaque treuil, l'autre extrémité du câble étant fixée à la superstructure inférieure (5) et l'équipement pour accrocher latéralement l'objet ou le vaisseau à secourir.

3. Bateau avec système de tirant d'eau vertical selon la revendication 2, **caractérisé en ce que** chaque équipement pour accrocher latéralement l'objet ou le vaisseau à secourir constitue une pluralité de bras hydrauliques articulés (8) fixés par une extrémité à l'équipement opérationnel hydroélectrique qui les entraîne fixé aux traverses télescopiques (14, 14', 14'', 14''') et le dessous de la superstructure inférieure (5) faisant face à la mer.

4. Bateau avec système de tirant d'eau vertical selon les revendications précédentes, **caractérisé en ce que** chaque colonne (2, 2', 3, 3') comprend une crémaillère conique avec une pointe émoussée le long de la longueur du côté faisant face à la superstructure inférieure (5) et supérieure (4) et **en ce que** chaque pièce enveloppante (10, 11) comprend une pluralité de roues qui s'interconnectent avec les dents coniques de la crémaillère sur la colonne correspon-

dante avec le côté caoutchouteux afin d'éviter l'écorchure du métal et étant actionnée hydrauliquement.

5. Bateau avec système de tirant d'eau vertical selon les revendications précédentes **caractérisé en ce que** la superstructure supérieure comprend un équipement de génération d'énergie électronique et hydraulique en cascade pour alimenter les machines distribuées autour du bateau. 5
- 10
6. Bateau avec système de tirant d'eau vertical selon les revendications précédentes **caractérisé en ce que** les coques (1, 1') comprennent une pluralité de siphons d'inondation dans les compartiments pour les immerger 15

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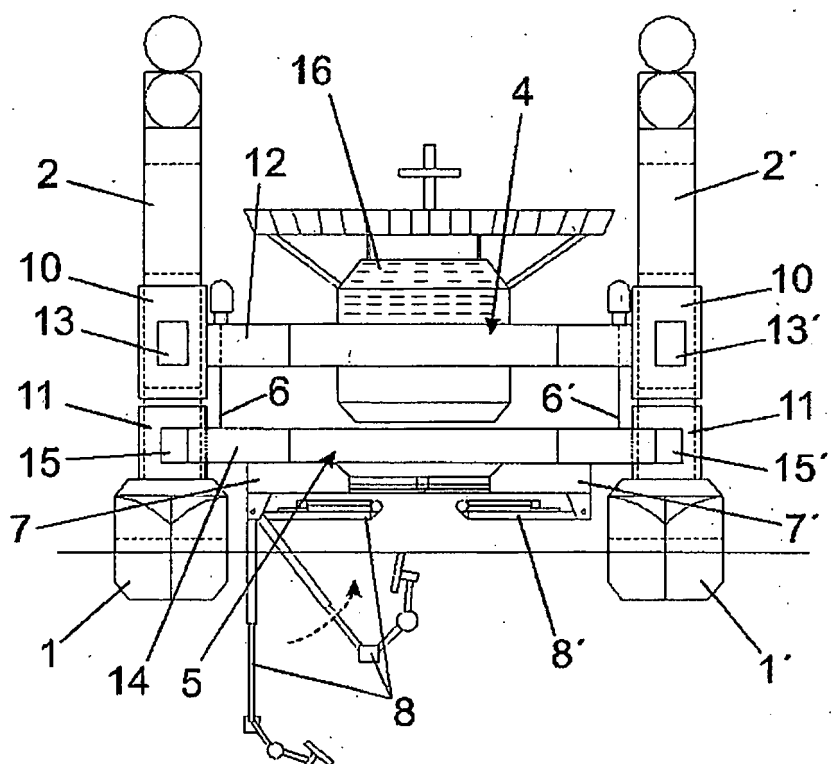


Fig. 1

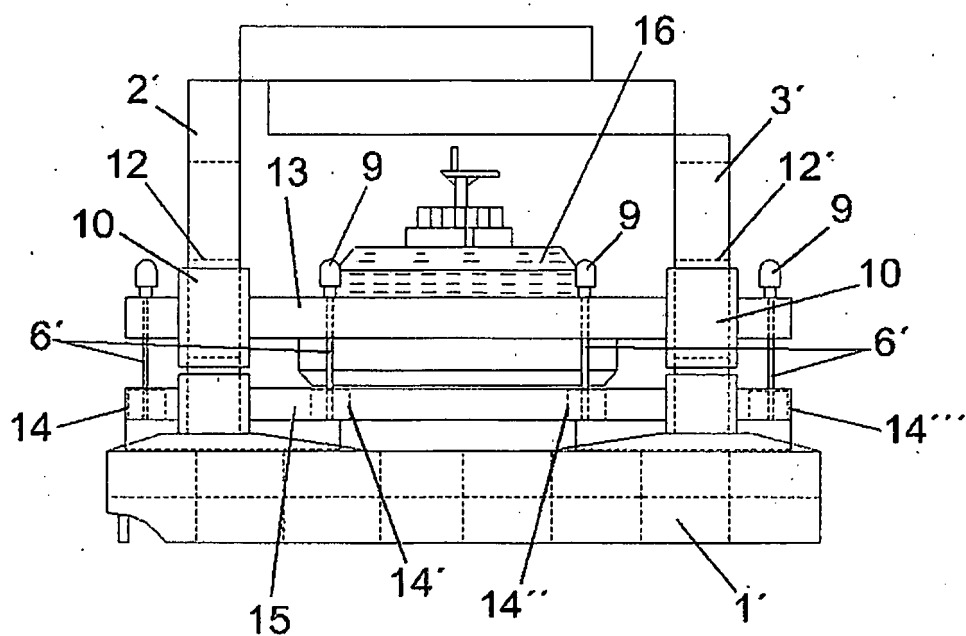


Fig. 2

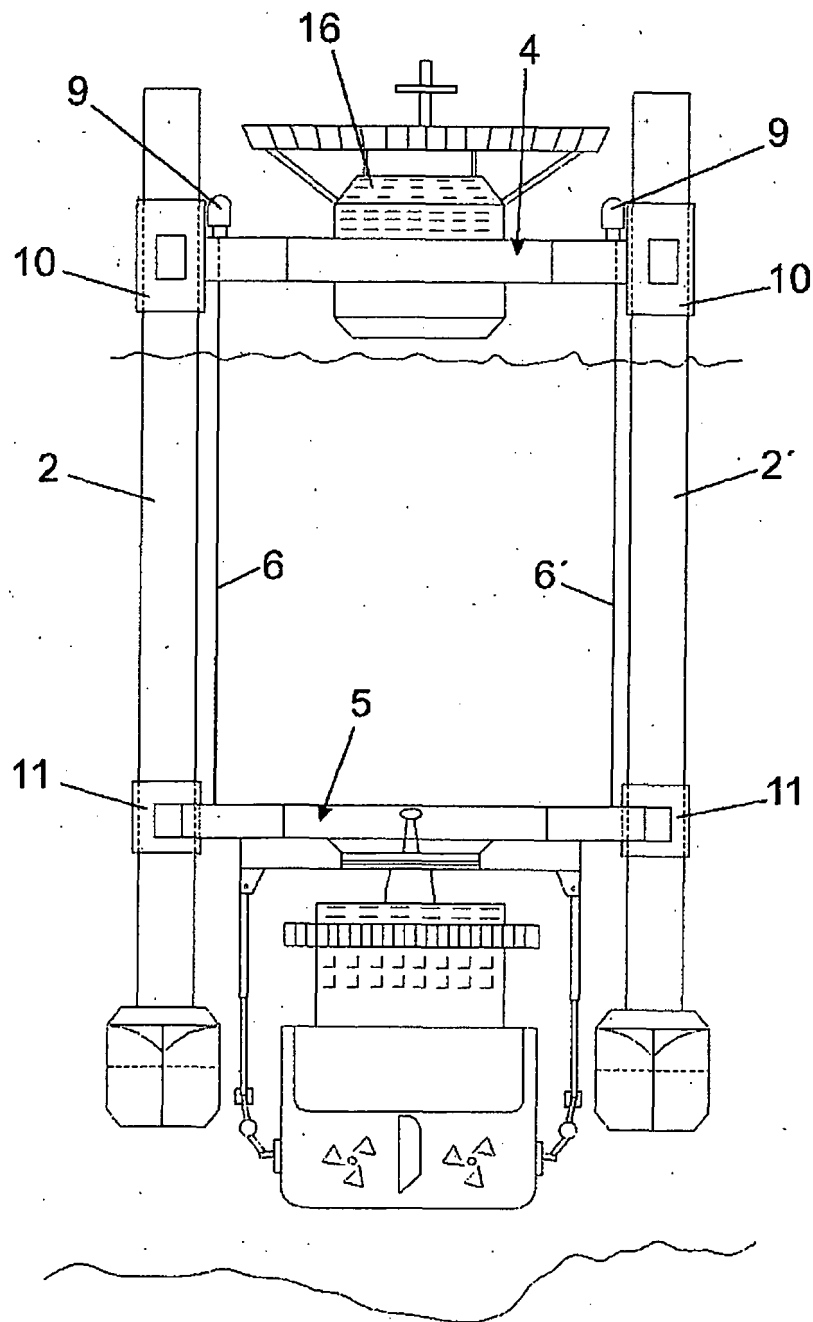


Fig. 3

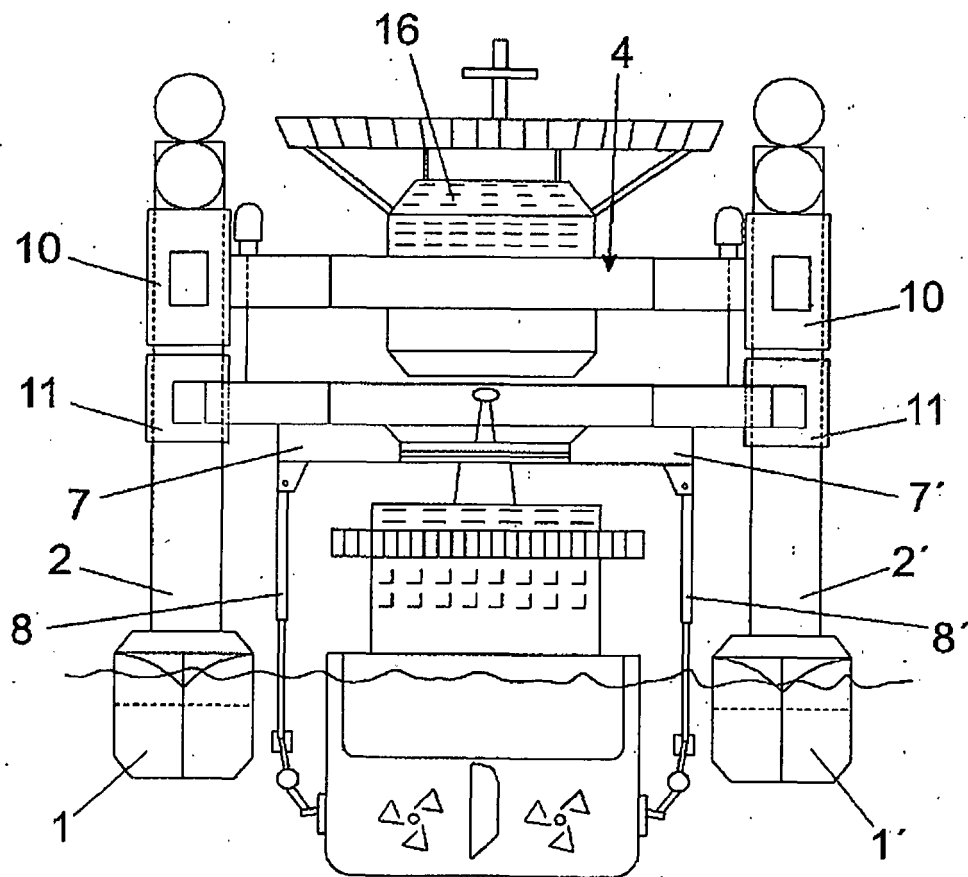


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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