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(54) FLOATING STATION

(57) A floating station for application of metal coats using the spray method onto hydrotechnical structures and crossings from the side of the water. The invention is characterized in that it uses the deck of a barge made of several connected pontoon floats (1) additionally fastened together with trusses (3). The invention is characterized by an optimized location of the elements of the metalizing station, including the jib (11), the compressor unit (10), and the power generator set (9).

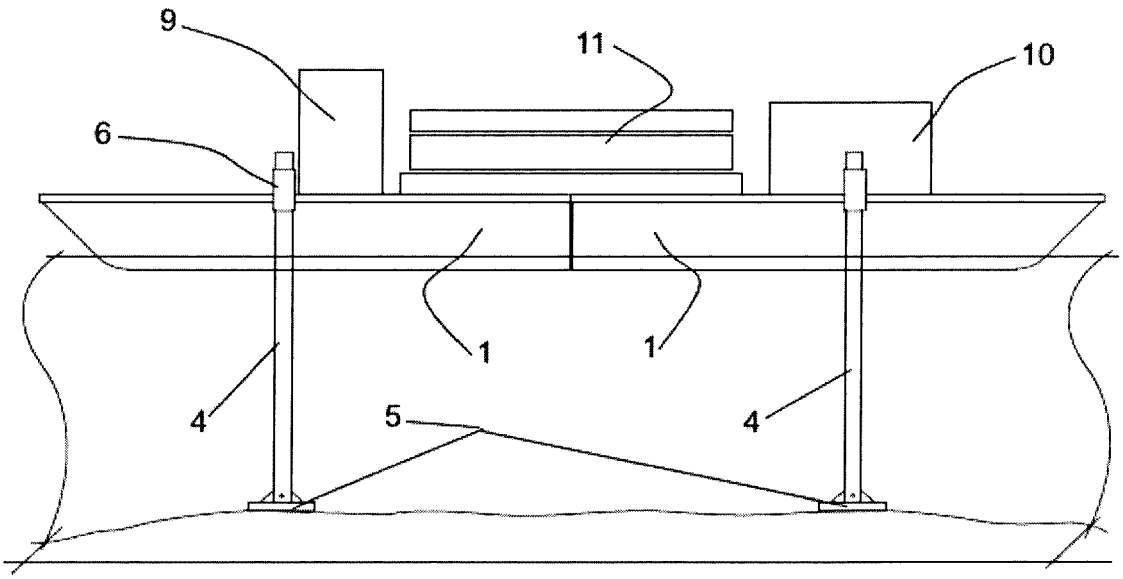

Fig.3B

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Description

Field of application

[0001] The present invention relates to a universal portable and modular, floating station for application of coats, especially metal and organic, on steel and reinforced concrete structures of hydrotechnical building structures and crossings. The station is placed on a barge-type floating unit. The innovative use of a floating structure supported on connected floats is intended for use in all hydrotechnical works that require access to the structure from the water side. The structure of the present invention can be used in particular during construction of bridge crossings, performance of erection and protection works on bridge structures and other structures surrounded by water. The invention is particularly suitable for use as a floating station for heat spraying of a melted stream of metal on metal structures. The method according to the invention assumes use of the structure of the present invention for performance of maintenance and repair works using heat spraying of a melted stream of metal, especially zinc and aluminum.

[0002] One of the major problems related to maintenance and repairs of steel and concrete structures, crossings, and hydrotechnical building structures is the need to shut them down for the purpose of performance of the works. This is because they require gathering and positioning a number of special devices that are necessary for the performance of the works, such as generator sets, compressors, cleaning equipment, scaffoldings, platforms, and temporary workshop, storage, and welfare facilities. On a majority of steel and concrete structures of crossings and hydrotechnical buildings that are normally operated (including for pedestrian and vehicular traffic), it is hard to find sufficiently large operating space for such equipment and materials. Therefore, it is necessary to shut down the relevant structure in order to achieve such space. The problem concerns in particular hydrotechnical building structures, such as weirs, dams, fish passes, sluices, canals, hydroelectric plants, pipelines, wharfs, piers, jetties, and breakwaters, but also, to the same extent, railroad crossing bridges and a large part of road bridges that do not have a separate part for pedestrian traffic. Shutting such structures down always involves a number of inconveniences, such as long detours or alternating traffic which tends to cause traffic jams, which contribute to excessive financial and social costs.

[0003] Some bridge structures are equipped with suspended maintenance platforms, but they are not suitable to withstand the load of the equipment used in modern maintenance methods.

[0004] A solution that enables conducting maintenance and repair works without the need to shut structures down is to place the technical facilities in close vicinity of the works, i.e. on the surface of the water, by using a specially designed floating station of the present invention.

[0005] Corrosion very highly contributes to loss of the media transmitted in pipelines. It is estimated that every 4-5 years, a yearly steel production is used to make up for corroded steel. It is estimated that the average yearly cost of corrosion to each person worldwide is USD 1,000. The economic losses caused by corrosion can be reduced thanks to introduction of new coating materials of durability that ensures many years of protection and of low associated maintenance costs. What is unique in the new approach to the corrosion problem is the interest in heavy corrosion protections made mostly by heat spraying of coating materials, in most cases alloys of such materials as zinc and aluminum.

[0006] The key problem that hinders the access from the water side to hydrotechnical building structures, such as for example supports or pipelines routed above the surface of water, is the stability of the work platform on which the spraying station is located. A spraying station consists as a minimum of a generator set, a compressor unit, a temporary storage site for abrasive material, a temporary storage space for coating material, and an elevating work platform. The total weight of such a station is equal to several tons. Operation of a gun that uses electric arc for melting of metal rods and ejecting a stream of melted metal at a high pressure requires a stable work platform.

Purpose of the present invention

[0007] The purpose of the present invention is to create a floating station for performance of corrosion-protection works on hydrotechnical building structures that is stable and, moreover, whose displacement is appropriate for the weight of the spray station, whose draft is small, and which is resistant to the action of waves. Other key parameters of the structure are its floatability and stability. At the same time, the design of the present invention should make it possible to disassemble it and move it to another location. The worker performing work on the platform must be safe even during strong wind gusts. The maximum wind speed allowed for scissor lifts is 5 m/s. However, in the case of the present invention, of greater importance are strong wind gusts that produce pressure on the level of 20 kg/m2, during which the platform should remain stable. It must be assumed that the deck of the unit may not tilt by more than 10 degrees.

State of the art

[0008] There is a known military pontoon, designated as PP-64 that is used for construction of pontoon bridge crossings. Pontoons of this type are connected to each other directly using side or stern pin fasteners, to form lines of any configuration. The use of such a connection system makes it possible to organize bridge and ferry crossings of any carrying capacity and length. A single PP-64 pontoon-segment is a fully welded structure made

of structural steel. The internal structure of stringers and bulkheads ensures appropriate rigidity, strength, and safety of use. A PP-64 type pontoon consists of a spatial frame, which constitutes the load-bearing structure of the pontoon, and external plating in the form of profiled sheet metal of appropriate thickness. The frame of the pontoon includes: two bulkheads with side fasteners, which are used to connect segments into assemblies of appropriate configuration, on which the lattice of the deck is positioned, which is used to transfer the load present on the surface of the assembly onto the entire structure. Side rabbets are used to stiffen the structure and the bottom of the pontoon by connecting them with the skid and the central stringer.

[0009] The international description of the invention WO2009028935 demonstrates unusual use of a known pontoon floating structure with a variable shape of the hull. According to the aforementioned invention, the required floatability of the platform is achieved by dynamically changing the shape of the hull. Variability of the shape of the hull is achieved by using pumpable pontoon elements in the central part of the hull.

[0010] The American description of the invention US5775248 presents a stabilized float with attachable sides and sterns. The float is the shape of a polygon, preferably made of plastic, and its side, stern, and bow have a number of keys and tongues that make it possible to connect the float to another float of the invention. In this design, the upper chambers of the float are filled with a medium that ensures the required floatability, such as a closed-cell foam, while the lower chamber of the float has openings that enable access of water to fill the lower part of the float, which in turn improves that stability of the entire structure when the float is subject to the action of waves or to unusual loads. The degree of stability or dampening is variable according to the size of the lower chamber and to the dimensions, location, and number of the opening that enable access of water into the lower chamber.

Essence of the solution

[0011] The essence of the solution of the present invention consists in use of floats in the form of the known PP-64 pontoons to build a barge-type floating unit. This type of pontoon in the present invention is used as a module to create a floating work platform that makes it possible to install a station for heat spray of a stream of melted metal. The platform consists of floats connected to each other by the sides, three in each row, with rows connected using stern fasteners. This connection, which complies with the operating instruction, makes it possible to create a stable and strong platform for repair and maintenance work on hydrotechnical building structures and crossings, using the heat spray method. The cohesion of the structure and its anchoring to the bottom of the water body is ensured by two trusses that bind and stiffen the pontoon assembly. A single truss has the form of a metal clasp that consists of two vertical telescopic supports connected with a binding horizontal element. Preferably, the clasp of the truss is made of three steel profiles or pipes. The elements that form a single truss are preferably connected with at least two angular connectors that fit the shape of the telescopic supports and the horizontal element. The trusses are placed transversely to the platform, above the bow bulkheads, and bind three pontoons in one row. The vertical telescopic supports are equipped with technical means of control of the depth of their immersion and moreover, are fitted with adjustable stabilizer that rest on the bottom of the water reservoir or watercourse.

[0012] An important issue for ensuring stability of the platform is appropriate positioning of the individual elements that form the station for heat spraying of metal, so as to ensure the most even distribution of the load on the deck. The elevating work platform, on which a lift is installed, that enables access of workers to higher elements of the building structure, is located in the central part of the deck, along its longitudinal axis.

[0013] The way that individual equipment is positioned on the platform is not strictly defined, with the exception self-evident requirement to distribute loads evenly. Proper positioning of the loads can be tested by measuring the height of the freeboard in four points. On the other hand, it is necessary to place the heaviest equipment centrally, close to the center of the assembly. The lift of the work platform must be positioned in the central field delineated with a rectangle whose surface area is not larger than a half of the surface area of a single pontoon float.

[0014] An optimum distribution of load is achieved when the center of the elevating work platform overlaps the cross-section of the transverse and longitudinal axis of the deck. Containers or temporary storage spaces for abrasive materials and coating materials are located on the opposite sides of the elevating work platform, at identical distances from the sides and ends of the elevating work platform. The source of electricity, namely the generator set, is located behind one of the ends of the elevating work platform and is perpendicular to the longitudinal axis of the deck. On the other hand, the compressor unit that generates a stream of gas that carries melted metal is located on the opposite end of the elevating work platform. The compressor unit is located along the longitudinal axis of the deck.

[0015] The tests and calculations that have been performed confirm that the configuration of the floats and the location of the individual elements of the station for heat spraying of a stream of melted metal onto hydrotechnical building structures are optimized from the standpoint of stability and floatability of the entire assembly.

Figure

[0016] Embodiments of the present invention are shown in figures where:

Fig. 1A shows an isometric view of the P-64 pontoon from the side of the deck;

Fig. 1B shows an isometric view of the P-64 pontoon from the side of the bottom;

Fig. 1C shows an isometric view of the P-64 pontoon from the side of the stern with the deck plating removed;

Fig. 1 D shows an isometric view of a longitudinal section of the P-64 pontoon;

Fig. 2 shows a general view of the metallization station during work on a bridge structure, as seen from the front;

Fig. 3A shows a top view of the barge with a schematic view of the location of the elements of the metallization station;

Fig. 3B shows a view of the barge with a schematic view of the location of the elements of the metallization station.

Embodiment

[0017] A floating metallization station consisting of six floats **1** in the form of PP-64 type pontoons connected by sides, in two rows of three, whereby the rows are connected to each other by sterns. All connections, both side and stern, are made using pin fasteners **2.** Each of the two rows of the assembly is additionally connected and fastened using a truss **3** that binds and stiffens the pontoon assembly. A single truss consists of two vertical telescopic supports **4** that end with adjustable stabilizers **5** supported on the bottom and connected using the angle connectors **6** to the horizontal element **7** in the form of a pipe, which binds the telescopic supports **4.** The trusses **3** are positioned so that the horizontal elements **7** are located above the bow bulkhead **8.** On the deck there are components of the station for heat spraying of metal coats. Those components are a generator set **9** with the capacity of 100 kVA/88 kW and weight of approx. 1,600 kg. The approximate dimensions of the generator set **9** are: L=2,300 mm, W=1,000 mm, H=1,500 mm. Another component is the compressor unit **10** whose capacity is equal to approx. 12.5 m^3/min., which weighs approx. 1,200 kg, and whose approximate dimensions are L=1,900 mm, W=900 mm, and H=1,100 mm. The compressor unit is used for abrasive blasting of a surface with the total output of approx. 18 m3/min., weight approx. 1,200 kg, approximate dimensions: 0550 mm H=1,300 mm. The central element of the work station is the elevating work platform **11** in the form of a scissor lift, weighing approx. 1,220 kg, whose approximate dimensions are L=1,900 mm, width S=800, H=1,800 mm (H=approx. 6,000 mm when fully extended); the permissible load of the elevating work platform is 227 kg. Given those dimensions, the surface of wind action on the elevating work platform **11** is equal to 3.420 m2 in the folded state and 10,868 m2 in the extended state. On the deck of the assembly there is also abrasive material **12** in a pallet container weighing approx. 1,000 kg and coating material **13** in a pallet container weighing approx. 500 kg. Optionally, on board of the assembly there may be such additional equipment as a combustion engine motor to propel the assembly, equal pressure units for abrasive blasting of surfaces, a hydrodynamic unit for application of paint coats, a unit for pressure washing of surfaces, a set of lamps, a tank with fuel for the generator sets, units, and possibly the propelling motor, a battery station, a crew cabin, and navigation equipment.

[0018] Hydrodynamic calculations indicate that the maximum haulage speed of the barge of the invention is 4.5 knots. Above this speed, the wave produced by the assembly (wave resistance) is too high and may hinder safe hauling. Moreover, there is a large total resistance constituting the sum of wave resistance and residual resistance, which can be overcome by increasing the power of the motors of the hauling set and by increasing the strength of the hauling rope. The maximum haulage speed is also equal to the maximum speed of the current of the watercourse in which the assembly is used. The minimum power of the motor needed for hauling the complete assembly is 77 hp. The minimum number of anchors for the assembly is four, each with the minimum load carrying capacity of 250 kg.

Advantages of the invention

[0019] An advantage of the floating assembly of the invention is its modular which makes it possible to disassemble the platform and to transport it to another body of water and its reassembly. Another advantage is the fact that the design of the invention makes it possible to perform repair projects that are cannot be performed from the ground due to the lack of access by heavy equipment. The use of the barge of the invention does not generate social costs associated with shutdown of bridge structures to traffic. What is also important is the economic aspect that consists in a reduction of costs of relocation of metalizing equipment, because water transport is cheaper than transport over land because it makes it possible to take the entire equipment on a single metallization station onboard of one unit, which is not possible when using standard road transport. The cost of operation of river transport is about 30% lower than the cost of railroad transport and as many as four times lower than the cost of road transport. Also, river barges are the most environment-friendly means of transport. River barges consume relatively the least fuel, generate the least noise, and require the smallest amount of land for the construction of new routes, requires the smallest amount of construction materials, such as railroad rails and asphalt or concrete surfaces, and causes the fewest hazards to the

natural environment.

Claims

1. A floating metallization station, in the form of a barge, supported on connected floats in the form of pontoons, **characterized in that** it consists of six crossing pontoons **(1)** organized in two rows connected with separable fasteners by sterns, and each row consists of three pontoons **(1)** connected with separable fasteners by sides; moreover, each row is connected with a truss **(3)** consisting of two vertical telescopic supports **(4)** connected in a separable manner with angle fasteners **(6)** with a horizontal element **(7);** on a deck made of connected pontoons **(1)** there are components of the metalizing stations which are located so that in the central part of the deck, on the cross-section of the transverse and longitudinal axis of the deck, there is the center of the elevating work platform **(11)** around which there are other elements of the metalizing station; on the sides of the elevating work platform **(11)** there are storage spaces for consumable materials **(12), (13)** and in front of the elevating work platform **(11)** there is a compressor unit **(10),** and behind the elevating work platform **(11)** there is the generator set **(9).**

2. A floating metallization station of claim 1, **characterized in that** the compressor unit **(10)** is located on the deck so that its longitudinal axis overlaps the longitudinal axis of the entire barge and the generator set **(9)** is located on the deck so that its transverse axis overlaps the longitudinal axis of the entire barge.

3. The floating metallization station of claim 1 **characterized in that** the horizontal element **(7)** of the truss **(3)** is located above the bow bulkhead **(8).**

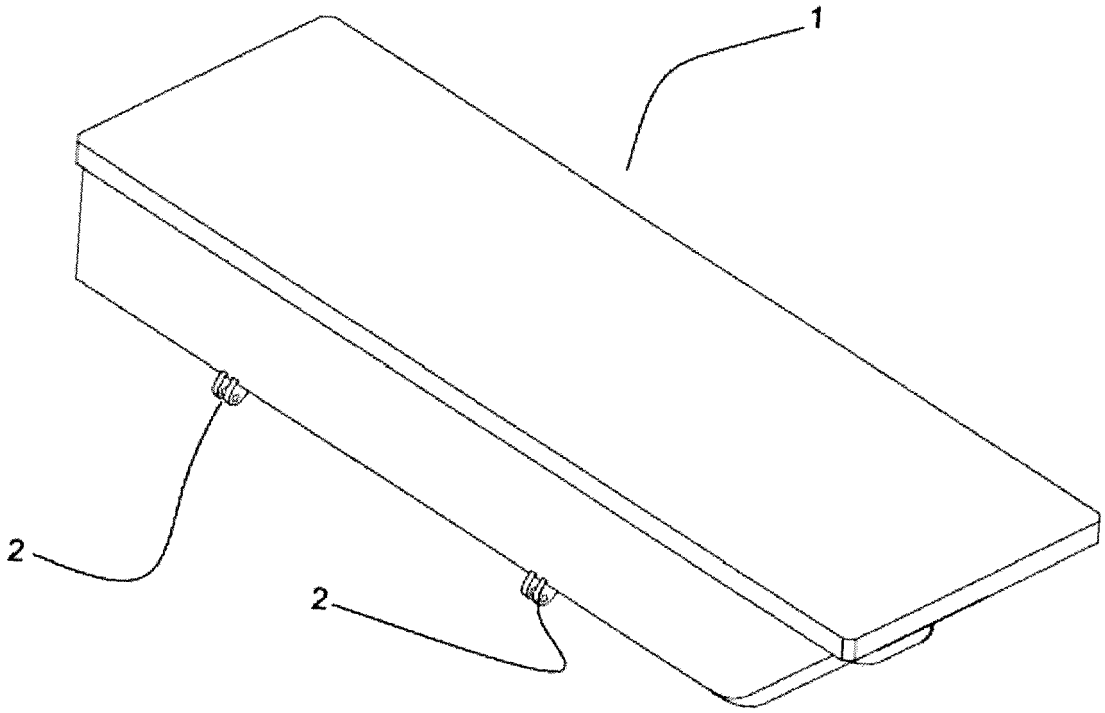

Fig.1A

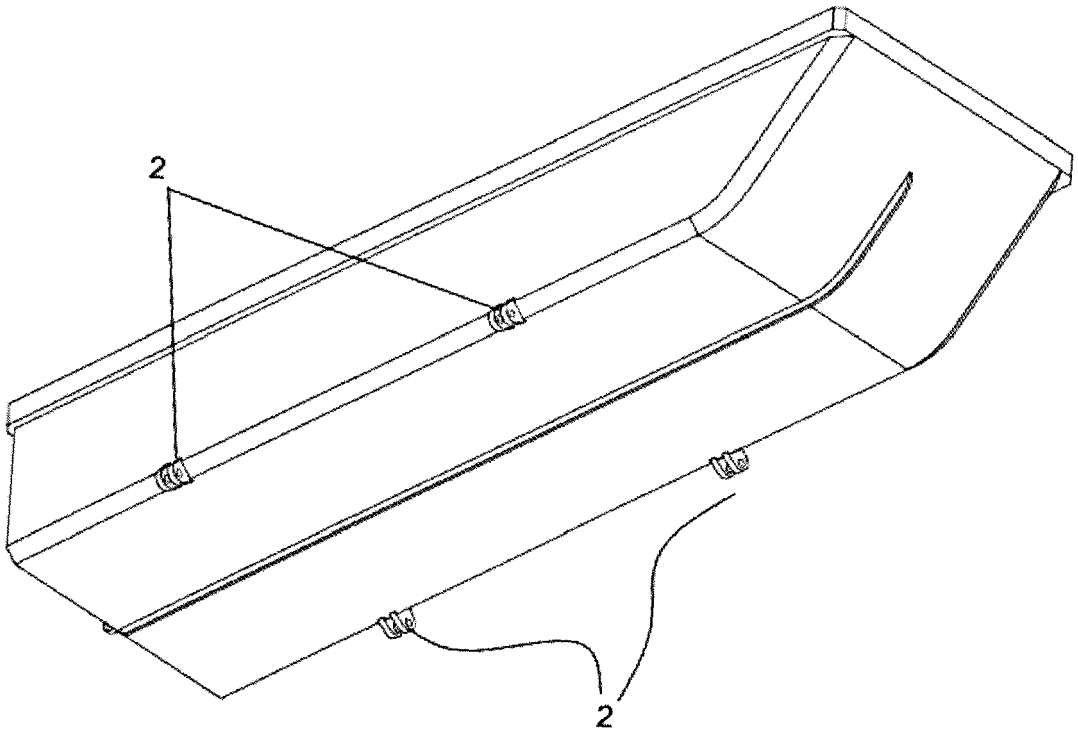

Fig.1B

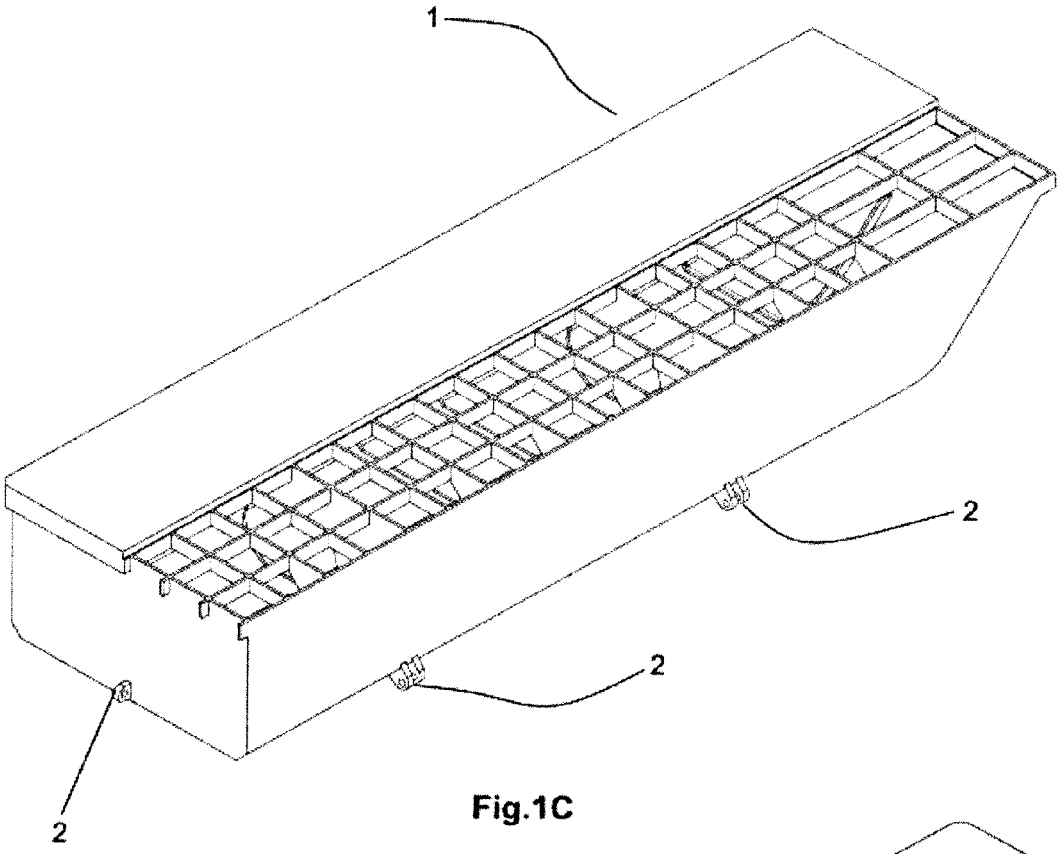

Fig.1C

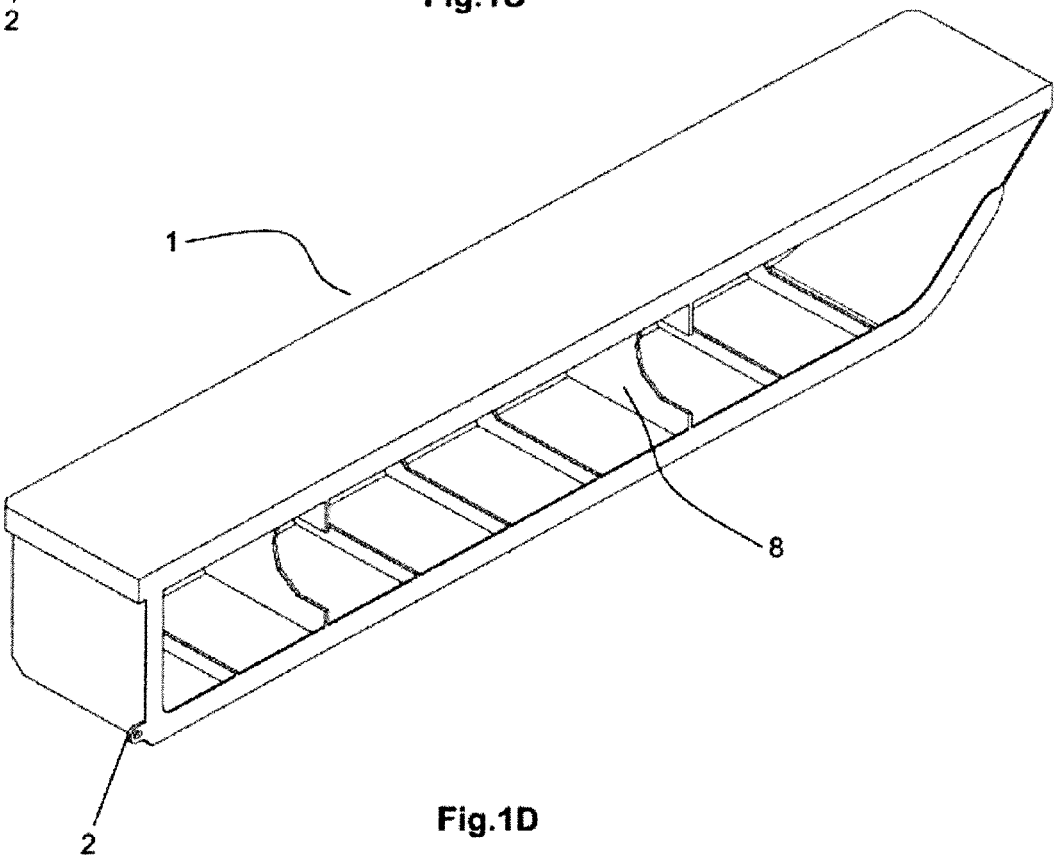

Fig.1D

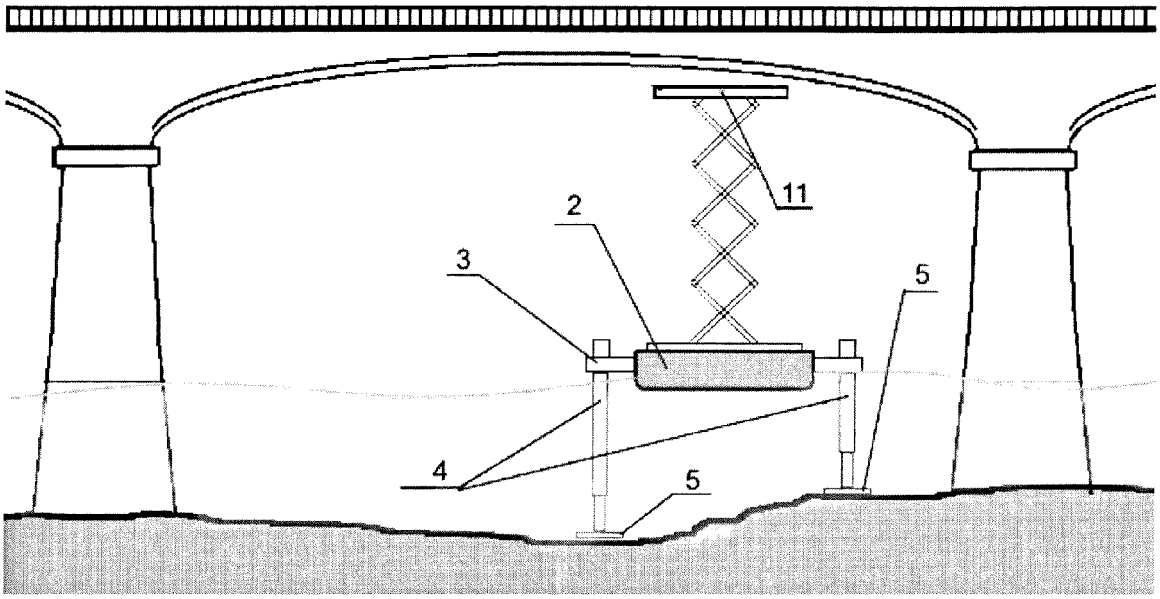

Fig.2

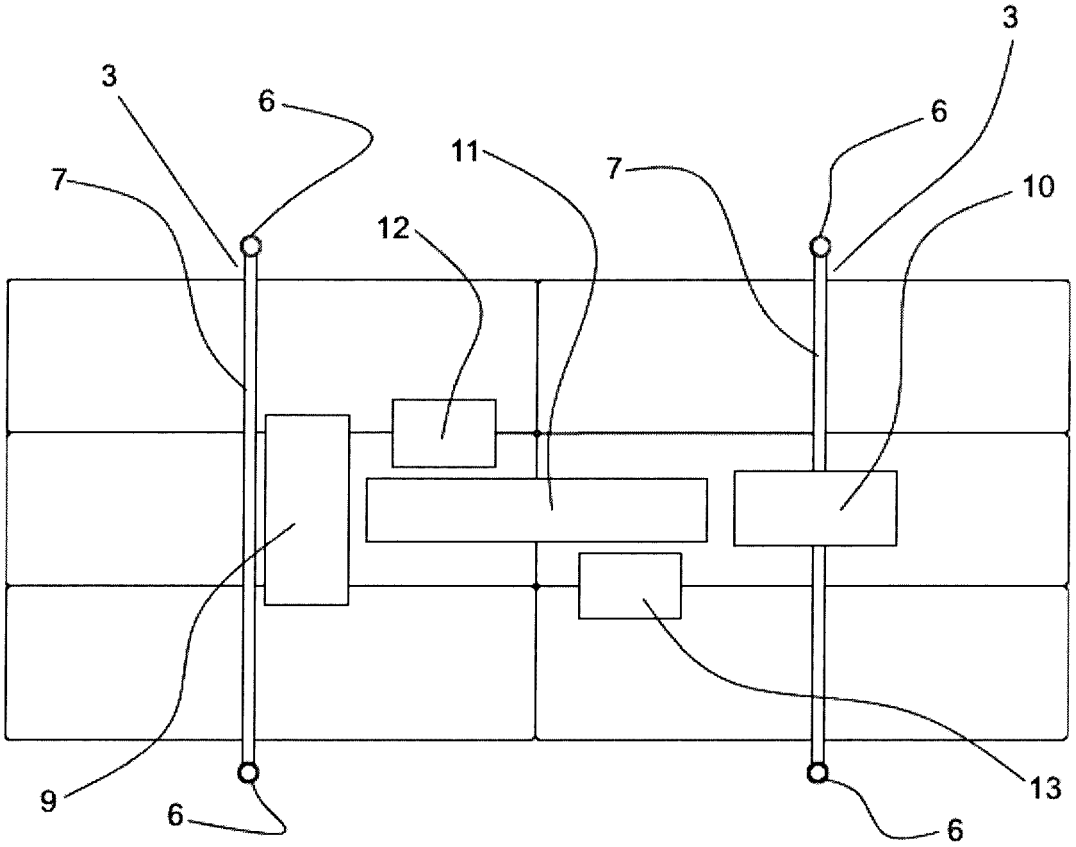

Fig.3A

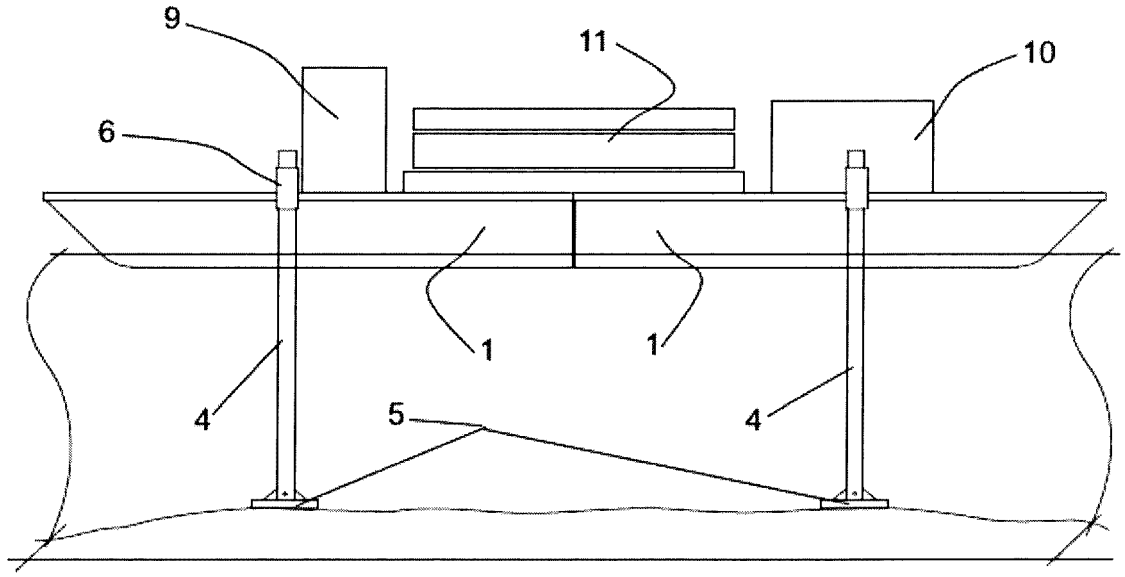

Fig.3B

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EUROPEAN SEARCH REPORT

Application Number
EP 16 46 0010

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2004/099192 A1 (MAYERS JOSEPH [US]) 27 May 2004 (2004-05-27) * paragraphs [0017], [0022] - [0026]; figures 1,2,5 *	1-3	INV. B63B35/28 B63B35/38 B66F11/04 E02F9/06
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A	US 2013/087087 A1 (WERBEL JONATHAN ADAM [US] ET AL) 11 April 2013 (2013-04-11) * paragraphs [0024], [0028] - [0034]; figures 3-10 *	1-3	
A	US 6 698 371 B1 (STOLTZFUS HAROLD A [US]) 2 March 2004 (2004-03-02) * column 2, line 58 - column 3, line 33; figures 1,3 *	1,2	TECHNICAL FIELDS SEARCHED (IPC) B63B B66F E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 November 2016	Mauriès, Laurent

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24-11-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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