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- (72) Inventor: VAN MIDDENDORP, Matthias; Nieuwe Haven 279c, 3117AC Schiedam (NL).
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- (74) Agent: ZACCO NORWAY AS; P.O.Box 488 Skøyen, 0213 Oslo (NO).
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- (71) Applicant: CLEAN SEA SOLUTIONS AS [NO/NO];
Krambugata 2, 7011 Trondheim (NO).

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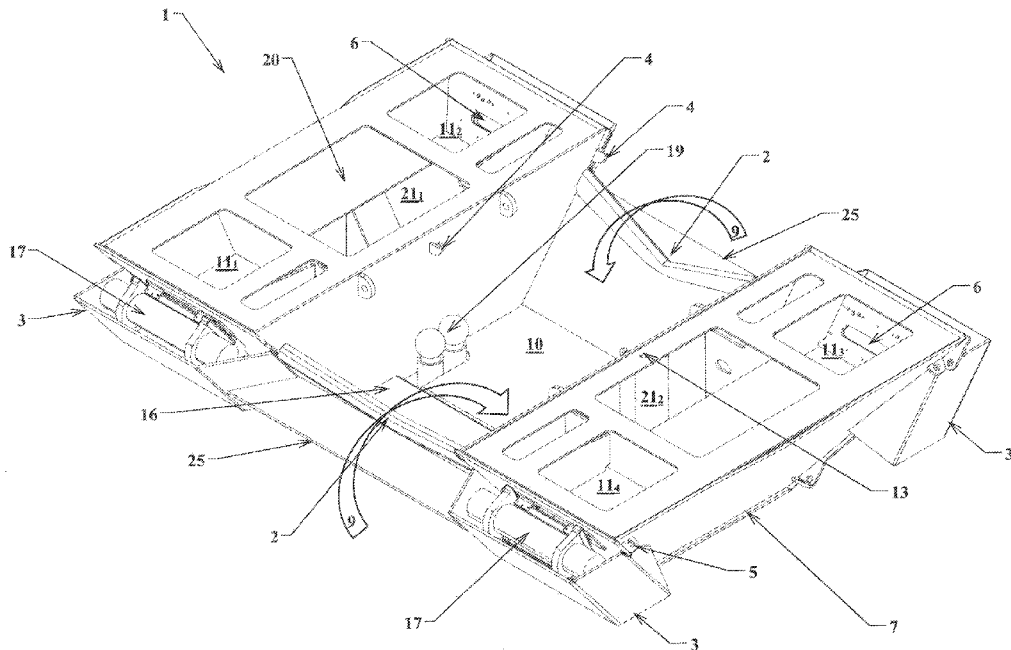


Fig. 1

(57) Abstract: A device (1) for collecting water-borne objects is configured for being arranged in a body of water and comprises a hull (7) with a central compartment (10) for holding a predefined volume of water and one or more collected objects. The central compartment (10) comprises at least one inlet (2) for allowing water and objects to float into the compartment. A plurality of control tanks (11-4) are arranged at a distance from, and being fluidly connected to, the central compartment (10). A pump (15) is arranged and configured to pump water from the central compartment (10) and into at least one of the control tanks, and each control tank comprises an outlet port (6) and an associated outflow valve (17) arranged at a distance (h) above the bottom of the central compartment (10). A level sensor (13) is arranged and configured for sensing the water level in the central compartment (10) and a control system (12) is connected to the level sensor (13) and to the pump (15), whereby the pump (15) is controllable based on information provided by



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the level sensor (13).

Device and assembly for collecting water-borne objects

Technical field of the invention

The present invention relates to a device and assembly for collecting water-borne objects. The invention is particularly useful for collecting debris and other waste
5 floating in a body of water, but may also have other applications.

Background of the invention

The prior art includes WO 2018/102869 A1, which describes a waste collection device comprising a receptacle having an opening in an upper end and a tubular member mounted for sliding movement within the opening. A pump is provided for pumping
10 water outwardly from within the receptacle and a basket is provided within the tubular member. The tubular member comprises a cylindrical inner wall and a cylindrical outer wall connected at upper and lower ends thereof to define an annular chamber to provide buoyancy to the tubular member.

The prior art also includes GB 2569788 A, which describes a water debris skimming
15 device comprising a cylinder which can be submerged just beneath the surface of the sea, having a pump to remove continuously water which has entered through the cylinder's mouth. A pump is provided to remove water by an outlet of the cylinder. A filter such as a wire mesh and/or filter bag is placed at the outlet to trap debris which has entered into the cylinder, therefore filtering water leaving the cylinder. The pump is
20 powered by a floating solar panel. The water debris skimming device may further comprise a one-way valve comprising at least one panel arranged to be biased to be horizontal and blocking the inlet.

The prior art also includes WO 2017/139855 A1, which describes a waste collection device comprising a receptacle having an open upper end for collecting waste from
25 adjacent a surface of a body of water. An upper rim is provided around the open upper end of the receptacle and an outlet is provided for pumping water outwardly from the receptacle. The waste collection device is provided with buoyancy such that the upper rim floats adjacent the surface of the water and the upper rim includes one or more recesses extending downwardly into the upper rim from an upper surface thereof. The

recesses allow water to flow inwardly into the receptacle, thereby capturing waste floating adjacent the surface of the body of water.

The prior art also includes WO 2021/089955 A1, which describes a device for collecting, by overflow, products floating on the surface of a body of water. The device
5 comprises: a tank, a holding member keeping the tank in a position such that the upper edge of the peripheral wall of the tank is situated beneath the free surface of the body of water, a tubular skimming member, which is movable with respect to the tank, comprising an inner shell fitted freely inside the tank and having an upper overflow threshold, and a liquid extraction member communicating with the lower part of the
10 tank, the tubular skimming member being exposed to the level of the liquid in the inner shell. The tubular skimming member comprises an isolating member which delimits, with the inner shell, an annular confinement space in which the upper part of the peripheral wall of the tank is freely fitted, in an interlocking position.

An object of the present invention is to present a device for collecting water-borne
15 objects that is more efficient and has a larger capacity than the prior art devices, and to present an assembly that is more compact and occupies less area near quays and jetties than the prior art assemblies.

Summary of the invention

The invention is set forth and characterized in the main claim, while the dependent
20 claims describe other characteristics of the invention.

It is thus provided a device for collecting water-borne objects, configured for being arranged in a body of water and comprising a hull with a central compartment for holding a predefined volume of water and one or more collected objects; the central compartment comprising at least one inlet for allowing water and objects to float into
25 the compartment, characterized by:

- a plurality of control tanks arranged at a distance from, and being fluidly connected to, the central compartment;
- a pump arranged and configured to pump water from the central compartment and into at least one of the control tanks, the control tanks being interconnected via at least a
30 fluid conduit;

- each control tank comprising an outlet port and an associated outflow valve arranged at a distance above the bottom of the central compartment.

In one embodiment, the device is configured for floating in a body of water and comprises a hull with one or more internal buoyancy chambers. In one embodiment, the device comprises one or more intake openings, with associated inflow valves, fluidly
5 connecting the central compartment to said body of water when the device is placed in the body of water.

In one embodiment, the outflow valve comprises a plate member which is connected to the hull via a hinge device above the outlet port. A buoyant float member is arranged on
10 the plate member in the vicinity of the hinge device and configured to generate an upward force from the water. In one embodiment, an opposing member is arranged in a lower region of the plate member, at a distance away from the hinge device. The opposing member may have a positive buoyancy or a negative buoyancy, wherein an opposing member comprising a ballast element and thus having a negative buoyancy
15 will contribute to the valve-opening moment caused by the buoyant float member, and wherein an opposing member comprising a buoyant element and thus having a positive buoyancy will counteract the valve-opening moment caused by the hydrostatic pressure in the control tank and the weight of the plate member.

In one embodiment, the device comprises a level sensor arranged and configured for
20 sensing the water level in the central compartment, and a control system is connected to the level sensor and to the pump, whereby the pump is controllable based on information provided by the level sensor.

In one embodiment, at least one of the control tanks comprises a drain valve which is configured to be operated to empty the control tanks when the collecting device is being
25 shut down.

It is also provided a method of operating the device according to the invention, characterized by: sensing the water level in the central compartment, comparing the sensed water level with a desired water level in the central compartment; pumping water from the central compartment and into at least one of the control tanks if the sensed
30 water level deviates by a predefined margin from the desired water level.

In one embodiment, a new desired water level is determined based on the average control speed of the pump. The desired water level may be lowered when the controller output pump speed average over a specified time period is higher than the desired range, and increased when it is lower than the desired range.

- 5 It is also provided an assembly for collecting water-borne objects, comprising a vessel, characterized in that the device according to the invention is flexibly connected underneath a portion of the vessel, the vessel comprising a deck and an opening arranged above the central compartment. In one embodiment, the vessel is a floating jetty or barge and the opening is covered by a hatch.

10 **Brief description of the drawings**

These and other characteristics of the invention will become clear from the following description of an embodiment of the invention, given as a non-restrictive example, with reference to the attached schematic drawings, wherein:

- Figure 1 is a perspective view of an embodiment of the collecting device
15 according to the invention, seen obliquely from above;

Figure 2 is a perspective view of the assembly according to the invention, comprising the device arranged in relation to a floating barge or jetty;

Figure 3 corresponds to figure 2, but shows the assembly from another perspective (view from underneath);

- 20 Figure 4 is a plan view from above of the device illustrated in figure 1;

Figure 5 is an elevation side view of the device illustrated in figure 1;

Figure 6 is a section view along section line F-F in figure 4;

Figure 7 is a section view along section line D-D in figure 5;

- Figure 8 is a perspective view of the device illustrated in figure 1 (view from
25 underneath);

Figure 9 is a section view along section line A-A in figure 5;

Figures 10a and 12b are enlarged views of areas B and C, respectively, in figure 9;

Figure 11 a section view along section line E-E in figure 4; and

Figure 12 is a schematic illustration of the device according to the invention.

5 Detailed description of embodiments of the invention

The following description may use terms such as “horizontal”, “vertical”, “lateral”, “back and forth”, “up and down”, “upper”, “lower”, “inner”, “outer”, “forward”, “rear”, “underneath”, “above”, etc. These terms generally refer to the views and orientations as shown in the drawings and that are associated with a normal use of the invention. The terms are used for the reader’s convenience only and shall not be limiting.

An embodiment of the collecting device according to the invention is illustrated in figures 1 and 4-11, while the diagram in figure 12 illustrates principles of the invention. The collection device 1 comprises a hull 7 which is designed and configured to float in a body of water (not shown). The hull may be made of metal, a thermoplastic material, or fibreglass, or any other material or combination of materials that are suited for the intended purpose. In one embodiment, the hull is inherently buoyant and comprises internal buoyancy chambers and/or elements 24 (see e.g. figure 9). In another embodiment, the hull may be suspended by a support structure, such as a floating jetty or barge. The buoyancy chambers may be sealed, air-filled compartments or may comprise a buoyant material. In the illustrated embodiment, the hull has a boat shape (i.e. is elongated in the horizontal plane), but it may have other shapes.

A central compartment, or cavity, 10 is arranged centrally within the hull 7. This compartment 10 is designed for receiving substances floating in the water in which the collecting device is floating. Such substances (not shown) may be debris, garbage, or any other items floating in the water, or a liquid floating in the water surface. The central compartment comprises fastening means 4 to which a removable bag may be connected. In the illustrated embodiment, the compartment 10 is open upwards, but this is not a requirement. Arranged on opposite sides of the central compartment 10 are a plurality of ballast tanks 11₁₋₄, 21_{1,2}. Reference numbers 11₁₋₄ denote "control tanks", and reference numbers 21_{1,2} denote "central tanks".

The first and second central tanks 21_{1,2} are fluidly connected to the central compartment 10 via first conduits 26 (see figure 11), such that water entering the central compartment will flow into the central tanks, without any pump assistance. The central compartment 10 and the central tanks 21_{1,2} may thus for operational purposes be regarded as one fluid compartment. In the illustrated embodiment, the central tanks 21_{1,2} comprise respective (optional) overflow outlets 22 (see e.g. figures 3 and 8) that preferably are V-shaped as a safety feature to ensure that the central tanks are not overfilled. The elevation of each overflow outlet 22 is dimensioned and arranged so as to ensure an outflow at a location where the water height is the highest regardless of movement of the collecting device.

Each central tank 21_{1,2} comprises a horizontal panel 20 (see e.g. figures 1, 4, 6), arranged immediately below the overflow outlet, which enhances hull stability and stops heeling and slows down flow through the overflow outlet. The figures show that one of the central tanks (in the illustrated embodiment: the first central tank 21₁) comprises a pump 15, which is configured and arranged for pumping water from the central tanks (and hence the central compartment 10) and into the control tanks 11₁₋₄. Although not illustrated, it should be understood that both central tanks may comprise such pump.

The control tanks 11₁₋₄ are in fact ballast chambers, and are preferably arranged symmetrically in relation to the central compartment 10. The tanks are used for controlling the buoyancy and the attitude of the collection device 1 when it is in operation in the water. In the illustrated embodiment, the control tanks 11₁₋₄ are located in hull's corner regions and are arranged at a higher level than the central tanks and the central compartment (see e.g. figure 9). Controlling the water volume inside each control tank (independently of each other) therefore controls the buoyancy and the attitude of the entire collecting device in response to the volume of water held in the central compartment and to forces and moments caused by external factors (waves, impacts, etc.), and contributes to keeping the device stable. The control tank design is very specific, to allow the desired flow through the system, keeping the system balanced in different conditions and flow speeds while enabling sufficient water loss with high pumps speeds and slow enough throughput with lower pump speeds allowing the collecting device to stay balanced in different conditions. The control tanks 11₁₋₄ are fluidly interconnected via one or more conduits (figure 1 shows one such conduit 16).

Pumping water from the central tanks and into one control tanks therefore effectively fills water into all of the control tanks.

Each control tank comprises an outlet port 6 for flowing water from the control tank to the outside, i.e. to reduce the water volume inside the tank. The outlet port 6 is arranged
5 at a distance h above the bottom of the central compartment 10 and is controlled by a float-controlled outflow valve 17, in the illustrated embodiment arranged on the outside of the hull. The float-controlled outflow valve may be surrounded by a skirt 3, the purpose of which is to protect the float-controlled outflow valve from impact from objects floating in the water, and to direct water flowing from the outlet port downwards
10 (so as not to interfere with water flowing into the central compartment).

Figures 9, 10a, and 10b show the float-controlled outflow valves 17 in detail. In these figures, the float-controlled outflow valve on the right-hand side is shown in a closed position and the float-controlled outflow valve on the left-hand side is shown in an open position. The float-controlled outflow valve 17 comprises a plate member 34 which is
15 connected to the hull via a hinge device 35 above the outlet port 6. A gasket may be arranged around the outlet port 6 and configured to seal against the plate member. A float member 36 is arranged on the plate member in the vicinity of the hinge device and will generate an upward force from the water, and thus bias the plate member outwards from the hull and open the outlet port 6. An opposing member 37 (optional) may be
20 arranged in a lower region of the plate member 35, at a distance away from the hinge device. The opposing member 37 may have a positive buoyancy or a negative buoyancy. An opposing member 37 having a negative buoyancy (i.e. comprising a ballast element) will contribute to the valve-opening moment caused by the buoyant float member 36. An opposing member 37 having a positive buoyancy (i.e. comprising
25 a buoyant element) will counteract the valve-opening moment caused by the hydrostatic pressure in the control tank and the weight of the plate member.

The central compartment 10 comprises inlets 2, in the illustrated embodiment, one on each side of the hull. The inlets preferably have a V-shape or a similar geometry (i.e. having a distinct lowest region) in order to facilitate collection of items or substances
30 floating in the water flowing into the compartment. This geometry makes the inlet less sensitive to waves and allows for items flowing deeper in the water to enter the central

compartment. Arranged below each inlet is a horizontal plate section 25 (optional), the purpose of which is to make the inflow more laminar and prevent upwards currents near the inlet 2. The arrows 9 in figure 1 illustrate water flowing into the central compartment 10.

5 The central compartment 10 comprises inflow valves 19 that are fluidly connected to respective intake openings 19' in the hull bottom. It should be understood that the valves and intake openings may be arranged on the side of the central compartment. The water intake opening may also be provided by changing the shape of the inlets 2, for example having them extend downwards, in which case designated intake openings and
10 associated valves are required. In the illustrated embodiment, four inflow valves 19 are arranged in the central compartment. In one embodiment, the inflow valves 19 are float-controlled and configured for controlling the minimum water level in the central compartment. The inflow valve may be a linear valve or a flap valve or any other suitable valve known in the art. It should be understood that the compartment may
15 comprises fewer or more inflow valves than those illustrated.

Although not illustrated in figures 1-11, at least one of the control tanks 11 comprises a drain valve which is used to empty the control tanks when the collecting device is being shut down. The drain valve may be a spring-actuated check valve, or any valve type
20 suitable for the intended purpose (Figure 12 schematically illustrates one such drain valve 18).

Referring now to figures 2 and 3, the invented collecting device 1 may be installed underneath a floating vessel 30, such as a barge or floating jetty. The vessel 30 comprises a deck 31 supported by a plurality of pontoons 32, and a hatch 33 is arranged in the deck. The hatch 33 covers an opening which is arranged above the collecting
25 device central cavity 10 (not shown in figures 2 and 3) and may be opened to give access to the central cavity, for inspection and for removing items that have been collected by the device 1 (e.g. in a cargo bag or net). The hatch 33 may be transparent or opaque. A device (not shown) for controlling the collecting device 1 (i.e. receiving and processing sensor information, controlling a pump) may be provided on the vessel deck
30 31. The collection device 1 is tethered to the vessel 30 in a manner known in the art (e.g. via chains or ropes, not shown) for example via padeyes 5, but the collection

device and the vessel are not rigidly connected so the buoyancy of the collection device does not affect the buoyancy of the vessel, and vice versa. It should be understood that the collection device 1 may be installed underneath or adjacent to any platform, be it a floating vessel such as the illustrated vessel 30 or a fixed structure. By integrating the collecting device 1 into the floating jetty, instead of arranging it on the side of it, utilizes the otherwise empty space between the jetty pontoons.

It should be understood that figures 1-11 are illustrations of a specific embodiment, and that the invention may comprise other valve types than those illustrated. Also, the figures only illustrate features that are necessary to elucidate the invention, and do not illustrate cables, wires, hoses and other parts that may be required to operate the device.

A unique feature of the collecting device according to the invention is that the device may be operated without influencing its buoyancy. Water that is pumped out of the device is simply topped up to the control tanks and therefore has a zero net effect on its buoyancy. The control tanks and their associated outflow valves are placed in the hull corners in order to counteract the instability which liquid ballast brings to the system.

If the collecting device sinks deeper in the water, the water intake via the V-shaped inlets 2 increases, but the outflow via the outflow valves 17 also increases, which make it possible to run the collecting device on a fixed pump speed, without compromising its buoyancy. As the plate member 34 is further from the rolling axis than the inflow point (i.e. the inlet 2), heavier waves cannot sink the system. The buoyant outflow valves 17 are not solely operated by the floatation height of the floaters, the hydrostatic pressure inside the ballast chambers also contribute to pushing the plate members open.

The collecting device 1 according to the invention will now be described in more general terms with reference to figure 12. Reference numbers used in figure 12 correspond to the reference numbers used above for the description of the specific embodiment illustrated in figures 1-11, but shall not be limited to that embodiment.

The central compartment 10 is configured for receiving an inflow 9 of water (and debris or other substances). Inflow valves (one or more) 19 are fluidly connected to the body of water in which the collection device 1 is floating when in operation, and allows a flow of water into the central compartment 10. The inflow valves may be level-

controlled (e.g. by means of a float device), but may also be controlled by other means. A pump 15 is arranged to pump water from the central compartment 10 and into the control tanks 11_{1,2}. A check valve 14 is arranged between the pump and the control tank. Figure 12 shows two control tanks, but it should be understood that the collecting device 1 may comprise other quantities of control tanks, for example as described above with reference to figures 1-11. The control tanks are arranged on opposite sides of the central compartment and at a distance sufficient for establishing a respective moment arm to the central compartment. The volume of the control tanks and their distances from the central compartment are dimensioned such that the control tanks may generate a sufficient righting moment due to changes in volume in the central compartment and/or external forces acting on the hull. Each control tank 11_{1,2} comprises an outlet port 6 and one or more outflow valves 17, for example of the kind described above with reference to figures 9, 10a, 10b. The outlet ports 6 are arranged at a distance h above the bottom of the central compartment 10. A fluid conduit 16 interconnects the control tanks, whereby all control tanks may be filled by the same pump. It should be understood that other pump configurations are possible. At least one – preferably all – of the control tanks comprises a drain valve 18, which is used to empty the control tanks when the collecting device is being shut down. The drain valve 18 may be any type in the art. A level sensor 13 is arranged and configured for sensing the water level in the central compartment 10, and may be a pressure sensor or a float-based height sensor. The level sensor 13 communicates with the control system 12, which in turn controls the pump 15. Reference number 8 denotes electronic communication, which may be by any means known in the art. Power cables and other ancillary equipment required to operate the collecting device are not illustrated, as these are well known in the art.

The collecting device is configured such that the inlet 2 is above water level when the collecting device is placed in the water and not in operation. This will prevent debris from escaping the central compartment when the pump is switched off. When the collecting device is in a start-up mode, i.e. having been placed in the water, the inflow valves 19 will allow water to flow into the central compartment 10. When the water level inside the central compartment 10 has reached a desired or pre-determined level, the pump 15 will start and pump water from central compartment 10 and into the control tanks 11₁₋₄. This start-up sequence is completed after a specified duration or

when the device has reached a desired draft (as determined by e.g. sensors). When the collecting device is in an operation mode, the pump 15 will run at a speed necessary to maintain a desired draft (and hence a desired water level above the bottom of the central compartment 10. Changes detected by sensors will be used to determine the pump
5 speed. Optionally, a new desired water level may be determined based on the average control speed of the pump. The desired water level may be lowered when the controller output pump speed average over a specified time period is higher than the desired range, and increased when it is lower than the desired range.

As running the collecting device is buoyancy neutral, the inflow valve 19 (e.g. a floater
10 valve) opens when the water level runs low, allowing additional water to flow into the system in the starting phase.

When stopping the pump, water flows out of the collecting device without flowing back via the pump. Therefore, two valves are implemented, a check valve 14 on the pump 15 outlet and a check valve on the side of device facing the pump outlet. The valves may
15 be spring-biased that may open the valve and close by the pressure provided by the pump. As soon as the pump stops, the control tanks 11 are drained via this valve 18 and the collecting device becomes more buoyant. A software stop sequence can help this process. Pumping full speed for a period of time will contribute to the device floating higher before stopping the pump. All these passive floater-based valves could also be
20 replaced by active/ controlled solutions.

In the embodiments described above, various features and details are shown in combination. The fact that several features are described with respect to a particular example should not be construed as implying that those features by necessity have to be included together in all embodiments of the invention. Conversely, features that are
25 described with reference to different embodiments should not be construed as mutually exclusive. As a person skilled in the art readily will understand, embodiments that incorporate any subset of features described herein and that are not expressly interdependent have been contemplated by the inventor and are part of the intended disclosure. However, explicit description of all such embodiments would not contribute
30 to the understanding of the principles of the invention, and consequently some permutations of features have been omitted for the sake of simplicity or brevity.

Claims

1. A device (1) for collecting water-borne objects, configured for being arranged in a body of water and comprising a hull (7) with a central compartment (10) for holding a predefined volume of water and one or more collected objects; the central compartment
5 (10) comprising at least one inlet (2) for allowing water and objects to float into the compartment, **characterized by:**
- a plurality of control tanks (11₁₋₄) arranged at a distance from, and being fluidly connected to, the central compartment (10);
 - a pump (15) arranged and configured to pump water from the central compartment
10 (10) and into at least one of the control tanks (11₁₋₄), the control tanks being interconnected via at least a fluid conduit (16);
 - each control tank (11₁₋₄) comprising an outlet port (6) and an associated outflow valve (17) arranged at a distance (*h*) above the bottom of the central compartment (10).
2. The device of claim 1, wherein the device is configured for floating in a body of
15 water and comprises a hull (7) with one or more internal buoyancy chambers (24).
3. The device of claim 1 or claim 2, further comprising one or more intake openings (19'), with associated valves (19), fluidly connecting the central compartment (10) to said body of water when the device (1) is placed in the body of water.
4. The device of any one of claims 1-3, wherein the outflow valve (17) comprises a
20 plate member (34) which is connected to the hull via a hinge device (35) above the outlet port (6).
5. The device of claim 4, wherein a buoyant float member (36) is arranged on the plate member in the vicinity of the hinge device and configured to generate an upward force from the water.
- 25 6. The device of claim 5, further comprising an opposing member (37) arranged in a lower region of the plate member (35), at a distance away from the hinge device (35).
7. The device of claim 6, wherein the opposing member (37) may have a positive buoyancy or a negative buoyancy,
- wherein an opposing member comprising a ballast element and thus having a negative

buoyancy will contribute to the valve-opening moment caused by the buoyant float member (36), and

- wherein an opposing member (37) comprising a buoyant element and thus having a positive buoyancy will counteract the valve-opening moment caused by the hydrostatic pressure in the control tank and the weight of the plate member.

8. The device of any one of claims 1-7, further comprising a level sensor (13) arranged and configured for sensing the water level in the central compartment (10), and a control system (12) is connected to the level sensor (13) and to the pump (15), whereby the pump (15) is controllable based on information provided by the level sensor (13).

9. The device of any one of claims 1-8, wherein at least one of the control tanks (11₁₋₄) comprises a drain valve (18) which is configured to be operated to empty the control tanks when the collecting device (1) is being shut down.

10. A method of operating the device (1) as defined by any one of claims 1-9, **characterized by:**

- sensing the water level in the central compartment (10),
- comparing the sensed water level with a desired water level in the central compartment;
- pumping water from the central compartment (10) and into at least one of the control tanks (11₁₋₄) if the sensed water level deviates by a predefined margin from the desired water level.

11. The method of claim 10, wherein a new desired water level is determined based on the average control speed of the pump.

12. The method of claim 11, wherein the desired water level is lowered when the controller output pump speed average over a specified time period is higher than the desired range, and increased when it is lower than the desired range.

13. An assembly for collecting water-borne objects, comprising a vessel (30), **characterized in that** the device of any one of claims 1-9 is flexibly connected underneath a portion of the vessel (30), the vessel comprising a deck (31) and an opening arranged above the central compartment (10).

14. The assembly of claim 13, wherein the vessel is a floating jetty or barge and the opening is covered by a hatch (33).

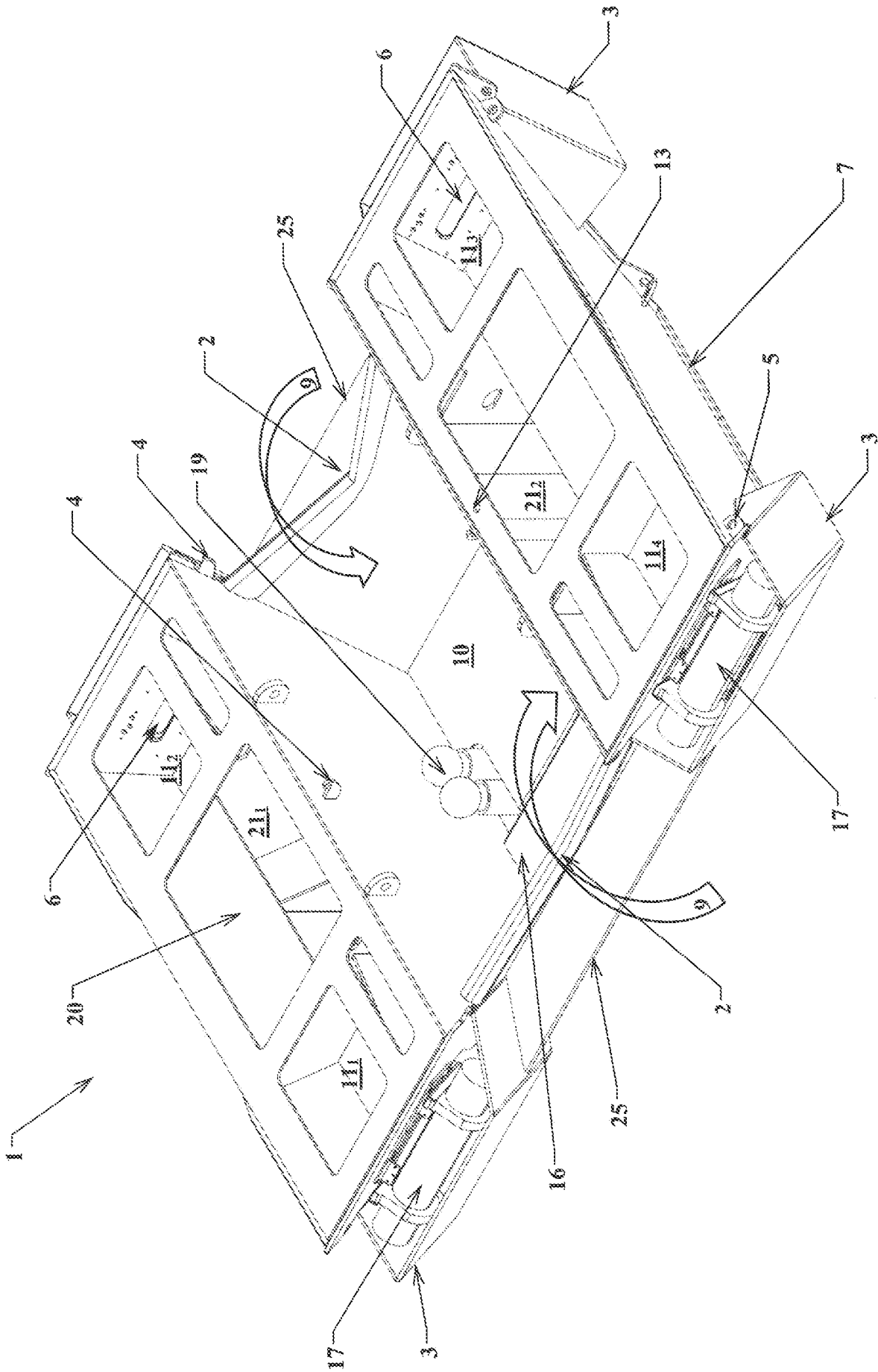


Fig. 1

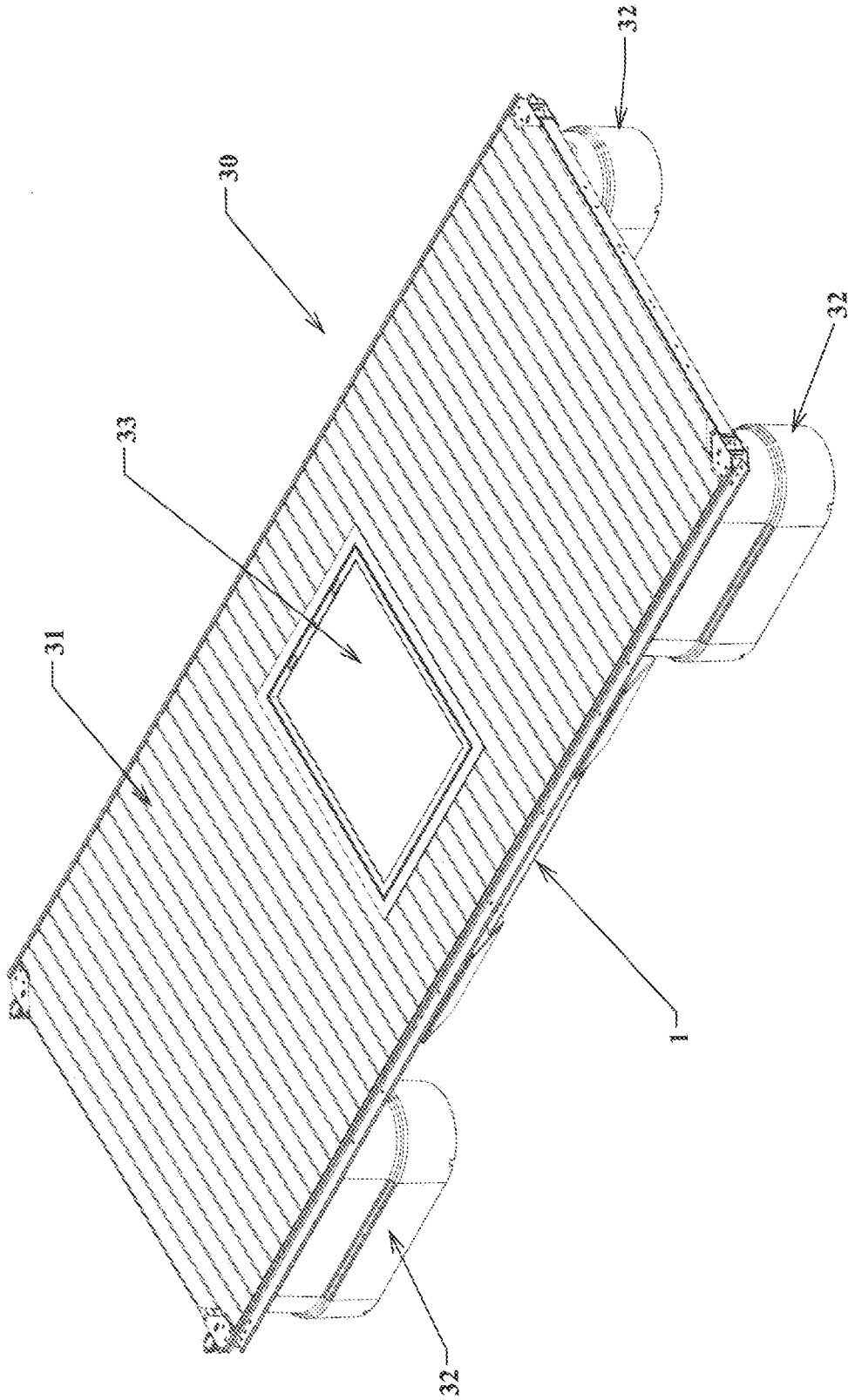


Fig. 2

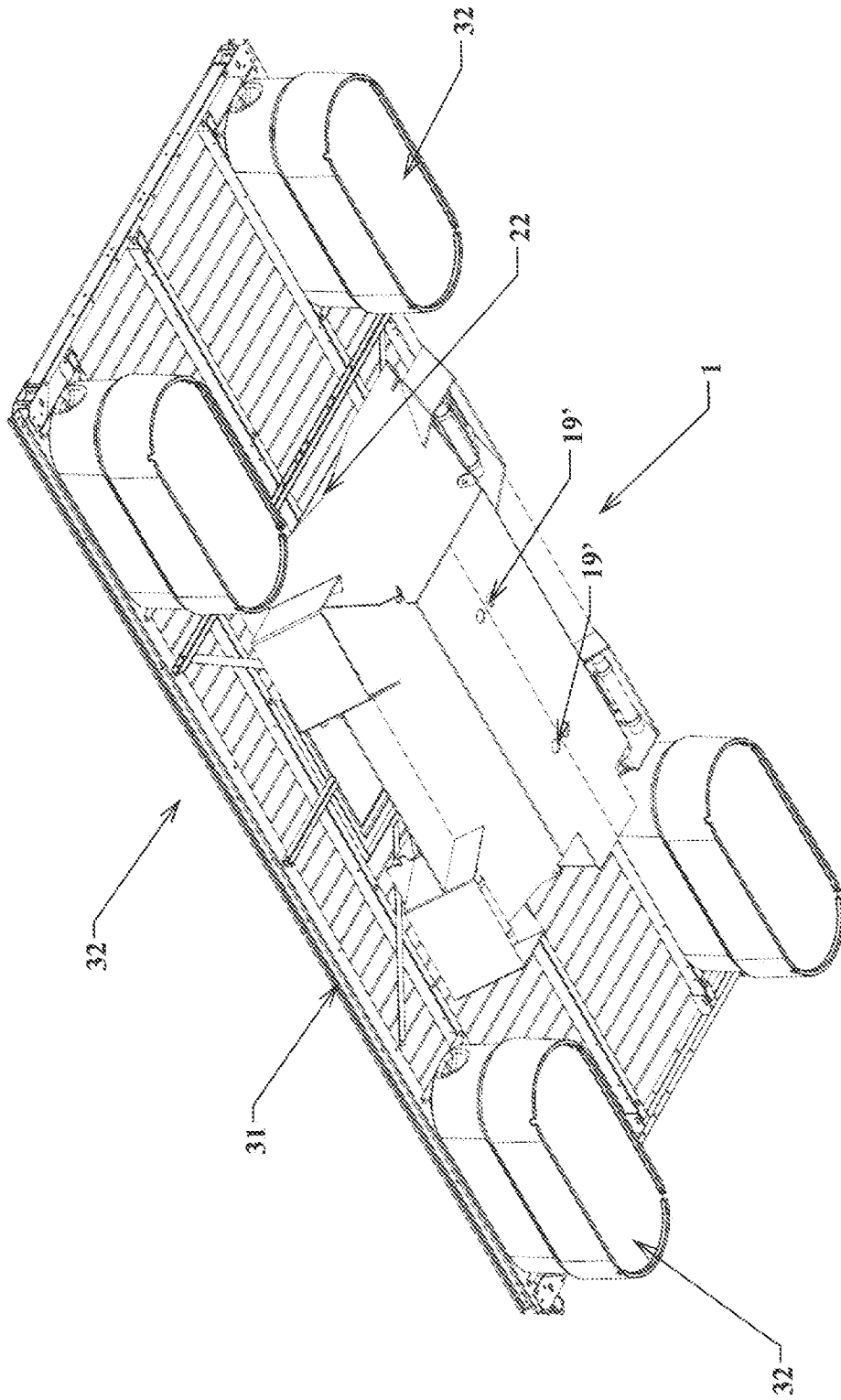


Fig. 3

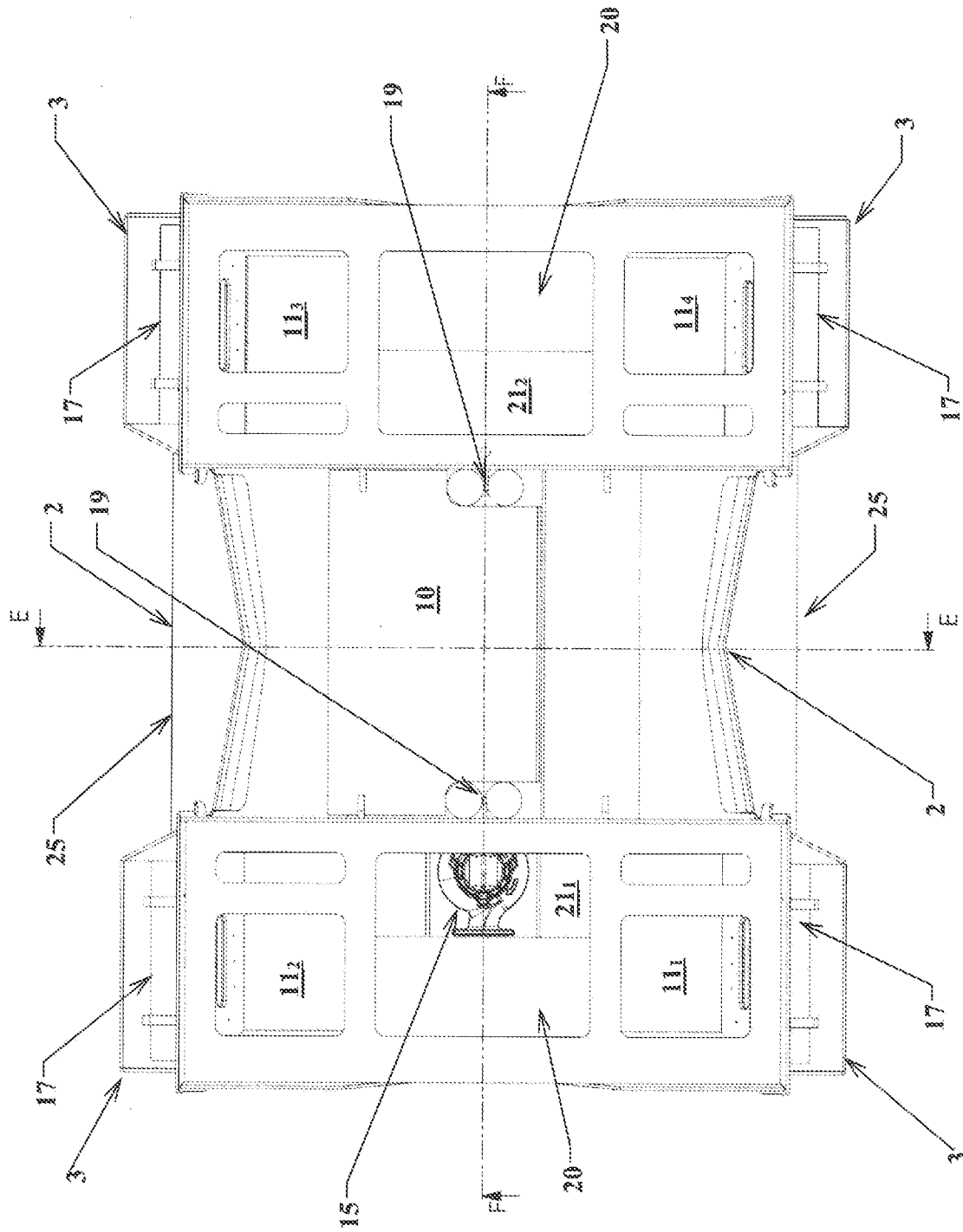


Fig. 4

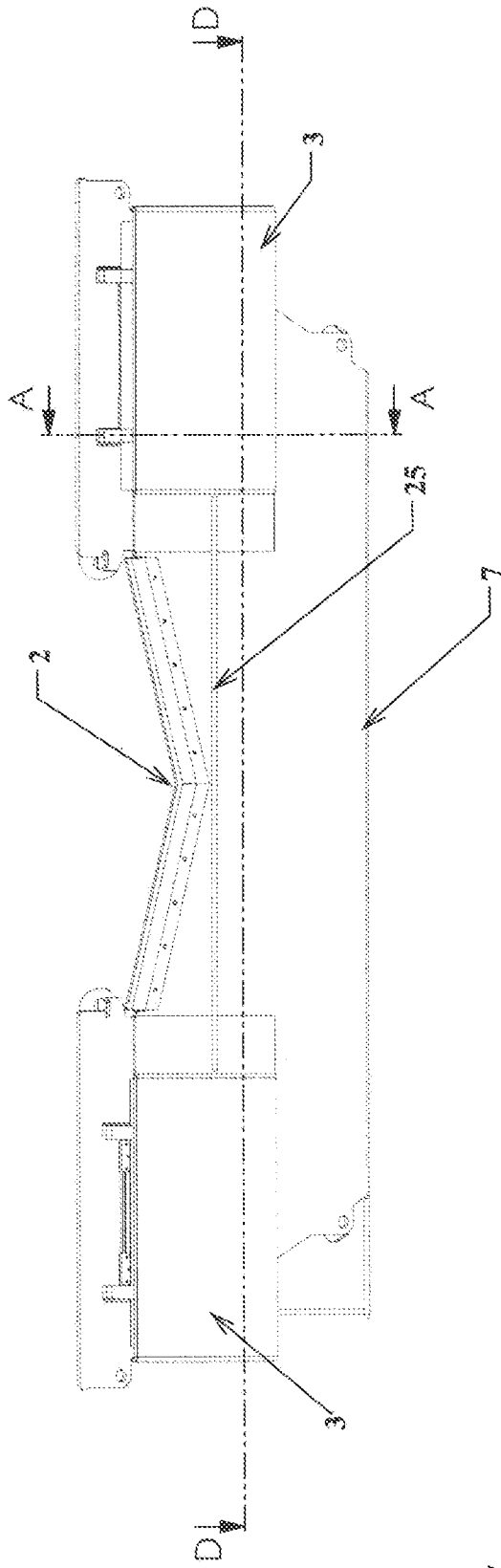


Fig. 5

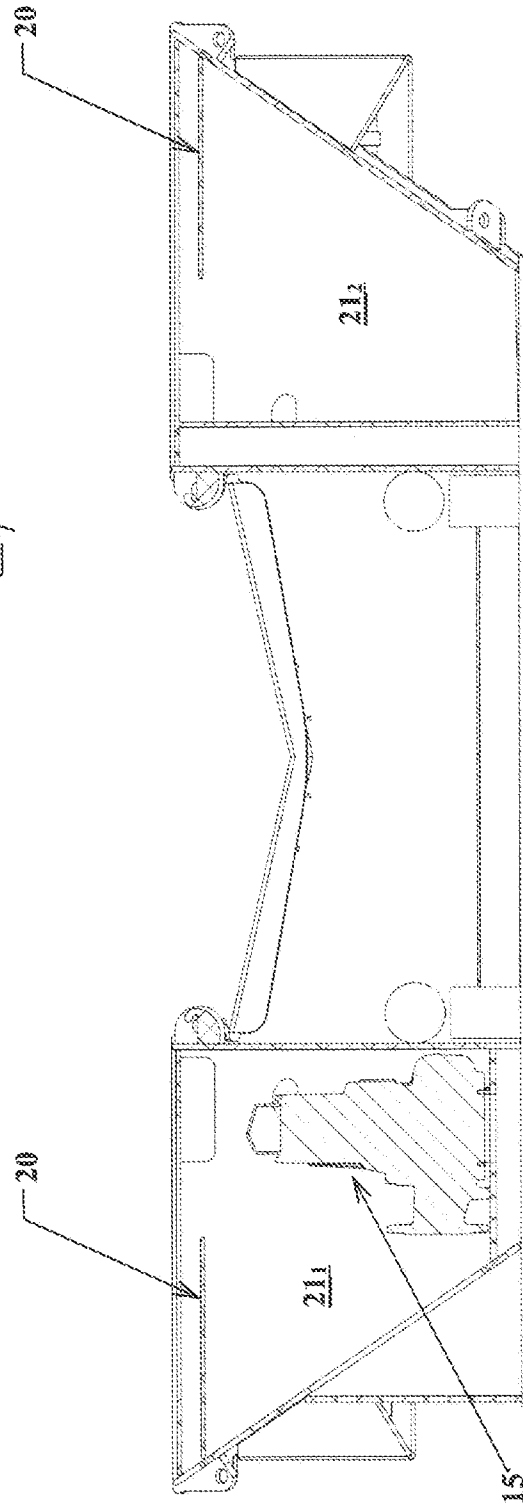


Fig. 6

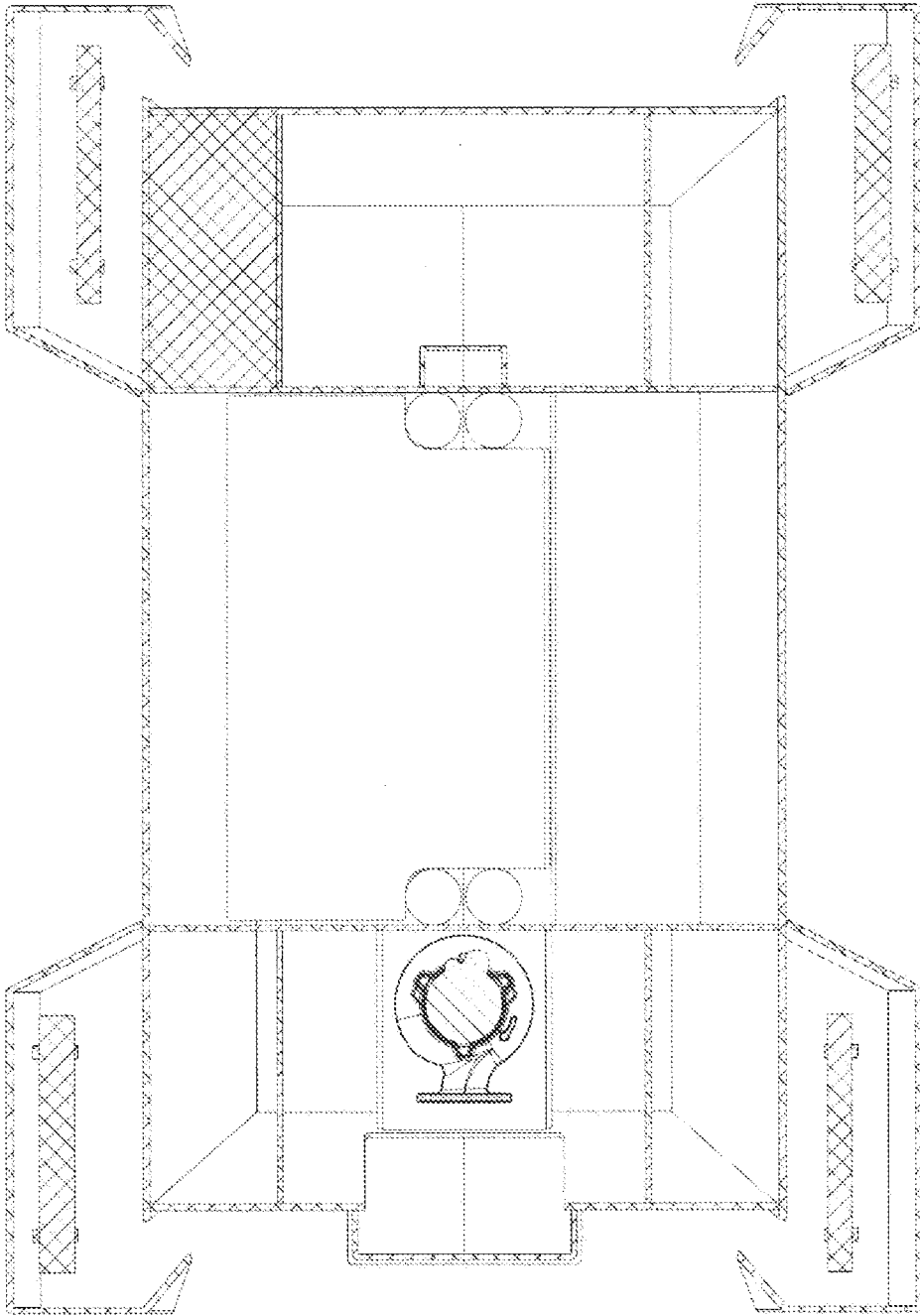


Fig. 7

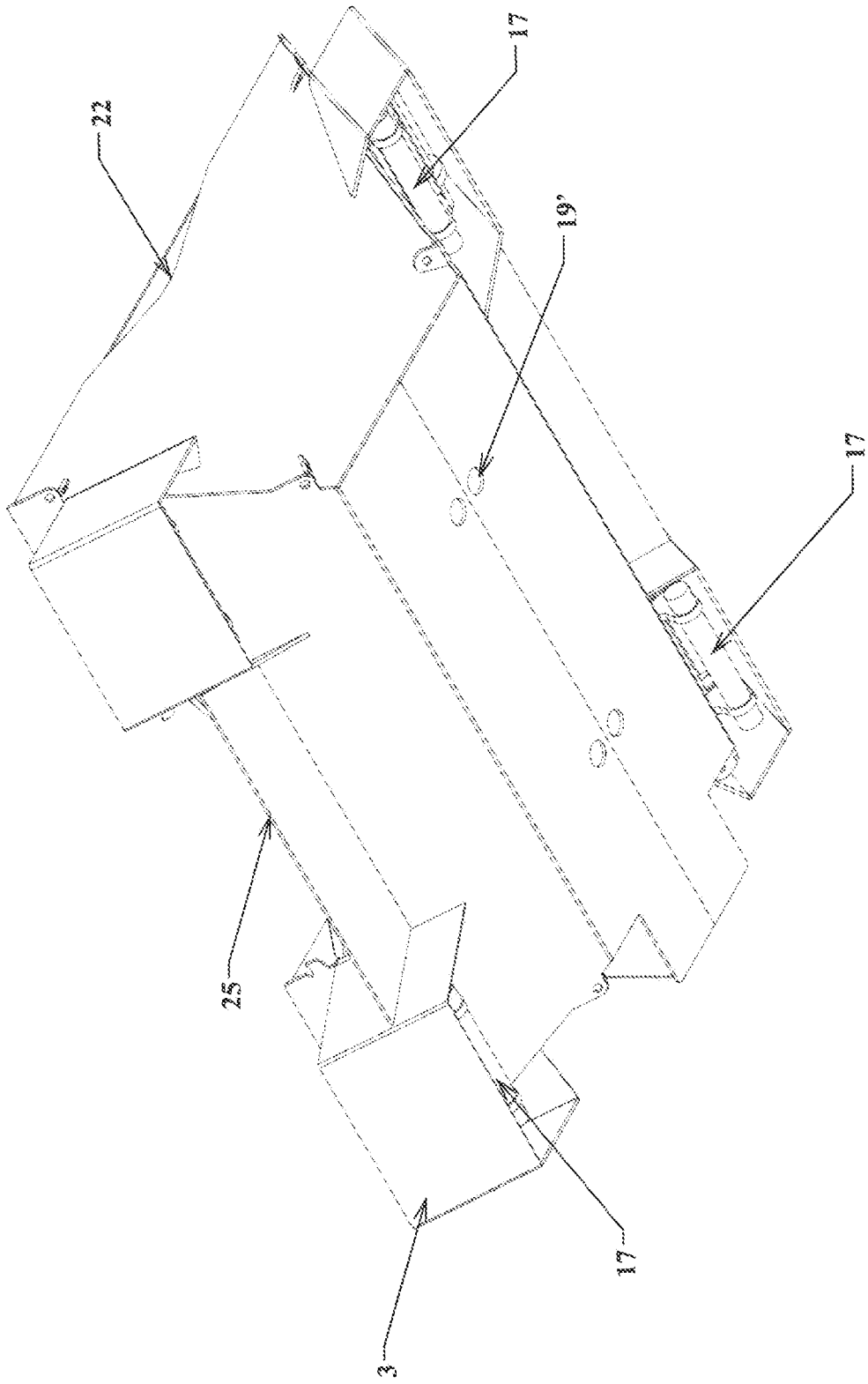


Fig. 8

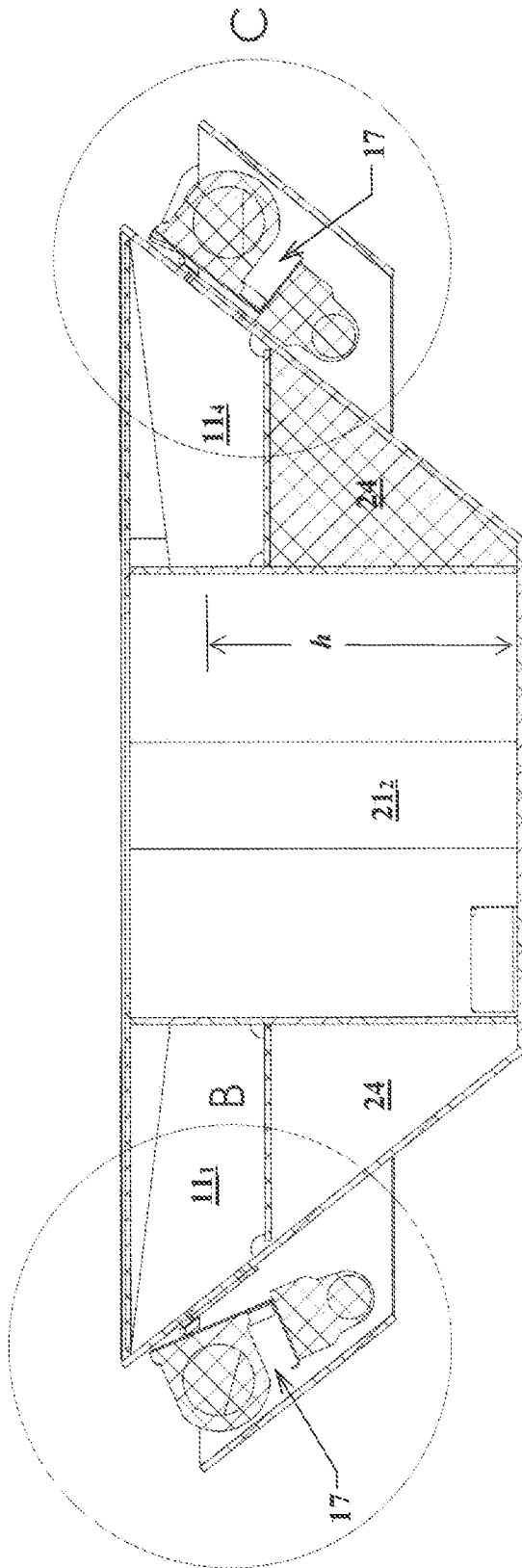
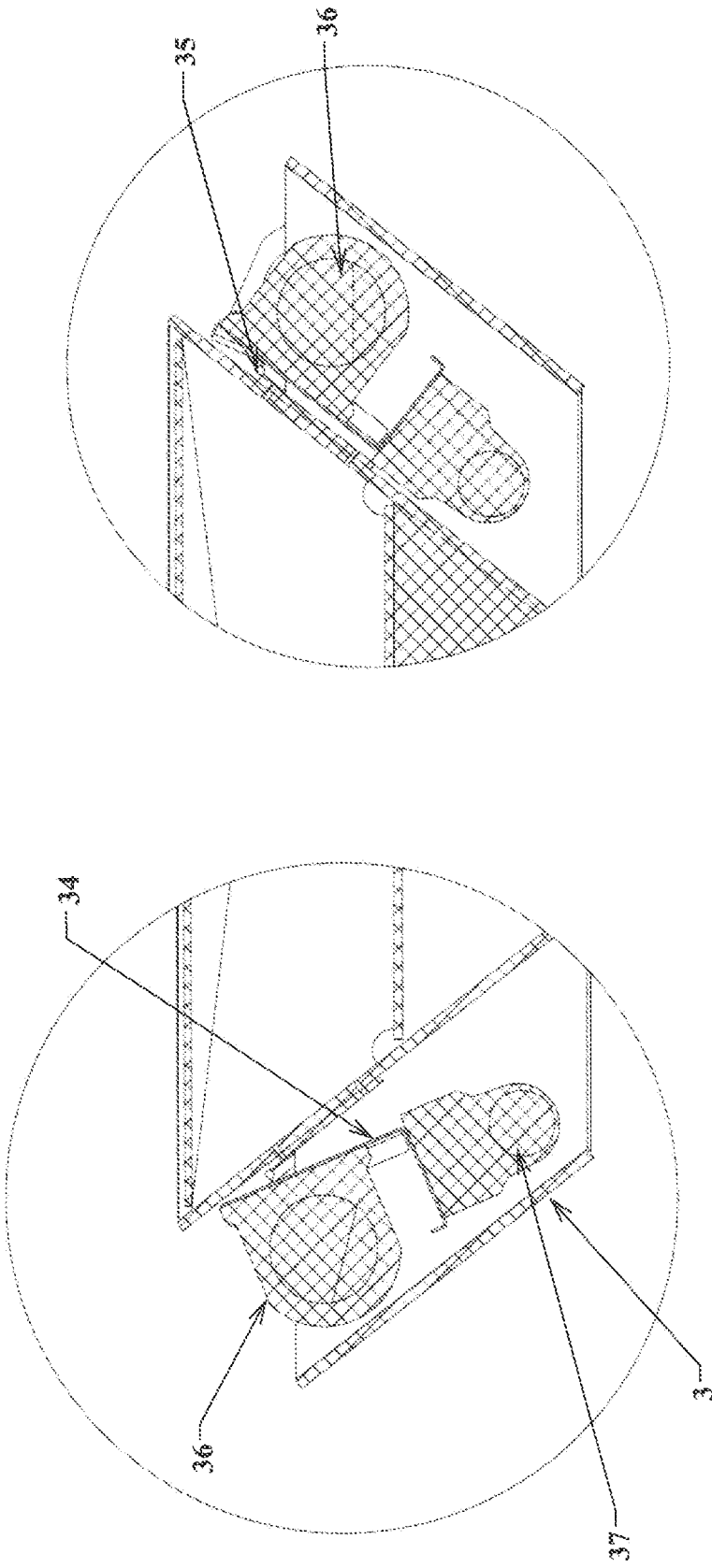


Fig. 9



(b)

(a)

Fig. 10

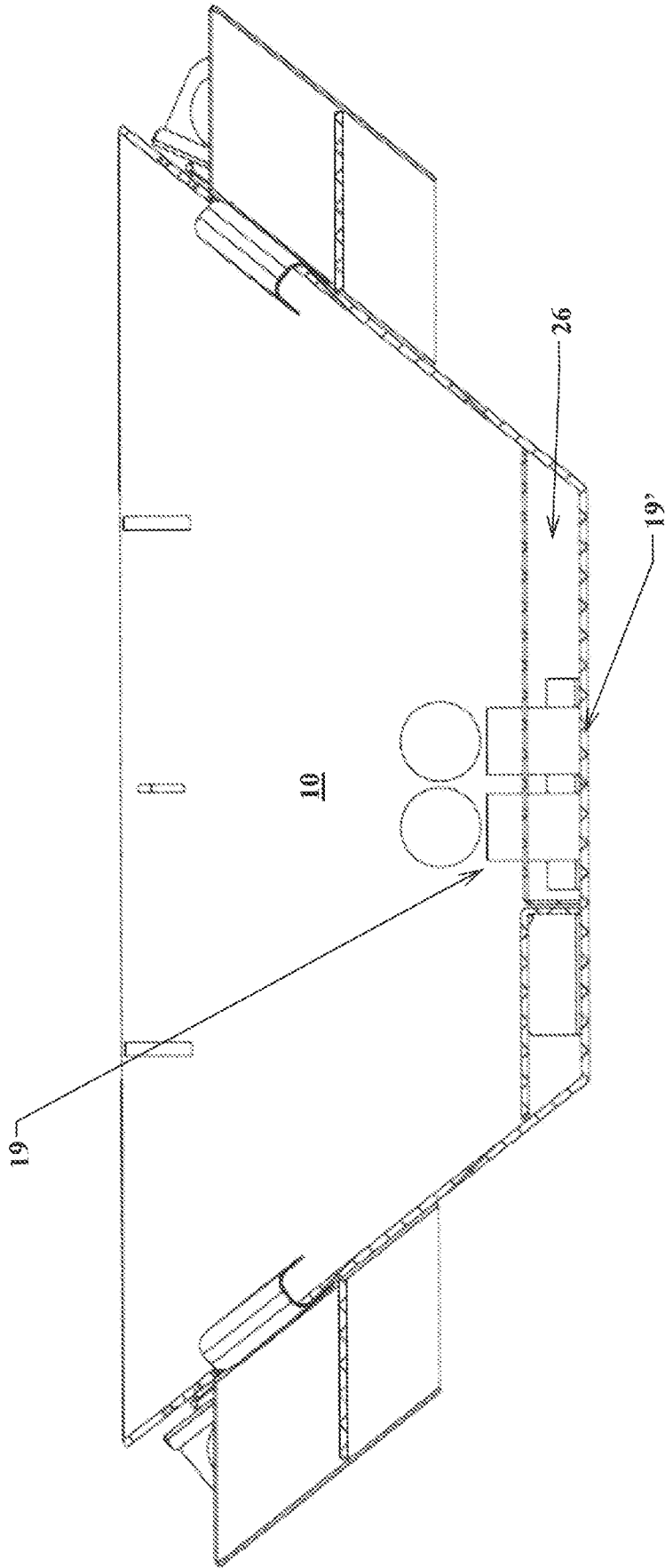


Fig. 11

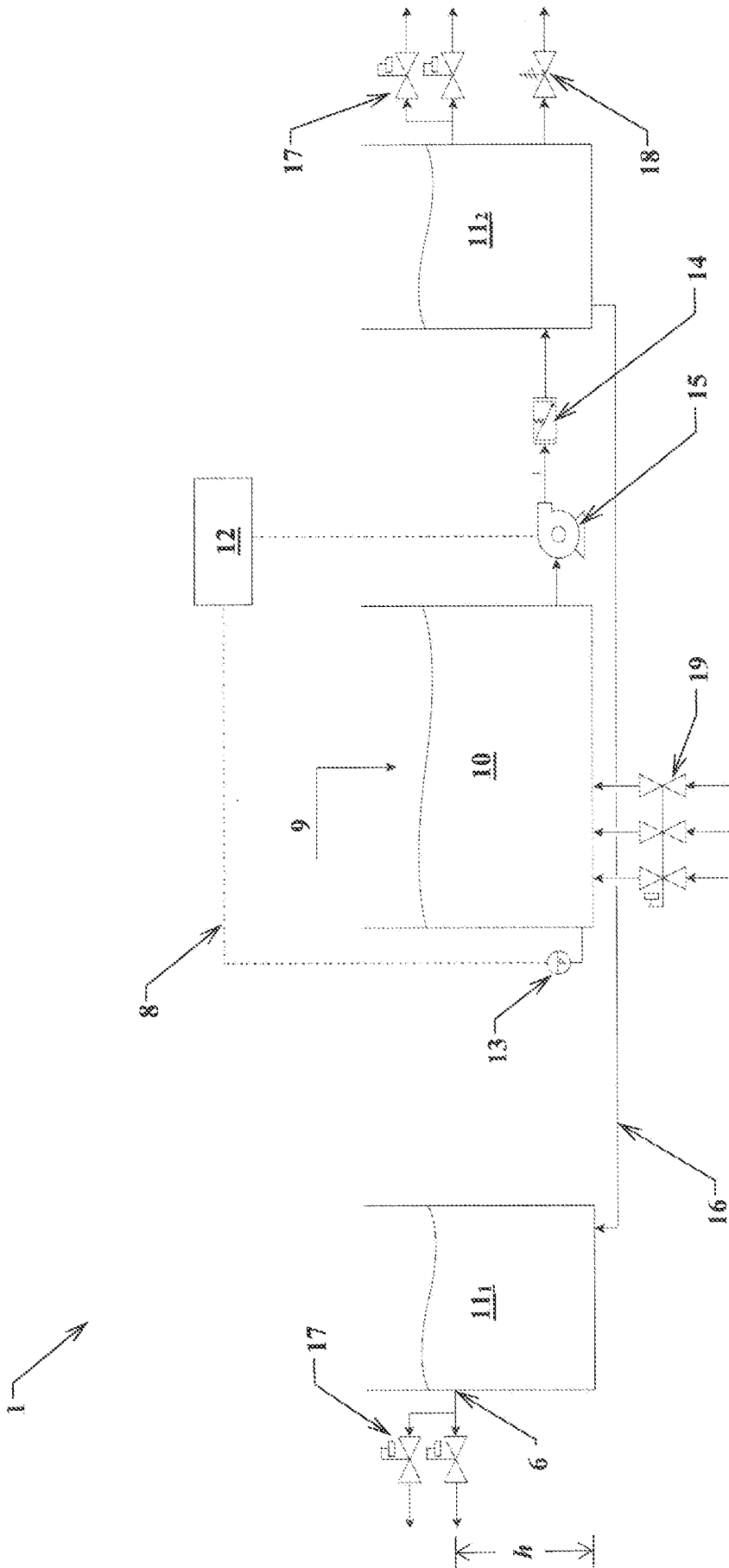


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2023/060087

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: B63B, E02B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20210000836 U (LEE J Y), 19 April 2021 (2021-04-19); whole document --	1-14
A	GB 2052282 A (MASSEI O), 28 January 1981 (1981-01-28); whole document --	1-14
A	US 3731813 A (TIPTON R), 8 May 1973 (1973-05-08); whole document --	1-14
A	US 20150129480 A1 (PASOZ LOUIS), 14 May 2015 (2015- 05-14); whole document -- -----	1-14
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
“A” document defining the general state of the art which is not considered to be of particular relevance	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
“D” document cited by the applicant in the international application	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
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“O” document referring to an oral disclosure, use, exhibition or other means		
“P” document published prior to the international filing date but later than the priority date claimed	“&” document member of the same patent family	
Date of the actual completion of the international search	Date of mailing of the international search report	
18-01-2024	18-01-2024	
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Lisa Sellgren Telephone No. + 46 8 782 28 00	

Continuation of: second sheet

International Patent Classification (IPC)

B63B 35/32 (2006.01)

E02B 15/04 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NO2023/060087

KR	20210000836 U	19/04/2021	NONE			
GB	2052282 A	28/01/1981	NONE			
US	3731813 A	08/05/1973	NONE			
US	20150129480 A1	14/05/2015	US	9580336 B2		28/02/2017