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ST. VINCENT AND THE GRENADINES**

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NOTICE OF GRANT OF PATENT

Volume 7 No: 9

TAKE NOTICE that the following Patent has been granted:

Title: DEVICE FOR CONVERSION OF WAVE ENERGY INTO ELECTRICAL ENERGY AND THE PROCESS FOR ITS DEPLOYMENT AT THE EXPLOITATION LOCATION

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Name of Applicant: DRAGIĆ, Mile
Address of Applicant: Makedonska 11, 23000 Zrenjanin (RS)
Name of Inventor: DRAGIĆ, Mile
Address of Inventor: Makedonska 11, 23000 Zrenjanin (RS)
Agent: L.A. Douglas Williams and/or Zoe Williams
Address of Agent: Hinds Building, Market Square, Kingstown
St. Vincent and the Grenadines

Priority Country: Serbia
Priority Number: P-2016/0217
Priority Date: April 6, 2016

Documents/References cited

Of Prior Arts:

- **WO 2012/010518 A1**
- **WO 2007/139395 A1**
- **EP 2 009 278 A2**
- **US 2010/259047 A1**
- **KR 2014 0093426 A**

Effective Date of Grant of Patent: March 17th, 2022

Abstract:

Device for conversion of wave energy into electrical energy and the process for its deployment at the exploitation location, wherein the device comprises a supporting construction (50) composed of buoyancy elements (52) and having a supporting tube (51) attached on the upper side. The device comprises a joint gear (30) on the inner circumference connected with the outside surface of the supporting tube (51) in a sliding manner and a sphere (32) to which is the floating body (20) pivotally connected. The device has two gears, the first flexible gear (1) for connecting the floating body (20) to the second gear and the second gear for connecting the flexible gear (1) to the generator. The flexible gear (1) consists of pulleys (6a, 6b, 6c) and a flexible element, e.g. a rope or a steel cable and the second gear can be arranged in several suitable forms, e.g. rigid elements as a set of a gear (4) and a rack (2) positioned inside the lower supporting tube (53) or a flexible element, e.g. a chain (3) and a sprocket wheel (5) set in the buoyancy element (52). The supporting construction (50) is by ropes (63) connected to the anchor weight (67) that is made in a form of a sphere segment either directly or through the rolling elements placed in the spherical dent of the anchor base(61). The invention comprises the process for device deployment at the exploitation location which is particularly suitable due to stable transport with low draught.

AMENDED CLAIMS

1. The device for conversion of wave energy into electrical energy wherein the device comprises a supporting construction, consisting of buoyancy elements, having a star shape, or cylindrical shape, with a supporting tube fixed to the top of the supporting construction, wherein the supporting tube comprises a joint gear; having a gliding connection on the inner circumference with the outside surface of the supporting tube, while a sphere is hinged or tightly fixed at its outside circumference to a floating body whereby the device has two gears, the first, flexible gear used for connecting the floating body to the second gear wherein the flexible gear comprises a flexible element in the form of a rope, a cable or the like, and at least two pulleys, whereby two pulleys are fixed to the supporting tube by means of their supports above the end point of the working stroke of the floating body so that they can rotate and a middle pulley is by means of its support fixed to the second gear that connects the flexible gear to the electric generator having additional mass connected with the lower tube of the supporting construction in the sliding manner, whereby the supporting construction is coupled to the anchor weight by ropes that can be positioned in the bearing in the anchor base characterized in that the flexible element of the flexible gear, e.g. a cable, is coupled to the floating body at one end, then passed over the pulley and over the pulley inside the tube and the pulley and by the other end again connected to the floating body or the flexible gear is composed of two identical flexible elements having one end attached to the floating body and one flexible element of the gear goes over pulley while the other flexible element of the gear goes over pulley and by the other end they are mutually connected by a lever pivotally attached to one end of the second rigid gear and the connecting points of the flexible gear and the floating body as well as two upper pulleys are mutually opposite and wherein at the end of the buoyancy element, at the upper tube side a casing is placed and the flexible ropes are at one end attached to the buoyancy element and to the floating body at the other end.
2. The device of claim 1, wherein the additional mass for balancing with the mass of the floating body and for adjusting the movement of the floating body on the waves is at the lower side attached to the second gear.

3. The device of claim 1, further comprising a device for braking the floating body, said braking device consisting of a flexible element, made up as monolithic or composite from synthetic materials, one end of the flexible element being attached to the bottom of the floating body, and the other end being fixed to the buoyancy element.
4. The device of claim 1, wherein the anchor weight is made of concrete and placed in the anchor base produced in the form of a hollow construction filled with water when the anchor base is at the anchorage location, ie. the location of the device exploitation.
5. The device of claim 1, wherein the floating body consists of a steel frame and having a closed chamber being coated with foam coating.
6. The device of claim 5, wherein the foam coating is composed of an external layer made of a tensile stress resistant material and an inner layer made of a shock absorbing material.
7. The device of claim 1, wherein the floating body is constructed as self-submerging floating body so its mass is bigger than its volume that provides its buoyancy.
8. The device of claim 1, wherein the added mass keeps the floating body on the water surface and regulates its draught depth.
9. The device of claim 1, wherein the second gear is connected with a flexible gear at one end, and at the other end with a generator of electrical energy, constructed of elements as a gear and the rack type, or a jackscrew and a nut or sprocket wheel and a chain situated in the lower supporting tube attached to the supporting structure.
10. The device of claim 1, wherein the second gear that is at one side connected to the flexible gear, and at the other side to the electrical generator, consists of a movable magnet and a fixed, immovable coil and located in the lower bearing tube attached to the supporting construction.
11. The device of claim 1, wherein the second gear being connected to the flexible gear at one side, and at the other side to the electrical generator, consists of gear comprising a jackscrew and a nut with recalculating balls and located in the lower supporting tube and attached to the supporting construction.

12. The device of claim 11, wherein the nut directly rotates the generator rotor.
13. The device of claim 1, wherein the second gear being connected to the flexible gear at one side, and at the other side to the electrical generator, consists of a flexible element consisting of as a chain and a sprocket wheel placed in the buoyancy element of the supporting construction.
14. The device of claim 13, wherein the second gear is coupled with the additional mass through a tackle system where the flexible element passes the pulleys of the tackle for connecting to the additional mass made up in the form of a rope, a sprocket wheel or any other suitable form.
15. The device of claim 1, wherein the device includes an automatic system for activating safety measures of the device.
16. The device of claim 15, wherein the automatic system operates the generator that converts to motor mode when the security measures are activated and increases the added mass to the upper end position securing it and thus leading to self- submerging of the floating body that enters the casing and remains there until the deactivation of the security measures.
17. The device of claim 1, wherein the flexible elements ensure that the floating body does not hit the upper part of the supporting tube.
18. The device of claim 1, wherein the floating body overlaps the casing and slows the floating body down and by hydrodynamic resistance prevents it from hitting the supporting structure.

19. The process for deployment on the exploitation location of the device for conversion of wave energy into electrical energy constructed according to claim 1, wherein the process comprises the following phases:

- assembling buoyancy elements into the supporting construction and placing the additional mass, lowering the superposed part of the supporting construction into the water by use of a crane and attaching it to a shipyard dock;

- coupling the remaining elements to the supporting construction to the final formation of the device,

- transport by water of the device to the deployment location where the stability of the transport is achieved by the additional mass;

- water transport of the anchor weight with the anchor base so that the anchor base floats acting as a pontoon for the transport of the anchor weight to the deployment location of the device;

- fixing the poles or construction of concrete base for the anchor base;

- lowering the anchor base by opening the valves and filling it with water;

- connecting the anchor base with the supporting construction, using ropes

- depth adjustment of the device, ie. adjustment its distance from the bottom of the sea.

20. The process for deployment on the exploitation location of claim 19, wherein, the transport phase is performed as transport with a low draught.

VC/A/2018/00003

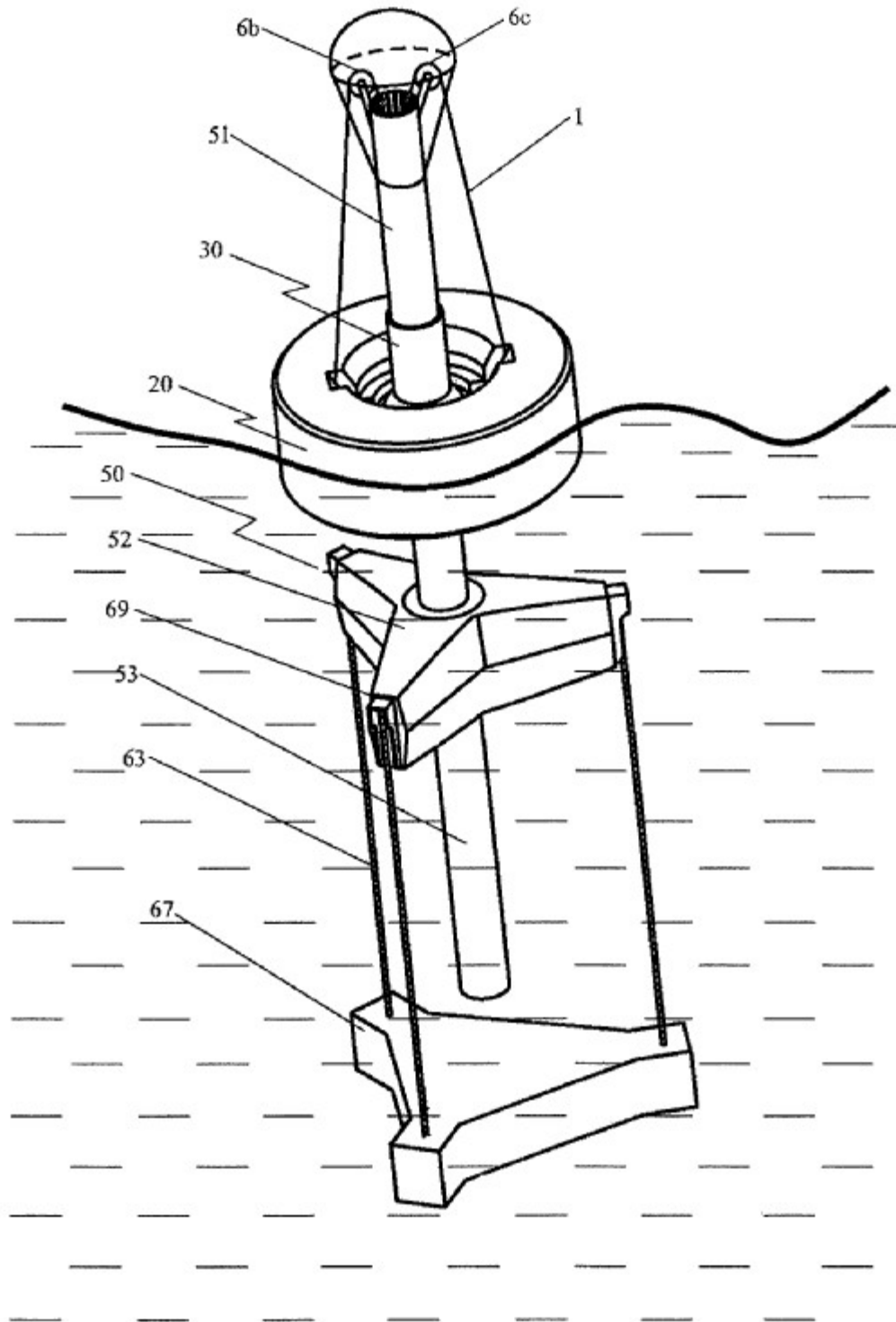


Figure 1

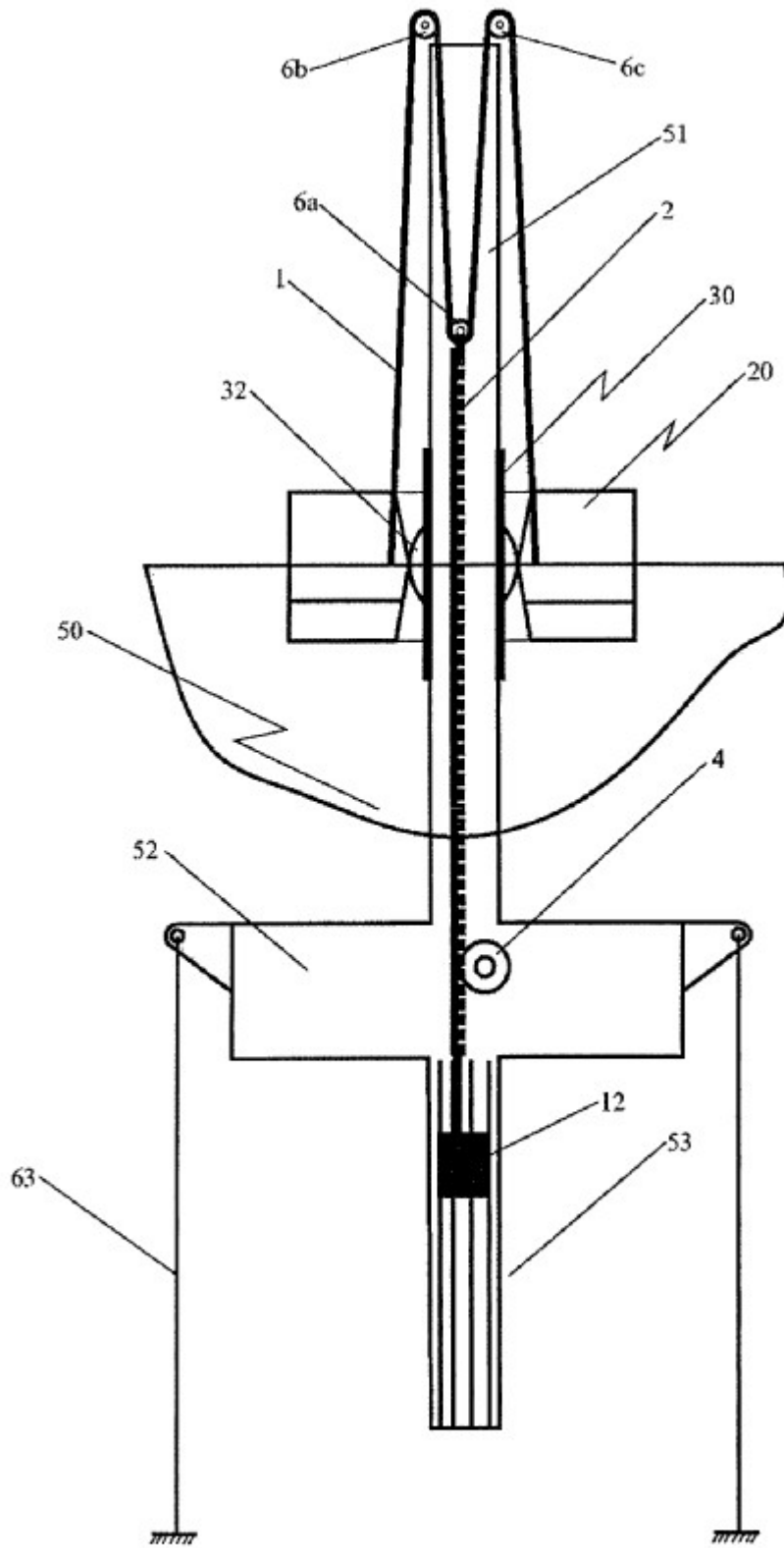


Figure 2

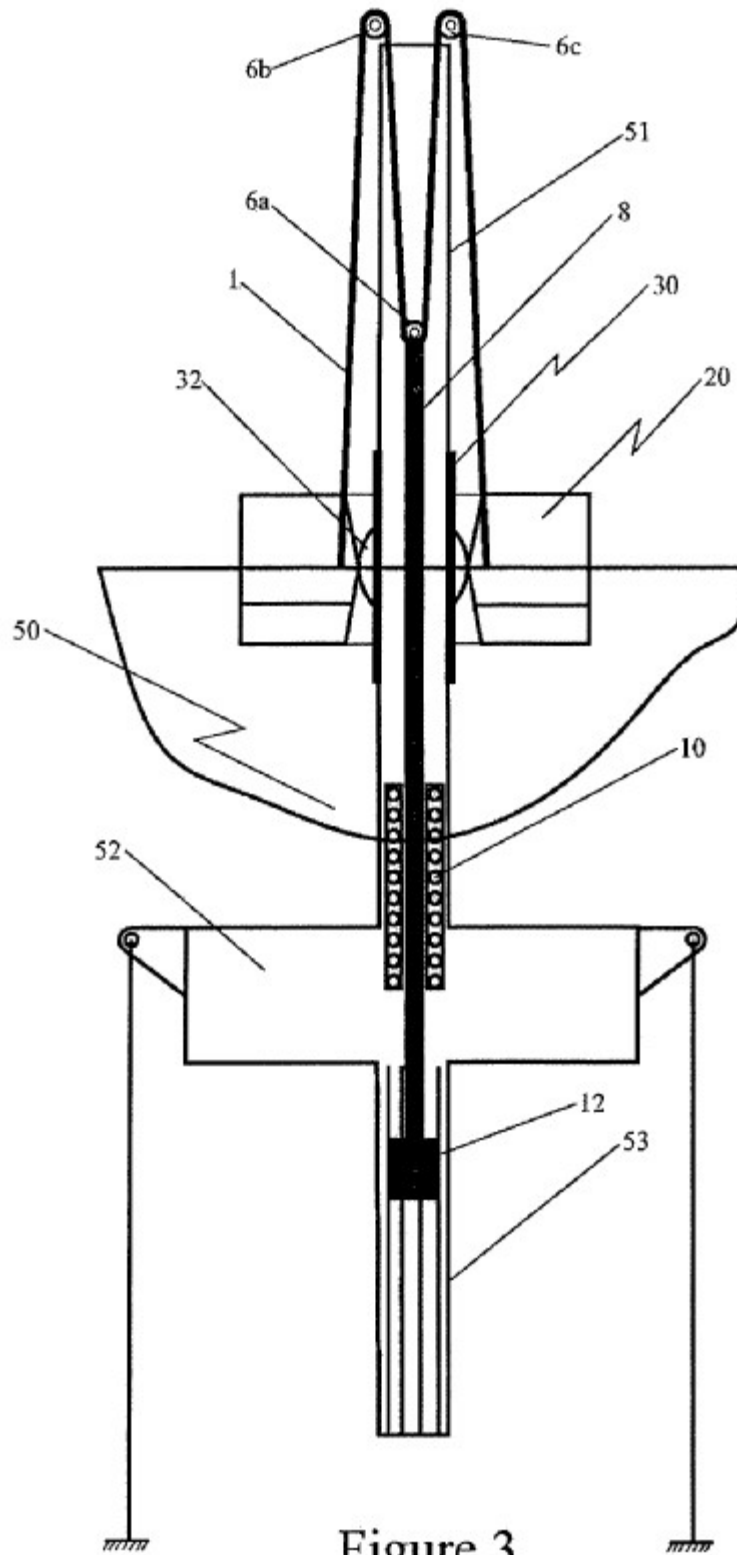


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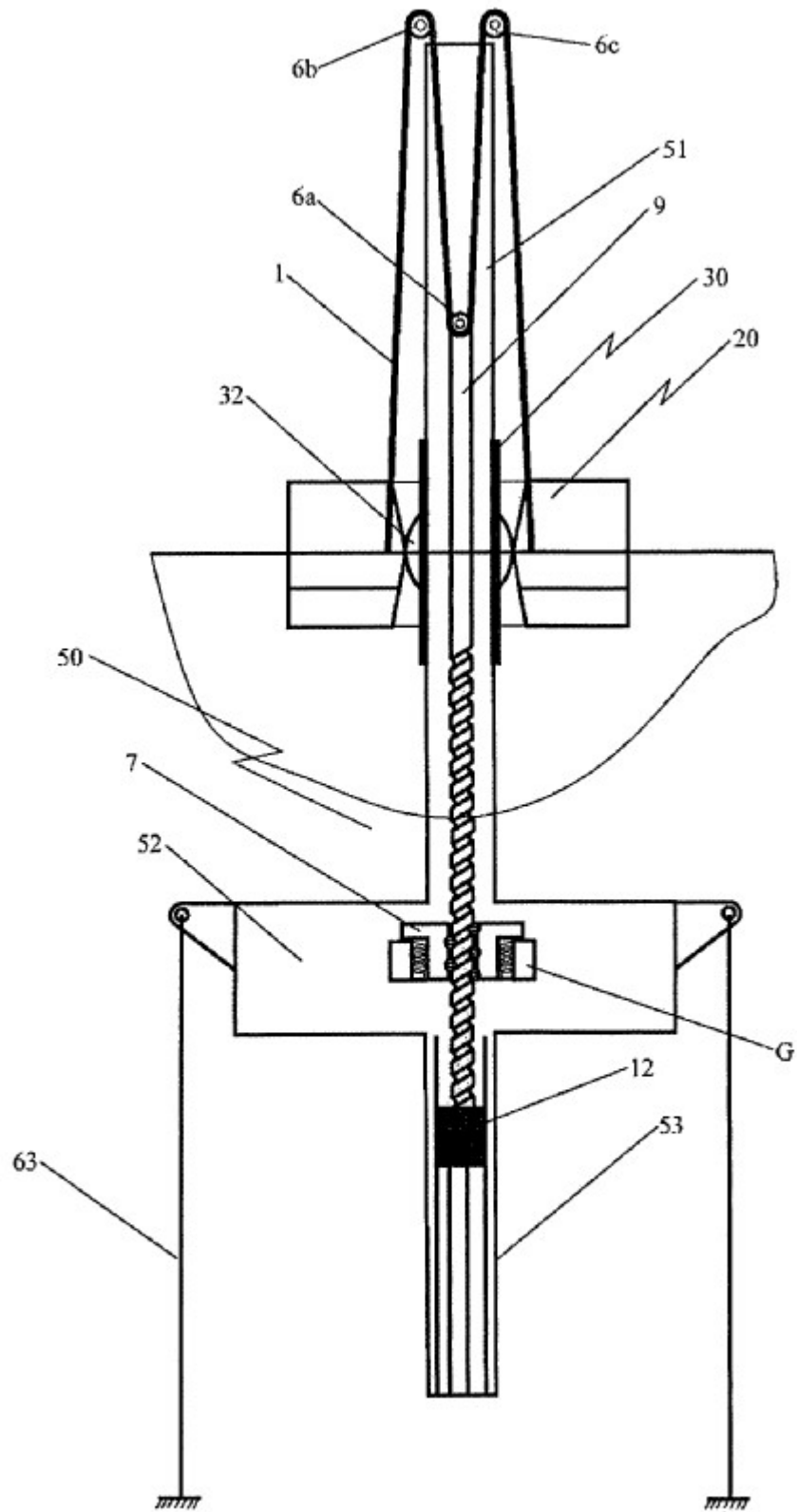


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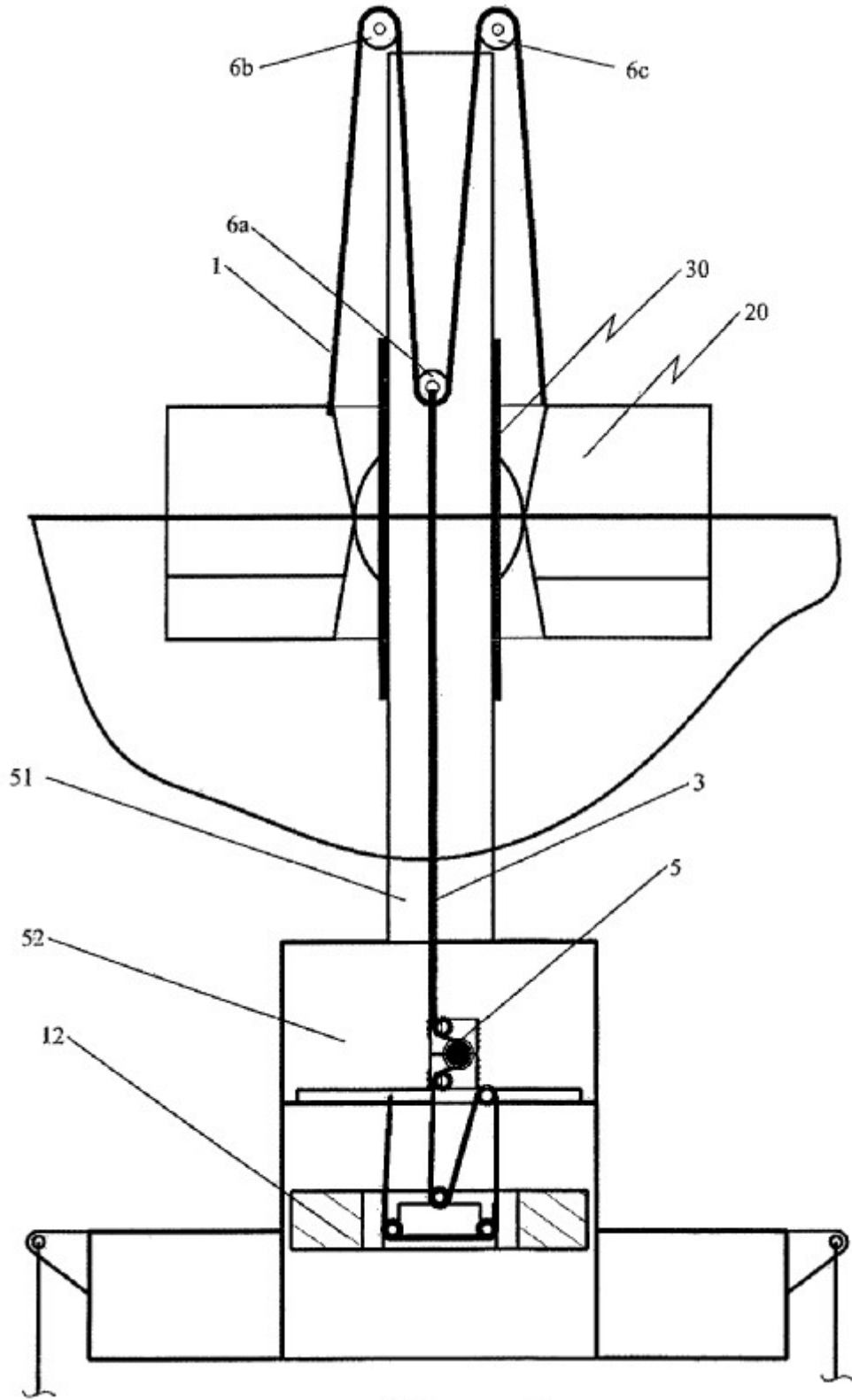


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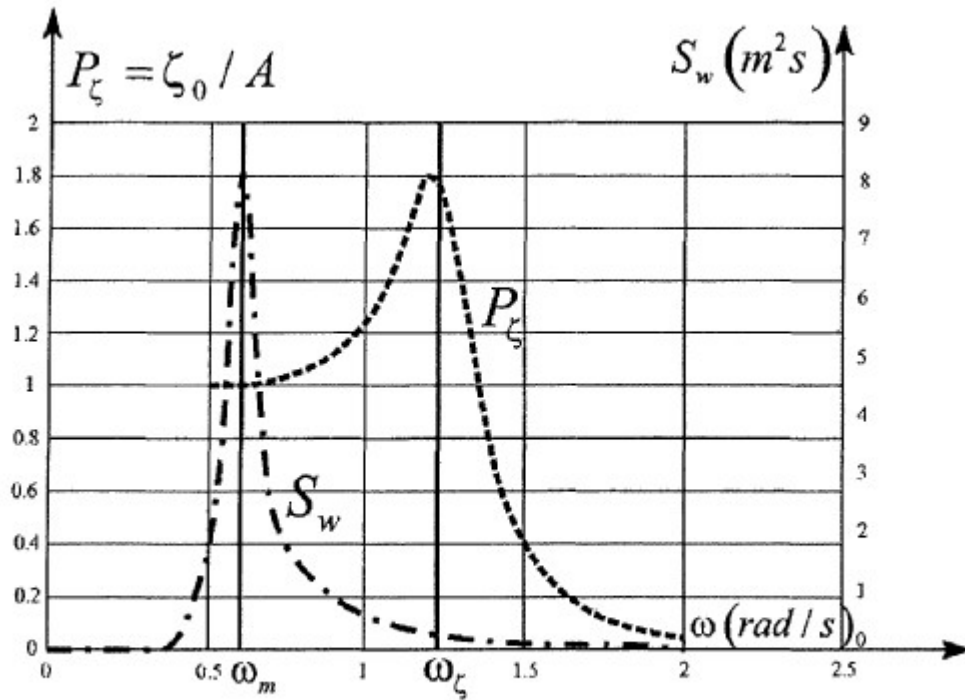


Figure 6a

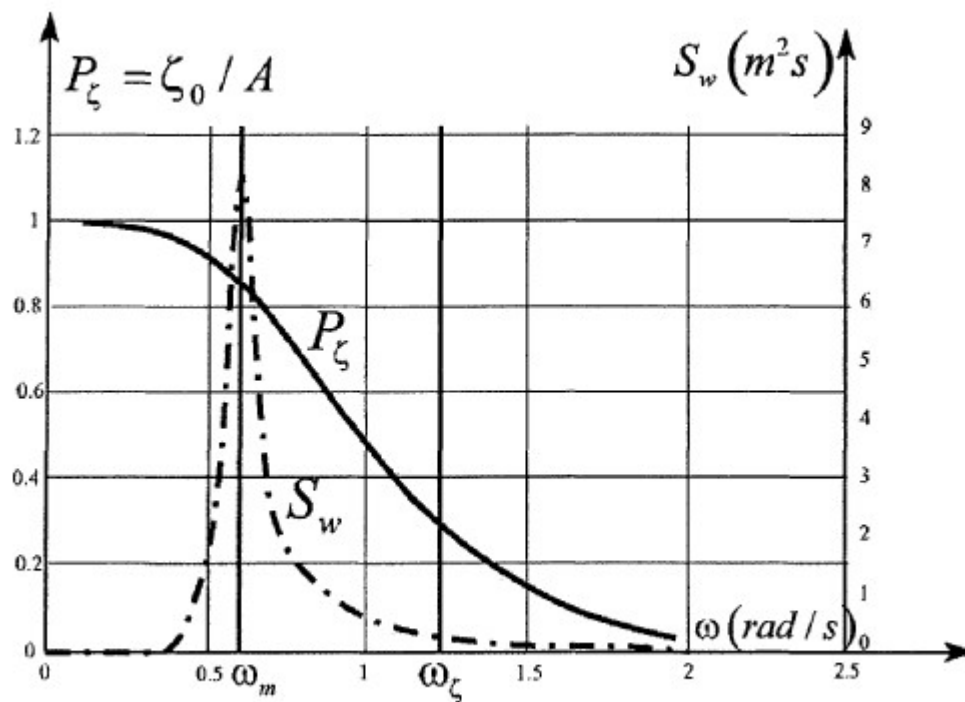


Figure 6b

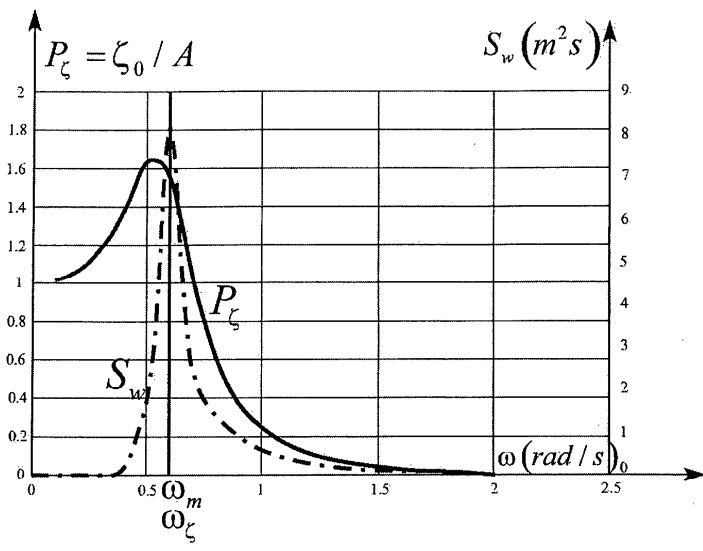


Figure 6c

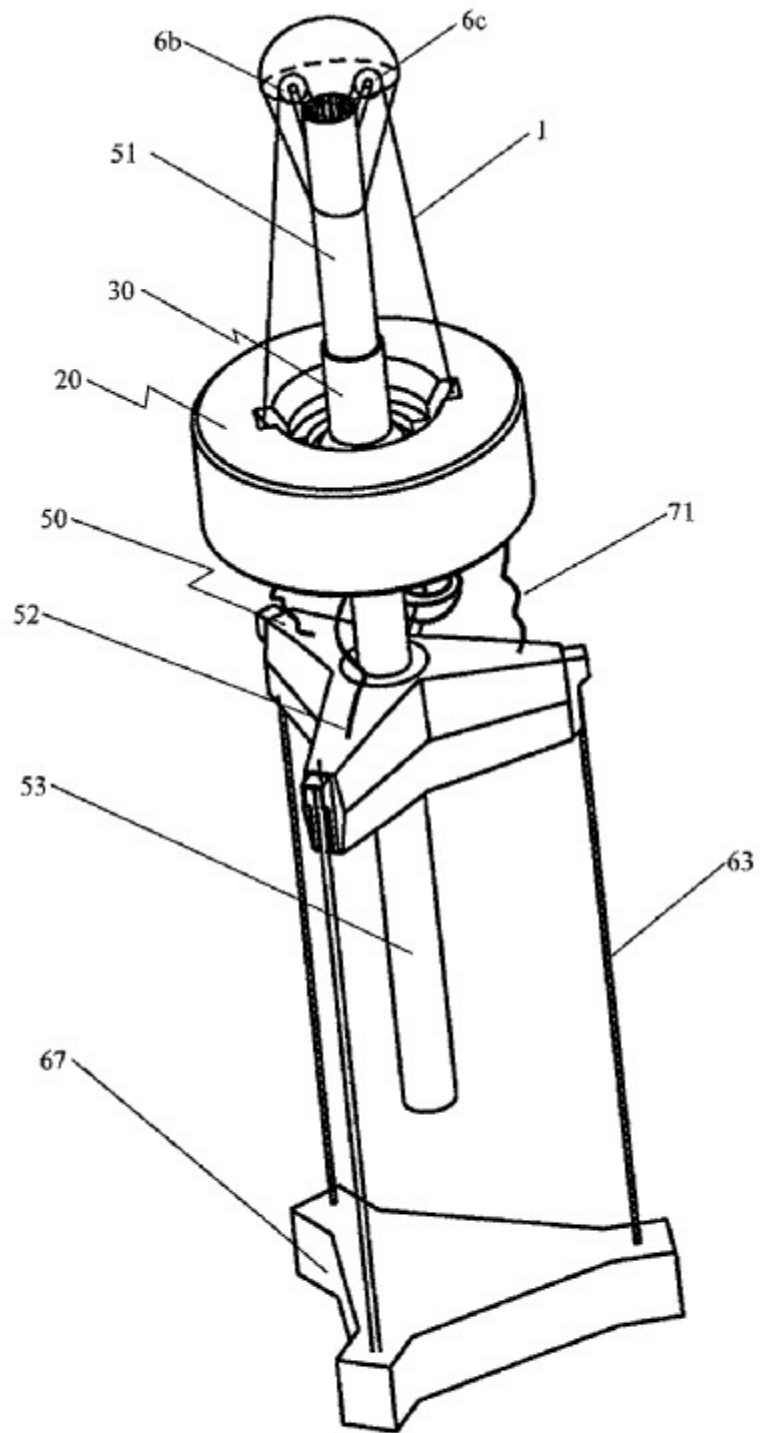


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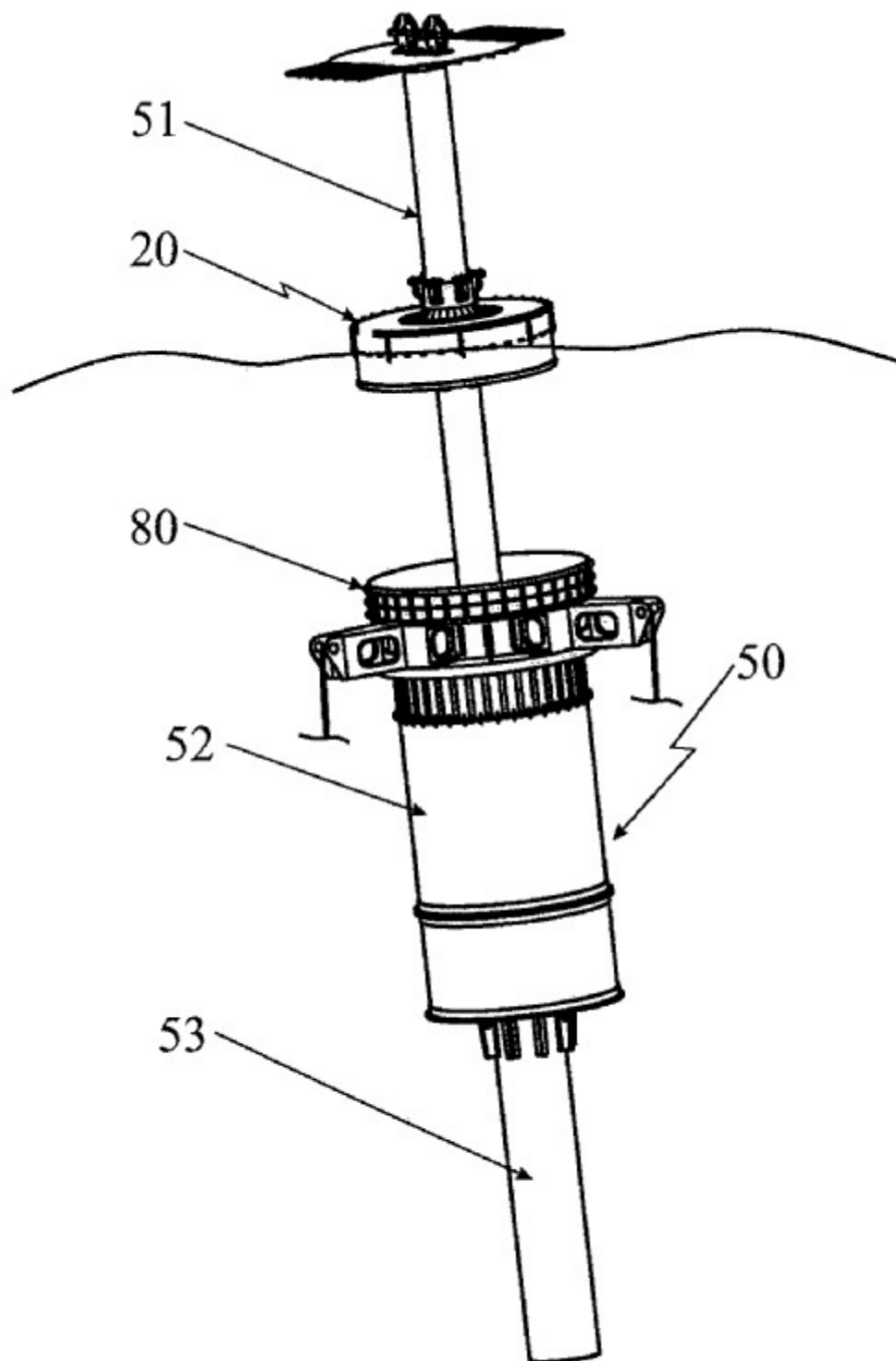


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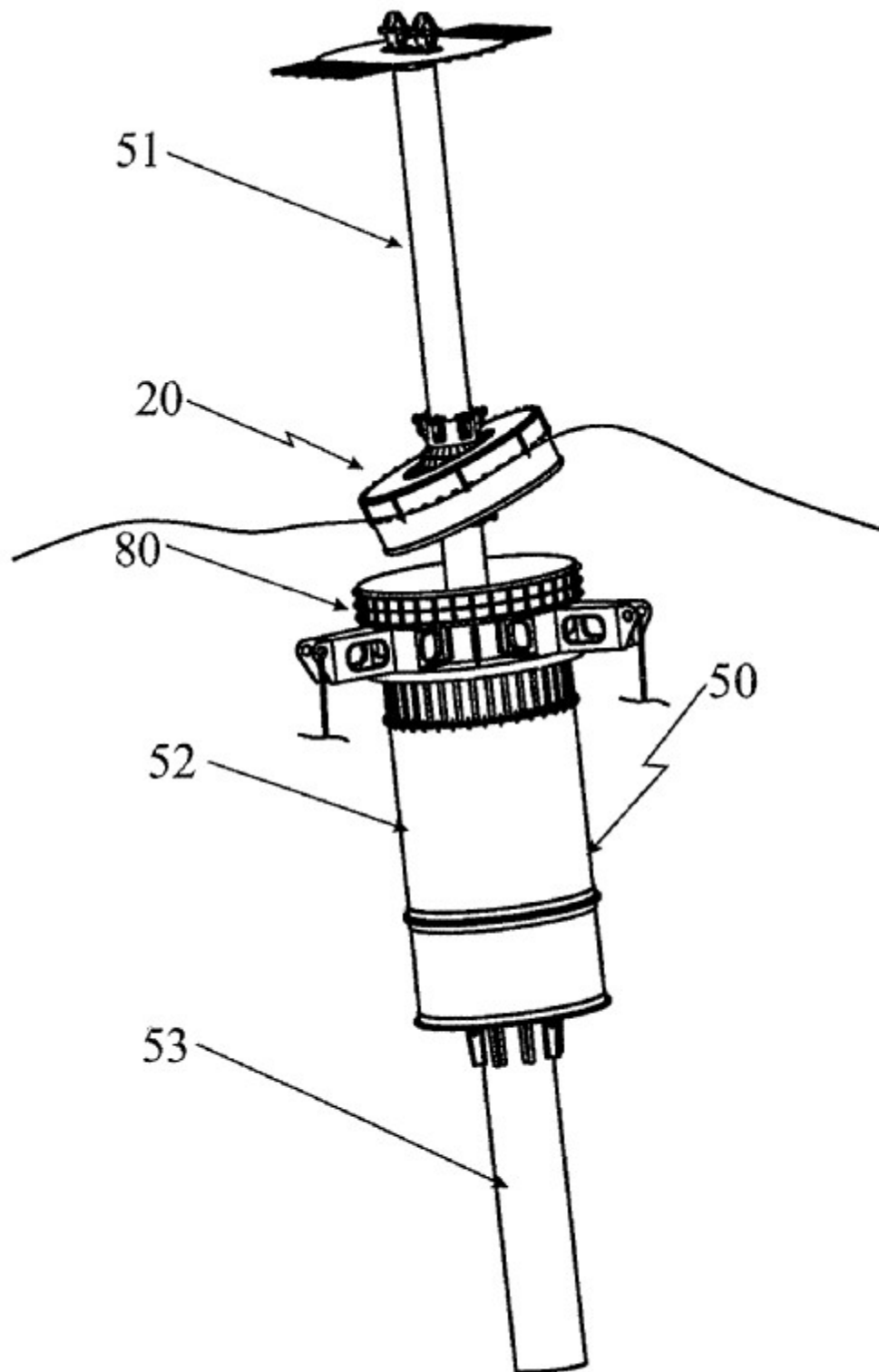


Figure 8a

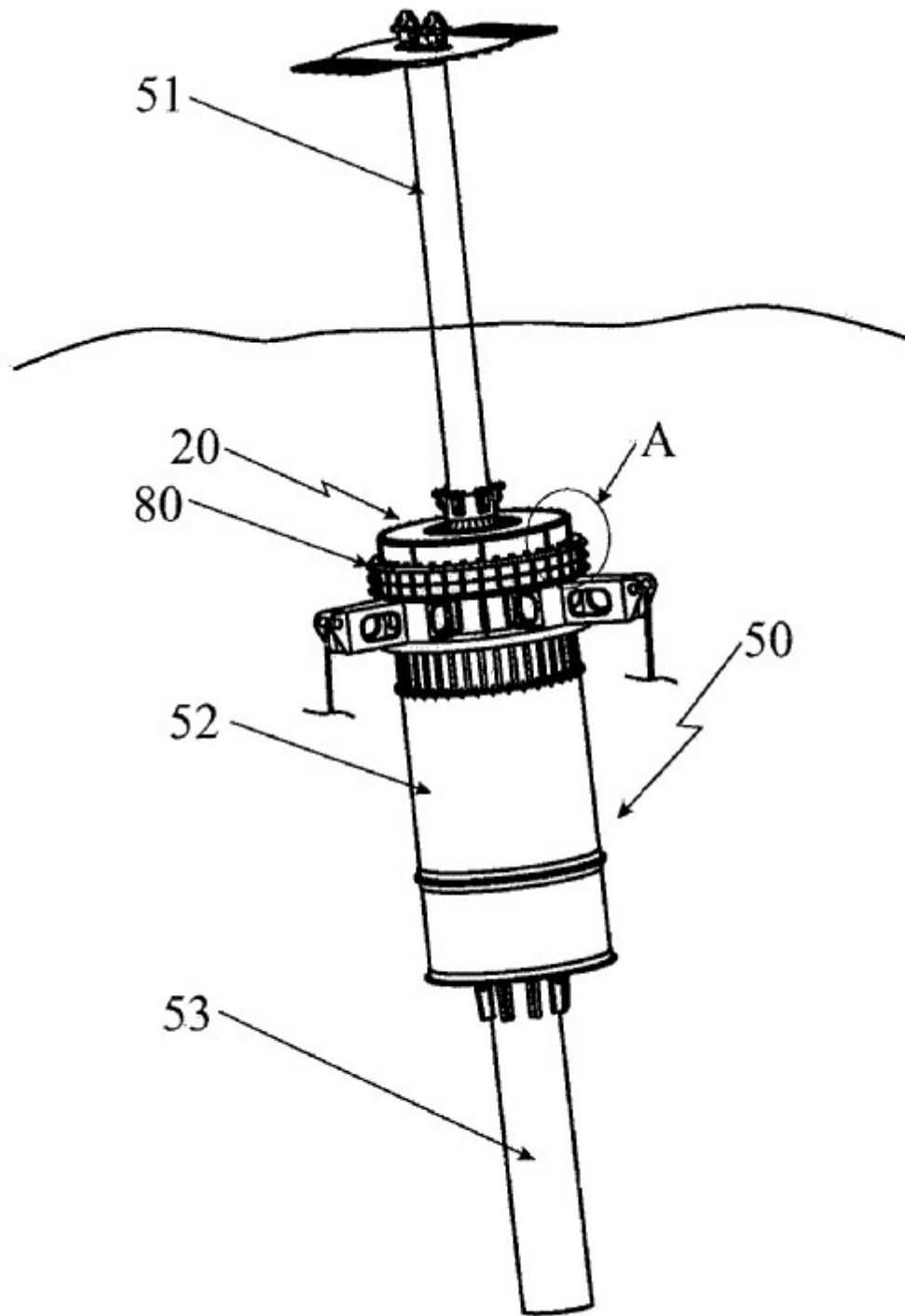


Figure 8b

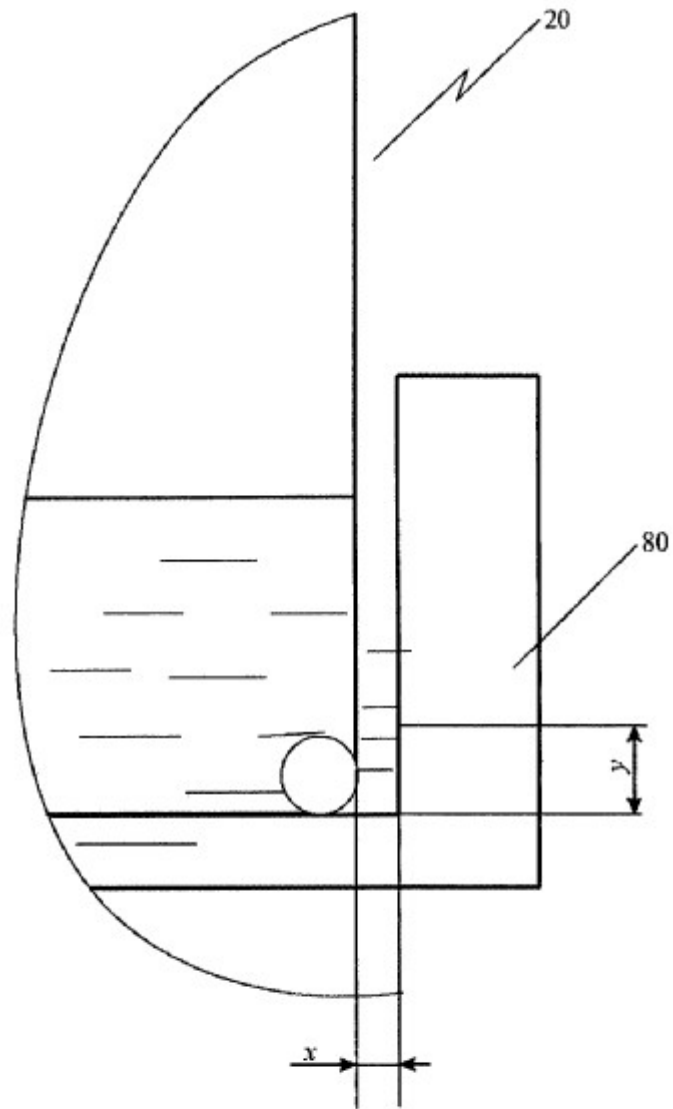


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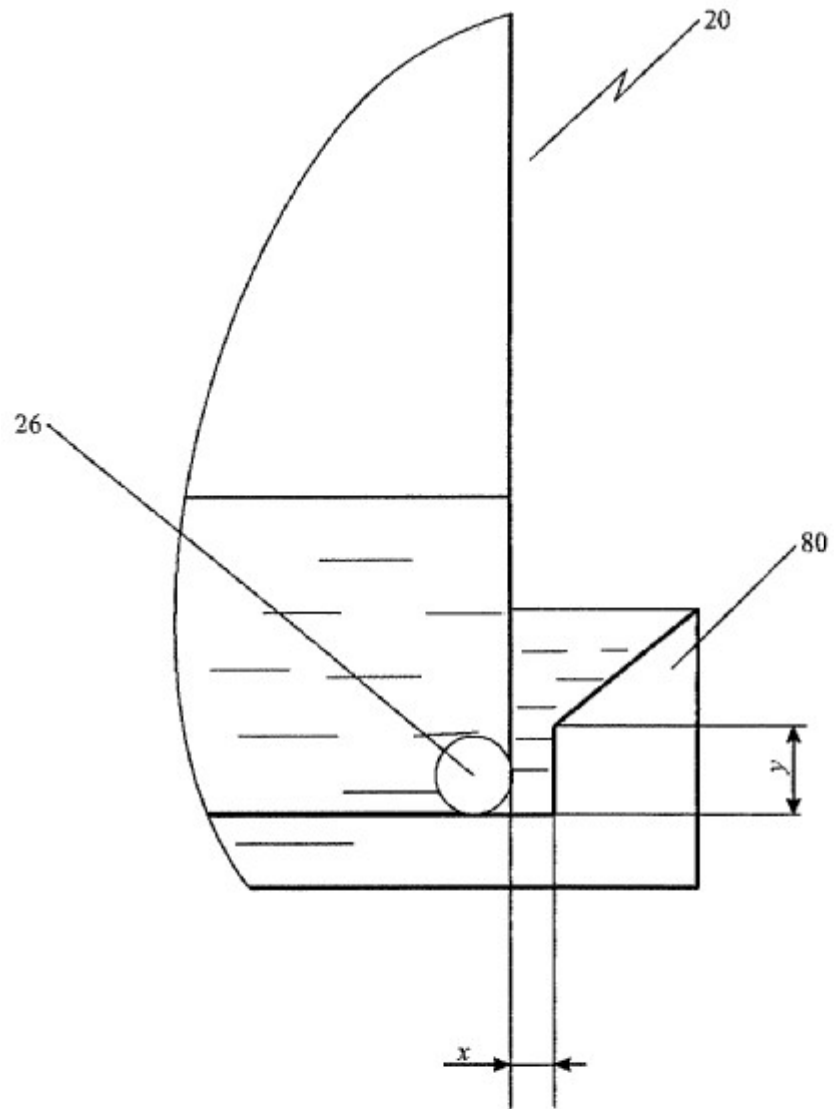


Figure 9a

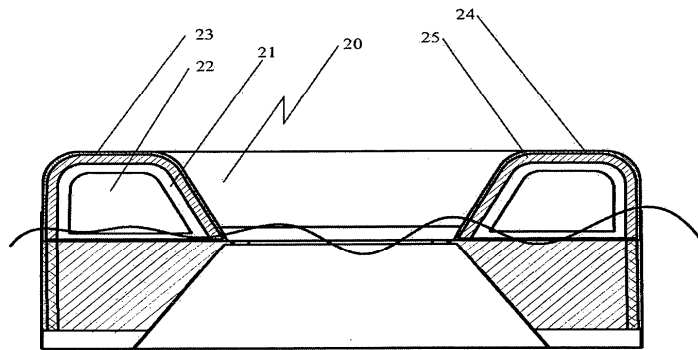


Figure 10

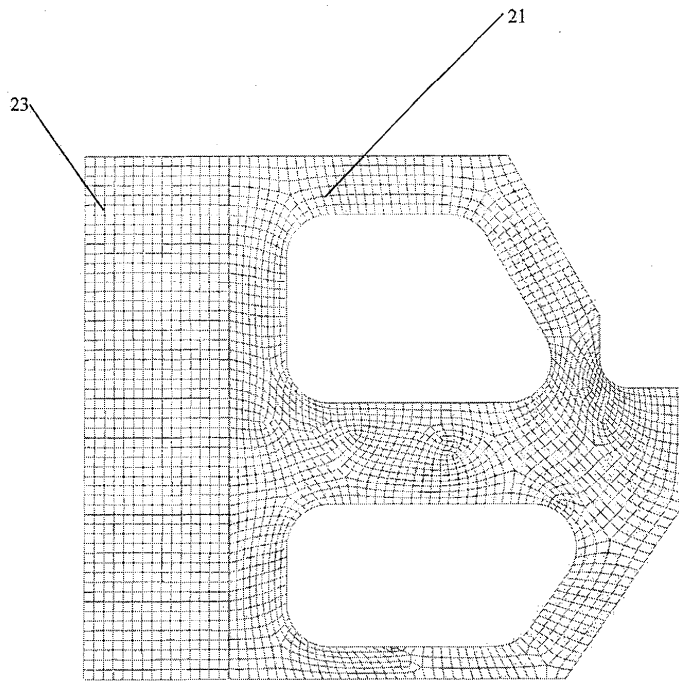


Figure 11

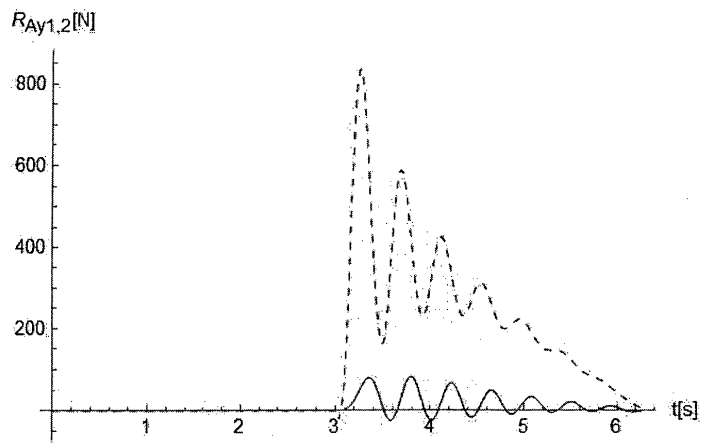


Figure 12

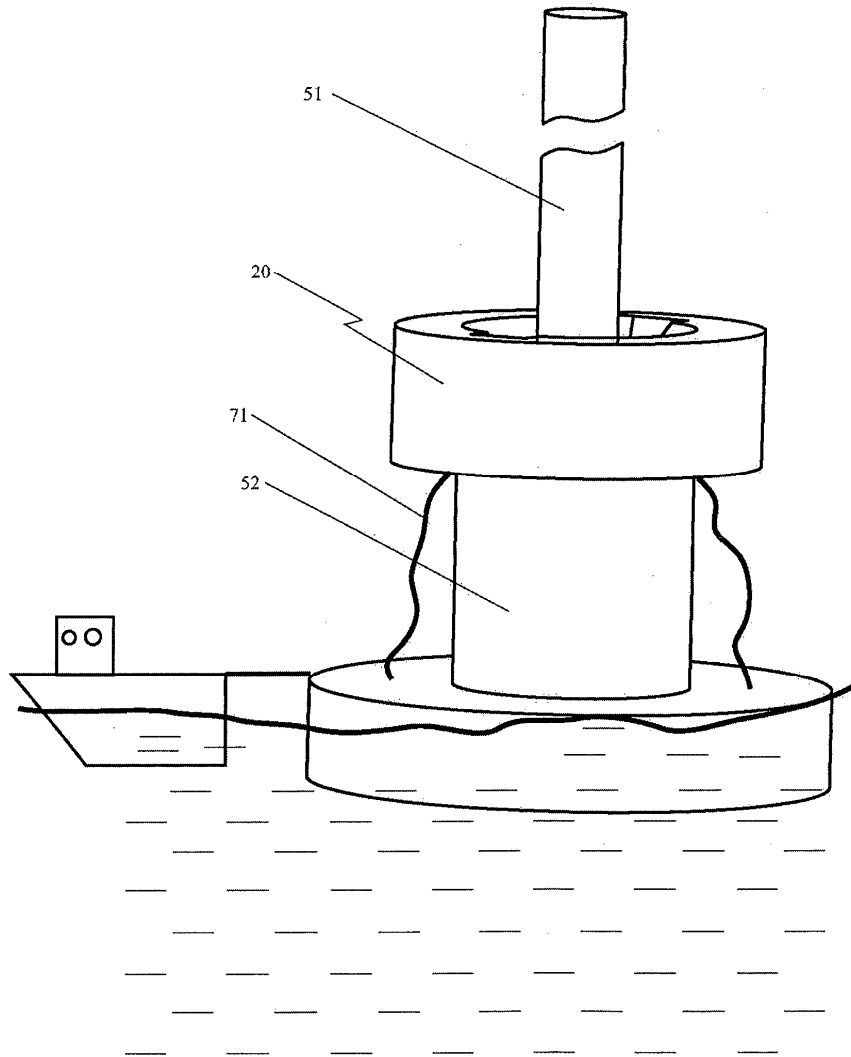


Figure 13

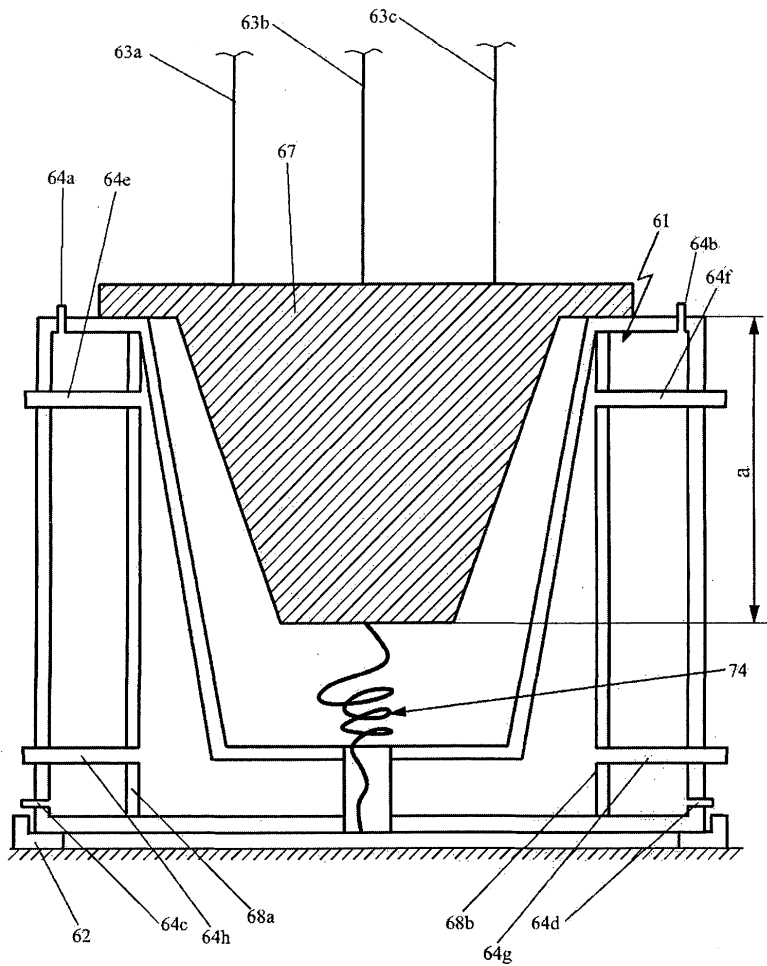


Figure 14

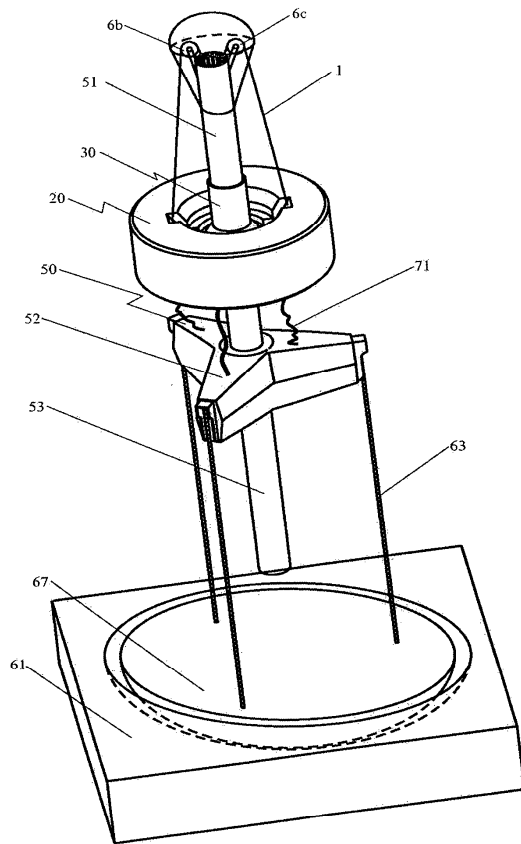


Figure 15

Lekeicha Caesar-Toney
Registrar, C.I.P.O
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