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(54) **DOCKING DEVICE FOR SELF-PROPELLED AUTONOMOUS UNDERWATER VEHICLES**

ANDOCKVORRICHTUNG FÜR AUTONOME UNTERWASSERFAHRZEUGE MIT EIGENANTRIEB

DISPOSITIF D'AMARRAGE POUR VEHICULES SOUS-MARINS AUTONOMES ET AUTOMOTEURS

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Description

TECHNICAL FIELD

[0001] The present invention relates to a docking device for self-propelled autonomous underwater vehicles.

BACKGROUND ART

[0002] Nowadays it is known to use autonomous underwater vehicles, also known as AUV, which are substantially constituted by an enclosure which has high-level hydrodynamic characteristics, and therefore is for example torpedo-shaped, and has its own propulsion system and suitable dedicated devices for its remote control; these vehicles are used for many purposes, such as underwater searches, inspections, and monitoring of natural or artificial infrastructures.

[0003] However, these autonomous underwater vehicles have a limited operating capability in terms of time, since they require periodic replenishment of the energy that can be stored in them for propulsion and for operating the various internal devices as well as for downloading the data acquired during their use.

[0004] US-5,349,916 is also known which discloses a vehicle which is connected, by means of a first cable, to a submarine; said vehicle can couple at an adapted underwater buoy which is substantially constituted by a base element, arranged on the seabed, from which a cable extends; at its other end, said cable is fixed to a float which is provided, for example, with a sonar beacon which allows the approach of the vehicle, since said vehicle is provided with a corresponding sonar detector.

[0005] The underwater vehicle has a device which is located in its front part and is shaped like a V in which the vertex starts from the nose of the vehicle; this shape allows to facilitate docking to the buoy.

[0006] It is also known to use docking stations which are anchored to the bottom of the ocean and are connected, for example, to an adapted buoy provided with means for satellite or cable communication, as disclosed in US-5,291,194, with a remote station.

[0007] These conventional docking stations are therefore constituted by a combination of inechanical and electronic devices which allow the underwater vehicle to approach from any direction, at the same time allowing to transfer data from said vehicle and, for example, to recharge its batteries.

[0008] In order to improve the docking of the underwater vehicle, the various conventional docking stations also include solutions which include a cable which is interposed between two adapted carriages and to which the front part or nose of the vehicle connects by way of an openable engagement means, allowing vertical sliding of the vehicle or of the two carriages, one carriage moving in an upward direction, until the entire vehicle or part thereof is enclosed.

[0009] Once engagement has occurred, the two carriages move mutually closer so as to lock the vehicle and prevent its accidental disengagement.

[0010] A basic problem that can be noted in the prior art is in fact constituted by the difficulty to maintain a stable connection of the vehicle so as to allow its subsequent maintenance at the end of the mission.

[0011] One solution to the connection of the vehicle, shown in US-5,291,194, uses a conical element which enters a complementarily shaped seat formed in the dorsal region of the vehicle; this solution is not free from drawbacks, such as possible jamming of the sliding of the cable or failed insertion of the conical element in the seat.

[0012] It is also known, inter alia from the publication XP002148334 "adocking system for REMUS, an autonomous underwater vehicle" oceans 1997 MTS/IEEE conference proceedings, institute of electrical and electronics engineers, Vol. 2, 6-9 october 1997, pages 1132-1136, to use an autonomous underwater vehicle known as REMUS (acronym of Remote Environmental Monitoring Unit) which uses in order to allow easier transfer of the vehicle from the deck of the ship to the sea and vice versa, a fixed cage-like frame which is substantially cylindrical and in which one end is closed and the other one is open for the insertion of the vehicle; the insertion being facilitated by a metallic guiding structure which has a conical shape. The publication cited discusses the solutions developed for enabling the vehicle to acoustically find and them move on the docking system; mechanically latching the vehicle to the dock; techniques for power and data transfer from the docking system to the vehicle.

[0013] This solution, too, has drawbacks, since centering during approach of the vehicle to the structure shaped like a rigid cage is not easy; moreover, the vehicle used is very light, weighing less than 30 kilograms, while a significantly heavy device which can be arranged on the front part or nose of the vehicle is required for its approach to the cage-like structure, and this makes navigation scarcely stable; moreover, this solution entailed, in order to allow the transfer of power to the vehicle, the use of an inductive coupling which has low energy transmission efficiency.

[0014] Moreover, the use of a rigid cage entails problems as regards possible damage to the vehicle during docking maneuvers, especially because damage can be caused at the front part or nose of the vehicle, which contains instruments.

[0015] For example, EP-0 532 096 discloses a machine for engaging a vehicle and lifting it out of the water: this machine, however, is used only to perform surface recovery of the vehicle, which is then subjected to maintenance on the deck of the ship.

[0016] This solution is therefore not suited for use for underwater vehicles which receive maintenance underwater.

[0017] Similar considerations can also be made as re-

gards the subject of US-3,807,335, which discloses an anchoring system for underwater vehicles which comprises a platform to which the vehicle can dock and which is lowered into the sea from the deck of a ship, so as to allow, by using particular tensioning devices, to support the platform, isolating it from the movement induced by the sea.

DISCLOSURE OF THE INVENTION

[0018] The aim of the present invention is therefore to solve the cited technical problems, eliminating the drawbacks of the cited prior art, by providing a device which allows to achieve docking for moving autonomous underwater vehicles rapidly and in safety as regards the integrity of said vehicle.

[0019] Within the scope of this aim, an important object is to provide a docking device which allows to rapidly and easily acquire or transmit data and power with respect to the vehicle.

[0020] Another important object is to provide a docking device which can also be used for autonomous underwater vehicles having mutually different dimensions.

[0021] This aim, these objects and others which will become better apparent hereinafter are achieved by a docking device according to claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a particular but not exclusive embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic view of a possible use of the docking device;
Figure 2 is another view of a second possible use of the docking device;
Figure 3 is a side view of the docking device;
Figure 4 is a view, similar to Figure 3, of the docking device with the vehicle associated therewith;
Figures 5 and 6 are front views of the docking device in the open condition and in the condition in which it is closed around the vehicle;
Figure 7 is a rear view of the device;
Figures 8, 9, 10 and 11 are views of the step for the docking of the autonomous underwater vehicle until it is arranged in an intended alignment and locking condition;
Figures 12 and 13 are two different views of means used for connection between the vehicle and the data transmission device;
Figure 14 is a partially sectional side view of the means for centering the vehicle in the docking device.

WAYS OF CARRYING OUT THE INVENTION

[0023] With reference to the above-cited figures, the reference numeral 1 designates the docking device particularly for autonomous underwater vehicles, designated by the reference numeral 2.

[0024] The docking device 1 is constituted by a closable cage-like frame 3 which can be provided with adapted perimetric guides 4 for adapted first cables 5 which are stretched between a submerged counterweight 6 and a trestle 7 which is rigidly coupled to a deck 8 of a vessel 9.

[0025] Second cables 10a, 10b are further slidingly associated along the first cables 5 and are associated, from the deck of the vessel, with the frame 3 for the necessary mechanical and electrical connections.

[0026] Alternatively, it is possible to associate with the frame 3 of the device 1, at one end, a first cable 5 which is connected, at its other end, at an adapted articulation 11 which is anchored to a base 12 which can be arranged on the seabed 13.

[0027] Second cables 10 for electrical connection to the device 1 are of course provided between the frame 3 and the articulation 11 and are further linked to an adapted land-based station.

[0028] Means for keeping the frame 3 of the device 1 in a horizontal position are further associated with the frame and are constituted for example by adapted floats 14, for example of the passive type, as shown in Figure 2.

[0029] In the solution shown in Figure 1, instead, suitable collapsible air tanks are associated with the frame 3 of the device 1, are contained within perforated containers 15 and can act as stabilizers supplied by air reserves 32.

[0030] The base 12 has a particular shape and is constituted by a body 16 which is substantially shaped like a parallelepiped and has, at one transverse side, a protrusion 17 which is inclined so as to form an acute angle with respect to said transverse side, taking a clockwise rotation as positive.

[0031] The shape of said protrusion allows, during the lowering of the base 12 to the seabed, the automatic tipping of said base once it has reached the bottom, since said protrusion axially offsets the vertical axis that passes through the center of gravity of said base.

[0032] The frame 3 of the docking device 1 is shaped like a closable cage and is substantially constituted by a plurality of first upper half-frames 18 which are optionally mutually equidistant; each half-frame is substantially C-shaped in a transverse cross-section and is fixed.

[0033] Two second half-frames 20a, 20b are rotatably freely associated with the ends of the first wings 19 of each first half-frame 18; said second half-frames are substantially L-shaped and have dimensions which form a cage-like structure once the free ends 21a, 21b are arranged mutually adjacent.

[0034] The movement of the second half-frames 20a,

20b occurs by means of adapted actuators which are constituted for example by pistons 22, whose body is rigidly coupled at a first plate 23 which is rigidly coupled to the first wing 19 of the first half-frame 18 and whose stem is rigidly coupled at a second plate 24 which is rigidly coupled to one of the wings of the second half-frames 20a, 20b.

[0035] Both the first half-frames and the second half-frames have centering means for the autonomous underwater vehicle 2; said means are preferably constituted by a plurality of contact pads 25 which are constituted by cylindrical bodies 26 which are rigidly coupled, at one end, to suitable third brackets 27 which are rigidly coupled to the first half-frame or to the second half-frame and with which heads 28 are telescopically associated which can slide in contrast with adapted flexible elements.

[0036] Preferably, eight contact pads 25 are provided and are arranged in pairs in a radial configuration, so that their heads 28 lie, when the frame is closed, approximately at a curve which corresponds to the external contour of the autonomous underwater vehicle 2.

[0037] Said contact pads 25 also constitute means for the alignment of the autonomous underwater vehicle 2 once it is arranged inside the frame 3.

[0038] Advantageously, the heads 28 of the contact pads 25 have a seat for a ball 29; the head 28 can be allowed to move between two conditions of maximum and minimum protrusion with respect to the cylindrical body.

[0039] Advantageously, the flexible element is constituted by a cylindrical helical compression spring 30.

[0040] The means for temporarily locking the vehicle are further associated with the frame 3 of the docking device 1 and are constituted by a plurality of bags 31 which can be filled with water, preferably from the outside environment, or with air or other gas mixture arriving from adapted containers 32.

[0041] Advantageously, a first bag and a second bag are arranged adjacent to the inner part of the frame 3 in a region that lies above the dorsal region of the autonomous underwater vehicle 2; a third bag is arranged at a first closed end 33 of said frame, and the prow 34 of the autonomous underwater vehicle 2 interacts with said third bag.

[0042] The third bag 31, arranged proximate to the first closed end 33 of the frame 3, cooperates in its actuation with additional means for the alignment and locking of the autonomous underwater vehicle 2; said means are constituted by two wings 35a, 35b which have a substantially triangular plan shape and are rotatably associated, at mutually parallel and adjacent planes, with a pair of bases 36a, 36b which are rigidly coupled to the frame 3 in a region that lies above the autonomous underwater vehicle, particularly in a region above a dorsal fin 37 thereof.

[0043] At rest, the wings 35a and 35b are arranged so that their tips are mutually opposite: when the autonomous underwater vehicle enters the frame 3, the fin 37 interacts by abutment with the wings 35a and 35b, forcing them to rotate so as to move mutually apart until the fin 37 can pass beyond them toward the first closed end 33 of the frame 3; this situation is shown in Figures 8 and 9.

[0044] The arrangement of the bases 36a and 36b and the shape of the third bag 31 rigidly coupled to the first closed end 33 of the frame 3 are such that the passage of the fin beyond the wings 35a and 35b corresponds to the resting of the nose 34 of the vehicle at the third bag 31; said bag, due to the inertia of the vehicle, expels the water contained therein through adapted venting valves and then, by pumping ambient water, expands and pushes the vehicle backward.

[0045] In the meantime, the wings 35a and 35b have returned to the initial condition, for example by using the flexible elements provided for this purpose; in this position they cannot rotate so that their vertices move away from the first closed end 33 of the frame 3.

[0046] In its backward movement, therefore, the vehicle makes contact, with the vertical dorsal region 38 of the fin 37, at the wings 35a and 35b, which lock it, preventing its movement and ensuring that the vehicle lies in an exact position with respect to the frame 3.

[0047] Advantageously, it is possible to provide mechanical guides for the correct alignment of the fin 37 in the interspace between the wings 35a and 35b and therefore, for example, by means of adapted inclined walls.

[0048] The third bag 31, which interacts with the nose of the vehicle, can of course be connected to adapted pumping elements in order to vary its volume according to specific requirements.

[0049] The described means therefore allow, for example, to arrange a device, which is designated by the reference numeral 39, is provided on the frame 3 and is meant to recharge the batteries of the vehicle and to download or upload data from or to said vehicle, at a suitable cavity 40 formed therein.

[0050] The device 39 can therefore be constituted by an arm 41 with which a sleeve 43 is coaxially associated so as to allow a slight rotation which is controlled by a pair of first springs 42a, 42b; said sleeve has a fork 44 between whose prongs a support 46 for an electric power and/or data transmission connector is associated along an axis which is approximately parallel to the axis of the arm 41 and so as to allow oscillation on the diametrical plane of said arm and on the central plane with respect to the fork 44.

[0051] Advantageously, the support 46 has a frustum-shaped tip which is shaped complementarily to the cavity 40 and from which a seat for said connectors protrudes axially.

[0052] A third spring 48, arranged between the lateral surface of the support 46 and the adjacent sleeve 43, allows to control the oscillation of said support.

[0053] The frame 3 of the device 1 has, at the second

open end 49 which lies opposite the first closed end 33, a guiding assembly 50 for the autonomous underwater vehicle 2; said guiding assembly is constituted by a plurality of individual laminas 51 which are arranged side by side and so as to give the guiding assembly 50 a preferably frustum-like shape whose transverse cross-section is similar to that of the vehicle and whose apex is directed toward the first closed end 33.

[0054] The guiding assembly 50 therefore has an end which lies outside the frame and which, in plan view, is substantially petal-shaped and such as to facilitate the conveyance of the vehicle into the frame.

[0055] Suitable devices 52 for transmitting/receiving signals which can be received and transmitted by other devices which are present inside the vehicle 2 are of course provided on the frame.

[0056] The device further comprises means suitable to lock the opening of said second half-frames 20a and 20b with respect to the first end 33 and to the second end 49; said means are constituted by suitable actuators 53 which are actuated by appropriately provided circuits and are adapted to force the interaction of a stem 54 which is connected to a body 55 which is respectively rigidly coupled to said second half-frames 20a and 20b, with said first and second ends 33 and 49, with which a preferably sleeve-shaped locator 56 is rigidly coupled.

[0057] It has thus been observed that the invention has achieved the intended aim and objects, a device having been provided which allows to provide docking for moving autonomous underwater vehicles rapidly and safety as regards the integrity of the vehicle by way of the closable cage-like configuration of the frame and of the means for its centering and alignment.

[0058] The device further allows to temporarily stably couple the vehicle, thus allowing to rapidly and easily perform data acquisition or transmission and to transfer the energy required to restore the charge of the batteries contained therein.

[0059] Finally, the particular configuration of the docking device allows to also use it for autonomous underwater vehicles having mutually different dimensions without particular adjustments or structural modifications.

[0060] The invention is of course susceptible of numerous modifications and variations, all of which are within the scope of the same inventive concept.

[0061] The materials that constitute the individual components of the device may of course also be the most pertinent according to specific requirements.

Claims

1. A docking device (1) for self-propelled autonomous underwater vehicles (2) comprising a frame (3) which has means for acquiring data and transmitting energy from and to said vehicles (2) and means for centering, alignment and temporary locking of said self-propelled vehicles (2) **characterized in that** said frame (3) comprises at least one first upper half-frame (18) and at least a couple of second half-frames (20a, 20b), each of said second half-frames (20a, 20b) being at one end rotatably freely associated to said at least one first half-frame (18) said couple of second half-frames (20a, 20b) forming a cage-like structure once the free ends (21a, 21b) thereof are arranged mutually adjacent.

2. The device according to claim 1, **characterized in that** said frame (3) comprises a plurality of said first half-frames (18) and a plurality of said couple of second half-frames (20a, 20b).

3. The device according to claim 1 or 2, **characterized in that** each of said first half-frames (18) has, in transverse cross-section, a substantially C-shaped configuration with two wings (19) and is fixed.

4. The device according to claim 3, **characterized in that** each of said second half-frames (18) is rotatably freely associated to one of said two wings (19) of one of said first half-frames (18).

5. The device according to anyone of the claims from 2 to 4, **characterized in that** said first half-frames (18) are mutually equidistant.

6. The device according to anyone of the preceding claims, **characterized in that** each of said second half-frames (20a, 20b) is substantially L-shaped.

7. The device according to anyone of the preceding claims, **characterized in that** it further comprises adapted perimetric guides (4) for adapted first (5) and second (10a, 10b) cables stretched between a submerged counterweight (6) and a trestle (7) which is rigidly coupled to the deck (8) of a vessel (9).

8. The device according to anyone of the claims from 1 to 6, **characterized in that** it is associated with a first cable (5) which is connected, at the other end, at a suitable articulation (11) which is anchored to a base (12) which can be arranged on the seabed (13).

9. The device according to claim 8, **characterized in that** said base (12) is constituted by a body (16) which is substantially shaped like a parallelepiped and has, at a transverse side, at least one protrusion (17) which is inclined so as to form an acute angle with said transverse side, taking a clockwise rotation as positive, said shape of said protrusion (17) allowing, during the lowering of said base (12) onto the seabed (13), the automatic tipping of said base (12) once it has reached the bottom.

10. The device according to anyone of the preceding claims, **characterized in that** said second half-frames (20a, 20b) are moved by means of suitable actuators which are constituted by a piston (22) whose body is rigidly coupled at a first plate (23) which is rigidly coupled to the first wing (19) of said first half-frame (18) and whose stem is rigidly coupled at a second plate (24) which is rigidly coupled to one said second half-frames (20a, 20b).

11. The device according to one or more of the preceding claims, **characterized in that** said first (18) and second (20a, 20b) half-frames have means for the centering and alignment of said autonomous underwater vehicle (2), said means being constituted by a plurality of contact pads (25) which comprise cylindrical bodies (26) which are rigidly coupled, at one end, to adapted third brackets (27) which are rigidly coupled to one of said first (18) or second (20a, 20b) half-frames and with which heads (28) are telescopically associated, said heads (28) being able to slide in opposition to appropriately provided flexible elements.

12. The device according to claim 11, **characterized in that** said contact pads (25) are arranged in a radial configuration so that their heads (28) lie, in the condition in which said frame (3) is closed, at a curve which corresponds to the external contour of said autonomous underwater vehicle (2).

13. The device according to claims 10 or 11, **characterized in that** said heads (28) have a seat for a ball (29), said heads (28) being allowed to move between two conditions of maximum and minimum protrusion with respect to said cylindrical body (26) by way of the presence of at least one flexible element, such as a cylindrical helical compression spring (30).

14. The device according to one or more of the preceding claims, **characterized in that** means for the temporary locking of said vehicle (2) are associated with said frame (3) and are constituted by a plurality of bags (31) which can be filled with water which is preferably taken from the outside environment by means of pumps.

15. The device according to claims 13, **characterized in that** it comprises a first bag and a second bag which are arranged adjacent to the inner part of said frame (3) arranged above the dorsal region of said autonomous underwater vehicle (2) when docked, and a third bag which is arranged at a first closed end (33) of said frame (3), to interact with the nose of said autonomous underwater vehicle (2).

16. The device according to claims 14, **characterized in that** said third bag cooperates, in its actuation, with additional means for the alignment and locking of said autonomous underwater vehicle (2), said means being constituted by two wings (35a, 35b) which have a substantially triangular plan shape and are rotatably associated, at mutually parallel and adjacent ends, with a pair of bases (36a, 36b) which are rigidly coupled to said frame (3) in a region located above the autonomous underwater vehicle (2) when docked, particularly in a region located above a dorsal fin (37) thereof.

17. The device according to claims 15, **characterized in that** said wings (35a, 35b) are arranged, at rest, so as to have mutually opposite vertices, said wings (35a, 35b) being able to rotate in a single direction so as to allow the complete passage of said fin (37) during the insertion of said vehicle (2) in said frame (3) and the locking of said fin (37) once an opposite movement is applied to said vehicle (2), flexible means interacting with said wings (35a, 35b) in order to reposition them so that their vertices are mutually opposite.

18. The device according to claims 14, **characterized in that** the arrangement of said bases (36a, 36b) and the shape of said third bag are such that the movement of said fin (37) beyond said wings (35a, 35b) corresponds to the resting of the prow (34) of said vehicle (2) at said third bag which, due to the inertia of the vehicle (2), is compressed, expelling the water pumped into it earlier, and is then filled with water again, expanding it, in order to push said vehicle (2) backward.

19. The device according to one or more of the preceding claims, **characterized in that** it comprises an additional device on said frame (3) which is meant to recharge the batteries of said vehicle (2) and to download or upload data from or to said vehicle (2), at an adapted cavity (40) formed therein, said additional device being constituted by an arm (41) with which a sleeve (43) is coaxially associated so that it can perform a slight rotation which is controlled by two first springs (42a, 42b), said sleeve (43) being provided with a fork (44) between whose prongs a support (46) for an electric power and/or data transmission connector is associated on an axis which is approximately parallel to the axis of said arm (41) and so as to allow oscillation on the diametrical plane of said arm and on a central plane with respect to said fork (44).

20. The device according to claims 18, **characterized in that** said support (46) has a frustum-shaped tip which is shaped complementarily to said cavity (40) and from which a seat (47) for said connectors protrudes axially, a third spring (48) arranged between

the lateral surface of said support (46) and said adjacent sleeve (43) allowing to control the oscillation of said support (46).

21. The device according to one or more of the preceding claims, **characterized in that** said frame (3) has, at its second open end (49), which lies opposite said first closed end (33), a guiding assembly (50) for said autonomous underwater vehicle (2), said guiding assembly (50) being constituted by a plurality of individual laminas (51) which are arranged mutually side by side and so as to give said guiding assembly (50) a frustum-shaped configuration whose apex is directed toward the first closed end (33).

22. The device according to one or more of the preceding claims, **characterized in that** it comprises means which are adapted to lock the opening of said second half-frames (20a, 20b) with respect to said first (33) and second (49) ends, said means being constituted by suitable actuators (53), actuated by appropriately provided circuits, which are adapted to force the interaction of a stem (54), which is connected to a body (55) which is rigidly coupled respectively to said second half-frames (20a, 20b), with said first (33) and second (49) ends and with which a preferably sleeve-shaped locator (56) is rigidly coupled.

Patentansprüche

1. Dockinggerät (1) für selbstangetriebene autonome Unterwasserfahrzeuge (2), das einen Rahmen (3) aufweist, der Mittel zur Datenerfassung und Übertragung von Energie von und zu dem Fahrzeug (2) sowie Mittel zur Zentrierung, Ausrichtung und zum zeitweiligen Feststellen des selbstangetriebenen Fahrzeugs (2) hat, **dadurch gekennzeichnet, dass** der Rahmen (3) wenigstens einen ersten oberen Halbrahmen (18) und wenigstens ein Paar zweiter Halbrahmen (20a, 20b) aufweist, von denen jeder zweite Halbrahmen (20a, 20b) an einem Ende frei schwenkbar dem wenigstens einen ersten Halbrahmen (18) zugeordnet ist und das Paar der zweiten Halbrahmen (20a, 20b) eine käfigartige Struktur bildet, sobald seine freien Enden (21 a, 21 b) einander benachbart angeordnet sind.

2. Gerät nach Anspruch 1, **dadurch gekennzeichnet, dass** der Rahmen (3) eine Vielzahl der ersten Halbrahmen (18) und eine Vielzahl der Paare der zweiten Halbrahmen (20a, 20b) aufweist.

3. Gerät nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** jeder erste Halbrahmen (18) im Querschnitt im Wesentlichen eine C-förmige Gestalt mit zwei Flügeln (19) hat und fest ist.

4. Gerät nach Anspruch 3, **dadurch gekennzeichnet, dass** jeder zweite Halbrahmen (18) frei schwenkbar einem der beiden Flügel (19) eines der ersten Halbrahmen (18) zugeordnet ist.

5. Gerät nach einem der Ansprüche 2 bis 4, **dadurch gekennzeichnet, dass** die ersten Halbrahmen (18) zueinander gleich beabstandet sind.

6. Gerät nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** jeder zweite Halbrahmen (20a, 20b) im Wesentlichen L-förmig ist.

7. Gerät nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** es außerdem angepasste Umfangsführungen (4) für angepasste erste (5) und zweite (10a, 10b) Kabel aufweist, die sich zwischen einem untergetauchten Gegengewicht (6) und einer starr mit dem Deck (8) eines Schiffs (9) gekoppelten Brücke (7) erstrecken.

8. Gerät nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** ihm ein erstes Kabel (6) zugeordnet ist, das an seinem anderen Ende mit einem geeigneten Gelenk (11) verbunden ist, welches an einer Basis (12) verankert ist, die am Meeresboden (13) angeordnet sein kann.

9. Gerät nach Anspruch 8, **dadurch gekennzeichnet, dass** die Basis (12) durch einen Körper (13) gebildet ist, der im Wesentlichen eine prismatische Gestalt und an einer Querseite wenigstens einen Vorsprung (17) hat, der schräg so verläuft, dass er einen spitzen Winkel mit der Querseite bildet, wobei eine Drehung im Uhrzeigersinn als positiv definiert ist und die Gestalt des Vorsprungs (17) während des Absenkens der Basis (12) auf den Meeresboden (13) ein automatisches Kippen der Basis (12) erlaubt, sobald diese den Boden erreicht hat.

10. Gerät nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Halbrahmen (20a, 20b) durch geeignete Stellorgane bewegt werden, die durch einen Kolben (22) gebildet sind, dessen Körper starr mit einer ersten Platte (23) gekoppelt ist, die ihrerseits starr mit dem ersten Flügel (19) des ersten Halbrahmens (18) starr verbunden ist und dessen Schaft starr mit einer zweiten Platte (24) gekoppelt ist, die ihrerseits starr mit einem der zweiten Halbrahmen (20a, 20b) gekoppelt ist.

11. Gerät nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die ersten (18) und zweiten (20a, 20b) Halbrahmen

Mittel zur Zentrierung und Ausrichtung des autonomen Unterwasserfahrzeugs (20) haben, wobei diese Mittel von mehreren Kontaktblöcken (25) gebildet sind, die zylindrische Körper (26) aufweisen, die an einem Ende starr mit angepassten dritten Stützwinkeln (27) gekoppelt sind, die ihrerseits starr mit einem der ersten (18) oder zweiten (20a, 20b) Halbrahmen gekoppelt sind und denen Köpfe (28) teleskopisch zugeordnet sind, die entgegengesetzt zu geeignet vorgesehenen flexiblen Elementen gleiten können.

12. Gerät nach Anspruch 11, **dadurch gekennzeichnet, dass** die Kontaktblöcke (25) in einer radialen Struktur so angeordnet sind, dass ihre Köpfe (28) in dem Zustand, in dem der Rahmen (3) geschlossen ist, auf einer Kurve liegen, die der äußeren Kontur des autonomen Unterwasserfahrzeugs (2) entspricht.

13. Gerät nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** die Köpfe (28) einen Sitz für eine Kugel (29) haben und sich zwischen zwei Zuständen ihres maximalen und minimalen Vorspringens bezogen auf den zylindrischen Körper (26) durch das Vorsehen wenigstens eines flexiblen Elements, wie z.B. einer zylindrischen Schraubendruckfeder (30) bewegen können.

14. Gerät nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Mittel zum zeitweiligen Festlegen des Fahrzeugs (2) zum Rahmen (3) gehören und durch mehrere Säcke (31) gebildet sind, die bevorzugt mit durch Pumpen aus der Umgebung genommenem Wasser gefüllt werden können.

15. Gerät nach Anspruch 13, **dadurch gekennzeichnet, dass** es einen ersten Sack und einen zweiten Sack, die neben dem inneren Teil des Rahmens (3) oberhalb des Seitenbereichs des angedockten autonomen Unterwasserfahrzeugs (2) angeordnet sind, und einen dritten Sack aufweist, der an einem ersten geschlossenen Ende (33) des Rahmens (3) angeordnet ist und mit der Nase des autonomen Unterwasserfahrzeugs (2) zusammenwirkt.

16. Gerät nach Anspruch 14, **dadurch gekennzeichnet, dass** der dritte Sack bei seiner Betätigung mit zusätzlichen Mitteln für die Ausrichtung und Festlegung des autonomen Unterwasserfahrzeugs (2) zusammenwirkt, wobei diese Mittel durch zwei Flügel (35a, 35b) gebildet sind, die im Wesentlichen Dreiecksform haben und drehbar an zueinander parallelen und benachbarten Enden einem Basispaar (36a, 36b) zugeordnet sind, welches starr mit dem Rahmen (3) in einem Bereich gekoppelt sind, der oberhalb des angedockten autonomen Unterwasserfahrzeugs (2) liegt, insbesondere in einem Bereich, der oberhalb einer Seitenfinne (37) desselben liegt.

17. Gerät nach Anspruch 15, **dadurch gekennzeichnet, dass** die Flügel (35a, 35b) in Ruhe so angeordnet sind, dass sie einander entgegengesetzte Scheitelpunkte haben und in einer einzigen Richtung drehbar sind, um so den vollständigen Durchgang der Finne (37) während des Einfahrens des Fahrzeugs (2) in den Rahmen (3) und die Verriegelung der Finne erlauben, sobald das Fahrzeug (2) einer Gegenbewegung unterworfen wird, wobei flexible Glieder mit den Flügeln (35a, 35b) zusammenwirken, um sie so erneut zu positionieren, dass ihre Scheitelpunkte einander entgegengesetzt sind.

18. Gerät nach Anspruch 14, **dadurch gekennzeichnet, dass** die Anordnung der Basen (36a, 36b) und die Gestalt des dritten Sacks so sind, dass die Bewegung der Finne (37) über die Flügel (35a, 35b) der Ruhelage des Bugs (34) des Fahrzeugs (2) an dem dritten Sack entspricht, der auf Grund der Trägheit des Fahrzeugs (2) zusammengedrückt wird und das zuvor in ihn gepumpte Wasser ausstößt und dann erneut mit Wasser gefüllt wird und sich ausdehnend das Fahrzeug (2) nach hinten stößt.

19. Gerät nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** es an dem Rahmen (3) ein Zusatzgerät aufweist, das zum Wiederaufladen der Batterien des Fahrzeugs (2) und Entladen oder Einladen von Daten aus dem oder in das Fahrzeug (2) an einem daran gebildeten und angepassten Hohlraum (40) dient und das durch einen Arm (41) gebildet ist, dem eine Hülse (43) koaxial so zugeordnet ist, dass sie eine leichte Drehung ausführen kann, die durch zwei erste Federn (42a, 42b) kontrolliert wird, wobei die Hülse (43) mit einer Gabel (44) versehen ist, zwischen deren Zinken eine für einen elektrischen Leistungs- und/oder Datenübertragungsstecker dienende Halterung (46) einer annähernd parallel zur Achse des Arms (41) liegenden Achse zugeordnet ist, um auf diese Weise eine Schwingung auf der diametralen Ebene des Arms und auf einer zentralen Ebene bezogen auf die Gabel (44) zu gestatten.

20. Gerät nach Anspruch 18, **dadurch gekennzeichnet, dass** die Halterung (46) eine kegelstumpfförmige Spitze hat, die komplementär zum Hohlraum (40) geformt ist und von der ein Sitz (47) für die Stecker axial vorsteht und dass eine dritte Feder (48) zwischen den Seitenflächen der Halterung (46) und der benachbarten Hülse (43) angeordnet ist, die die Kontrolle der Schwingung der Halterung (46) gestattet.

21. Gerät nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Rahmen (3) an seinem zweiten offenen Ende (49), das dem ersten geschlossenen Ende (33) gegenüberliegt, eine Führungsbaugruppe (50) für das autonome Unterwasserfahrzeug (2) hat, die durch eine Vielzahl einzelner Lamellen (51) gebildet ist, die Seite an Seite zueinander liegen und so der Führungsbaugruppe (50) eine kegelstumpfförmige Gestalt geben, deren Scheitelpunkt zum ersten geschlossenen Ende (33) hin zeigt.

22. Gerät nach einem oder mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** es Mittel aufweist, die dazu eingerichtet sind, die Öffnung der zweiten Halbrahmen (20a, 20b) bezogen auf das erste (33) und zweite (49) Ende zu verschließen, wobei diese Mittel durch geeignete Stellglieder (53) gebildet sind, die durch entsprechend vorgesehene Schaltungen betätigt werden, die dazu eingerichtet sind, die Einwirkung eines Stempels (54), der mit einem Körper (55) verbunden ist, welcher seinerseits starr jeweils mit den zweiten Halbrahmen (20a, 20b) gekoppelt ist, auf das erste (33) und zweite (49) Ende zu erzwingen, wobei mit dem Körper (55) eine bevorzugt hülsenförmige Aufnahme (56) starr gekoppelt ist.

Revendications

1. Dispositif d'amarrage (1) pour véhicules sous-marins autonomes et automoteurs (2) comprenant un châssis (3) pourvu de moyens pour acquérir des données et transmettre de l'énergie depuis et vers lesdits véhicules (2) et des moyens pour le centrage, l'alignement et l'immobilisation temporaire desdits véhicules automoteurs (2), **caractérisé en ce que** ledit châssis (3) comporte au moins un premier demi-châssis supérieur (18) et au moins une paire de seconds demi-châssis (20a, 20b), chacun desdits seconds demi-châssis (20a, 20b) étant librement associé, à une extrémité, audit au moins un premier demi-châssis (18), ladite paire de seconds demi-châssis (20a, 20b) formant une structure analogue à une cage une fois que les extrémités libres (21a, 21b) de ceux-ci sont disposées de manière mutuellement adjacente.

2. Dispositif selon la revendication 1, **caractérisé en ce que** ledit châssis (3) comporte une pluralité desdits premiers demi-châssis (18) et une pluralité de ladite paire de seconds demi-châssis (20a, 20b).

3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** chacun desdits premiers demi-châssis (18) a, en coupe transversale, une configuration sensiblement en C avec deux ailes (19) et est fixe.

4. Dispositif selon la revendication 3, **caractérisé en ce que** chacun desdits seconds demi-châssis (18) est librement associé de manière rotative avec l'une desdites deux ailes (19) d'un desdits premiers demi-châssis (18).

5. Dispositif selon l'une quelconque des revendications 2 à 4, **caractérisé en ce que** lesdits premiers demi-châssis (18) sont mutuellement équidistante.

6. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chacun desdits seconds demi-châssis (20a, 20b) est sensiblement en L.

7. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il comprend en outre sur son pourtour des guides adaptés (4) pour des premiers (5) et deuxièmes (10a, 10b) câbles tendus entre un contrepoids immergé (6) et un portique (7) solidaire avec le pont (8) d'un bateau (9).

8. Dispositif selon l'une quelconque des revendications 1 à 6, **caractérisé en ce qu'**il est associé à un premier câble (5) qui, à l'autre extrémité, est accouplé au niveau d'une articulation appropriée (11) qui est accrochée à une embase (12) qui peut être placée au fond (13) de la mer.

9. Dispositif selon la revendication 8, **caractérisé en ce que** ladite embase (12) est constituée par un corps (16) de forme sensiblement parallélépipédique et ayant, au niveau d'un côté transversal, au moins une saillie (17) qui est inclinée afin de former un angle aigu avec ledit côté transversal, en considérant comme positive une rotation dans le sens horaire, ladite forme de ladite saillie (17) permettant, pendant la descente de ladite embase (12) vers le fond de la mer (13), le basculement automatique de ladite embase (12) une fois qu'elle a atteint le fond.

10. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdits seconds demi-châssis (20a, 20b) sont mus à l'aide d'actionneurs appropriés constitués par un piston (22) dont le corps est solidaire d'une première plaque (23) qui est solidaire de la première aile (19) dudit premier demi-châssis (18) et dont la tige est solidaire d'une deuxième plaque (24) qui est solidaire de l'un desdits seconds demi-châssis (20a, 20b).

11. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits premier (18) et seconds (20a, 20b) demi-châssis comportent des moyens pour le centrage et l'aligne-

ment dudit véhicule sous-marin autonome (2), lesdits moyens étant constitués par une pluralité de patins de contact (25) qui comportent des corps cylindriques (26) solidaires, à une extrémité, de troisièmes supports adaptés (27) qui sont solidaires de l'un desdits premier (18) et seconds (20a, 20b) demi-châssis et auxquels sont associées de manière télescopique des têtes (28), lesdites têtes (28) étant aptes à coulisser en opposition à des éléments flexibles disposés de manière appropriée.

12. Dispositif selon la revendication 11, **caractérisé en ce que** lesdits patins de contact (25) sont disposés suivant une configuration radiale de façon que leurs têtes (28) soient situées, dans l'état dans lequel ledit châssis (3) est fermé, sur une courbe qui correspond au contour extérieur dudit véhicule sous-marin autonome (2).

13. Dispositif selon la revendication 10 ou 11, **caractérisé en ce que** lesdites têtes (28) ont un siège pour une bille (29), lesdites têtes (28) ayant la possibilité de bouger entre deux états de dépassement maximal et minimal par rapport audit corps cylindrique (26) du fait de la présence d'au moins un élément flexible tel qu'un ressort cylindrique hélicoïdal de compression (30).

14. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** des moyens pour l'immobilisation temporaire dudit véhicule (2) sont associés audit châssis (3) et sont constitués par une pluralité de poches (31) qui peuvent être remplies d'eau, laquelle est de préférence prélevée dans le milieu extérieur à l'aide de pompes.

15. Dispositif selon la revendication 13, **caractérisé en ce qu'**il comprend une première poche et une deuxième poche qui sont disposées au voisinage immédiat de la partie interne dudit châssis (3) disposée au-dessus de la région dorsale dudit véhicule sous-marin autonome (2) lorsqu'il est amarré, et une troisième poche qui est disposée à une première extrémité fermée (33) dudit châssis (3), pour coopérer avec le nez dudit véhicule sous-marin autonome (2).

16. Dispositif selon la revendication 14, **caractérisé en ce que** ladite troisième poche coopère, au cours de son actionnement, avec des moyens supplémentaires pour l'alignement et l'immobilisation dudit véhicule sous-marin autonome (2), lesdits moyens étant constitués par deux ailettes (35a, 35b) qui ont, dans le plan, une forme sensiblement triangulaire et sont associées de manière rotative, à des extrémités mutuellement parallèles et adjacentes, avec une paire d'embases (36a, 36b) solidaires dudit châssis (3) dans une région située au-dessus du véhicule sous-marin autonome (2) lorsqu'il est amarré, en particulier dans une région située au-dessus d'un aileron dorsal (37) de celui-ci.

17. Dispositif selon la revendication 15, **caractérisé en ce que** lesdites ailettes (35a, 35b) sont agencées, au repos, de façon à avoir des sommets mutuellement opposés, lesdites ailettes (35a, 35b) pouvant tourner dans un seul sens afin de laisser entièrement passer ledit aileron (37) pendant l'insertion dudit véhicule (2) dans ledit châssis (3) et l'immobilisation dudit aileron (37) une fois qu'un mouvement opposé est exercé sur ledit véhicule (2), des moyens flexibles coopérant avec lesdites ailettes (35a, 35b) afin de les remettre en position de façon que leurs sommets soient mutuellement opposés.

18. Dispositif selon la revendication 14, **caractérisé en ce que** l'agencement desdites embases (36a, 36b) et la forme de ladite troisième poche sont tels que le mouvement dudit aileron (37) au-delà desdites ailettes (35a, 35b) correspond à la venue en appui de la proue (34) dudit véhicule sur ladite troisième poche qui, en raison de l'inertie du véhicule (2), est comprimée, expulsant l'eau introduite antérieurement par pompage dans celle-ci, et est à nouveau remplie d'eau, ce qui l'amène à se déployer, afin de repousser vers l'arrière ledit véhicule (2).

19. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend, sur ledit châssis (3), un dispositif supplémentaire servant à recharger les batteries dudit véhicule (2) et à télécharger des données depuis ou vers ledit véhicule (2), au niveau d'une cavité adaptée (40) formée dans celui-ci, ledit dispositif supplémentaire étant constitué par un bras (41) auquel est associé de manière coaxiale un manchon (43) de façon qu'il puisse exécuter une légère rotation qui est commandée par deux premiers ressorts (42a, 42b), ledit manchon (43) étant pourvu d'une fourche (44) entre les dents de laquelle un support (46) pour un connecteur d'alimentation électrique et/ou de transmission de données est associé sur un axe approximativement parallèle à l'axe dudit bras (41) et afin de permettre une oscillation dans le plan diamétral dudit bras et dans un plan central par rapport à ladite fourche (44).

20. Dispositif selon la revendication 18, **caractérisé en ce que** ledit support (46) a un bout de forme tronconique qui a une forme complémentaire de celle de ladite cavité (40) et depuis lequel fait axialement saillie un siège (47) pour lesdits connecteurs, un troisième ressort (48) disposé entre la surface latérale dudit support (46) et ledit manchon adjacent (43) permettant de commander l'oscillation dudit

support (46).

21. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit châssis (3) a, à sa deuxième extrémité ouverte (49), qui est disposée de manière opposée à ladite première extrémité fermée (33), un ensemble de guidage (50) pour ledit véhicule sous-marin autonome (2), ledit ensemble de guidage (50) étant constitué par une pluralité de plaques minces (51) qui sont disposées mutuellement côte à côte de façon à donner audit ensemble de guidage (50) une configuration de forme tronconique dont le sommet est dirigé vers la première extrémité fermée (33).

22. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend des moyens aptes à verrouiller l'ouverture desdits seconds demi-châssis (20a, 20b) par rapport auxdites première (33) et deuxième (49) extrémités, lesdits moyens étant constitués par des actionneurs appropriés (53), actionnés par des circuits réalisés d'une façon appropriée, qui sont aptes, à provoquer l'interaction d'une tige, qui est accouplée à un corps (55) solidaire respectivement desdits seconds demi-châssis (20a, 20b), avec lesdites première (33) et deuxième (49) extrémités et duquel est solidaire un moyen de positionnement (56) de préférence en forme de manchon.

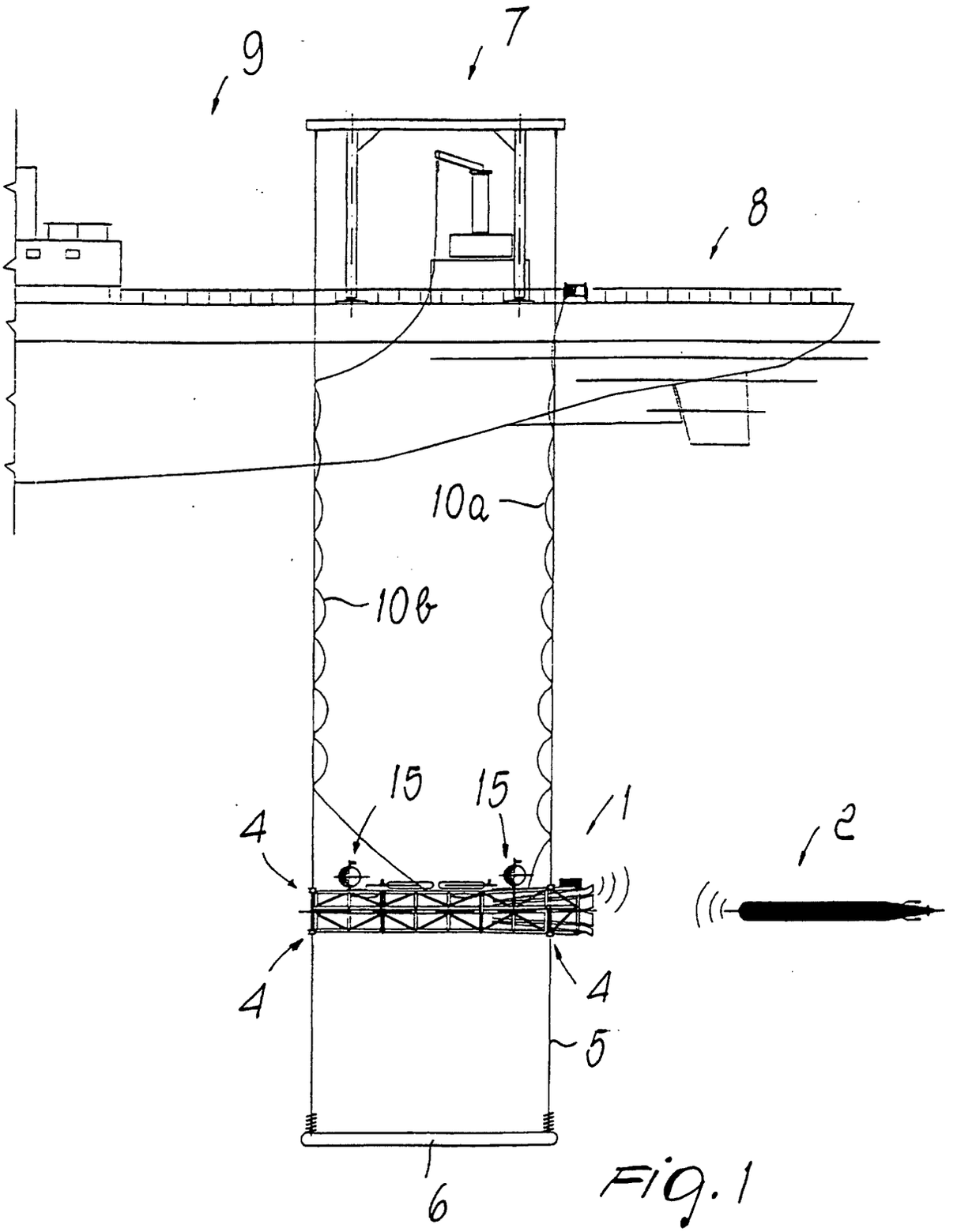


Fig. 1

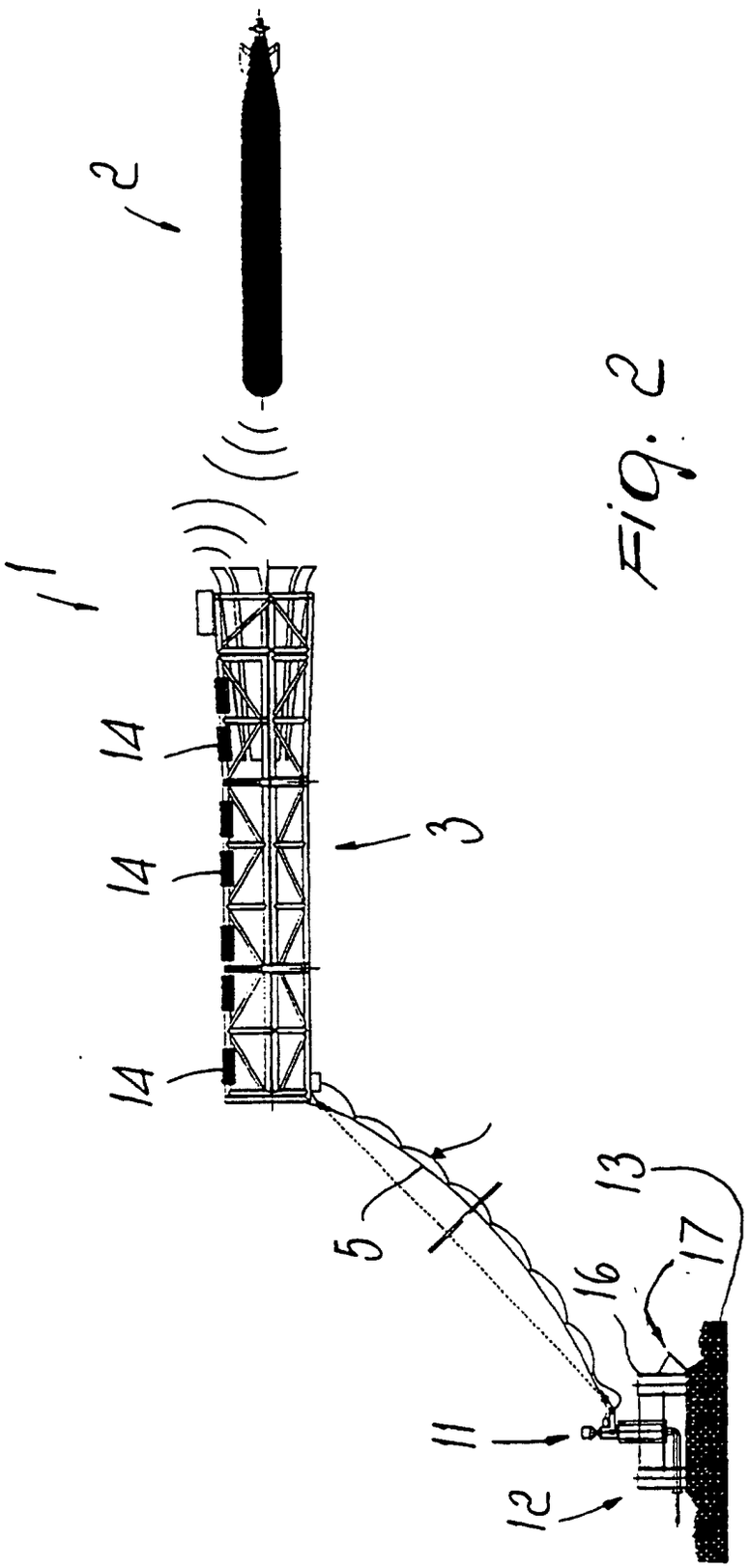


Fig. 2

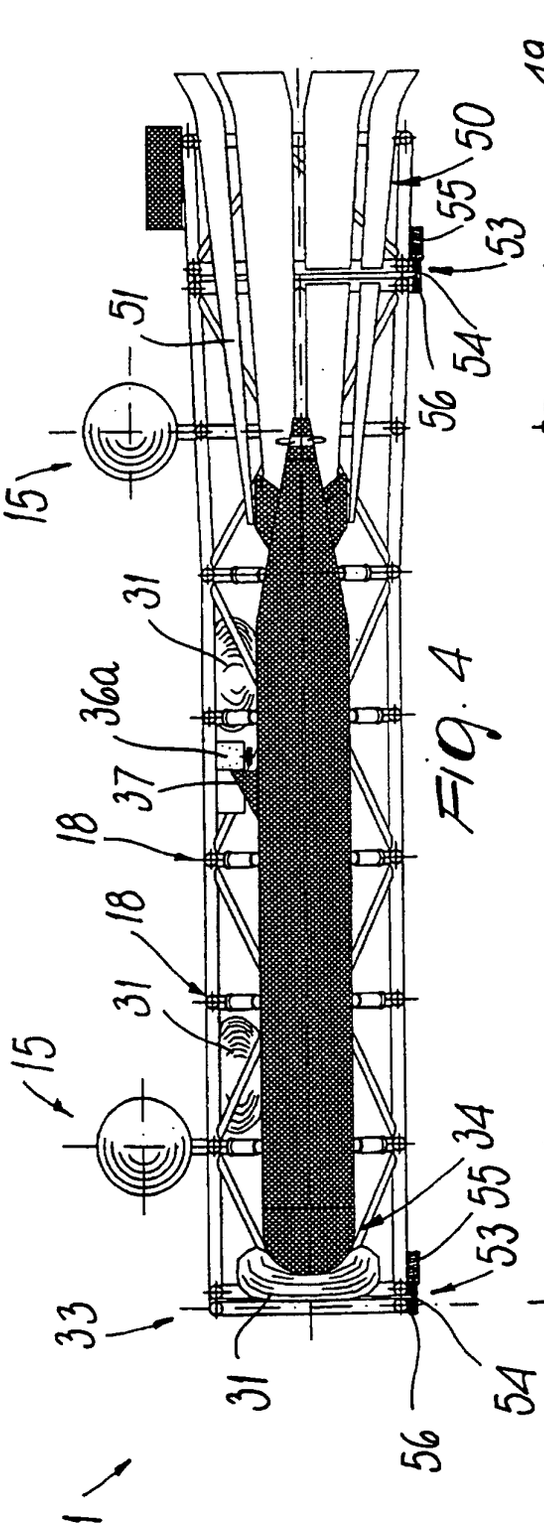


Fig. 4

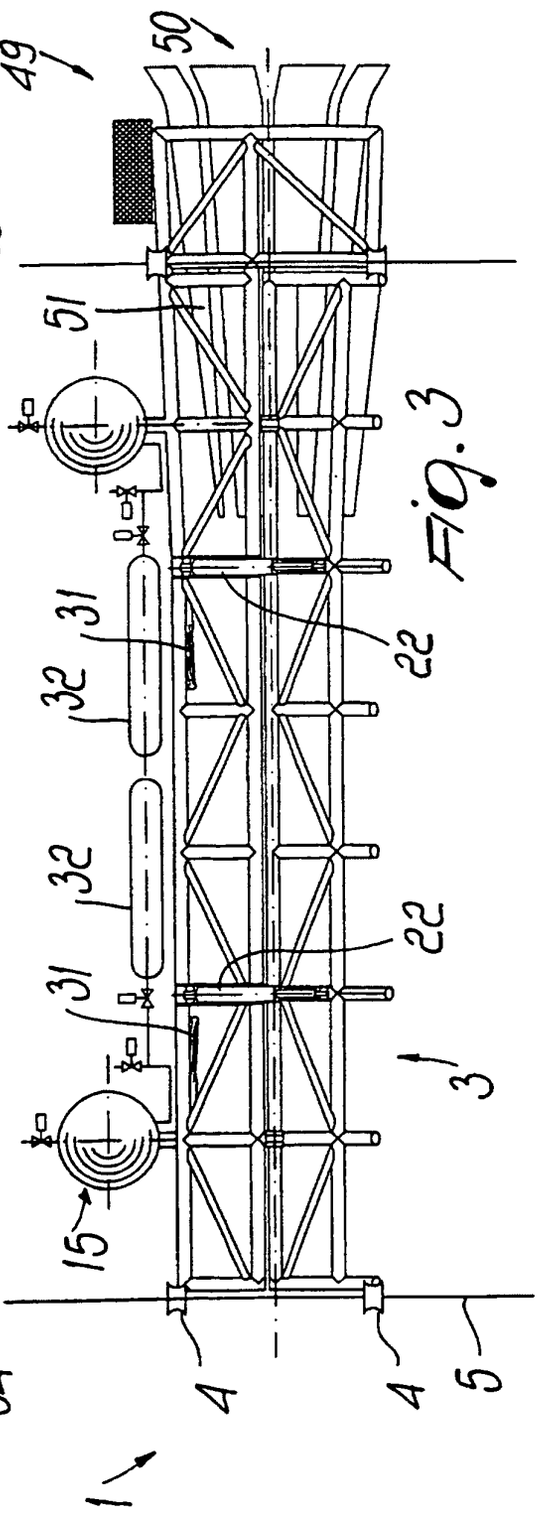


Fig. 3

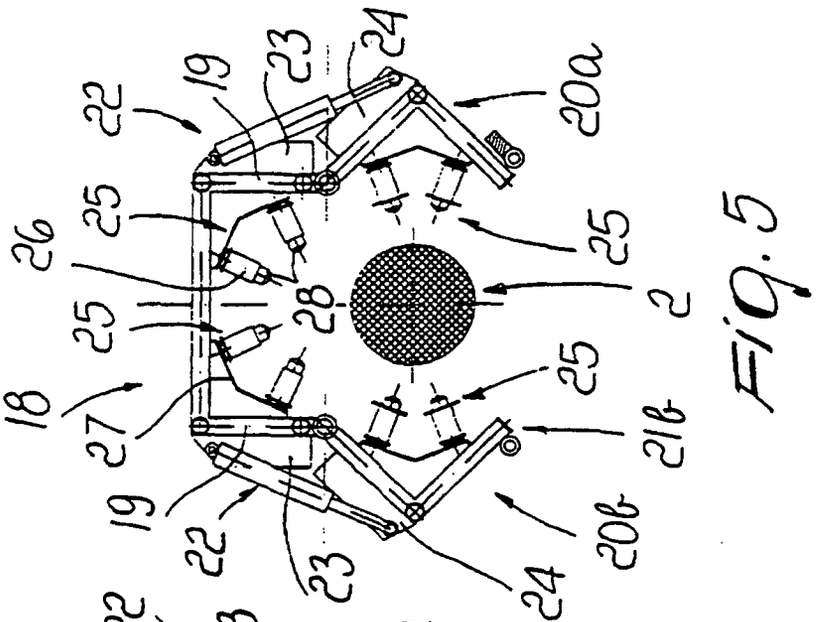


Fig. 5

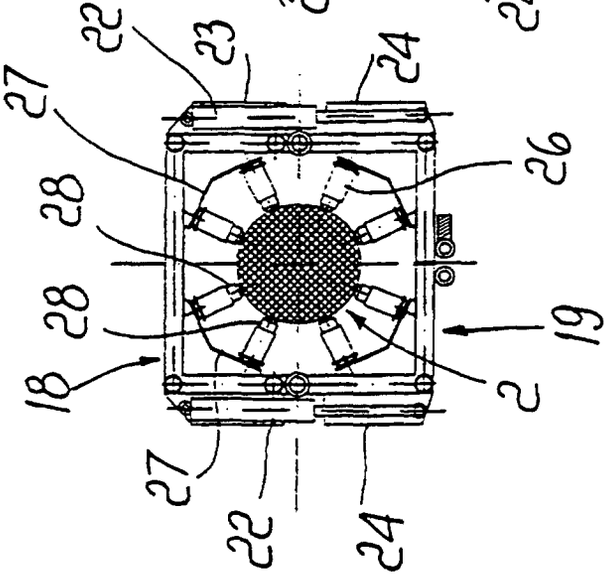


Fig. 6

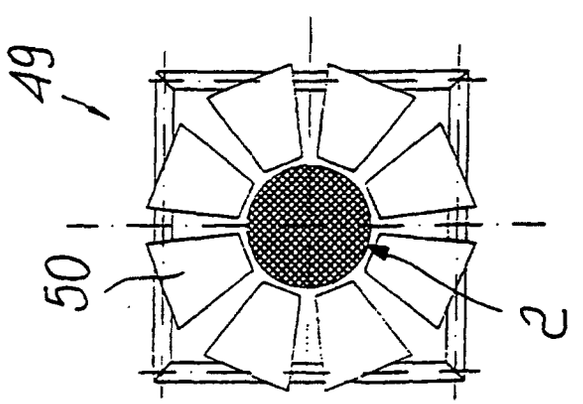


Fig. 7

Fig. 8

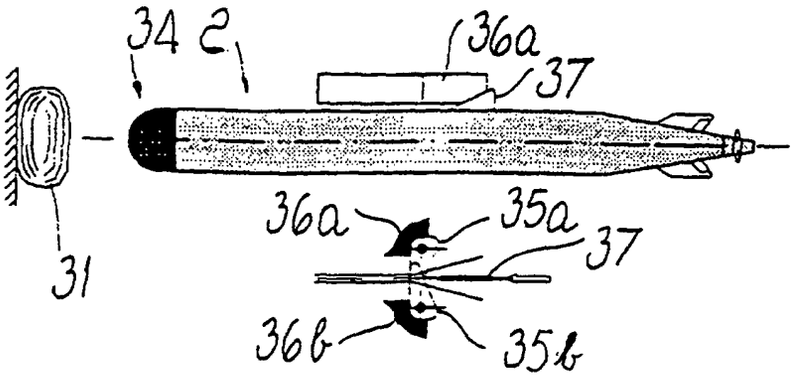


Fig. 9

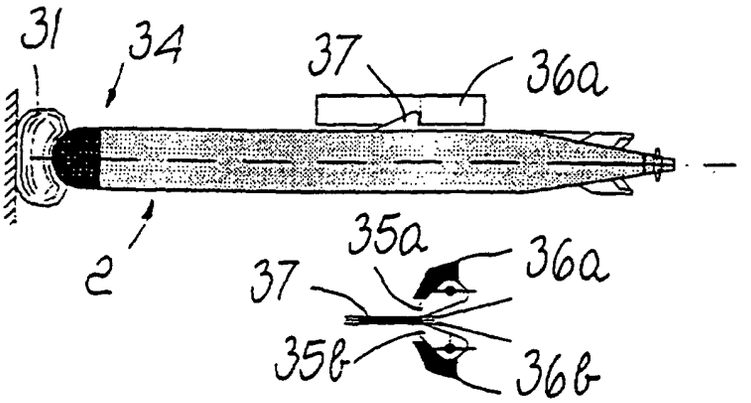


Fig. 10

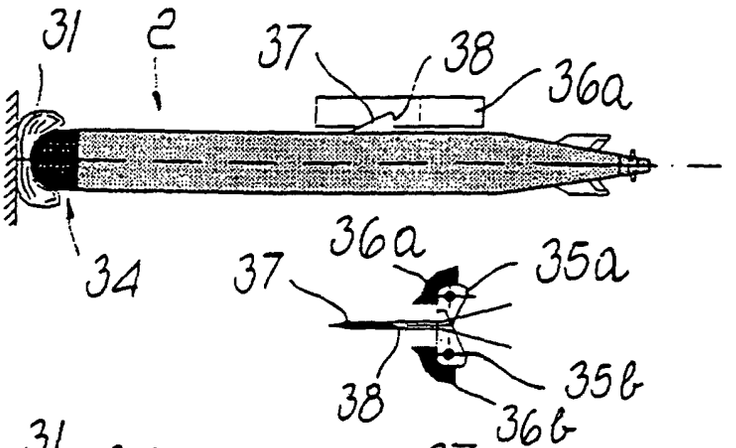
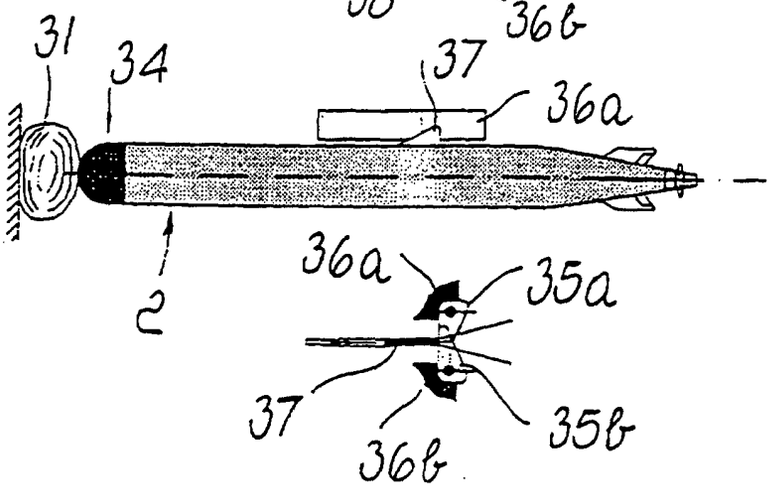


Fig. 11



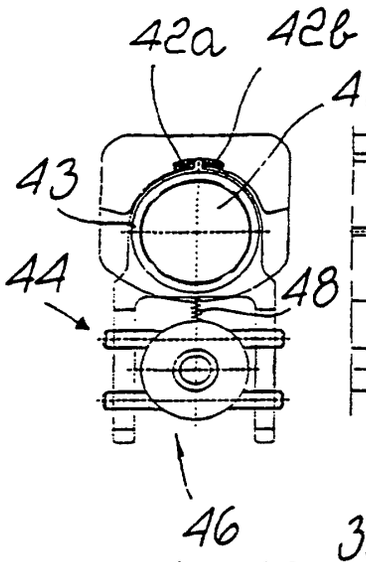


Fig.12

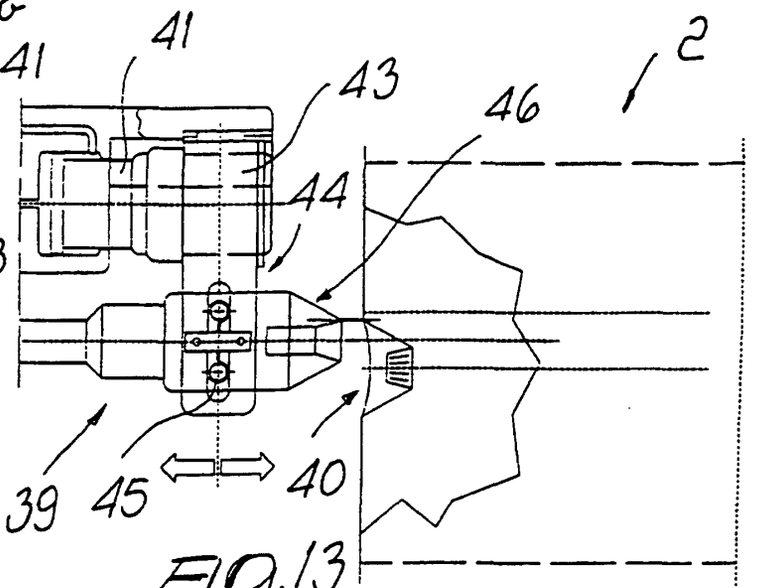


Fig.13

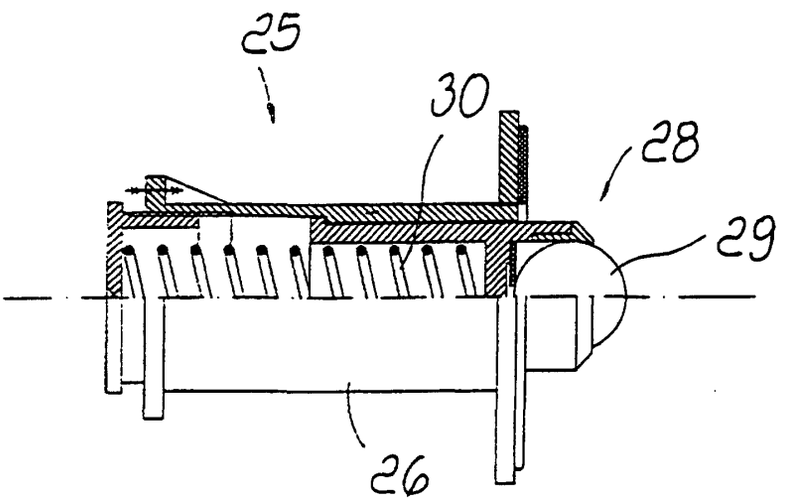


Fig. 14