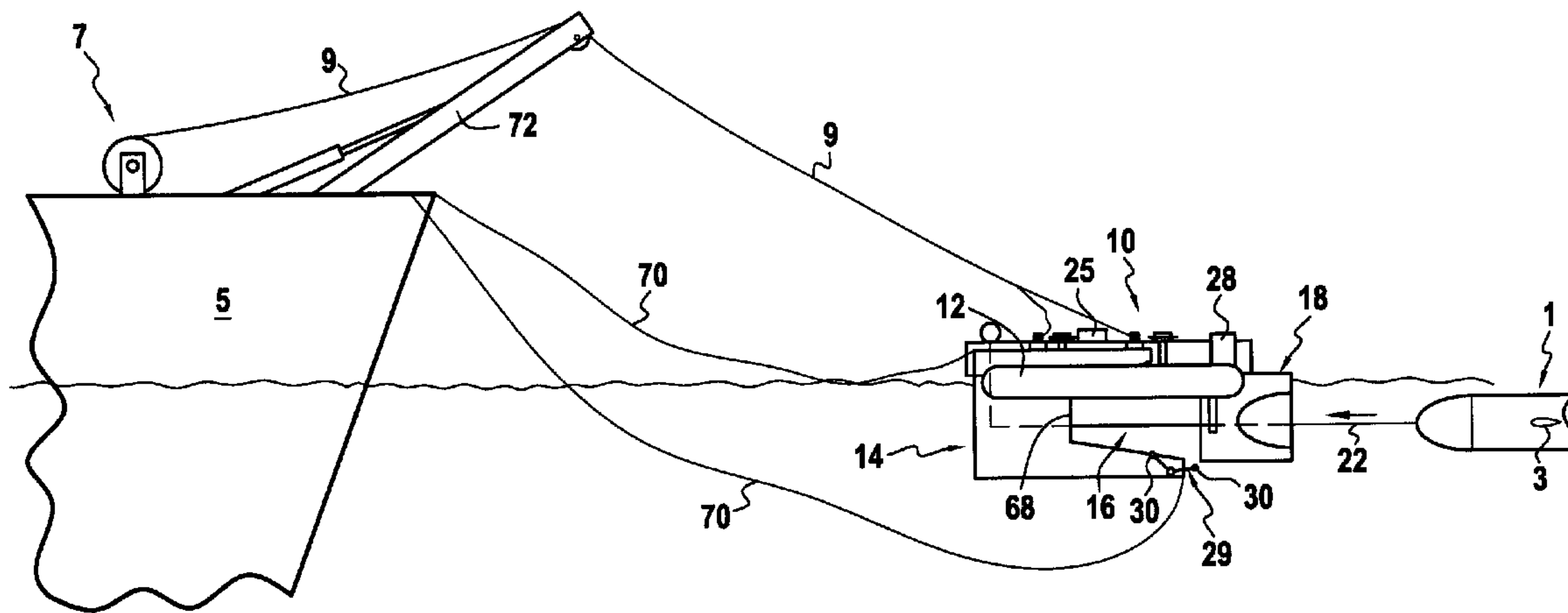




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(54) Titre : INSTALLATION ET PROCEDE DE RECUPERATION D'UN VEHICULE MARIN DE SURFACE OU D'UN VEHICULE SOUS-MARIN  
 (54) Title: AN INSTALLATION AND A METHOD FOR RECOVERING A SURFACE MARINE VEHICLE OR AN UNDERWATER VEHICLE



(57) Abrégé/Abstract:

Installation and methods for recovering and/or launching an underwater or marine vehicle (1), particularly an AUV, from a recovery base (5). The installation comprises a floating cage (10) defining a housing (16) that at least part of said vehicle (1) can enter, first hauling means mounted on said cage and capable of hauling said vehicle into said housing, via a first flexible link, typically a cable (22), and second hauling means (7) intended to be mounted on the recovery base (5) and capable of hauling said cage via a second flexible link (9, 70) different from the first one.

## A B S T R A C T

AN INSTALLATION AND A METHOD FOR RECOVERING A SURFACE  
MARINE VEHICLE OR AN UNDERWATER VEHICLE

5

An installation and methods for recovering and/or  
launching a surface marine vehicle or an underwater  
vehicle (1), in particular an AUV, from a recovery base  
(5). The installation comprises a floating cage (10)  
10 defining a housing (16) in which at least a portion of  
said vehicle (1) can penetrate, first puller means  
mounted on said cage and capable of pulling said vehicle  
into said housing, via a first flexible connection,  
typically a cable (22), and second puller means (7) for  
15 mounting on the recovery base (5) and capable of pulling  
said cage via a second flexible connection (9, 70)  
distinct from the first.

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Translation of the title and the abstract as they were when originally filed by the  
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AN INSTALLATION AND A METHOD FOR RECOVERING A SURFACE  
MARINE VEHICLE OR AN UNDERWATER VEHICLE

The invention relates to an installation and a  
method for recovering a surface marine vehicle or an  
5 underwater vehicle that is in the water, from a recovery  
base.

The installation may be used in particular for  
recovering an autonomous underwater vehicle (AUV).

An installation is already known that enables an AUV  
10 in the water to be recovered from a boat, the  
installation comprising a ramp having one end hinged to  
the stern of the boat and having its other end floating  
on the surface of the water. A winch mounted on the boat  
pulls the AUV via its nose (i.e. its front end) by means  
15 of a cable in order to pull it up along the ramp.

That known installation presents the following  
drawbacks. Firstly, it is necessary to align the AUV  
properly with the ramp, and in practice this can be found  
to be difficult, in particular in rough water, since the  
20 boat is oscillating (pitching, rolling, heaving) and it  
entrains the ramp together therewith so the ramp is  
continuously changing its alignment. Furthermore, high  
stresses are exerted on the AUV while it is being pulled  
along the ramp, and that runs the risk of damaging the  
25 AUV. Finally, that type of installation is not suitable  
for recovering AUVs having fins since the fins would be  
damaged while the AUV is sliding on the ramp.

An object of the invention is to propose an  
installation enabling a surface marine vehicle or an  
30 underwater vehicle to be recovered easily from the water  
without running the risk of damaging it.

This object is achieved by an installation for  
recovering a surface marine vehicle or an underwater  
vehicle in water, from a recovery base, the installation  
35 being characterized in that it comprises a floating cage  
defining a housing in which at least a portion of said  
vehicle can penetrate, first puller means mounted on said

cage and capable of pulling said vehicle into said housing via a first flexible connection, and second puller means designed to be mounted on the recovery base and capable of pulling said cage via a second flexible connection distinct from the first.

This installation can be used for recovering various types of vehicle, whether floating or in controlled immersion, and in particular an AUV, a torpedo, a surface drone, or a vehicle of similar architecture. In general, it is used for recovering a vehicle floating on the surface of the water. Furthermore, the recovery base may be a boat, a quay, an off-shore platform, etc.

The term "flexible connection" is used to designate any type of connection capable of tensioning and relaxing as a function of the traction exerted thereon. When it is relaxed, the second flexible connection allows the cage to move freely relative to the recovery base. More particularly, when the recovery base is a boat, this avoids the boat entraining the cage together therewith when the boat is oscillating (in pitching, rolling, heaving). This makes it easier to bring the vehicle into alignment with the cage into which it is to penetrate.

Typically, the flexible connections of the installation are cables, and the puller means comprise cable winder devices for winding cable in and out.

In an embodiment, the cage is fitted with means for receiving, guiding, and determining the orientation of said vehicle as it penetrates into the cage. This makes it easier to bring the cage and the vehicle into alignment, and also makes it easier for the vehicle to penetrate into the cage. These various means are described in detail below.

When the vehicle has fins, the shape of the cage is adapted accordingly: for example, its sides may present lateral openings into which the fins can pass.

The first and second puller means enable the distance between the vehicle and the cage and the

distance between the cage and the recovery base to be controlled independently, thereby enabling these distances to be adapted as a function of operating conditions.

5           Advantageously, the first puller means are controlled remotely from the recovery base.

          The second puller means are generally mechanical means, but if the weight of the cage plus the vehicle makes this possible, they could be constituted by  
10 operators pulling manually on the second flexible connection. A plurality of flexible connections can be used for pulling the cage from the recovery base.

          In an embodiment, handling means are used in association with the second puller means mounted on the  
15 recovery base, the handling means likewise being mounted on said base. They may be constituted by a crane, a gantry, or a jib. The second puller means and the handling means serve to enable the cage and the vehicle to be hoisted onto the recovery base and make it easy for  
20 them to be placed on a appropriate support.

          The invention also provides a method of recovering a surface marine vehicle or an underwater vehicle in water, from a recovery base, the method comprising: launching a floating cage of the above-specified type that defines a  
25 housing in which at least a portion of said vehicle can penetrate; pulling said vehicle into said housing with the help of first puller means mounted on said cage and connected to said vehicle via a first flexible connection; and pulling said cage together with said  
30 vehicle using second puller means mounted on the recovery base and connected to said cage via a second flexible connection distinct from the first.

          In an implementation of the recovery method, prior to launching said cage, said first flexible connection  
35 connected to the vehicle is recovered in the water from the recovery base, e.g. with the help of a boat-hook. The first flexible connection is then connected to the

first puller means of the cage, while the cage is on the recovery base. Only thereafter is the cage launched, it being understood that the cage is launched while being connected to the second puller means via the second  
5 flexible connection. In this method, there is no need at any time to call on divers, thereby achieving savings in terms of time and human resources.

In another aspect, the invention provides a method of launching or underwater vehicle from a launching base.

10 A method of the above-specified type is already known that makes use of a ramp hinged to the stern of the launching base. In that method, the vehicle (an AUV) is caused to slide along the ramp in order to launch it.

15 With that known method, high stresses are exerted on the vehicle as it slides along the ramp and as it penetrates into the water, and that can risk damaging the vehicle. That phenomenon is even more marked when the sea is rough, since the ramp then oscillates together with the boat (pitching, rolling, heaving).

20 In addition, as mentioned above, the use of a ramp is not suitable with vehicles that have fins since the fins run the risk of being damaged when the vehicle slides on the ramp.

25 An object of the invention is to provide a method enabling a surface marine vehicle or an underwater vehicle to be launched easily from a launching base, without running the risk of damaging the vehicle.

This object is achieved by a method comprising the steps of:

30 • launching a floating cage together with a vehicle housed at least in part inside the cage, the cage being connected to the launching base via a flexible connection; and

35 • pulling the vehicle out from the cage with the help of puller means mounted on said cage.

According to the invention, the cage and the vehicle are launched together. During this step, the vehicle is

protected by the cage that surrounds and the vehicle is subjected to low levels of stress only.

Since the cage is connected to the launching base via a flexible connection, once they are in the water, the vehicle and the cage can move freely relative to the boat so that any oscillations of the boat do not disturb them. This makes it easy to extract the vehicle from the cage.

In an implementation of the method, the vehicle is held relative to the cage while the cage is being launched, and until the vehicle is released with the help of release means. This makes it possible to avoid impacts occurring between the cage and the vehicle during launching.

The vehicle is finally released (if it was previously held relative to the cage) and is then pulled out from the cage. Advantageously, these last two actions are remotely controlled from the launching base.

The invention and its advantages can be better understood on reading the following detailed description. The description is given with reference to the accompanying sheets of figures, in which:

- Figures 1 to 3 show an example of a recovery installation of the invention respectively in side view, plan view, and end view;

- Figure 4 shows the installation of Figures 1 to 3 in side view when the vehicle for recovery is taken out of the water;

- Figures 5 to 7 show, in part only, an example of recovery apparatus of the invention, respectively in side view in longitudinal section, in plan view, and in end view; and

- Figure 8 shows the apparatus of Figures 5 to 7 being used, in this example, to launch a vehicle.

The installation of Figures 1 to 4 serves to recover a vehicle 1 from the water and/or to launch it.

By way of example, the vehicle 1 is an AUV that is

torpedo-shaped. It should be observed that it has two large side fins in its middle portion.

The installation comprises a boat 5 as a recovery base. The boat 5 is fitted with a winch 7 for winding a cable 9 in and out. The cable is preferably a textile cable.

The installation also comprises a recovery apparatus within which the vehicle 1 can be received, at least in part.

10 To refer to the recovery apparatus, the term "cage" 10 is used below. The cage 10 is fitted on its sides with floats 12 that enable it to remain at the surface of the water and to adjust its immersion depth.

In a particular embodiment, the floats 12 are connected to said cage via hinges that allow the floats to flap up and down. On the surface of the water, the floats thus move away from the cage so as to maximize stability and avoiding impeding entry of the vehicle 1. Advantageously, when not in the water, the floats 12 extend along the cage 10 on either side thereof in such a manner as to protect it (and also the vehicle 1) from possible lateral impacts. Such lateral impacts may occur, in particular, while the cage 10 is being hoisted on board the boat 5. The floats 12 are for example boat fenders.

The cage 10 comprises:

• A frame 14 defining a housing 16 with an entrance through which the vehicle 1 can penetrate. In Figures 1 and 2, this entrance is to the right of the cage, and in 30 Figure 3, the entrance is seen end on.

• Receiver means 18 suitable for receiving the front portion of the vehicle 1, referred to below as its "nose". The receiver means 18 define a cavity 20 of shape that is complementary to the shape of the nose of the vehicle 1. These receiver means 18 have a cable 22 35 passing therethrough, a passage 23 being formed for this purpose in the receiver means 18 through the end of the

cavity 20 (see Figures 5 and 7).

• Guide means for guiding and aligning the receiver means 18 together with the vehicle 1 relative to the frame 14 so as to facilitate penetration of the vehicle 1 into the cage 10.

• Puller means fastened to frame 14 enabling the vehicle 1 to be pulled into the housing 16 inside the cage 10, via a flexible connection, typically the cable 22, connected to the vehicle 1. These puller means comprise a winder device for winding the cable 22 in and/or out, which device is formed by a winch 24. The cable 22 may be a textile cable or a metal cable. The winch 24 may be remotely controlled, and in particular controlled from the boat.

• Holder means for holding the vehicle 1 inside the housing 16 and suitable for preventing the vehicle 1 from moving back out from the cage 10 once it has entered it.

• At least one energy source (e.g. at least one battery 25) for powering the puller means and, if necessary, the holder means. It is possible to provide holder means that are not powered with energy, being triggered mechanically by the vehicle 1 going past.

It should be observed that Figures 5 to 9 do not show all of the portions of the cage 10. In particular, the bottom portions of the cage are not shown. These figures seek to show more particularly the reception means and the guide means.

Said reception means 18 comprise an element 32 that is movable between the entrance and the end of the cavity 20. The cable 22 passes through this movable element 32, preferably through its center. In this example, the movable element 32 comprises a cup 34 suitable for receiving the nose of the vehicle 1 (see Figure 7), and presenting a central hole 35 through which the cable 22 passes. A plurality of guide branches 36 (generally at least two diametrically-opposite branches) extend from the periphery of the cup 34 and connect it to the

structure 37 of the reception means 18. The end of each branch 36 can slide relative to said structure 37 so that the movable element 32 can slide between the entrance and the end of the cavity 20, as represented by double-headed arrow A in Figure 5.

The cage 10 includes first blocking means 38 (see Figure 5) for holding said reception means 18 in the vicinity of the entrance to the housing 16, before the vehicle 1 reaches the cage. Thus, said reception means 18 are in position for receiving the vehicle 1 when it arrives. In addition, insofar as the vehicle 1 is being pulled and is coming closer, the portion of the cable 22 that extends between the winch 24 and the reception means 18 (more precisely between the pulley 40, the passage 23, and the nose of the vehicle 1 - see Figures 5 and 6) forms a lever arm that serves to cause the cage 10 to point towards the nose of the vehicle 1, thereby making it easier to recover. It should be observed that the cage is capable of being aligned since it can move freely in the water, the cable(s) 9 (70) connecting the cage 10 to the boat 5 being slack.

The first blocking means 38 release said reception means 18 only when the nose of the vehicle 1 is fully engaged in the reception means 18 (more precisely in the cavity 20) and is about to penetrate into the housing 16. In this example, the first blocking means 38 comprise an abutment capable of retracting when the vehicle 1 exerts a thrust force thereon that is greater than a predetermined force. In practice, the abutment is formed by an arm 42 pivotally mounted on the frame 14, with a wheel 46 mounted at the end of the arm. The arm 42 is connected to a spring 44 of stiffness that is selected such that beyond a certain thrust force exerted by the vehicle 1 on the arm 42 via the reception means 18, the spring 44 deforms and allows the arm to retract by pivoting as represented by arrow B (see Figure 5). Other types of blocking means could naturally be envisaged.

The cage also has second blocking means 48 (see Figure 6) for holding the moving element 32 of the reception means 18 at the entrance of the cavity 20, these second blocking means 48 releasing the movable  
5 element 32 when the vehicle 1 comes into contact with the movable element 32 (more precisely with the cup 34). By way of example, these second blocking means 48 operate on the same principle as the first blocking means 38 and  
10 comprise an abutment capable of retracting when the vehicle 1 acts thereon, via the movable element 32, to exert a thrust force that is greater than a predetermined force.

The presence of the movable element 32 and the blocking of the movable element at the end of the cavity  
15 20 enable the portion of cable 22 that is tensioned between the end of the cavity 20, the entrance to said cavity, and the nose of the vehicle 1, to behave like a lever arm, thereby pointing said cavity 20 to face the vehicle 1, as the vehicle approaches. This makes the  
20 vehicle easier to recover.

The blocking force of the second blocking means 48 is less than the blocking force of the first blocking means 38, such that when the vehicle 1 penetrates into the reception means 18 (more precisely into the cavity  
25 20), the second blocking means 48 give way before the first blocking means 38 give way.

Said reception means 18 are secured to a rod 50. When the cage 10 is in the water and floating, the rod 50 extends vertically (relative to the horizontal defined by  
30 the water). The rod 50 is mounted on a carriage 52 so as to be capable of pivoting about its axis C as represented by double-headed arrow D in Figures 5 to 7. The carriage 52 is guided along the housing 16 of the cage 10 by said guide means.

35 The reception means 18 are mounted on the rod 50 in such a manner:

- as to be driven by the rod 50 when it pivots as

represented by double-headed arrow D, referred to below as "horizontal" pivoting; and

• as to be capable of pivoting about an axis perpendicular to the axis C of the rod, as represented in Figures 5 and 7 by double-headed arrow E, referred to below as "vertical" pivoting.

These freedoms to move in vertical and horizontal pivoting enable the reception means 18 to point to face the nose of the vehicle 1 as it approaches, and once the nose of the vehicle 1 is received in the cavity 20, to follow the oscillations of the vehicle 1, until it comes to bear against the cradles of the rocker 29 (described below).

In this example, the bottom end of the rod 50 carries a fork 51, and between the two branches of the fork 51 there extends an axis F perpendicular to the axis C of the rod, about which the reception means are pivotally mounted. Abutments 53 limit the vertical pivot angle of the reception means 18.

A guide arm 54 is fastened to the end of the rod 50 so as to enable it to be entrained and pivoted about its axis C as represented by double-headed arrow D. The arm 54 presents a first end engaged with the rod 50 and a second end having a wheel 56 mounted thereon.

Said guide means comprise first and second superposed guides 58 and 60 extending along the housing 16.

The first guide 58 guides the carriage 52 along the housing 16. It is formed by a pair of parallel rails 64, and the carriage 52 is fitted with wheels 62 enabling it to move along the rails 64 as represented by double-headed arrow G shown in Figure 6.

The second guide 60 guides the guide arm 54 and, as a result, turns the rod 50 and the reception means 18 by causing them to pivot horizontally as represented by double-headed arrow D. It is situated above the first guide 58. It is formed by a pair of rails 66 that come

closer to each other on going away from the entrance to the cage 10. The guide arm 54 can pivot between these rails 66 as represented by double-headed arrow D, between a first position in which the wheel 56 is in contact with one of the rails 66, and a second position in which the wheel 56 is in contact with the other rail 66. The greater the spacing between the rails 66 the greater the freedom of the arm 54, and thus of the rod 50 and of the reception means 18 to pivot horizontally. Conversely, the further the vehicle 1 penetrates into the cage 10, the more the carriage 52 advances along the rails 66 that approach each other, and the smaller the freedom of the reception means 18 to pivot horizontally. Thus, as the vehicle 1 penetrates into the cage 10, the arm 54 and the reception means 18 are brought progressively into alignment along the main axis H of the cage 10. The reception means 18 entrain the vehicle 1 via its nose, and the vehicle 1 is likewise brought into alignment along the axis H (see Figure 6). It thus penetrates easily into the cage 10.

In its sides, the frame 14 of the cage 10 presents notches 68 that are open towards the entrance of the cage 10, serving to allow the lateral fins 3 of the vehicle 1 to pass therethrough (see Figures 1 and 4). Since the vehicle 1 is guided and correctly aligned on penetrating into the cage 10, the fins 3 are received in the notches 68 and are therefore not damaged.

In this example, said holder means comprise two rods 26 fitted with shoes at their ends, together with a mechanism for raising/lowering the rods. The rods 26 slide inside two boxes 28 containing said mechanism. These boxes 28 are fastened on either side of the frame 14 in the vicinity of the entrance to the cage 10. In the lowered position, the rods 26 are in contact with the top face of the vehicle 1, as shown in Figures 4 and 8. It should be observed that the pressure exerted by the rods 26 on the vehicle 1 needs to be controlled so as to

avoid damaging the vehicle.

In another embodiment (not shown), the holder means comprise a rod that is pivotally mounted on the frame 14 together with a mechanism, e.g. an actuator, for causing  
5 the rod to pivot. At its end, the rod carries a cradle that surrounds the top face of the vehicle 1. The vehicle 1 may possibly present a member that projects from its top face. After the vehicle has penetrated into the housing 16, the cradle is lowered and takes up  
10 position behind the projecting member, thereby enabling the vehicle 1 to be held inside the cage 10.

Other types of holder means could be envisaged. Advantageously, such means are remotely controlled, and preferably they are controlled from the boat 5.

15 Furthermore, the bottom face of the vehicle 1 bears against a rocker 29 mounted on the frame. This rocker 29 carries at each of its ends a respective cradle 30 on which the vehicle 1 rests. As shown in Figures 1 and 3, the cradles 30 extend transversely relative to the cage  
20 10, under the housing 16. These cradles are easily withdrawn when the vehicle 1 is placed on a suitable working support present on the boat 5.

An example of the method for recovering a surface marine vehicle or an underwater vehicle from a recovery  
25 base is described below, which method makes use of the above-described cage 10. In this example, the recovery base is the boat 5, and the vehicle to be recovered is the vehicle 1.

Depending on the embodiment of the vehicle 1 and  
30 depending on operating circumstances, a cable 22' connected to the nose of the vehicle 1 is recovered from on board the boat 5. Thereafter, the cable 22' is connected to a cable 22" that is waiting in the cage 10. The cables 22' and 22" then form the above-mentioned  
35 cable 22 that is caused to pass through the movable element 32, the passage 23 in the reception means 18, and around the pulley 40 situated at the end of the housing

16, and that is connected to the winch 24 of the cage 10 (see Figure 5).

In the following step, the cage 10 is launched into the water. It remains connected to the boat 5 via the traction cable 9, also referred to as hoist cable, and via other cables 70 referred to as guide cables. At this stage, the cables 9 and 70 are relaxed such that the boat 5 does not entrain the cage 10 in its own movement. The cage 10 thus moves freely in the water.

In the following step, the winch 24 is remotely controlled to wind in the cable 22 so as to pull the vehicle 1, the reception means 18 situated at the entrance of the cage 10, and the winch 24 (in fact the pulley 40) situated at the end of the cage 10, forms a lever arm that causes the cage 10 to turn so that the axis H of the cage approaches the nose of the vehicle 1. In the same manner, the reception means 18 turn to face the nose of the vehicle 1 as it approaches because of the length of the cable 22 that extends from the end of the cavity 20 (i.e. the passage 23), via the movable element 32, to the nose of the vehicle 1.

The nose of the vehicle 1 initially comes into contact with the movable element 32, and as traction continues on the vehicle 1 it exerts thereon an ever increasing thrust force. Beyond a limit force, the second blocking means 48 release the movable element 32, which then moves in translation together with the nose of the vehicle 1 to the end of the cavity 20. The nose of the vehicle 1 then occupies the cavity 20. Relative movements between the reception means 18 and thus the vehicle 1 and the cage 10 are still allowed at this stage. The reception means can pivot vertically and horizontally as represented by double-headed arrows E and D. This limits the stresses that are exerted on the nose of the vehicle 1, associated with the relative movement between the vehicle 1 and the cage 10.

As traction continues, the vehicle 1 exerts an ever

increasing thrust force on the reception means 18. Beyond a limit force, the first blocking means 38 release the carriage 52 to which the reception means 18 are connected via the rod 50. The carriage 52 then runs  
5 along the first guide 60 towards the end of the housing 16. Simultaneously, the guide arm 54 is guided along the first guide 58 and its freedom to move as represented by double-headed arrow D decreases progressively. The reception means 18 and the vehicle 1 thus become  
10 progressively aligned along the main axis H of the cage.

Once the nose of the vehicle 1 reaches the end of the housing 16, the rods 26 are remotely controlled to move down so as to hold the vehicle 1 in the cage. In this example, it should be observed that only a fraction  
15 of the vehicle 1 penetrates into the cage 10.

In the following step, the cage 10 together with the vehicle 1 is pulled by the cable 9 towards the boat 5 in order to be hoisted on board the boat 5. The guide cables 70 can also be used for pulling the cage 10 and  
20 the vehicle 1. For this purpose, the guide cables 70 can be pulled by hand or they may be connected to a cable winder device, e.g. winches analogous to the winch 7. Under such circumstances, the cables 70 and their winder devices form part of the puller means mounted on the  
25 recovery base, in the meaning of the invention.

When, as in this example, the cable 9 is associated with a gantry crane 72, the guide cables 70 are used to direct the cage 10 and the vehicle 1 so as to pass through the gantry 72. The cage 10 and the vehicle 1 are  
30 extracted from the water using the cable 9, while the cables 70 are used for guiding and passing the cage 10 and the vehicle 1 through the gantry 72 prior to placing them on the deck of the boat 5.

An example of the method for launching a vehicle  
35 from a recovery base is described below, which method makes use of the above-described cage 10.

In this example, the recovery base is the boat 5 and

the vehicle to be recovered is the vehicle 1. To begin with the vehicle 1 is held in the cage 10 and the cage is on board the boat 5.

In a first step, the winch 7, the traction cable 9, the gantry crane 72, and possibly the guide cables 70 are used to launch the cage 10.

Once the cage 10 is in the water, the vehicle previously held relative to the cage 10 (by the above-mentioned holder means) is released with the help of release means. In this example, the release means comprise a mechanism enabling the rods 26 to be raised. These release means are controlled remotely, advantageously from the launching base (i.e. the boat 5).

In the following step, the vehicle 1 is pulled out from the cage 10 with the help of puller means mounted on the cage. With reference to Figure 8, these puller means comprise a cable winder device, i.e. the winch 24 and the cable 22 as described above, together with a pulley 74 situated level with the entrance to the housing 16 of the cage 10. The cable 22 is connected to the winch 24, extends as far as the pulley 74, passes round the pulley, and extends back to the carriage 52 to which it is connected. To extract the vehicle 1 from the cage 10, the winch 24 is actuated so that the carriage 52, the reception means 18, and the nose of the vehicle 1 are pulled by the cable 22 towards the entrance of the housing 16. When the reception means 18 come close to the entrance of the housing 16, their freedom to move in pivoting (associated with the freedom of the guide arm 54) increases because of the wider spacing between the rails 66 of the second guide 60. Thus, the freedom of the vehicle 1 to move relative to the cage 10 increases as the vehicle 1 is extracted from the cage 10, thereby limiting or even avoiding mechanical stresses appearing in the nose of the vehicle 1. Said puller means are controlled remotely, advantageously from the launching base. When the vehicle 1 is fully extracted from its

housing, it moves away from the cage 10 on its own since it is no longer connected thereto.

Depending on operating conditions, the vehicle 1 may be secured to the reception means 18 until the end of the  
5 extraction movement. It is then finally released either on command from the boat 5, as is advantageous, or else by means of a mechanical device placed on the reception means 18 and triggered automatically at the end of the stroke of said reception means.

10 It should be observed that in the above-described examples of the recovery method and of the launching method, there is no need for divers to intervene, the various steps of the method being capable of being performed on the boat 5 or of being controlled therefrom.

## CLAIMS

1. An installation for recovering a surface marine vehicle or an underwater vehicle (1) in water, from a recovery base (5), the installation being characterized  
5 in that it comprises a floating cage (10) defining a housing (16) in which at least a portion of said vehicle can penetrate, first puller means (24) mounted on said cage and capable of pulling said vehicle into said housing via a first flexible connection (22), and second  
10 puller means (7) mounted on the recovery base (5) and capable of pulling said cage via a second flexible connection (9, 70) distinct from the first flexible connection.
- 15 2. An installation according to claim 1, wherein said cage is fitted with reception means (18) adapted for receiving a front portion of said vehicle (1), said first flexible connection (22) passing through the reception means, and the reception means being adapted for moving  
20 along said housing (16) together with the vehicle (1) when the first flexible connection (22) is tensioned.
3. An installation according to claim 2, wherein said cage (10) is fitted with guide means for guiding and  
25 orientating said reception means (18) together with the vehicle (1) relative to a frame (14) of the cage (10), thereby facilitating penetration of the vehicle (1) into the cage (10) when the vehicle (1) is pulled into the housing (16) by the first flexible connection (22).
- 30 4. An installation according to any one of claims 1 to 3, wherein said cage (10) is fitted with holder means (26, 28) for holding said vehicle (1) inside said housing (16).
- 35 5. An installation according to claim 4, wherein said cage (10) is fitted with at least one energy source (25)

for operating the first puller means (24) and the holder means (26, 28).

6. An installation according to claim 4 or claim 5,  
5 including means for remotely controlling the first puller means (4) and the holder means (26, 28).

7. An installation according to any one of claims 1 to 4,  
10 wherein said cage (10) is fitted with at least one energy source (25) for operating the first puller means (24).

8. An installation according to any one of claims 1 to 5,  
including means for remotely controlling the first puller means (4).

15

9. An installation according to any one of claims 1 to 8,  
wherein said flexible connections (9, 70; 22) are cables.

10. A method of recovering a surface marine vehicle or an  
20 underwater vehicle (1) in water, from a recovery base, the method comprising:

· launching a floating cage (10) that defines a housing (16) in which at least a portion of said vehicle can penetrate;

25 · pulling said vehicle (1) into said housing with the help of first puller means (24) mounted on said cage (10) and connected to said vehicle via a first flexible connection (22); and

30 · pulling said cage (10) together with said vehicle using second puller means (7) mounted on the recovery base (5) and connected to said cage via a second flexible connection (9, 70) distinct from the first flexible connection.

35 11. A method according to claim 10, wherein, prior to launching said cage (10), said first flexible connection, (22) connected to the vehicle (1) is recovered in the

water from the recovery base (5), and said first flexible connection (22) is connected to the first puller means (24) mounted on the cage (10).

5 12. A method according to claim 10 or claim 11, wherein,  
prior to launching the cage (10), said cage (10) is  
connected to the recovery base (5) by means of said  
second flexible connection (9, 70), said second flexible  
connection (9, 70) being relaxed after the cage (10) has  
10 been launched so that the cage (10) can move freely in  
the water.

13. A method according to any one of claims 10 to 12,  
wherein the vehicle (1) is held relative to the cage with  
15 the help of holder means (26, 28) once the vehicle has  
entered said housing (16).

14. A method according to claim 13, wherein said first  
puller means (24) and said holder means (26, 28) are  
20 controlled remotely.

15. A method according to claim 14, wherein said first  
puller means (24) and said holder means (26, 28) are  
controlled remotely from the recovery base (5).

25 16. A method according to any one of claims 10 to 13,  
wherein said first puller means (24) are controlled  
remotely.

30 17. A method according to claim 16, wherein said first  
puller means (24) are controlled remotely from the  
recovery base (5).

35 18. A method according to any one of claims 10 to 17, for  
recovering an autonomous underwater vehicle (1).

19. A method of launching a surface marine vehicle or an underwater vehicle (1) from a launching base (5), the method comprising:

5       · launching a floating cage (10) together with a vehicle (1) housed at least in part inside the cage, the cage being connected to the launching base via a flexible connection (9, 70); and

      · pulling the vehicle (1) out from the cage with the help of puller means (24) mounted on said cage.

10

20. A method according to claim 19, wherein said vehicle (1) is held relative to the cage (10) while it is being launched, until the vehicle is released with the help of release means.

15

21. A method according to claim 20, wherein said puller means (24) and said release means are remotely controlled.

20

22. A method according to claim 21, wherein said puller means (24) and said release means are remotely controlled from the launching base (5).

25

23. A method according to claim 19 or claim 20, wherein said puller means (24) are remotely controlled.

24. A method according to claim 23, wherein said puller means (24) are remotely controlled from the launching base (5).

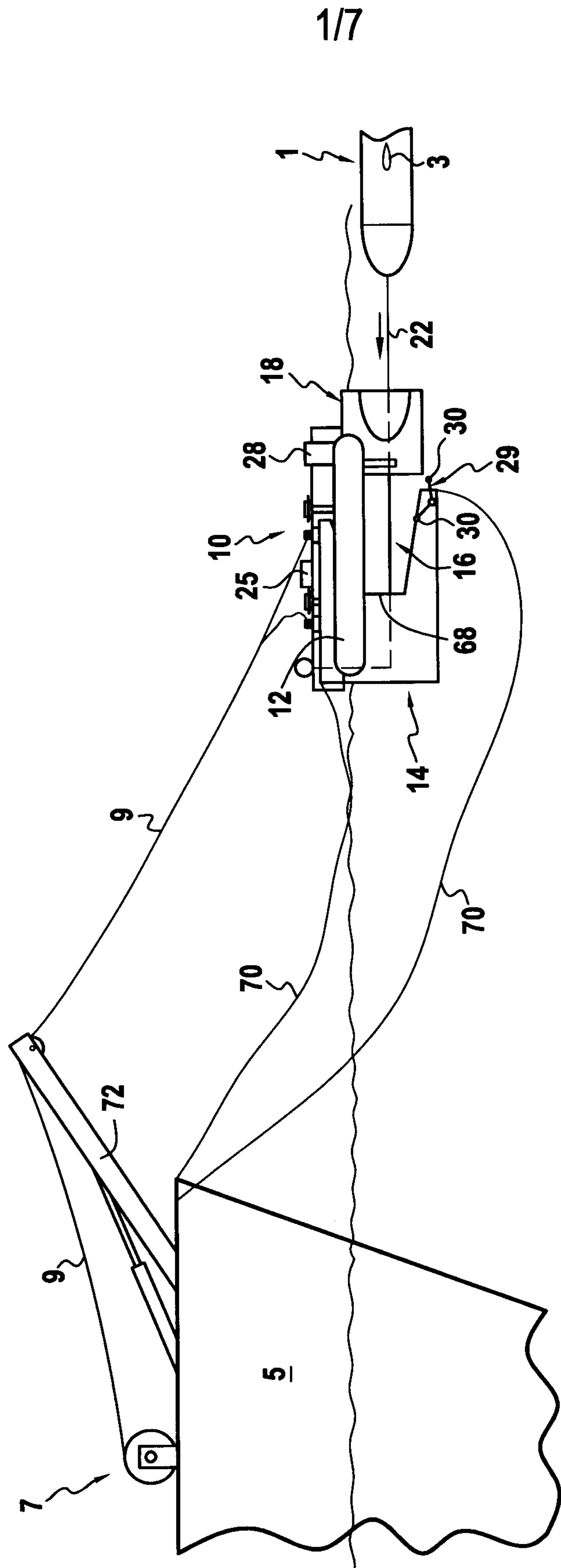


FIG.1

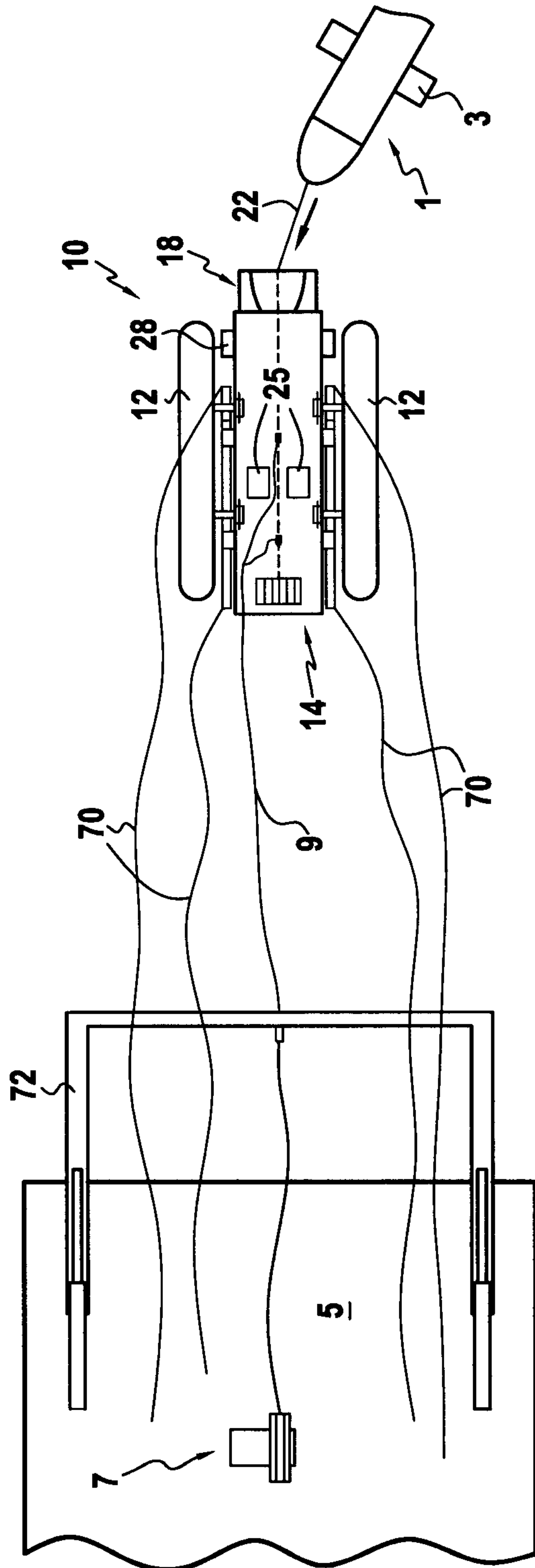


FIG.2

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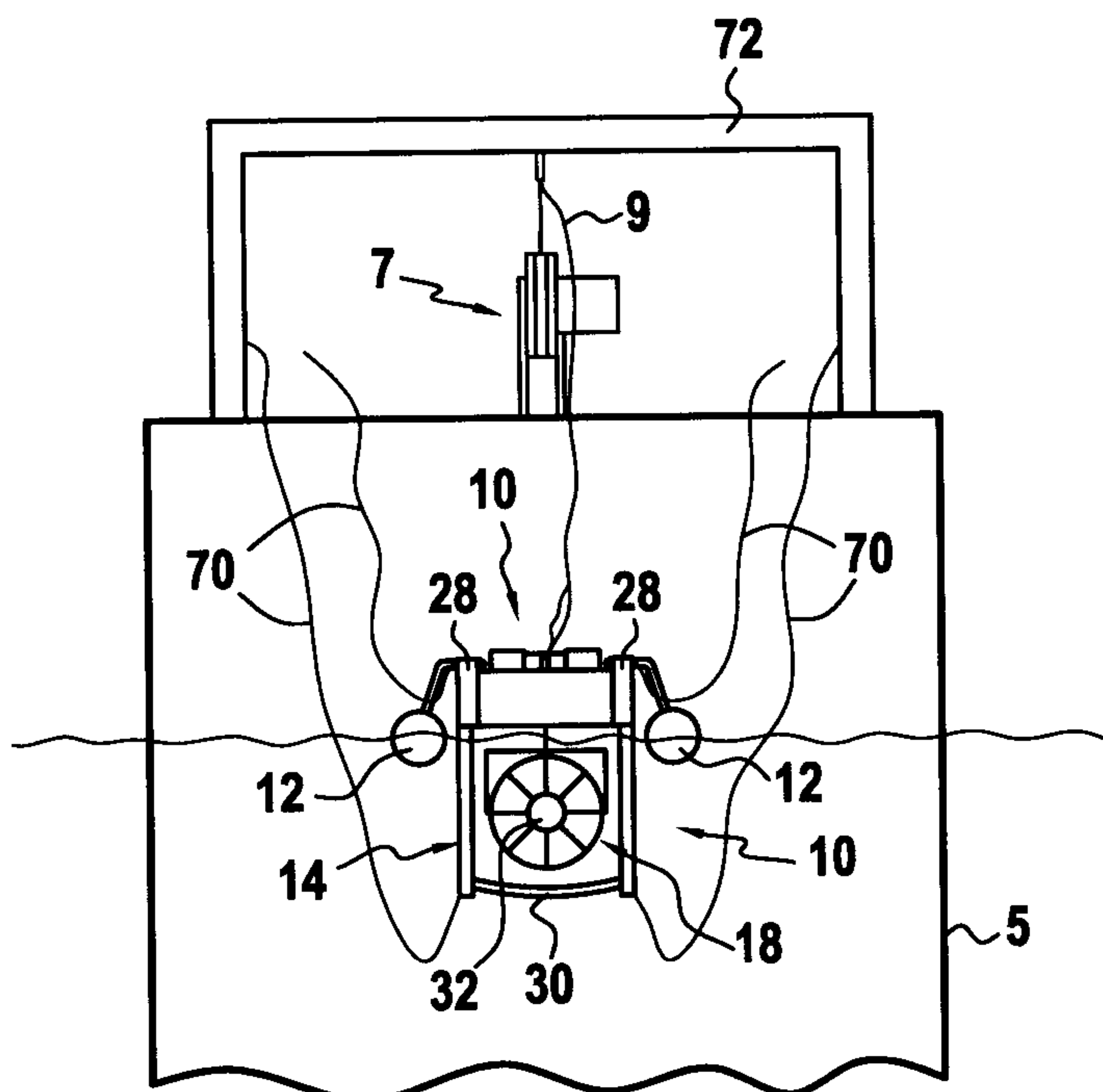


FIG.3

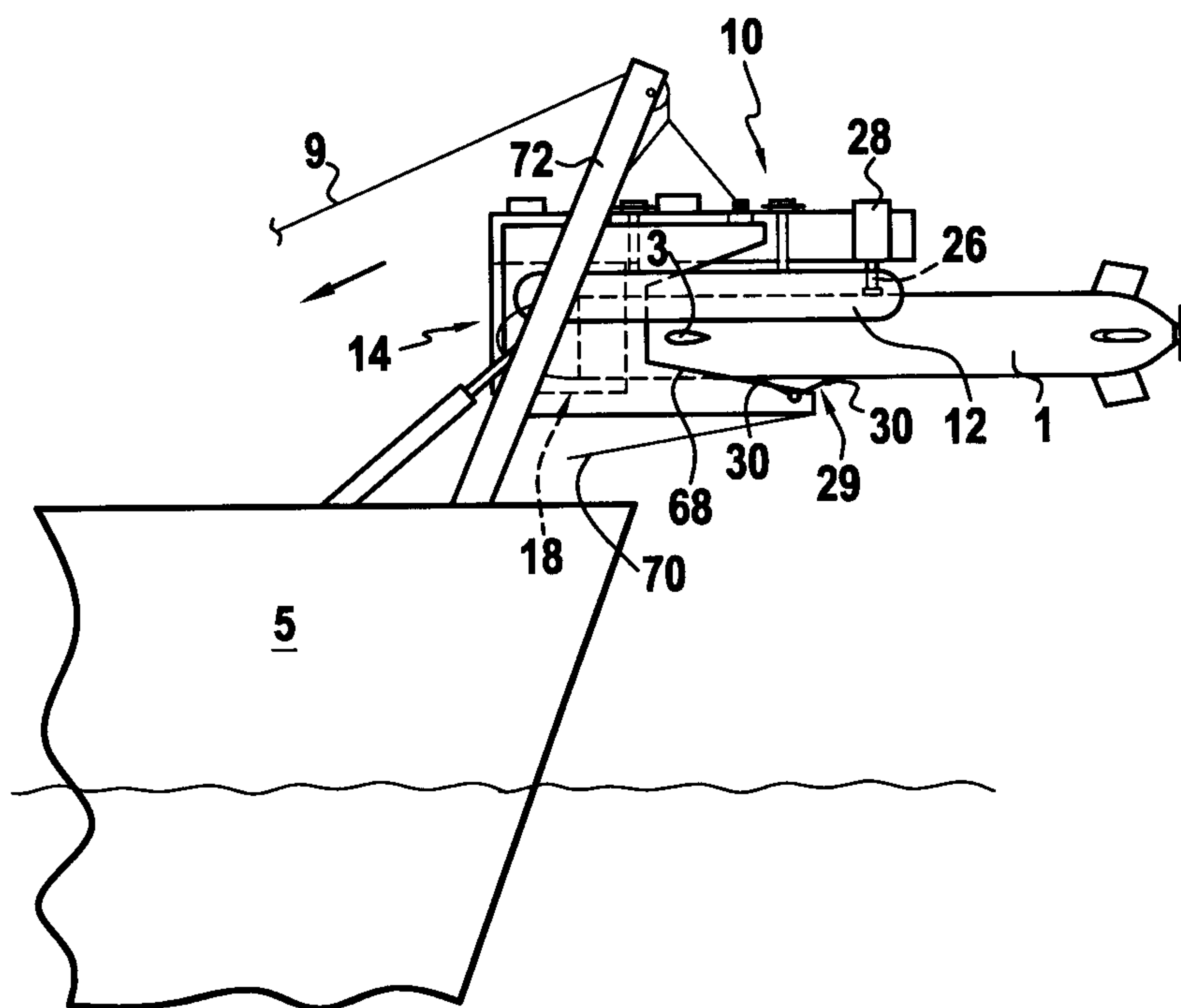


FIG.4

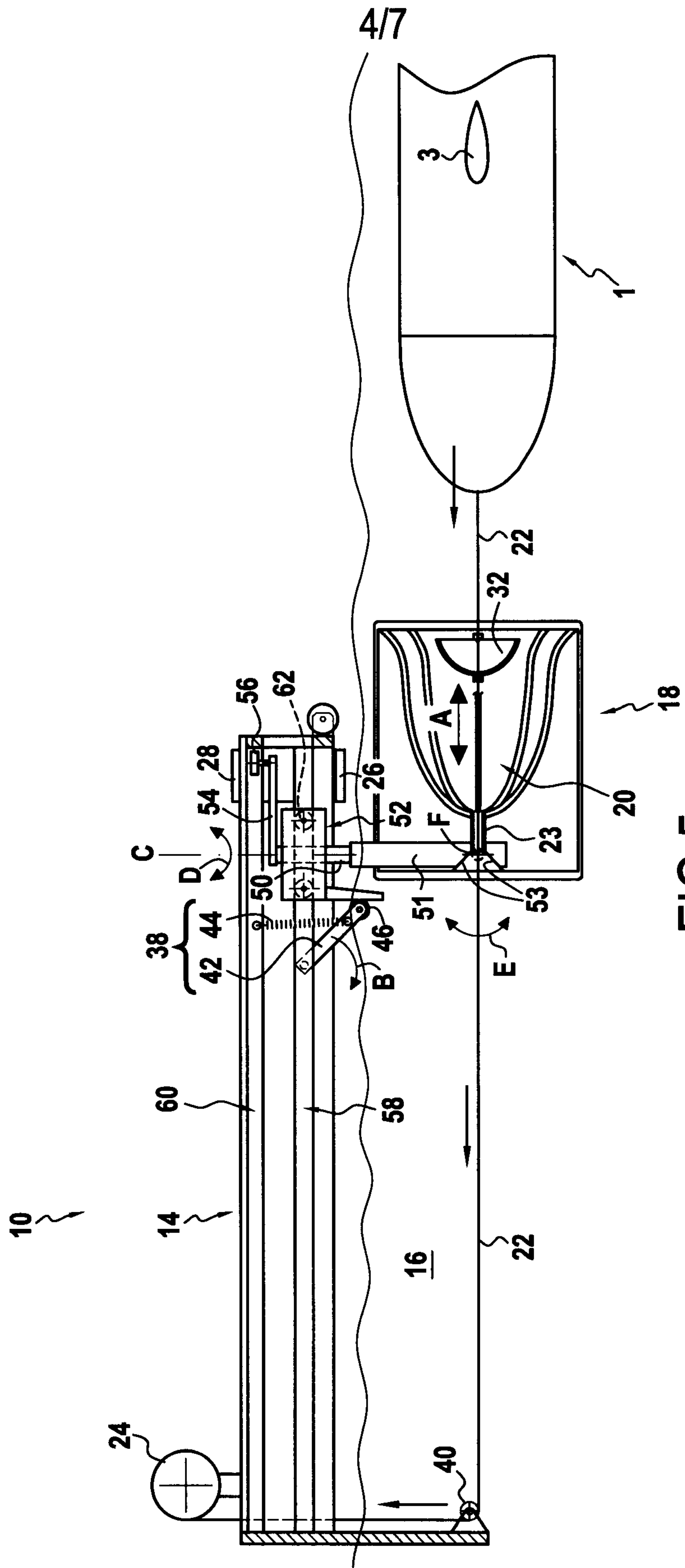


FIG.5

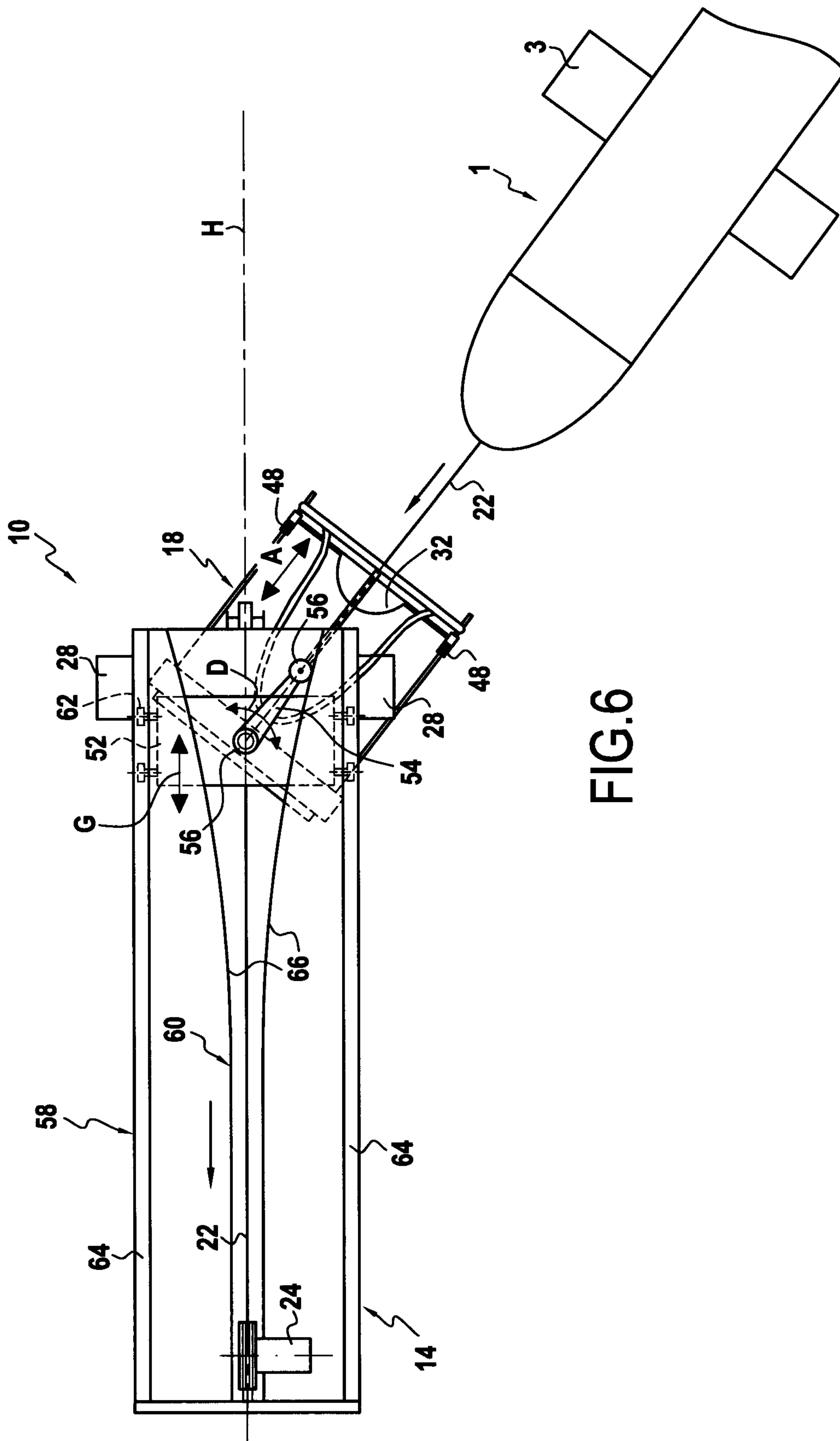


FIG.6

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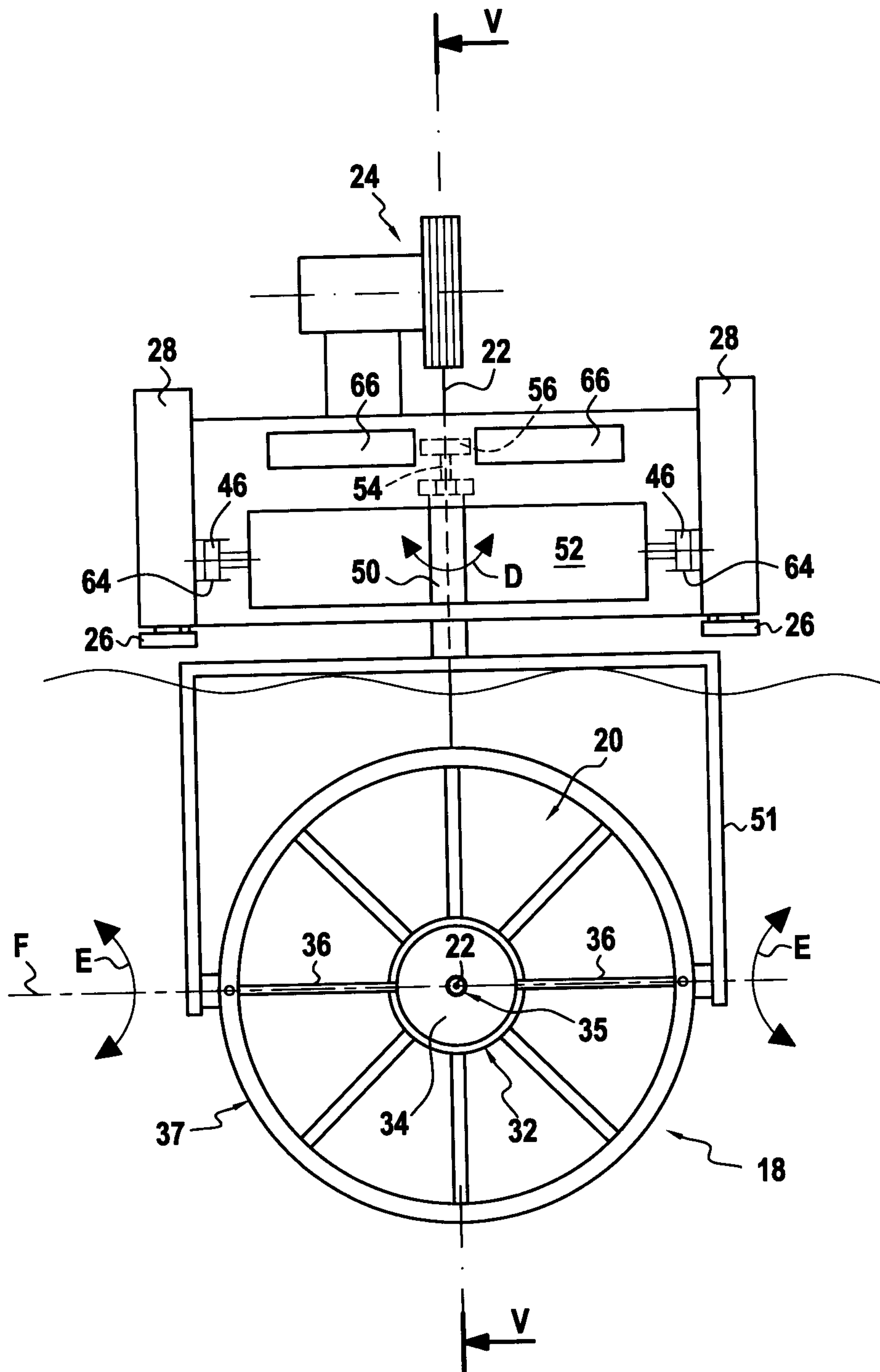


FIG. 7

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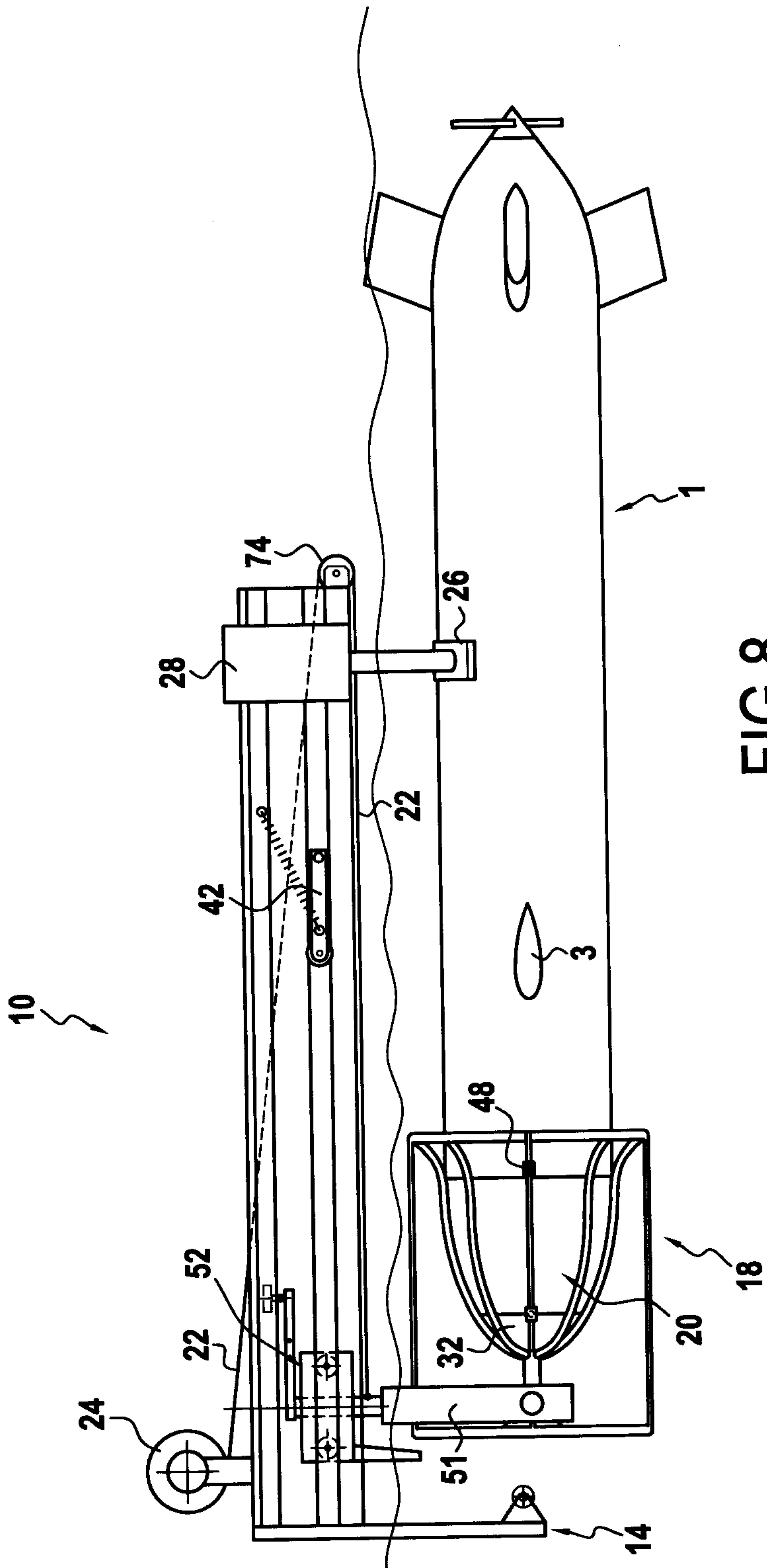


FIG. 8

