

**System for launching and recovering underwater
vehicles, notably towed underwater vehicles**

The invention falls within the naval field and relates
5 more specifically to the handling and lifting systems
mounted on ships for launching and recovering marine or
underwater vehicles from these ships, the vehicles in
question being either towed vehicles or self-propelled
vehicles, the latter then being fitted with a temporary
10 tether while they are being launched and recovered.

The operations of launching and recovering a marine or
underwater vehicle from a ship which also has the task
of transporting this vehicle generally include a phase
15 that is critical, especially in rough seas, which is
the transition from the fully emerged state in which
the vehicle is secured to the handling means used, to
the fully immersed state in which the vehicle has no
further contact with these means, and vice versa. This
20 is because it is during these critical phases that the
movements of the swell are most dangerous to the
integrity of the vehicle, this vehicle being tossed
about by the swell while it is in a region on the
surface where it is likely violently to strike either
25 the structure of the ship or that of the lifting and
handling means.

This is particularly true of a self-propelled vehicle
in the launch or recovery phase when, with the vehicle
30 already in the water or still in the water, the lifting
and handling means do not yet (or any longer) have full
control over its movements. This is also true of a
towed vehicle in the phases in which the towing cable
is holding it near the hull of the ship while the
35 lifting and handling means have not yet (or any longer)
got full control over its movements.

To limit these risks of collision there are known solutions, which generally employ means that involve the intervention of human operators.

5 Thus, as far as the self-propelled vehicles are concerned, these not being towed by the ship, one known solution is to provide mooring means on the hull of the vehicle, for example securing rings, these securing means being arranged in such a way that the vehicle can
10 be lifted while maintaining a horizontal position. Launch and recovery can then, for example, be performed using a winch mounted on a mobile gantry positioned at the rear of the ship, or even a crane, the gantry or the crane allowing the lifting winch to be positioned
15 over the recovery zone. As a result, launch and lift are performed vertically, thus limiting the possibilities of collision with the ship during lowering or raising. As an alternative, the vehicle can be lifted by placing it in a gondola-like device which
20 itself comprises suitable fixing points.

This type of solution can be applied, notably autonomously, to vehicles towed from the middle but is not, however, readily applicable to the case of
25 vehicles that are towed from the front because, for obvious reasons of efficiency, it is desirable for it to be possible for the vehicle to be towed and handled using the one same cable. Handling using means such as those described hereinabove using a single cable would
30 prove tricky because it entails the vehicle passing from the vertical position to the horizontal position during launch and vice versa during recovery. This handling further requires additional operations the purpose of which, once the vehicle has been lifted and
35 positioned over the deck of the ship, is to lay the vehicle down flat on the deck of the ship or, more generally, on a storage area. These operations themselves generally require the intervention of human

operators, which intervention is made trickier and more hazardous when the sea is rough.

5 As a result, as far as vehicles towed from the front are concerned, the solution generally preferred is to use a handling cable secured temporarily above the center of gravity of the vehicle.

10 Another solution that is also used is handling based on the installation of means comprising an inclined ramp along which the vehicle slides in order to reach the surface of the water or leave the water and return to the ship. The ramp is generally configured so that it guides the vehicle in a straight path, thus avoiding
15 the vehicle having to follow a lateral course. However, such a ramp is generally ill suited to use in heavy seas, because lateral movements of the vehicle could then damage that vehicle.

20 The use of such means advantageously allows the vehicle to be launched and deployed at the rear of the ship in a simple way by letting the towing cable out and, conversely, allows the vehicle to be returned on board the ship simply by winding the cable in, onto the drum
25 of a winch for example. The launch and recovery of the vehicle can therefore moreover be performed while the ship is underway, which means that the vehicle, towed by the ship, naturally positions itself along the line of forward travel of the ship.

30 Nonetheless, the use of such means involves a critical phase which occurs between the moment the vehicle comes into contact with the ramp and the time it is fully in position thereon. Specifically, the transition of the
35 vehicle from the surface of the water to the ramp involves the nose of the vehicle coming into contact with the ramp, and this contact, notably when the sea is rough, can be fairly violent and cause damage to the

vehicle but also prevent the vehicle from being brought up.

5 In order to alleviate these difficulties of initial contact, various solutions have been developed, which solutions are generally best suited to one given type of vehicle. These known solutions generally involve reinforcing the structure of the vehicle, mainly the nose, so that it is able to withstand the knocks
10 resulting from its coming into contact with the end of the ramp. It also involves the use of means for minimizing these impacts, particularly by configuring the ramp in such a way that its end lies beneath the surface of the water so that the vehicle floating on
15 the surface comes into contact with the inclined surface of the ramp rather than with the end thereof. Such solutions nonetheless prove to be insufficient in rough seas, the slamming effect of the waves then being heightened by the movement of the ship.

20 It is one object of the invention to propose means for launching and recovering a marine or underwater vehicle in the safest possible way, it being possible for these means to be deployed entirely automatically, with no
25 human intervention or monitoring. A more particular object of the invention is to provide means suited to the handling of underwater vehicles that are towed from the front or of underwater vehicles that do not have any means of vertical lifting but which are temporarily
30 connected to hauling means, a cable driven by a winch for example, during the launch and recovery phases.

To this end, one subject of the invention is a system for launching and recovering a marine or underwater
35 vehicle, said system being intended to be installed on a ship that stores the underwater vehicle and transports it to its zone of action.

The subject of the invention is a system for automatically, even in rough seas, launching and recovering a marine or underwater vehicle from an underway carrier ship, of the type comprising:

- 5 - an inclinable articulated ramp itself comprising a bottom and edges,
- first drive means for lowering and raising the ramp and hauling means for controlling the sliding of the vehicle along the ramp during the launch and for
- 10 hoisting the vehicle up along the ramp during recovery, the ramp having an emerged end that occupies a fixed position, this end being able to move only in terms of rotation at least about a horizontal axis perpendicular to the axis of the ship, and a free end the position of
- 15 which varies, under the action of the first drive means, between an immersed position in which it dips down into the water and an emerged position in which the ramp is in a horizontal position.

- 20 The system according to the invention also comprises buoyancy means configured and arranged on the ramp in such a way that the free end of the ramp floats at the surface or near the surface of the water when the ramp is lowered. According to the invention, the bottom of
- 25 the articulated ramp has an external face configured to form streamlining the cross-sectional profiles of which are defined to minimize the lift and drag forces imparted to the ramp by the movement of the ship and the vertical dynamic movements brought about by the
- 30 waves when its free end is in contact with the water.

According to one particular embodiment, the edges of the ramp are configured so that they, jointly with the streamlining of the lower part of the ramp, provide the

35 free end of the ramp with buoyancy.

According to another particular embodiment, the buoyancy means consist of floats attached to the ramp at its free end.

- 5 According to one embodiment, the edges of the ramp are configured to hold the vehicle on the ramp and limit the rolling movements imparted to the vehicle.

According to another embodiment, the system according
10 to the invention further comprises holding and guiding means comprising a holding device configured to hold the end of the vehicle and remain in contact with the vehicle during the launch and recovery operations, the holding device being driven with the vehicle by the
15 hauling means.

According to an alternative form of the previous embodiment, the hauling means comprising a hauling cable driven by a winch, the holding device consists of
20 a fairlead configured to slide along the ramp and through which the hauling cable passes.

According to another alternative form, the holding device further comprises vertical protection elements
25 on which the wings of the vehicle rest when its end is engaged in the holding device, the frontal support thus afforded contributing to keeping the vehicle along the axis of the ramp.

30 According to another alternative form, the holding and guiding means further comprise drive means configured to keep the holding device in contact with the end of the vehicle as long as the vehicle is progressing along the ramp.

35 According to another form of embodiment, the system according to the invention further comprises additional support means for keeping the vehicle in a fixed

storage position when the ramp is returned to its raised position; the vehicle therefore being stored on the ramp.

5 The device according to the invention thus consists of a recovery system that advantageously limits the vertical relative movements between this system and the underwater or marine vehicle when this vehicle is floating at the surface, particularly at the critical
10 moment of contact between these two entities during recovery. It allows the vehicle to be launched automatically from its storage position and then allows this vehicle to be recovered following use and returned to its storage position.

15 The vertical relative movements are successfully limited by means of an inclinable ramp that is articulated in its upstream part and that in its rear part comprises buoyancy means that allow its free end
20 to float at the surface. Moreover, the streamlined underside of the ramp advantageously limits the impact of the speed of forward travel of the ship and the slamming effects due to the waves on the relative positioning of the rear end of the ramp with respect to
25 the surface of the water, and does so for different sea conditions and different speeds of travel in relation to the water.

The features and advantages of the invention will be
30 better assessed through the description which follows, which description introduces one particular embodiment which embodiment does not limit the scope of the invention. This description relies on the attached figures which depict:

35 - figure 1, a schematic overview of one particular embodiment of the device according to the invention, showing the ramp in the lowered position;

- figure 2, partial schematic views, in different planes, relating to the hydrodynamic features of the ramp that forms the device according to the invention;

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- figure 3, a schematic overview of one particular embodiment of the device according to the invention, showing the ramp in the raised position.

10 As stated earlier, the description which follows introduces one embodiment of the device according to the invention, which embodiment does not limit the scope of the invention. This embodiment introduces both the essential features of the invention and additional
15 features connected with this embodiment.

Figure 1 gives an overview of this embodiment. In this embodiment, the device is shown on a ship 10 of the catamaran type, between the two hulls thereof. As this
20 figure illustrates, the device according to the invention chiefly comprises the following elements:

- A streamlined articulated ramp 11 preferably situated at the rear of the ship and having one end 111
25 attached to the ship and one free end 112.

The fixed end 111 of the ramp is connected to the carrier leaving at least one degree of freedom to rotate about a horizontal axis perpendicular to the
30 main axis of the ramp so that the free end can be raised or lowered in the manner of a drawbridge.

According to the invention, the ramp 11 is in the overall shape of a chute or channel section with a
35 bottom 113 and edges 114 and 115 the height of which is notably determined according to the size and geometry of the vehicle 15 being handled.

- Means 12 mounted on the ramp and intended to encourage the vehicle to progress along the ramp under the action of the hauling performed by the cable (in the case of recovery) or under the effect of gravity
5 (in the case of launch). These means are, for example, rollers or rolling runners positioned laterally on the bottom 113 of the ramp and over which the vehicle 15 rolls.

10 - Holding and guiding means the function of which is to ensure that the vehicle is aligned with the axis of the ramp so as to allow the vehicle to roll or slide correctly throughout its travel along the ramp (up or down). These means consist, for example, as illustrated
15 in figure 1, of a device 13 acting as a fairlead, through which the hauling cable 14 used to haul the vehicle passes. This element is configured so that it moves along the ramp 11, for example on a rail positioned along the longitudinal axis thereof (not
20 depicted in the figure).

- Buoyancy means, the main purpose of which is to ensure that the free end 112 of the ramp can naturally remain at the surface of the water when there are no
25 waves or when the waves have a wavelength that is long in comparison with the dimensions of the recovery system. In the embodiment of figure 1, these means consist of lateral floats forming the edges 114 and 115 of the ramp, and of the bottom of the ramp that forms
30 the streamlined part. However, in an alternative embodiment, these means may simply consist of floats attached to the ramp at the free end 112 or of any other combination of suitable means.

35 During a phase of launching the vehicle or bringing it back on board the ship, the end 151 of the vehicle, attached to the hauling cable, is inserted into the element 13 and remains in close contact therewith, and

this has the advantageous effect of keeping the axis of the vehicle along the axis of the ramp 11 as the vehicle travels along this ramp.

5 This ensuring contact is obtained naturally inasmuch as the holding element 13 is a solid element that has a tendency, under the effect of its weight, to drop down along the ramp, thus checking the progress of the fish as it is being raised back up and assisting with its
10 lowering.

However, in one particular embodiment, the holding and guiding means may also comprise drive means (not present in the example of figure 1) configured so that
15 the holding element 13 is kept in contact with the end of the vehicle 15 as long as the latter is progressing along the ramp 11. These means work for example by applying a certain resistance to the travel of the fairlead toward the fixed end of the ramp.

20 According to the embodiment considered, these drive means may for example consist of an auxiliary winch which pulls the holding device 13 (the fairlead) toward the free end 112 of the ramp 11 (downward) by means of
25 a cable returned by a pulley situated at the free end of the ramp. Adjusting the tension of the auxiliary winch in relation to the tension generated by the towing winch 16 then allows contact between the vehicle 15 and the fairlead 13 to be actively maintained as the
30 vehicle 15 is being raised back up along the ramp 11, without, however, impeding this raising.

Alternatively, according to another embodiment, the vehicle can be secured to the holding element when its
35 end is inserted therein. In this case, the action of drive means becomes less necessary.

Illustrations 2-a, 2-b and 2-c of figure 2 illustrate an essential feature of the invention. Illustration 2-a is a schematic side view of the ramp 11, in a lowered configuration for which the free end 112 is immersed in the water. This configuration corresponds to use of the ramp for operations of launching and recovering the vehicle 15. Illustration 2-b shows, for the same configuration (ramp lowered), a view of the ramp with a horizontal plane of section passing through the axis Δ_2 shown in the side view 2-a. Illustration 2-c on the other hand shows a view of the ramp on a vertical plane of section passing through the axis Δ_1 shown on the side view 2-a and perpendicular to the axis of the ramp 11.

According to this feature, the bottom 113 of the articulated ramp 11 has an external face 21 intended to come into contact with the surface of the water, which forms streamlining the cross-sectional profile of which is defined, as illustrated by views 2-b and 2-c, in such a way as to minimize the lift and drag forces caused, when the free end of the ramp is in contact with the water (ramp lowered) according to the schematic view 2-a, by the speed of forward travel of the ship on the one hand and so as to minimize the effect of slamming caused by the waves on the other. In other words, the profile of the external face 21 of the bottom 113 of the ramp 11 is defined so that it acts like a breakwater to break the wave front likely to collide with the ramp 11 as a result notably of the movement of the ship 10, before these waves reach the free end 112 of the ramp and, at the pace of the waves passing under the ramp 11, cause sharp variations in the vertical position of the free end 112 of the ramp 111 in relation to the surrounding water surface. This sharp variation, if not compensated for, notably results in an uncontrolled variation in the vertical position of the end 112 of the ramp 11 relative to that

of the end 151 of the vehicle 15, which can cause damage to the latter if it occurs just at the moment that the vehicle enters the ramp.

5 In one particular embodiment, illustrated by figure 2, the external face 21 of the bottom 113 of the ramp 11 forms streamlining with a V-shaped cross-sectional profile. In an alternative embodiment, this face 21 forms streamlining with a W-shaped cross-sectional
10 profile.

Advantageously, the use of a ramp 11 fitted with buoyancy means that act chiefly on the free end 112 of the ramp so as to keep the latter at a given position
15 with respect to the water surface, either at the surface or slightly immersed for example, and the underside 21 of which has the cross-sectional profile defined hereinabove, allows two significant effects to be minimized:

20 - the dynamic rise of the free end 112 of the ramp 11 above the surface (surfing effect) connected with the resistance of the ramp to the forward travel of the ship and to the lift of the ramp: this phenomenon, which is a result of the speed of the ship, is likely
25 to make it difficult for the end of the vehicle 15 to come into contact with the fairlead 13 without colliding with it, particularly during operations of recovering the vehicle 15;

- the sharp vertical dynamic movements performed by
30 the free end 112 of the ramp 11 as a result notably of the slamming effect caused by the waves particularly when the waves are short (the combined effect of a deflection of the water and significant hydrostatic return), which movement is also likely to make it
35 difficult for the end of the vehicle 15 to come into contact with the fairlead 13 without colliding with it, particularly during operations of recovering the vehicle 15 and which may have the additional effect of

causing the vehicle to jump when installed on the ramp and of causing it to collide with the bottom of the ramp with the risk of damaging it.

5 The minimizing of these two effects, which has been obtained by implementing the invention, thus represents an essential factor in limiting the instances of heavy knocks between the vehicle 15 and the ramp 11, notably during the phase in which the vehicle is approaching
10 the ramp and in which its end, hauled by the cable, is ready to enter the fairlead 13 and take up position on the ramp 11 and during the phases in which the vehicle is sliding along the ramp. This factor is particularly essential inasmuch as launch and recovery of the
15 vehicle are performed when, in order to ensure good overall stability, the ship is still under way.

These two complementary means, the buoyancy means and the streamlining of the external face of the ramp, thus
20 advantageously ensure a stable vertical position with respect to the surface for the rear end 112 of the ramp 11 and therefore for the holding device 13, particularly during that critical phase when the vehicle is approaching the ship 10 in order to take up
25 position on the ramp.

Thus, by virtue of the essential features described in the foregoing text, the device according to the invention allows an underwater or marine vehicle to be
30 recovered safely even when the ship tasked with recovering it is under way at a non-zero speed in a sea that is not calm.

The fact that the device is designed to be used from a
35 ship under way, advantageously allows this ship to have greater maneuverability and limits the amplitude of its movements under the action of the movements of the sea. As a result, adopting a suitable heading facing into or

out of the swell means that rolling movements can be greatly limited. The speed of forward travel of the carrier ship 10 also, as has already been stated, makes it easier to stabilize the position of the vehicle 15
5 along the axis of the ramp 11.

The device according to the invention also has the advantage that it can be installed on a wide variety of ships of varying shapes and tonnages. It may also,
10 depending on the target application, in addition to comprising the essential characteristic elements described above, comprise additional elements which, for example, make it easier to operate in the target operational context.

15 In the embodiment of figure 1, the device according to the invention is, for example, positioned between the two hulls of a ship of the catamaran type, preferably toward the rear of the ship. The vehicle 15 considered
20 here is a towed underwater vehicle with wings 151 that perform a depressing function. The size and construction of these winglets also make them relatively fragile. The vehicle 15 here is towed by means of a towing cable 14, an electric towing cable
25 for example, wound on a towing winch 16.

According to the above explanations, the device comprises the essential constituent elements described hereinabove and, in particular, a narrow ramp 11 the
30 width of which substantially corresponds to the cross section of the body of the vehicle, combined with buoyancy means the action of which is essentially applied to the free end of the ramp and with holding and guiding means consisting of the device 13.
35 Likewise, the external face of the bottom of the ramp has a narrow streamlined shape, which is V-shaped.

However, in this embodiment, the ramp 11 is mounted on the ship via fixing means 17 which allow it to pivot about an axis perpendicular to the axis of the ship. The fixing means are mounted on the end 111 of the ramp
5 that faces toward the front of the ship 10, and this allows the end 112 of the ramp directed toward the rear to be free of the pitching movements of the carrier ship.

10 Moreover, as far as the holding and guiding means are concerned, the device (the fairlead) 13 in this example comprises vertical protection elements 131 against which the wings 151 of the vehicle rest when the end of the vehicle is engaged in the guide element 13, the
15 support thus provided contributing toward keeping the vehicle 15 along the axis of the ramp 11.

In the embodiment illustrated in figure 1, the device according to the invention also comprises lifting means
20 allowing the mobile end 112 of the ramp 11 to be raised when the device is not in use, notably outside of periods of launching and of recovering the vehicle and allowing the ramp 11 and, where appropriate, the vehicle 15, to be brought into a horizontal storage
25 position illustrated in figure 3 above the surface of the water.

These additional lifting means may, as illustrated in figure 1, consist of a winch 18 which winds and unwinds
30 two cables 181 and 182 in synchronism. The cables 181 and 182 are returned by pulleys placed on a gantry 19 and are attached on each side of the ramp 11, preferably near the free end 112. The raised position of the ramp is, for example, determined by a system of
35 end stops positioned on the gantry. The lowered position is not itself identified by an end stop because the ramp is supposed to float.

Moreover, in this exemplary embodiment, the edges 114 and 115 of the ramp 11, in addition to being configured to make the free end 112 of the ramp 11 buoyant, are also configured to form semirigid longitudinal support elements. The thickness of the edges is therefore suited to the dimensions of the vehicle 15 concerned so that when this vehicle is installed on the ramp 11, its body rests on the means 12 while its wings 151 rest on the edges 114 and 115 along which they slide.

10

It should be noted that although the stability of the vertical position of the rear end 112 of the ramp with respect to the water surface is normally assured, by optimizing the hydrostatic properties (mass volume) and the hydrodynamic properties of the ramp, through the presence of the buoyancy means and via the cross-sectional profile of the streamlined hull formed by the bottom 113 of the ramp 11, it is nonetheless possible, for certain specific applications, to supplement the action of these means by controlling the position of the free end 112 of the ramp in the vertical plane using additional means, for example rams, or even by using lifting means capable of effecting this control, it being possible for these means to be those used to raise the ramp and keep it in the raised position.

From an operational standpoint, the device according to the invention advantageously allows the operations of launching and recovering marine or underwater vehicles, particularly towed vehicles, to be carried out without any need for any human intervention for mooring or handling.

Thus, in order to recover a vehicle after use, all that is required is for the free end of the ramp 11, initially in a horizontal position, to be lowered by operating the motor 18 of the lifting means.

The ramp 11 thus lowered advantageously, thanks to the means that provides its free end 112 with buoyancy and thanks to its streamlining, keeps the holding and guiding means in position, and in particular keeps the
5 entry to the device 13 (the fairlead) level with the surface of the sea irrespective of the height of the waves. The fairlead 13 thus follows the surface of the water just like the towed vehicle 15 floating at the surface thereof.

10

As a result, the vehicle 15 can be towed into a position in which it comes into contact with the fairlead 13 while these two elements are positioned substantially at one and the same height. In that way,
15 the end of the vehicle 15 can insert itself into the fairlead 13 with a minimal risk of violent frontal and vertical collision.

Once the end of the vehicle 15 has thus been inserted
20 into the device 13, the forward travel of the ship 10 has the effect of causing the vehicle to position itself, through inertia, along the longitudinal axis of the ramp 11. Moreover if, as in the example of figure 1, the device 13 is equipped with vertical protection
25 elements 131, the fact of the wings 151 of the vehicle 15 coming into contact with these vertical elements 151 encourages the vehicle 15 to realign itself along the axis of the ramp 11 at the moment of contact with the device 13. The presence of these vertical elements
30 further limits yawing, surging and swaying of the vehicle 15 when full contact with the device 13 is made.

Correct positioning of the vehicle with respect to the
35 ramp now having been assured, the actual raising of the vehicle 15 up along the ramp 11 can be performed by continuing to actuate the towing winch 16, the movement of the vehicle 15 causing that of the fairlead 13

through which the towing cable 14 passes and in which its end 15 is inserted, while the wings 151 of the vehicle 15 are supported across a broad front.

- 5 The assembly thus rises up along the ramp, sliding or rolling thereon, toward the fixed end 111, the holding element 131 being kept in contact with the end of the vehicle by the drive means 132 described earlier.
- 10 Thereafter, as the vehicle gradually ascends and emerges from the water, contact between the vehicle 15 and the ramp 11 becomes increasingly close. The ramp 11 becomes heavier which means that it swings down into the water and becomes more inclined. Collisions between
- 15 the vehicle and the ramp are therefore attenuated, notably as a result of the increased angle of inclination of the ramp as a result of the weight of the vehicle. Moreover, the fact that the wings 151 are resting against the edges 114 and 115 of the ramp
- 20 limits any potential rolling of the vehicle during this raising operation. Any pitching of the vehicle is itself gradually attenuated until it becomes zero when upthrust becomes insufficient to lift the vehicle in relation to the ramp 11. The vehicle 15 is then fully
- 25 resting on the ramp 11 and all six of its degrees of freedom are under control.

It should be noted that in one particular embodiment suited to operation in heavy seas leading to relative

30 vertical accelerations of more than 1g, the device according to the invention may comprise an additional means, a rigid arm for example, that immobilizes the vehicle with respect to the holding device 13 and therefore with respect to the ramp.

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According to the invention, once the vehicle 15 is completely resting on the ramp 11, it is possible to

return the ramp 11 to a horizontal position using the lifting means.

5 Thereafter, with the vehicle 15 placed in a stable manner on the ramp 11, it is possible, by adopting a configuration known as the "transit" configuration illustrated in figure 3, to transport it, keeping it stored on the ramp 11. In this configuration, additional fasteners 1011 that hold the vehicle 15
10 firmly on the ramp 11 are used. Thus, the device according to the invention and the vehicle can, without damage, be subjected to vertical accelerations of several g.

15 Alternatively, if suitable handling means are available on board the ship, the vehicle can, from this stable position, be detached from the towing cable 14 and placed in a dedicated storage area. In such a case, the action of the lifting means during the transit phases
20 is confined to keeping the ramp in the raised position.

From an operational standpoint, the maneuver of launching the vehicle is a maneuver that is the opposite of that of recovering it.

25 Thus, during that maneuver, with the vehicle 15 positioned on the ramp 11, the latter is lowered, the lifting means ensuring a controlled lowering of the free end 112 of the ramp 11 toward the surface of the
30 water. Once the free end 112 has been fully lowered, the free part of the ramp 11, still fitted with the towed vehicle 15, floats, sinking slightly below the surface of the water at its rear end 112. Next, the towing winch 16 is actuated to release the vehicle 15
35 which slides along the ramp 11 under its self weight or, in the alternative form of embodiment described earlier, under the action of drive means which act on the holding device 13, until it completely leaves the

ramp 11, the end of the vehicle 15 then being separated from the fairlead 13.

5 During the phase of releasing the vehicle, the lifting means are preferably kept under tension to prevent the lifting cables 181 and 182 which are unloaded from containing any "slack" which would be detrimental to the correct execution of the operation.

CLAIMS

1. System for automatically, even in rough seas, launching and recovering a marine or underwater vehicle (15) from an under way carrier ship (10), of the type comprising an inclinable articulated ramp (11) in the form of a channel section comprising a bottom (113) and edges (114, 115), first drive means (18, 181, 182) for lowering and raising the ramp and hauling means (14, 16) for controlling the sliding of the vehicle (15) along the ramp (11) during the launch and for hoisting the vehicle (15) up along the ramp (11) during recovery, the ramp (11) having a free end (112) and an emerged end (111) which is connected to the ship while leaving at least free a degree of rotation about a horizontal axis perpendicular to the principal axis of the ramp so that the free end can be raised and lowered in the manner of a drawbridge, the first drive means being able to lower and raise the ramp in such a way that the position of the free end varies between an immersed position in which it dips down into the water and an emerged position for which the ramp is in a horizontal position, characterized in that the ramp (11) also comprises buoyancy means configured and arranged on the ramp in such a way that the free end of the ramp floats at the surface or near the surface of the water when the ramp is lowered and in that the bottom (113) of the articulated ramp (11) has an external face (21) that forms streamlining the cross-sectional profile of which is V-shaped or W-shaped, said system comprising holding and guiding means comprising a holding device (13) configured to hold the end of the vehicle (15) and remain in contact with the vehicle (15) during the launch and recovery operations, the holding device being driven with the vehicle (15) by the hauling means, the system further comprising vertical protection elements (131) designed to provide a support for the wings (151) of the vehicle when its end is engaged in the holding device (13), the broad

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frontal support thus afforded contributing to keeping the vehicle (15) along the axis of the ramp (11).

2. System according to claim 1, characterized in that the edges (114, 115) of the ramp (11) are configured so that they, jointly with the streamlining of the lower part of the ramp, provide the free end (112) of the ramp with buoyancy.

3. System according to claim 1, characterized in that the buoyancy means consist of floats attached to the ramp at its free end (112).

4. System according to any of claims 1 to 3, characterized in that the edges (114, 115) of the ramp (11) are configured to hold the vehicle (15) on the ramp and limit the rolling movements imparted to the vehicle (15).

5. System according to any one of the preceding claims, characterized in that, the hauling means comprising a hauling cable (14) driven by a winch (16), the holding device (13) consists of a fairlead configured to slide along the ramp (11) and through which the hauling cable (14) passes.

6. System according to any one of the preceding claims, characterized in that the holding and guiding means further comprise drive means configured to keep the holding device (13) in contact with the end of the vehicle (15) as long as the vehicle is progressing along the ramp 11.

7. System according to any one of the preceding claims, characterized in that it further comprises additional support means (1011) for keeping the vehicle in a fixed storage position when the ramp is returned

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to its raised position; the vehicle therefore being stored on the ramp.

8. System according to any one of the preceding
5 claims, in which the emerged end occupies a fixed position, this end being able to move only in terms of rotation at least about a horizontal axis perpendicular to the axis of the ship.