

System for manoeuvring a marine craft

DESCRIPTION

Technical field

[0001] The present invention lies in the naval field and relates to a system for launching and recovering a marine or underwater craft (an "L.A.R.S" which stands for Launch And Recovery System), capable, on the one hand, of lifting the craft out of the water to a towing system carried on board a carrier ship, and, on the other hand, of lowering the craft from the carrier ship into the sea. It applies notably to the launching of towed or autonomous underwater craft, the latter then being equipped with a temporary connection during the launch and recovery phases.

Prior art

[0002] The operations of launching and recovering a marine or underwater craft from a carrier ship which, moreover, is tasked with transporting this craft, generally includes a critical phase, especially when the sea is rough. This phase consists in the transition from the fully emerged state in which the craft is secured to the handling means that are being used, to the fully submerged state in which the craft is no longer connected to these, and vice versa. Specifically, it is during these critical phases that the heave motion is the most dangerous to the integrity of the craft, the latter being shaken around by the heave while it is close either to the structure of the ship or to that of the lifting and handling means, with the risk of colliding therewith. This is particularly the case for a marine or underwater craft in the launch or recovery phase, while the craft is partially in the water: the movements of the craft are then not yet (or are no longer) fully under the control of the lifting and handling means. Thus, so far as autonomous craft, not towed by the ship, are concerned, one known solution is to provide lashing means on the hull of the craft, for example fixing eyes, these fixing means being arranged in such a way that the craft can be lifted while maintaining a horizontal position. Launch and recovery can then, for example, be performed by means of a winch mounted on a mobile gantry placed at the stern of the ship, or else a crane, the gantry or the crane enabling the lifting winch to be positioned over the recovery zone. As a result, the launching and the recovery lifting are done vertically, thereby limiting the possibilities of collision with the ship during

lowering or recovery lifting. Alternatively, the lifting of the craft may be performed by placing same in a cradle-type device itself comprising suitable fixing points.

[0003] This type of solution can be applied, notably autonomously, to craft towed using a single cable, preferably situated in vertical alignment with the center of gravity. Handling using means such as those described hereinabove using a single cable entails additional operations aimed at, once the craft has been lifted and positioned over the deck of the ship, laying the craft down flat on the deck of the ship or more generally on a storage area. These operations generally entail the intervention of human operators, which intervention is made all the more tricky and all the more dangerous in heavy seas. When using craft that are towed from the front, the solution generally preferred consists in using a handling cable temporarily attached above the center of gravity of the craft.

[0004] One solution also used envisions handling based on the installation of means comprising an inclined ramp along which the craft slides in order to reach the surface of the water or exit same and return to the ship. The ramp is generally configured in such a way as to guide the craft along a rectilinear path, thereby preventing the craft from being able to shift laterally. However, such a ramp is generally not suitable for use in heavy seas. Specifically, lateral shifting of the craft may damage it, but so too may vertical relative movements when the craft is in a transition zone.

[0005] The use of such means advantageously allows the craft to be launched into the sea and deployed behind the ship by allowing the towing cable to run out and, conversely, allows the craft to be recovered on board the ship by winding the cable onto the drum of a winch for example. In this way, the launch and recovery of the craft can be performed while the ship is in motion, so that the craft, towed by the ship, naturally positions itself along the line of travel of said ship.

[0006] There are various solutions that have been developed in order to alleviate these difficulties of establishing contact, which solutions are generally tailored to a given type of craft. These known solutions generally consist in reinforcing the structure of the craft, chiefly the nose, so that it is able to withstand the impacts resulting from coming into contact with the end of the ramp. It also consists in employing means for minimizing these impacts, particularly by configuring the ramp in such a way that its end is situated below the water surface so that the craft floating on the surface comes into contact with the inclined surface of the ramp and not the end thereof. Such solutions nevertheless proved to be insufficient in heavy seas

because the “slamming” effect caused by the pounding of the waves is then exacerbated by the movement of the ship.

[0007] Other solutions have been developed (for example EP 20110793422 and US 8430049B1) in which an inclinable articulated ramp is incorporated into the ship. Inclining the ramp makes it possible to control the submerged part of the ramp. Once the ramp is submerged, pulling on the craft allows it to overcome the abutment separating the ramp from the surface of the water. In addition, in heavy seas, the ramp can be raised out of the water.

[0008] Document WO2016062870 discloses a solution in which a protective element is designed to cause a marine craft to pass toward a ramp. However, in certain applications, notably with a very high deck or with the ship moving significantly with the heave, this solution reaches its limits and, in the case of an underwater vehicle that is towed from the front and equipped with fins, leads to a situation whereby, as the vehicle is being recovery lifted, it rests on the trailing edge of its front fins, despite the use of a curved part acting as a fender. Repeated contact with the trailing edge of the fins may, over time, lead to damage to these fins.

[0009] There is therefore still a need to propose a simple and practical solution for improving the maneuvering of the marine craft during launch or recovery operations while at the same time minimizing mechanical damage to this marine craft during the course of these operations.

Description of the invention

[0010] The present invention aims to meet this need at least in part.

[0011] More specifically, the objective of the present invention is to promote the maneuverability of autonomous marine craft that may have certain delicate features.

[0012] In order to do that, a first subject matter of the invention relates to a system for maneuvering a marine craft, said system being intended to be placed at the edge of a ship. The system comprises:

- a ramp positioned on said ship, said ramp comprising an end, said end being not submerged in the water;
- a winch arranged at an end of the ramp opposite to the end, said winch being designed to command the hauling-in and the paying-out of a cable, said cable being designed to move the marine craft;

- a carriage designed to move along the ramp between the rounded end and the winch under the effect of a movement of the marine craft;
- a fender body connected to the carriage and designed to press against the ramp, said fender body being able to rotate with respect to the carriage;
- at least one fender arm designed to press against a runway, said fender arm being designed to extend the fender body toward the water, said fender arm being able to rotate through a limited angular range with respect to the fender body.

[0013] The attachment/detachment of the marine craft with respect to the ship are thus improved. Specifically, the fender arm is in a raised position during recovery at the moment at which the marine craft begins to touch said fender arms. This raised position is brought about chiefly through the fact that, in the lowered position, the entirety of the fender body rests on the fender arms. It is thus possible to have arms that plunge more deeply into the water in order to accept the marine craft, while still having an inclined V-shaped profile, when viewed from the side. Furthermore, this solution is particularly well suited to marine craft having two horizontal bearing surfaces at the front, such as fins, positioned one on each side of a main body. Specifically, during the recovery lifting, and specifically during the critical passage over a stern transom, the fender arms transition into a lowered position under the effect of the weight of the fender body and because it is the arms that are pressing against the runway. Considering recovery, the marine craft can thus dock onto these fender arms, which will limit the surge, sway, heave, roll and yaw movements. The marine craft advances onto the fenders through the effect of the cable being taken in by the winch. The fenders then, as the carriage moves forward, allow the front of the marine craft to be raised purely mechanically, namely using the hauling force of the winch, in order to bring it up to the ramp. Once the step has been overcome, the marine craft can then begin to slide along the ramp until it has been fully recovered. During launch, the fender arms also accompany the marine craft, setting it down in the water without the possibility of the front of said marine craft being able to sustain impacts capable of damaging it. Pressure on the trailing edge of the fins is also avoided because of the fact that the fender arms can be retracted except when they are needed (in the lowered position) or if they are not troublesome (notably on the top part of the ramp). This solution can be fully automated and requires the minimum of actuators.

[0014] In one particular embodiment, the limited angular range is less than or equal to 10°.

[0015] In one particular embodiment, the limited angular range is achieved by means of:

- a pivot connection between the fender body and the fender arm;
- a slot in the fender arm, said slot being distant from the pivot connection;
- a pin belonging to the fender body and able to move in the slot.

[0016] In one particular embodiment, the fender arm is curved.

[0017] In one particular embodiment, the runway associated with the fender arm comprises a first part belonging to the ship and a second part extending the first part of the runway in the continuation of the end of the ramp.

[0018] In one particular embodiment, the fender arm comprises a protuberance intended to press against the second part of the runway.

[0019] In one particular embodiment, said system comprises two fender arms positioned one on each side of the fender body.

[0020] In one particular embodiment, the carriage is a roller chock.

[0021] Another subject matter of the invention relates to a system for maneuvering a marine craft according to the invention.

[0022] The present invention will be better understood on reading the detailed description of embodiments which are given by way of non-limiting examples and illustrated by the appended drawings, in which:

[0023] [Fig 1] figure 1 illustrates, in side view, the system according to the invention for maneuvering a marine craft in a phase of docking of this craft;

[0024] [Fig 2] figure 2 illustrates the position of a pin in a slot of the system of figure 1 in the phase of start of recovery lifting of the marine craft;

[0025] [Fig 3] figure 3 illustrates, in side view, the system of figure 1 in a phase of start of recovery lifting of the marine craft;

[0026] [Fig 4] figure 4 illustrates the position of the pin in the slot of the system of figure 3 in the phase of start of recovery lifting of the marine craft;

[0027] [Fig 5] figure 5 illustrates, in side view, the system of figure 1 in a phase of continuing recovery lifting of the marine craft;

[0028] [Fig 6] figure 6 illustrates the position of the pin in the slot of the system of figure 5 in the phase of continuing recovery lifting of the marine craft.

[0029] Figure 1 illustrates a system 10 for maneuvering a marine craft 20.

[0030] This system 10 is designed to be placed on a ship 30, for example a small ship measuring less than 50 meters. More particularly, the system 10 is positioned at an edge 310 of this ship 30. As a preference, the system 10 is installed at the stern of this ship 30.

[0031] The system 10 for maneuvering the marine craft 20 comprises:

- a ramp 110;
- a winch (not depicted);
- a carriage 120;
- a fender body 130;
- at least one fender arm 140.

[0032] The ramp 110 extends along the ship 30 from one end 1101 toward the winch. It may be in the form of a guide rail defining a guideway. It is at a certain inclination α to facilitate launching of the marine craft 20. More particularly, the ramp 110 straddles the edge 310 of the ship 30 so that the end 110 overhangs this edge 310 toward the water, which is represented by a waterline 40 in figure 1. However, this end 1101 is not submerged in the water but is, to a limited extent, for example between 0 and 50 cm, out of the water.

[0033] The winch is arranged at an end of the ramp 110 that is opposite to the end 1011. This winch is designed to command the hauling-in and the paying-out of a cable (not depicted). During a phase of hauling-in of the cable, the marine craft 20 is pulled along the ramp 110 by the cable in order to bring it out of the water. Conversely, during a phase of paying-out of the cable, the craft 20 slides along the ramp 110 under the effect of its weight so as to be launched. As a variant, the carriage may contribute to the launching (and to the recovery) by being positively controlled, for example, with a limited force always exerted downward. On launch, the winch pays out the cable and the mass of the marine craft, the mass of the carriage and the force drive the whole entity downward. The advantage is that it ensures that the marine craft and the fenders are pressed together, notably in instances where there is no latching on the fenders.

[0034] The carriage 120 is designed to move along the ramp 110 between the end 1011 and the winch under the effect of a movement of the marine craft hauled by the cable. As a preference, the carriage 120 is a carriage of the roller chock type.

[0035] The fender body 130 comprises an elongate part 1301, a bump 1302 (visible in figure 2) and a plurality of contact points 1303. The elongate part 1301 provides for connection between the fender body 130 and the carriage 120. More particularly, the fender body 130 is designed to rotate with respect to the carriage 120 about a pivot connection 1201. Such rotation of the fender body 130 with the carriage 120 allows this fender body 130 to be kept in contact with the ramp 110, notably at the contact points 1303. The fender body 130 also comprises a bump 1302.

[0036] The fender arm 140 extends the fender body 130 toward the water. This fender arm 140 is able to rotate with respect to the fender body 130 through a limited angular range. As a preference, this limited angular range is less than 10° . The fender arm 140 thus rotates about a pivot connection 1401. This rotation is blocked by a pin 1304 of the fender body 130 which moves in a slot 1402 belonging to the fender arm 140. It will be noted that the fender arm 140 is designed to press against a runway 150. This runway 150 is different than the ramp 110. This runway comprises a first part 1501 belonging to the ship 30, and a second part 1502 extending the first part 1501 toward the water. The second part 1502 extends the first part 1501 in the continuity of the end 1101 of the ramp 110. As a preference, the runway 150 is parallel to the ramp 110. The runway projects beyond the edge 310 of the ship and has a rounded shape.

[0037] The marine craft 20 is, for example, an autonomous marine craft 20. It may comprise:

- a main body 210;
- at least one fin 220;
- a first attachment device (not depicted).

[0038] The main body 210 is designed to remain at the surface dynamically by having a non-zero speed and lift-inducing surfaces. As a variant, the main body 210 may float on the water. It is able to carry a payload, such as a sonar, having delicate elements. The main body 210 may also carry drive elements in order to cause the marine craft 21 to move over the water.

[0039] The fin 220 is designed to make the marine craft 20 easier to steer as it moves over the water. This fin 220 may take the form of a foil with a leading edge 2201 on its upper part and a trailing edge 2202 on its lower part. As a preference, the marine craft 20 comprises two fins, positioned one on each side of the main body 210. In figures 1, 3 and 5, the fin 220 is inclined, with the leading edge inclined upward.

[0040] The first attachment device of the marine craft 20 is situated at the front of the main body 210. This first attachment device is designed to be connected to the cable of the main winch.

[0041] Figure 1 illustrates the system 10 in a phase of docking of the naval craft 20. In this docking phase, the carriage 120 is as close as possible to the end 1101 and the fender body 130 and the fender arm 140 are partly submerged. The fin 220 of the marine craft 20 can therefore come into abutment with the fender body 130. Furthermore, this fin 220 also comes into abutment with the fender 140 in a bump-free bearing zone. The fender arm 140 is in this instance in a raised position in which the pin 1304 is in a bottom part of the slot 1402. This positioning of the pin 1304 is more particularly illustrated in figure 2 which is an enlargement of the fender body 130 in the region of the slot 1402. The fender arm 140 is kept in its raised position under the action of the marine craft 20 against the fender arm 140 and pressure on the second part 1502 of the runway 150 via a protuberance 1403.

[0042] Figure 3 illustrates the system 10 in a phase of start of recovery lifting of the marine craft 20. During this phase, the cable is hauled in by the winch, causing the marine craft 20, the fender body 130 and the fender arm 140 to be hauled. With the movement of the carriage 120, the fender arm 140 pivots about the pivot connection 1401 to reach an intermediate position. As illustrated in figure 4, in this intermediate position, the pin 1304 is between the two ends of the slot 1402. This positioning of the pin 1304 is more particularly illustrated in figure 4. The connection between the marine craft 20 and the system 10 is thus improved. Because of the curved shape of the fender arm 140, the front of the marine craft 20 is raised. Furthermore, through this rotation about the pivot connection 1401, the fender arm 140 is retracted under the effect of its own weight, enabling it not to touch the trailing edge 2202 of the horizontal surface 220 in this position which is critical for overcoming the step formed by the stern transom of the boat.

[0043] Figure 5 illustrates the system 10 in a phase of continuing recovery lifting of the marine craft. During this phase, the cable continues to be hauled in by the winch, causing the marine craft 20 via the carriage 120, the fender body 130 and the fender arm 140 to be hauled. This marine craft 20 then comes to rest directly on the ramp 110. With the movement of the carriage 120, the fender arm 140 pivots about the pivot connection 1401 to reach a lowered position. In this lowered position, the pin 1304 is in an upper part of the slot 1402. This positioning of the pin 1304 is more

particularly illustrated in figure 6. The fender arm 140 arrives in the second part 1502 of the runway 150. This second part 1502 has a rectilinear shape. Just as in the previous phase, the fender arm 140 does not touch the trailing edge 2202 of the horizontal surface 220.

[0044] If recovery lifting continues, the fender arm 140 arrives in a third part 1503 which in this instance is horizontal. As the marine craft 20 continues to slide along the ramp 110, the second attachment device of the fender arm 140 retracts and disconnects from the marine craft 20.

[0045] The description developed hereinabove also applies to an operation of lowering the marine craft 20 from the ship 30. The winch will then progressively release the cable. The fender body 130 and the fender arm 140 will pass successively through the various positions as illustrated in figures 6 to 1.

[0046] Another subject matter of the invention also relates to a ship 30 comprising the system 10 for maneuvering a marine craft 20 as described hereinabove.

[0047] The invention thus proposes equipping fenders with moving parts notably on a system of mobile curved fenders connected by a pivot to a carriage of the roller chock type. This carriage moves along a ramp that is slightly inclined with respect to the water and the end of which is not submerged.

[0048] The invention allows a marine craft to be launched and recovered while notably protecting the craft's front part which may incorporate delicate sensors. It allows the craft to be accompanied as it passes over the step between the end of the ramp and the water by supporting the body via the lateral horizontal surfaces while freeing up the space that the trailing edge of the surfaces might occupy so as not to press against these throughout the entire launch or recovery process.

[0049] It is mainly the extension piece formed by the fender arm or arms that allows the marine craft to be received deeper down in the water. Once contact has been made fairly high up along this arm, the winch causes it to continue to be recovery lifted. The marine craft then passes along the main fender body then becomes blocked on the vertical part of the main fender body.

[0050] The invention is not limited to the embodiments and variants presented, and other embodiments and variants will be clearly apparent to a person skilled in the art.

[0051] Thus, the carriage 120 is connected to the winch via the cable. This solution is particularly advantageous in the case of an autonomous marine craft that latches

onto the fenders, either by latching directly onto the fenders or by latching on via a capture station before coming into contact with the fenders.

[0052] Thus, the bump 1302 is designed to house a device for attachment to the marine craft 20.

[0053] Thus, the ramp stops abruptly without protruding beyond the edge 310 of the ship 30, with just a horizontal fender or a roller for the moment at which the marine craft touches down.

[0054] This then blocks the degree of rotation of the arm in the lowered position in order to force it into a preferred position and to release it as soon as the carriage is brought back up.

CLAIMS

1. A system for maneuvering a marine craft (20), said system (10) being intended to be placed at the edge (310) of a ship (30), said system (10) comprising:
 - a ramp (110) positioned on said ship (30), said ramp (110) comprising a first end (1101) not submerged in the water;
 - a winch arranged at a second end of the ramp (110) opposite to the first end (1101), said winch being designed to command the hauling-in and the paying-out of a cable, said cable being designed to move the marine craft;
 - a carriage (120) designed to move along the ramp (110) between the first end (1101) and the winch under the effect of a movement of the marine craft;
 - a fender body (130) connected to the carriage (120) and designed to press against the ramp (110), said fender body (130) being able to rotate with respect to the carriage (120);
 - at least one fender arm (140) designed to press against a runway (150), said fender arm (140) being designed to extend the fender body (130) toward the water, said fender arm (140) being able to rotate through a limited angular range with respect to the fender body (130).
2. The system for maneuvering a marine craft as claimed in claim 1, wherein the limited angular range is less than or equal to 10°.
3. The system for maneuvering a marine craft as claimed in either one of claims 1 and 2, wherein the limited angular range is achieved by means of:
 - a pivot connection (1401) between the fender body (130) and the fender arm (140);
 - a slot (1402) in the fender arm (140), said slot (1402) being distant from the pivot connection (1401);
 - a pin (1304) belonging to the fender body (130) and able to move in the slot (1402).
4. The system for maneuvering a marine craft (20) as claimed in any one of claims 1 to 3, wherein the fender arm (140) is curved.
5. The system for maneuvering a marine craft (20) as claimed in any one of claims 1 to 4, wherein the runway (150) associated with the fender arm (140) comprises a first part (1501) belonging to the ship and a second part (1502) extending the first part (1501) toward the water, said second part (1502) being in the continuation of the end of the ramp (110).

6. The system for maneuvering a marine craft (20) as claimed in any one of claims 1 to 5, wherein said system comprises two fender arms (140) positioned one on each side of the fender body (130).
7. The system for maneuvering a marine craft (20) as claimed in any one of claims 1 to 6, wherein the carriage (120) is a roller chock.
8. A ship comprising a system for maneuvering a marine craft (20) as claimed in any one of claims 1 to 7.