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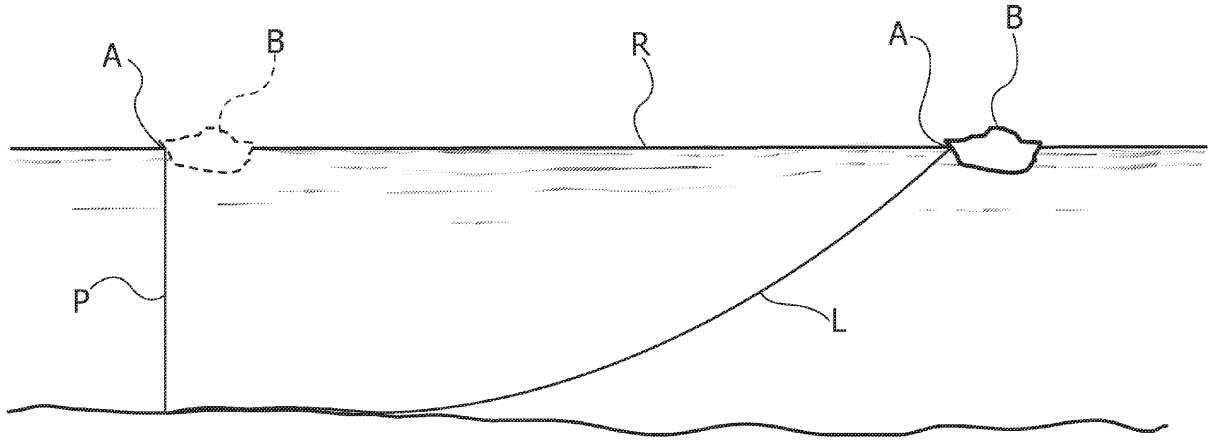
(54) Method and system for virtual dynamic anchoring of watercraft

(57) A method for dynamic anchoring of watercraft with a virtual anchor, comprising the steps of:
- acquiring the position of a virtual-anchorage point (A) of the watercraft (B);
- determining a virtual anchorage radius (R) as a function of the depth (P) in said virtual-anchorage point (A);
- periodically defining the geographical co-ordinates of a mooring point (S, S') situated at a distance from said virtual-anchorage point (A) equal to said virtual anchorage radius (R) and on a half-line having origin in said anchorage point (A) and direction coinciding with the direction of the wind (W, W'); and
- positioning and maintaining the watercraft (B) in the proximity of said mooring point (S, S').

FIG. 2



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Description

TEXT OF THE DESCRIPTION

Background of the invention

[0001] The present invention relates to a method and a system for virtual dynamic anchoring of watercraft.

[0002] By "virtual dynamic anchoring" is meant a system that enables a watercraft to be set and kept in a position without using a conventional physical anchor.

Description of the prior art

[0003] In the state of the art, solutions have already been proposed for positioning of watercraft without the use of an anchor. The document No. US2003/0191562 describes an anchorless positioning system, which sets and keeps a watercraft in a selected geographical position without the use of a conventional anchor. The system of a known type uses a steerable motor, the thrust and direction of steering of which are determined and controlled on the basis of position signals received from GPS satellites. The system continuously monitors the position and movement of the watercraft and compares them with the co-ordinates stored of a selected anchoring position for generating control signals for the steering motor. A similar positioning system is also described in the document No. WO95/28682.

[0004] The positioning systems according to the known art keep the watercraft in the proximity of a selected point. Consequently, a watercraft equipped with a anchorless positioning system according to the known art tends to remain stationary or to remain very close to the selected point.

[0005] The empirical rule for anchoring watercraft with an anchor of a conventional type envisages that the length of the chain of the anchor is approximately four times the depth. Given that the typical lengths of the chain are not more than one hundred metres, if the depth exceeds 50 m, an anchored mooring cannot be performed. Below said depth, instead, normally an anchored mooring is performed. Consequently, the watercraft moored with a conventional anchor are liable to move according to the direction of the wind on a circumference with centre in the anchorage point and with a radius given by the catenary that is formed between the bow of the boat and the anchor.

[0006] The use of an anchorless positioning system according to the known art involves a risk of collision in the case where a watercraft with anchorless positioning system is positioned in the proximity of watercraft moored with conventional anchors. In fact, whereas the watercraft with anchorless positioning system tends to remain stationary or very close to the selected point, the watercraft moored with conventional anchors are displaced by even considerable distances as the direction of the wind changes. The movement of the watercraft moored with conventional anchors could bring said watercraft into a collision course with a watercraft that remains stationary as the direction of the wind changes.

[0007] In general, there do not, instead, exist risks of collision between watercraft moored with conventional anchors since said watercraft move in a concordant way as the direction of the wind changes.

Object and summary of the invention

[0008] The object of the present invention is to provide a method and a system for dynamic anchoring with a virtual anchor that will prevent the risk of the watercraft equipped with said anchoring system from coming into collision with watercraft moored with conventional anchors.

[0009] According to the present invention, said object is achieved by a method and by a system for dynamic anchoring with a virtual anchor that present the characteristics forming the subject of the claims.

[0010] The method and the system according to the present invention provide an anchorless positioning that simulates with an excellent degree of precision the behaviour of a watercraft moored with a conventional anchor.

[0011] Consequently, a watercraft equipped with a virtual dynamic anchoring system according to the present invention moves as the direction of the wind changes in a way altogether similar to a watercraft moored with a conventional anchor. This enables elimination of the risk of collision with which the anchorless positioning systems according to the known art are affected.

Brief description of the drawings

[0012] The present invention will now be described in detail with reference to the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a block diagram of a system for dynamic anchoring with a virtual anchor according to the present invention;
- Figure 2 is a schematic side view of a watercraft equipped with an anchoring system according to the present invention; and
- Figure 3 is a schematic top plan view illustrating the behaviour of a watercraft equipped with a system according to the present invention according to the variation of the direction of the wind.

Detailed description of an embodiment of the invention

[0013] With reference to Figure 1, a system for dynamic anchoring with a virtual anchor according to the present invention is designated as a whole by 10. The system 10 comprises an electronic control unit 12, which receives the signals coming from a set of detection apparatuses

14 that form part of the standard equipment of a watercraft. The set of detection apparatuses 14 comprises:

- a device 16 for standard or differential satellite detection of position, designed to detect the geographical position of the watercraft;
- a depth finder 18 for measuring the depth below the watercraft;
- an anemometer 20 for measuring the intensity and direction of the wind;
- an electronic compass 22; and
- optional proximity sensors 24, designed to detect the presence of obstacles in the vicinity of the watercraft.

[0014] The system 10 for dynamic anchoring with a virtual anchor further comprises a manoeuvring assembly 26, which also forms part of the standard equipment of the watercraft. The manoeuvring assembly 26 comprises a bow propeller 28 and a stern propeller 30, or alternatively a stern propeller steerable through 360°, governed by respective electric motors supplied by a pack of batteries 32. The pack of batteries 32 is associated to a battery-charger 34, which receives the electrical supply from a generator 36 or from a mains supply (socket available on the quay) 38. The electronic control unit 12 can be associated to an alarm-warning device 40.

[0015] With reference to Figures 2 and 3, operation of the system 10 for dynamic anchoring with a virtual anchor according to the present invention will now be described. The point A indicates a point of virtual anchoring of the watercraft B. The virtual-anchorage point A is the position of the bow of the watercraft B at the moment in which the virtual anchoring system 10 is activated.

[0016] When the system 10 is activated, for example by means of a push-button or a touch-screen, the electronic control unit 12 detects the depth P detected by means of the depth finder 18 and acquires the geographical position of the virtual-anchorage point A via the satellite position-detection device 16.

[0017] The electronic control unit 12 then computes a virtual length of chain L equal to four times the depth P, on the basis of the empirical rules used for mooring watercraft with conventional anchors. On the basis of the values of the depth P and of the virtual length of chain L, the electronic control unit 12 computes a virtual dynamic anchorage radius R. The virtual anchorage radius R is obtained from the calculation of the catenary that, in the case of a physical anchor, would be formed between the anchor and the bow of the boat.

[0018] The calculation of the virtual length of chain L and of the virtual anchorage radius R is made only in the case where the depth P is less than 50 m. If the depth P is greater than 50 m, the electronic control unit 12 governs the manoeuvring assembly 26 so as to maintain the watercraft B in the proximity of the virtual-anchorage point A, in a way similar to the anchorless positioning devices according to the known art, maintaining in any case the bow in the direction of the wind for minimizing the pressure thereof on the watercraft. In fact, the rules for mooring watercraft with conventional anchors envisage that anchoring of the watercraft is not performed when the depth is greater than 50 m.

[0019] If the depth P is less than 50 m, the electronic control unit 12 governs the electric motors for operating the bow propeller 28 and the stern propeller 30 (or in the case of steerable stern motor only the latter) so as to position the watercraft B automatically in a mooring point S. The mooring point S is situated at a distance from the virtual-anchorage point A equal to the virtual anchorage radius and is situated on a half-line having origin in the virtual-anchorage point A and oriented according to the direction of the wind W.

[0020] As long as it remains active, the virtual dynamic anchoring system 10 according to the present invention periodically detects the position of the watercraft B via the satellite position-detection device 16 and brings back the watercraft B into the mooring point S if the watercraft has moved away from the mooring point S. The virtual anchoring system 10 periodically controls the direction of the wind W and corrects the position of the mooring point S as the direction of the wind changes. As is illustrated in Figure 3, if the direction of the wind changes from W to W' the system corrects the position of the mooring point from S to S'. Consequently, the watercraft B moves as the direction of the wind changes in a way substantially identical to a watercraft moored with a conventional anchor.

[0021] The electronic control unit 12 is preferably programmed for orienting the watercraft B according to the direction of the wind W on the basis of the information supplied by the compass 22.

[0022] When the virtual dynamic anchoring system is active, the electronic control unit 12 periodically detects the depth via the depth finder 18 and activates the alarm device 40 if the depth detected drops below a pre-set safety level. The electronic control unit 12 moreover activates the alarm device 40 if the proximity sensors 24 detect an obstacle in the vicinity of the watercraft.

[0023] The virtual dynamic anchoring system according to the present invention can also be used for assistance to mooring in a port. It is sufficient to set the coordinates of the berth to be reached and the course to be followed and the system can suggest or make autonomously the corrections necessary to bring the watercraft into the desired position, in which it will be possible to carry out mooring with the traditional methods. The presence of the proximity sensors reduces the risk of collisions during mooring manoeuvres.

[0024] Furthermore, the system can be used with a function of anti-piracy alarm. During stay in open berth upon signalling of proximity of an object all the lights on board and possible additional lights can be automatically activated, as an action of deterrence.

[0025] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what is described

and illustrated herein, without thereby departing from the scope of the invention as defined by the ensuing claims.

Claims

1. A method for dynamic anchoring of watercraft with a virtual anchor, comprising the steps of:

   - acquiring the position of a point of virtual anchorage (A) of the watercraft (B);
   - determining a virtual anchorage radius (R) as a function of the depth (P) in said virtual-anchorage point (A);
   - periodically defining the geographical co-ordinates of a mooring point (S, S') situated at a distance from said virtual-anchorage point (A) equal to said virtual anchorage radius (R) and on a half-line having origin in said virtual-anchorage point (A) and direction coinciding with the direction of the wind (W, W'); and
   - positioning and maintaining the watercraft (B) in the proximity of said mooring point (S, S').

2. The method according to Claim 1, further comprising the step of maintaining the watercraft (B) aligned to said direction of the wind (W, W').

3. The method according to Claim 1, wherein said virtual anchorage radius (R) is determined by setting a virtual length of anchoring chain (L) equal to four times the depth (P).

4. The method according to Claim 3, wherein said mooring point (S) is made to coincide with said virtual-anchorage point (A) when the depth (P) is greater than a predetermined threshold.

5. A system for anchoring watercraft with a virtual anchor, wherein the watercraft (B) comprises:

   - a satellite position-detection device (16);
   - a depth finder (18);
   - a device for measuring the direction of the wind (20); and
   - a manoeuvring assembly (26) including a stern propeller (30) and a bow propeller (28) governed by respective electric motors or a single manoeuvring stern assembly steerable through 360°,

   the virtual anchoring system (10) comprising an electronic control unit (12) programmed for:

   - acquiring the position of a virtual-anchorage point (A) by means of said satellite position-detection device (16);
   - determining a virtual anchorage radius (R) as a function of the depth (P) in said virtual-anchorage point (A);
   - periodically defining a mooring point (S, S') situated at a distance from said virtual-anchorage point (A) equal to said virtual anchorage radius (R) and on a half-line having origin in said virtual-anchorage point (A) and oriented according to the direction of the wind (W, W'); and
   - governing the electric motors of said stern propellers (30) and bow propeller (28) or of a single manoeuvring stern assembly steerable through 360° for positioning and maintaining the watercraft (B) in the proximity of said mooring point (S, S').

6. The virtual dynamic anchoring system according to Claim 5, wherein the electronic control unit (12) moreover receives signals coming from an electronic compass (22) and is programmed for governing the electric motors of said stern propeller (30) and of said bow propeller (28) or of a single manoeuvring stern assembly steerable through 360° for maintaining the watercraft (B) aligned to said direction of the wind (W, W').

7. The virtual dynamic anchoring system according to Claim 5, wherein the electronic control unit (12) moreover receives signals coming from proximity sensors (24) and is programmed for activating an alarm-warning device (40) when said proximity sensors (24) signal the vicinity of the watercraft (B) to obstacles.

8. The virtual dynamic anchoring system according to Claim 6, wherein said electronic control unit (12) is programmed for activating said alarm-warning device (40) when the depth detected by means of said depth finder (18) is lower than a pre-set safety level.

FIG. 1

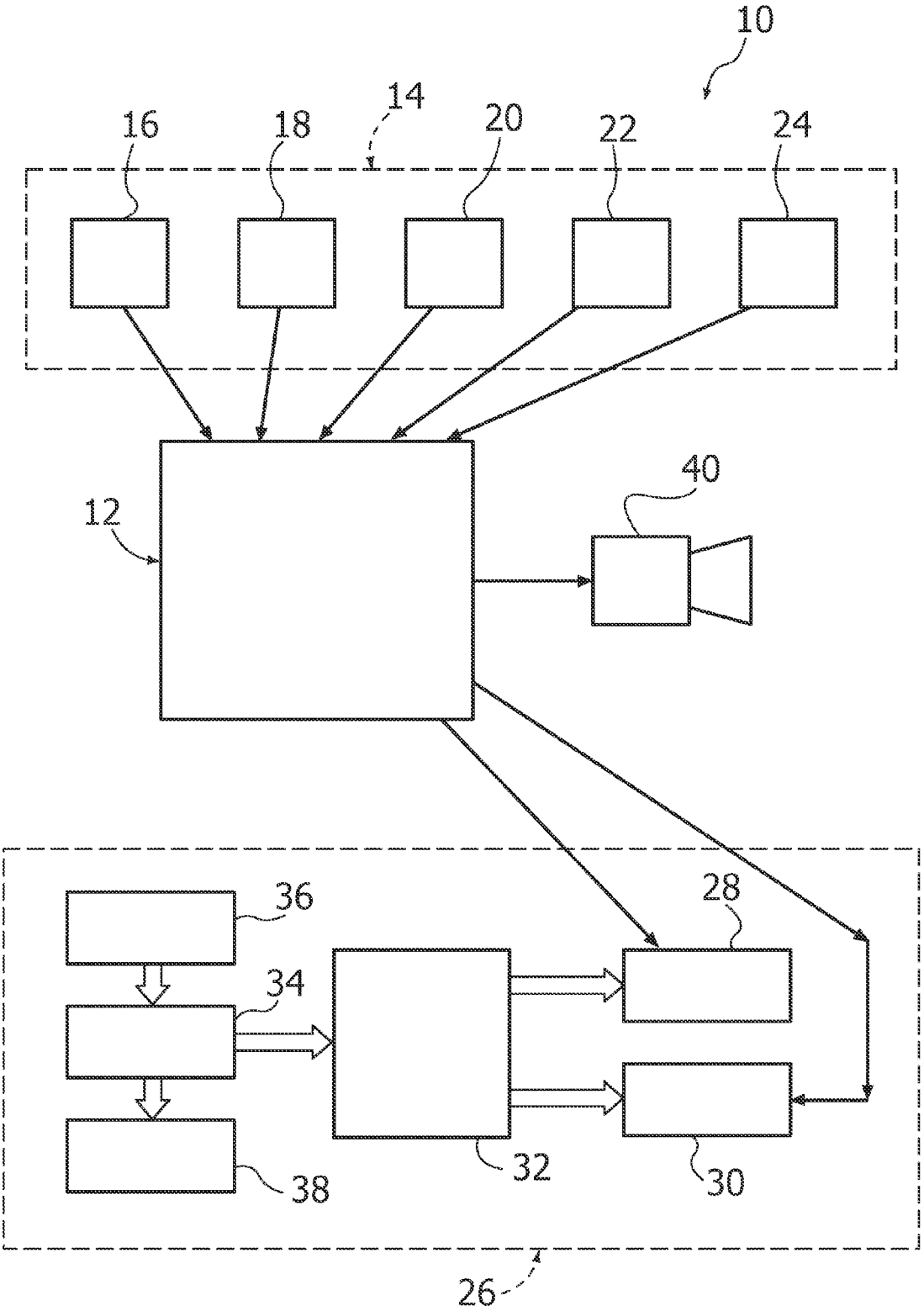


FIG. 2

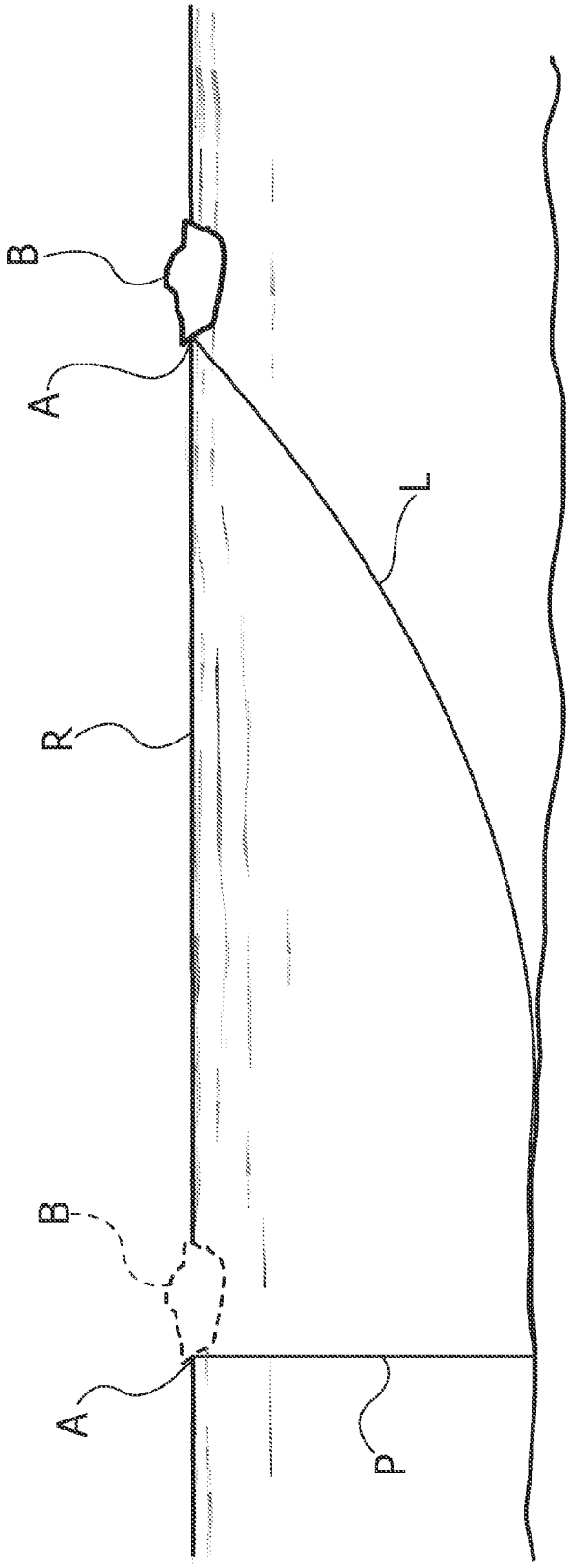
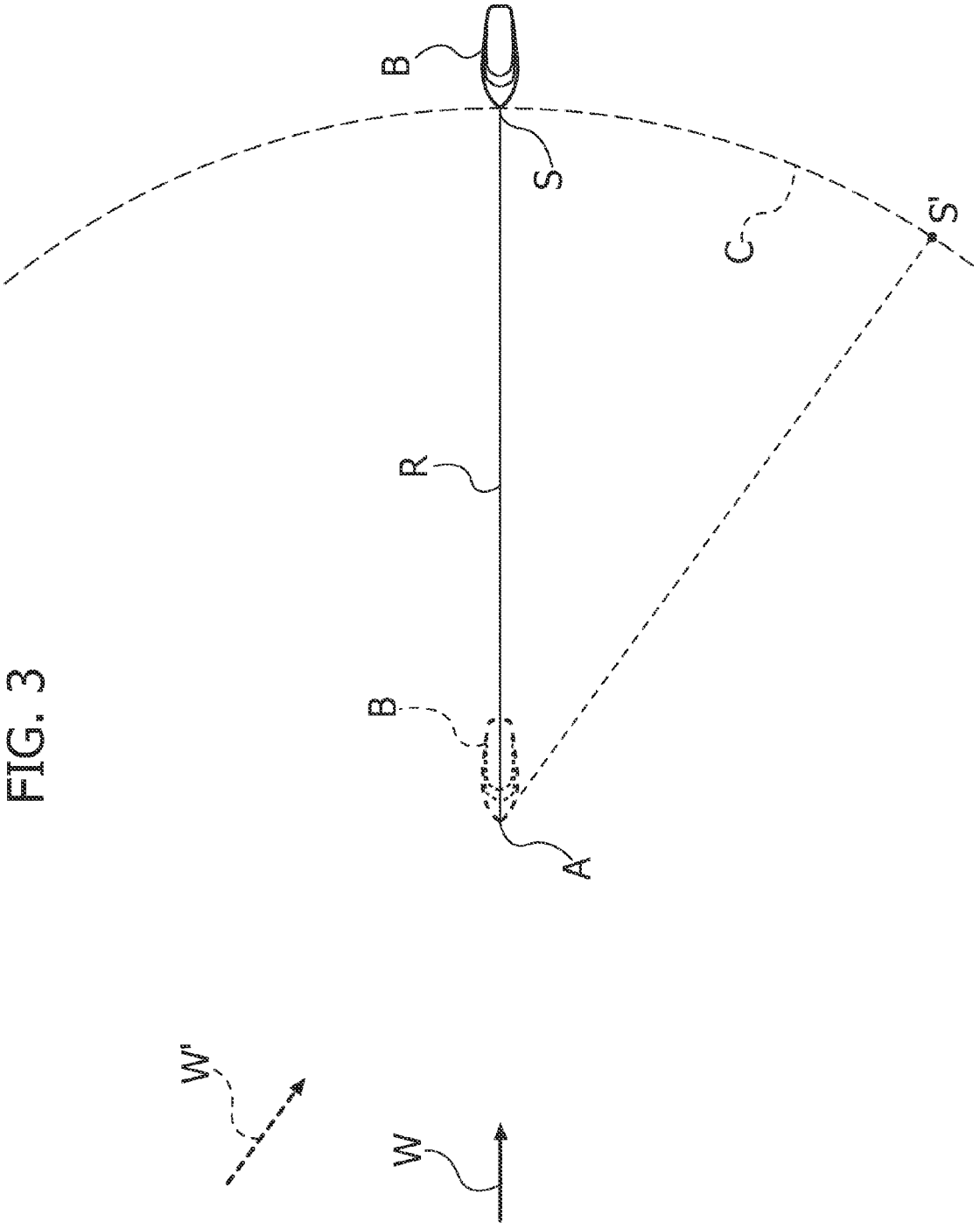


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 2914

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 April 2011	Lendfers, Paul

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 2914

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The present search report has been drawn up for all claims

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Munich	1 April 2011	Lendfers, Paul

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