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(54) Tugboat

(57) Tugboat comprising a hull (5), propulsion means, and a winch (16) placed on the deck and having one or more winch drums (14), for winding up a towing cable (1), and a cable guide bracket (15) placed behind the winch, for guiding a towing cable to the winch drum in question, which towing cable can exert a backward force on the winch drum, a front cable guide bracket (11) being placed in front of the winch, in order to guide a towing cable (31) in the forward direction, which towing cable can exert a forward force on the winch drum in question.

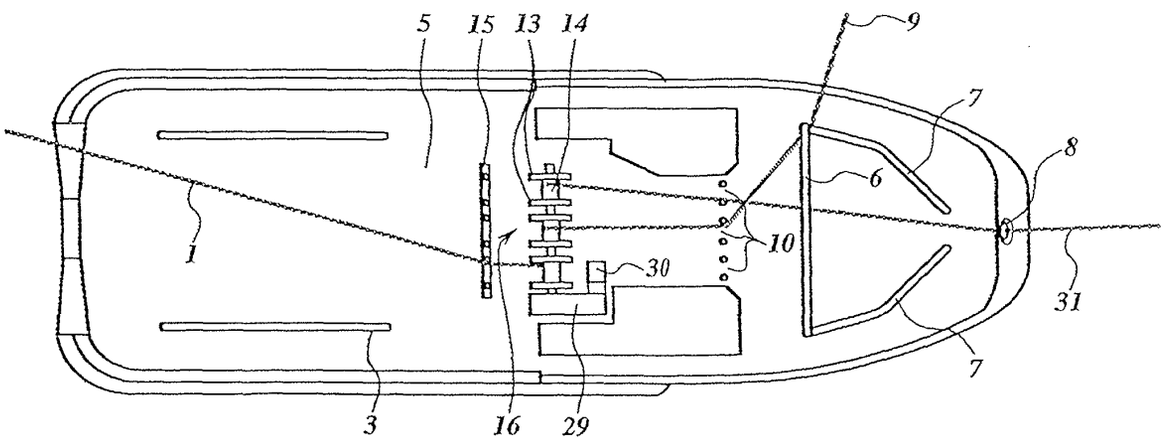

Fig. 4

EP 1 253 074 A1

Description

[0001] The invention relates to a tugboat according to the preamble of Claim 1. Such tugboats are known. In the case of the known tugboats there is one winch for a towing cable running in the rearward direction. In practice, it appears that towing cables are also increasingly frequently being run out in the forward direction, and that it is desirable to be able by means of a winch to vary the length of a towing cable run out in the forward direction. For that purpose, a second winch is placed on the foredeck in the known tugboats. Such a second winch necessitates additional investment in winch and cable, additional maintenance and, besides, this second winch often has to be smaller in size because there is only limited space on the foredeck.

[0002] In order to avoid the abovementioned disadvantages, the device according to the invention is designed according to the characterizing part of Claim 1. This means that the winch can be used when the towing cable is being paid out over the foredeck and when the towing cable is being paid out over the stern, so that the load on the winch can be the same in both cases.

[0003] According to an improvement, the device is designed according to Claim 2. This produces better operational reliability of the winch, and thus of the tugboat.

[0004] According to an improvement, the tugboat is designed according to Claim 3. The result of this is a reduction of the upsetting moment that is exerted upon the tugboat by a towing cable that is run out in the forward direction when the towing cable is directed upwards, as is the case when the towing cable is attached to a ship with a high freeboard.

[0005] According to an improvement, the tugboat is designed according to Claim 4. This means that the force exerted by the tugboat on a towing cable run out in the forward direction is increased with the same transverse force of the second propulsion means.

[0006] According to an improvement, the tugboat is designed according to Claim 5. This means that the tugboat can exert a greater force on a towing cable paid out in the transverse direction.

[0007] According to an improvement, the tugboat is designed according to Claim 6. This means that a compact construction of the tugboat is obtained.

[0008] According to an improvement, the tugboat is designed according to Claim 7. This produces second propulsion means, by means of which there can be a rapid reaction to changing circumstances.

[0009] According to an improvement, the tugboat is designed according to Claim 8. This means that second propulsion means are obtained in a simple manner without parts projecting from the hull.

[0010] According to an improvement, the tugboat is designed according to Claim 9 or 10. This means that the jet pipe can develop propulsion power in an efficient manner.

[0011] According to an improvement, the tugboat is designed according to Claim 11. In this case the lateral resistance of the fore cutwater is increased additionally, with the result that greater transverse forces can be generated.

[0012] The invention is explained below on the basis of an exemplary embodiment with reference to a drawing.

[0013] In the drawing:

Figure 1 shows a perspective front view of a tugboat;
Figure 2 shows a perspective rear view of the tugboat of Figure 1;
Figure 3 shows a diagrammatic side view of the tugboat of Figure 1;
Figure 4 shows a diagrammatic top view of the tugboat of Figure 1;
Figure 5 shows a detail along the section V-V in Figure 3;
Figure 6 shows a detail along section VI-VI in Figure 3;
Figure 7 shows a perspective front view of the bow of the tugboat of Figure 1;
Figure 8 shows a top view of the use of a tugboat during the guidance of a ship; and
Figure 9 shows diagrammatically various forces that are exerted upon the tugboat by a towing cable.

[0014] Figure 1 shows a hull 5 of a tugboat, which tugboat is suitable for towing away objects floating in the water, and in particular is suitable for guiding ships. A railing 2 is fitted in the known manner around the hull 5 near the afterdeck, amidships there is a pilot house 12, and the chimneys 4 of the propulsion means (not shown) can be seen.

[0015] For towing away objects floating in the water, a rear towing cable 1 can be attached to the tugboat, and protection brackets 3 are provided on either side on the afterdeck, in order to ensure that the towing cable 1 does not come into contact with objects placed on the afterdeck. For the guidance of ships, a towing cable 31 can be guided by way of a front hawse-hole 8 and an aperture 10 into a front cable guide bracket 11 to a winch 16 (see Figure 2). In another method of guiding a ship, it is also possible to guide a towing cable 9 underneath a guide arch 6 to an aperture 10 in the cable guide bracket 11. When the direction of pull on the towing cable 9 is changed, said towing cable 9 can move over the foredeck. In order to prevent the towing cable 9 from undesirably coming into contact with objects on the foredeck, protection brackets 7 are provided on either side on the foredeck.

[0016] In Figure 2 the winch 16 can be seen with three winch drums 14, each provided with two drum cheeks 13. A front cable guide bracket 11 is placed in front of the winch 16, and a rear cable guide bracket 15 is placed behind the winch 16. Each cable guide bracket has three apertures 10, through which towing cables are guided

to the winch drums 14 in such a way that said cables wind up evenly. The front cable guide bracket 11 forms part of a wall by means of which the winch 16 is protected from spray splashing on the foredeck.

[0017] Figure 3 shows the tugboat in side view, a water surface 17 also being indicated. The hull 5 is provided on the front side with a bulbous stem 27, and on the underside with a fore cutwater 25 and an aft cutwater 21. For the propulsion of the tugboat, first propulsion means, composed of a stern drive 20, are provided in a known manner on the rear side of the hull 5. Said stern drive may be of a dual design. Each stern drive 20 has a motor 22 and a nozzle 18 in which a propeller 19 can rotate. The nozzle 18 and the propeller 19 are rotatable about a vertical axis in a known manner.

[0018] Second propulsion means are provided on the front side of the tugboat, by means of which propulsion means forces can be exerted on the hull 5 transversely to the longitudinal direction of the tugboat, and by means of which forces can preferably also be exerted in the direction of travel. The transverse forces are exerted on the hull 5 as far forward as possible, and preferably in front of the bracket 6, so that the force exerted by the second propulsion means can exert the greatest possible steering torque on the tugboat. In the embodiment shown, the second propulsion means comprise a jet pipe 26, which can rotate about a vertical axis of rotation 28 with the aid of a directional drive 37.

[0019] Figures 5 and 6 show the second propulsion means in greater detail. The jet pipe 26 can rotate about the vertical axis 28 in a chamber 32, which is hollowed out on the underside of the broad part of the fore cutwater 25. The direction of the water jet from the jet pipe 26 forms an angle α of approximately 20 degrees with the horizontal plane. The water propelled out of the jet pipe 26 is sucked in through a suction channel 34, which begins on either side of the narrow part of the fore cutwater 25 with suction apertures 35, which may be provided with a grille. A propeller 24 is accommodated in the suction channel 34, which propeller is driven by a motor 23. It can also be seen in Figures 5 and 6 that the fore cutwater 25 is provided with an end plate 33 which, viewed in the horizontal plane, is larger all round than the horizontal section of the fore cutwater 25. The end plate 33 preferably forms an edge 200 to 300 mm wide on the underside of the fore cutwater 25.

[0020] Figure 4 shows the top view of the tugboat, and it can be seen that the winch 16 is situated more or less in the centre, halfway along the hull 5. A winch drive 29 and a drive motor 30 can also be seen. The winch 16 is in the form of three winch drums 14, each of which can be driven separately. In order to increase the operational reliability of the winch 16, the drive of the winch drums 14 is preferably dual, for example by providing two drive motors 30.

[0021] Figure 7 shows the front side of the hull 5, and in particular the prow on the underside. It can be seen here that the prow is provided with the bulbous stem 27, and that the fore cutwater 25 begins at said bulbous stem 27. It can also be seen that the fore cutwater 25 has a streamlined profile with a maximum width at the front side. At the position of said maximum width, the chamber 32 for the jet pipe 26 is provided in the fore cutwater 25. The suction apertures 35 are provided on either side of the narrow part of the fore cutwater 25 in the bottom surface of the hull 5.

[0022] Figure 8 shows an example of the use of the tugboat according to the invention to guide a boat B. The boat B is travelling in direction V_B and is being guided by a front tugboat C, which is travelling in direction V_C, and a rear tugboat A, which is travelling in direction V_A. The boat B is guided, for example, when it is approaching a harbour or if no risk may be taken that the boat B might become uncontrollable should the rudder of boat B go out of order. This occurs, for example, if boat B is full of oil and is sailing along a rocky coastline, where running aground would lead to unacceptable pollution of the coastline. As shown in Figure 8, the longitudinal axis of the rear tugboat A forms an angle γ with the direction V_A in which the tugboat A is moving through the water. In this instance, the lateral surface of the tugboat gives a great lateral resistance, which is indicated by R in Figure 9. Said lateral resistance R is additionally great through the fore cutwater 25 and the end plate 33. Said lateral resistance is partly the reason why a great force F can be exerted on the towing cable 9, with the result that the boat B can change direction. The force F in the towing cable 9 will try to change the course of the tugboat and make the angle γ smaller. This is prevented by, inter alia, the second propulsion means, it being an advantage that the jet pipe 26 lies in front of the action point of the towing cable 9.

[0023] The lateral resistance, together with the force F in the towing cable 9, exerts an upsetting moment on the hull 5 of the tugboat. Owing to the difference in height between the freeboard of the boat B and the tugboat, said upsetting moment can be reduced, as shown in Figure 9. If the towing cable 9 were to act on the hull near the centre and, for example, to run directly from the aperture 10 of the first guide bracket 11 to the boat B, as indicated by line 1 in Figure 9, then the distance to a line n parallel to 1 and running through the centre of gravity 2 would be equal to b. This distance is proportionate to the upsetting moment on the hull 5. By guiding the towing cable 9 by way of bracket 6, it is ensured that the direction of pull of the towing cable 9 is in the direction of line n, and the distance to the line n through the centre of gravity z is equal to a, which distance is much shorter than the distance b, so that the upsetting moment is also considerably smaller as a result of the force F in the towing cable 9. It is advantageous here if the bracket 6 is as wide as possible, and preferably wider than half the width of the tugboat.

Claims

1. Tugboat comprising a hull (5), on the rear side of the hull first propulsion means (18, 19, 20), a deck, a winch (16) placed on the deck and having one or more winch drums (14), each for winding up a towing cable (1, 9, 31), and a cable guide bracket (15) placed behind the winch, for guiding a towing cable (1) to the winch drum in question, which towing cable can exert a backward force on the winch drum, **characterized in that** a front cable guide bracket (11) is placed in front of the winch, in order to guide a towing cable (9, 31) in the forward direction, which towing cable can exert a forward force on the winch drum (14) in question.

2. Tugboat according to Claim 1, **characterized in that** the winch is provided with two independently operating drive systems (29, 30) for the winch drum (s).

3. Tugboat according to Claim 1 or 2, **characterized in that** a guide arch (6) is placed in front of the front cable guide bracket (11), in order to guide a towing cable (9) within a guide range, the guide range being wider than a third of - and preferably wider than half - the width of the tugboat.

4. Tugboat according to Claim 3, with second propulsion means (26) being present on the front side of the hull, which second propulsion means can exert forces directed in the lateral direction on the hull, **characterized in that** the guide arch is placed behind the second propulsion means.

5. Tugboat according to one of the preceding claims, **characterized in that** the hull is provided on the front side with a bulbous stem (27) and on the underside with a fore cutwater (25) running in the longitudinal direction, which fore cutwater begins at the position of the bulbous stem.

6. Tugboat according to one of the preceding claims, in which second propulsion means (26) are present on the front side of the hull and can exert forces in the transverse direction on the hull, **characterized in that** the hull is provided on the underside with a fore cutwater (25) running in the longitudinal direction, which fore cutwater begins near the front side of the hull, and the second propulsion means (26) being provided in the fore cutwater.

7. Tugboat according to Claim 6, **characterized in that** the second propulsion means comprise a jet pipe (26) for rapidly flowing water, which jet pipe is rotatable about a vertical axis (28).

8. Tugboat according to Claim 7, **characterized in that** the fore cutwater (25) is provided with a chamber (32) that is open at the underside and in which the jet pipe can rotate.

9. Tugboat according to Claim 7 or 8, **characterized in that** the direction of the jet from the jet pipe forms an angle (α) of less than thirty degrees with the horizontal plane.

10. Tugboat according to Claim 7, 8 or 9, **characterized in that** the direction of the jet from the jet pipe forms an angle (α) of approximately twenty degrees with the horizontal plane.

11. Tugboat according to one of Claims 5 - 10, **characterized in that** the fore cutwater (25) is provided on the underside with an end plate (33) for guiding water along the cutwater in the horizontal direction.

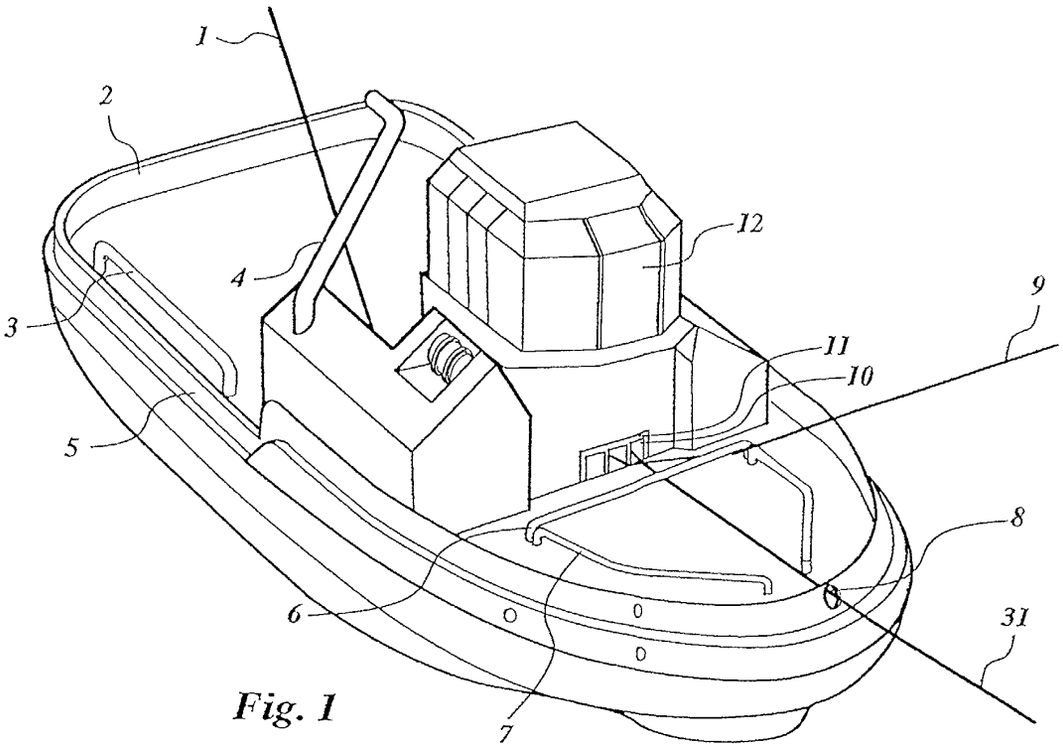

Fig. 1

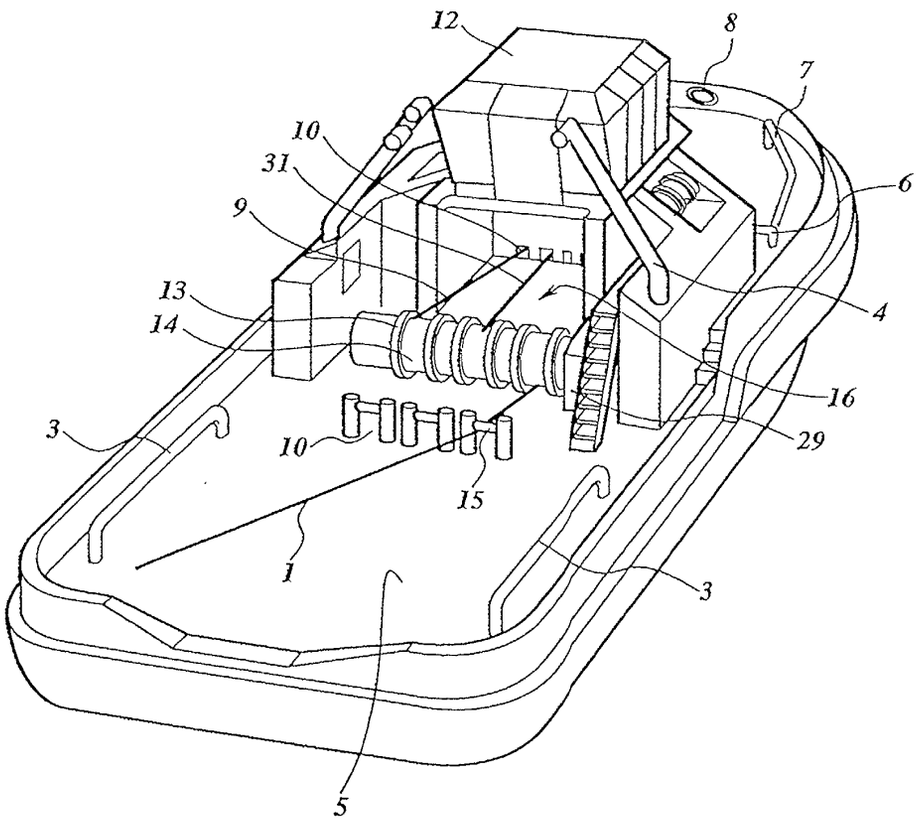

Fig. 2

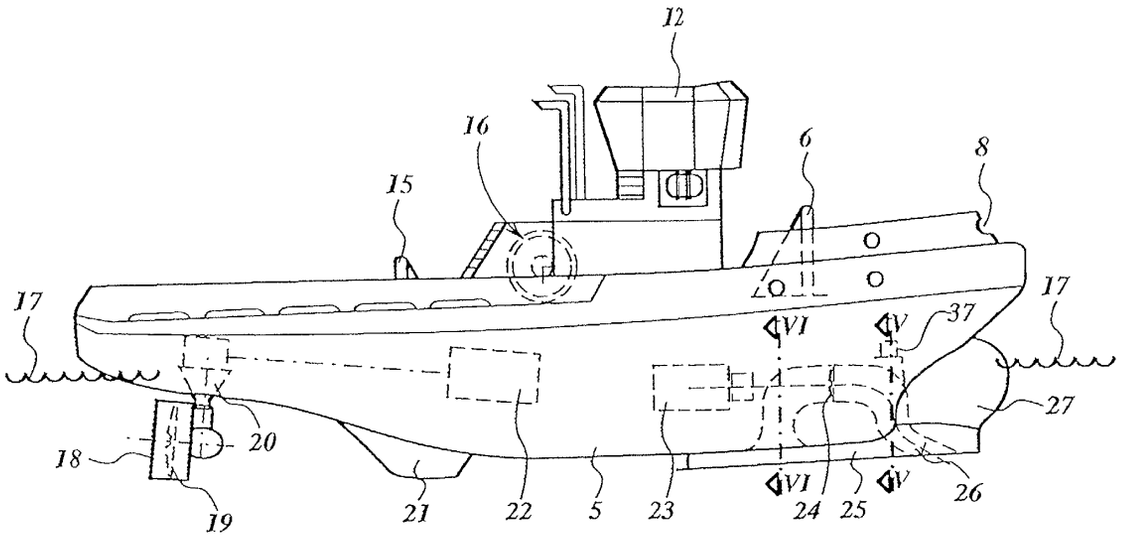
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Fig. 3

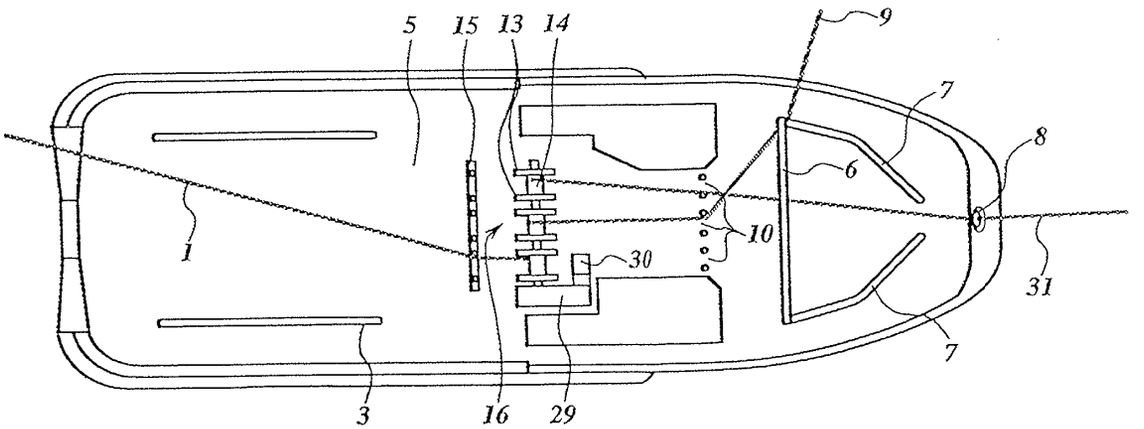
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Fig. 4

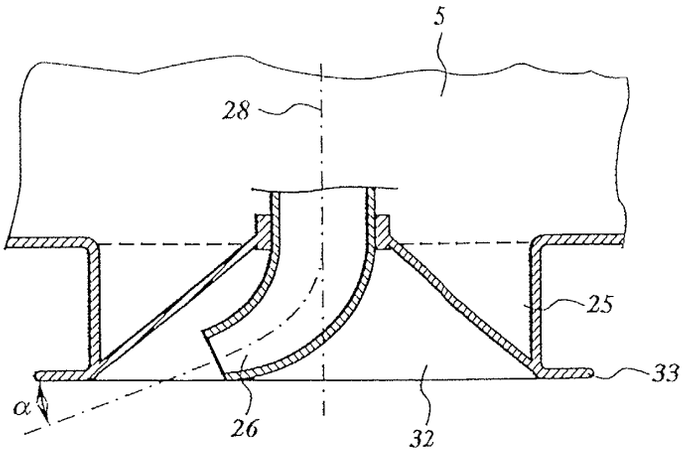

Fig. 5

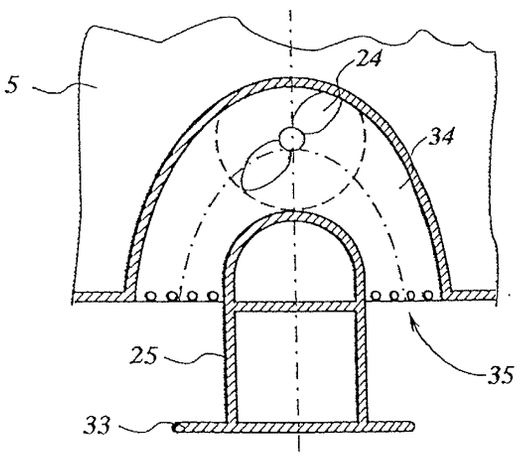

Fig. 6

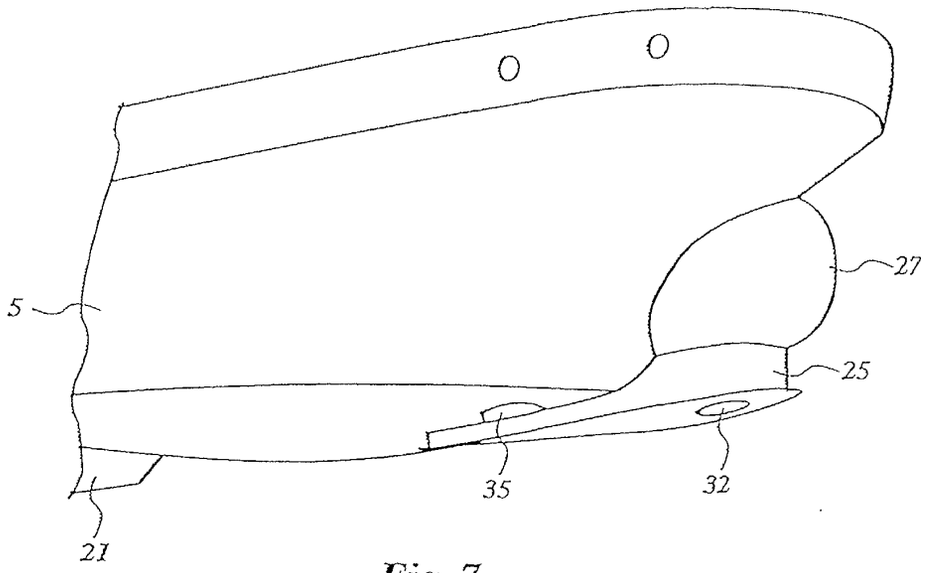

Fig. 7

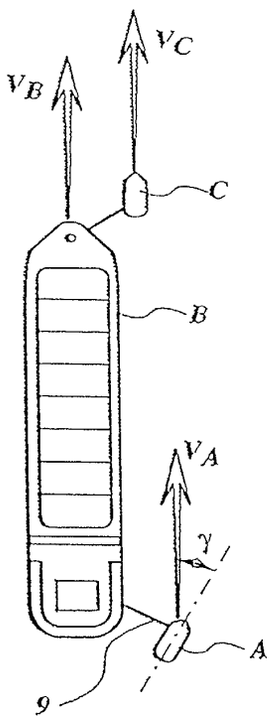

Fig. 8

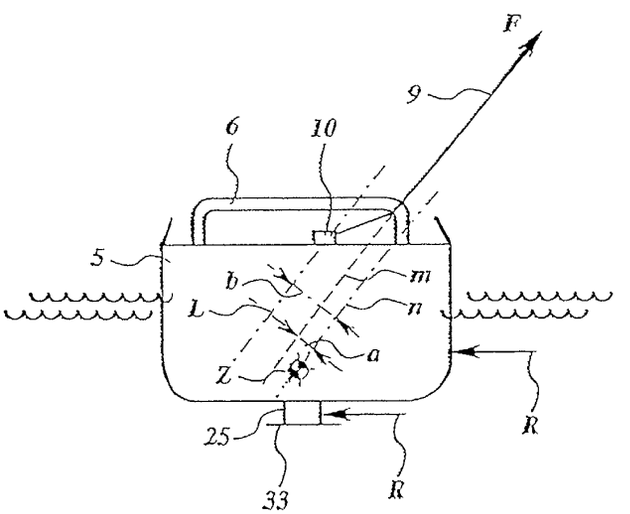

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 6631

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	US 3 892 386 A (HOGAN ELMER R) 1 July 1975 (1975-07-01) * figure 1 *	1	
A	NN: "Novel tug design" SHIP AND BOAT INTERNATIONAL, ROYAL INSTITUTION OF NAVAL ARCHITECTS, LONDON, GB, no. 96/2, March 1996 (1996-03), page 27,29 XP002136313 ISSN: 0037-3834 * figures *	1	
A	FR 2 675 764 A (COZIAN ALAIN) 30 October 1992 (1992-10-30) * figures *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B63B B63H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 July 2002	van Rooij, M

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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30-07-2002

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