



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.09.2008 Bulletin 2008/39

(51) Int Cl.:
B63H 1/18 (2006.01) B63H 1/16 (2006.01)

(21) Application number: **07425174.5**

(22) Date of filing: **23.03.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(72) Inventor: **Acampora, Brunello**
80100 Napoli NA (IT)

(74) Representative: **Leone, Mario et al**
Studio Associato LEONE & SPADARO
Viale Europa, 15
00144 Roma (IT)

(71) Applicant: **Flexitab S.r.l.**
80121 Napoli (IT)

(54) **Partially submerged propeller drive system**

(57) A partially submerged propeller drive system (1), of the kind having a partially submerged propeller placed at the transom (T) of a watercraft provided with one or more propellers (2) mounted at the lower part of the transom (T) of a watercraft (S), with the drive shaft projecting astern, allows a more effective directing of the wake wave, so as to achieve at the propellers a working

condition at lower speeds nearer to ideal one, partially submerged and at a lower pressure, preventing them to be affected at the rated cruise speed designed for the watercraft and comprises, at each drive shaft, a flap (100) between the transom (T) and the propeller (2), positioned so as to intercept the wake wave (W), when the watercraft (S) moves at a speed lower than the rated speed.

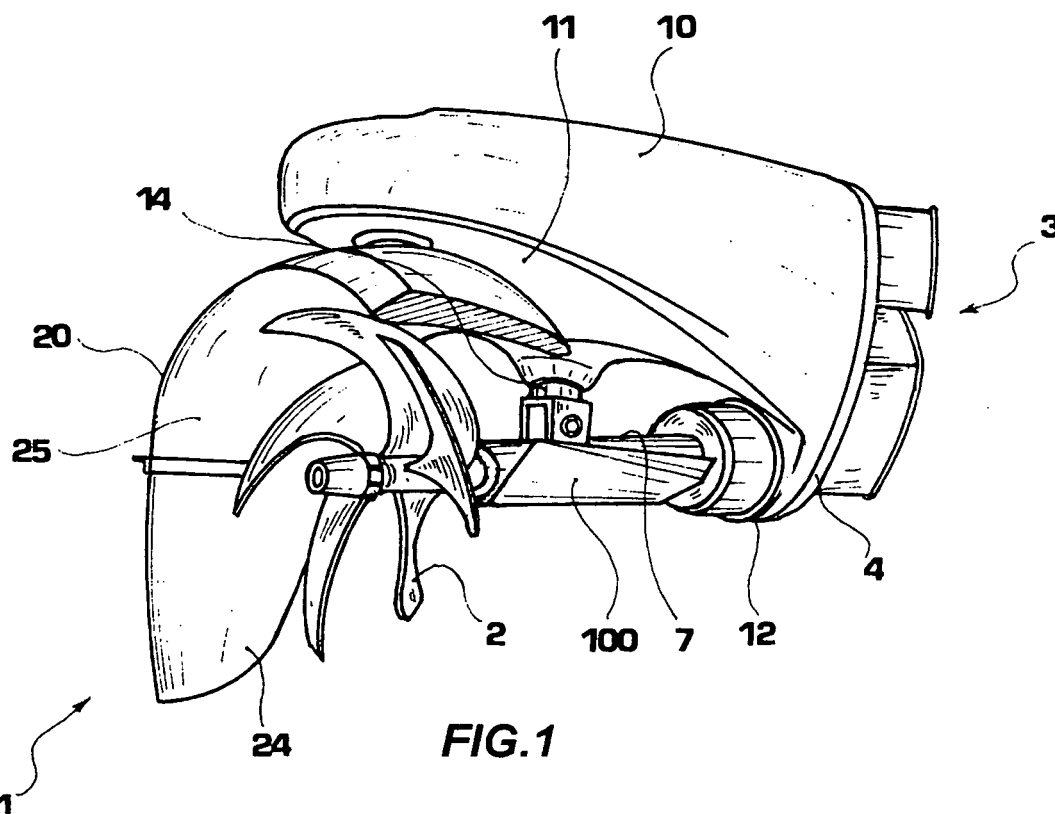


FIG. 1

Description

[0001] The present invention relates to a marine drive system of the kind having a partially submerged propeller, provided with one or more propellers positioned at the lower part of the transom of a watercraft, with the drive shaft projecting astern.

[0002] Many different types of the above specified system are known, available e.g. in the Italian Patent No. 1,184,406 and in the international patent applications Publ. No. WO 92/06000 and WO 96/40550.

[0003] In this drive system typology, the propeller is intended to remain only partially submerged in the operation thereof, causing a driving flow localized at the water surface. This system, being generally adoptable on every watercraft, in the current state of the art finds its preferred application in the field of high speed planning watercrafts, for competition, sporting and yachting.

[0004] It is understood that the propeller efficiency, intended as the ratio between the driving power actually transferred to the water and actually exploited and the power at the drive shaft, is optimized in the partially submerged operation, wherein the water level, obviously considering the wave generated by the wake, substantially corresponds to the propeller centre line, i.e. about to the drive shaft (50% disc area submerged).

[0005] However, this condition generally does not occur in all the motion conditions. As a matter of fact, when the watercraft moves at the rated design speed, she assumes a different configuration with respect to that assumed when the watercraft is still, when it is fully displaced, which is planing or in a partially displaced configuration. In fact, increasing the speed until the rated design speeds are reached, the watercraft continuously varies the immersion and the longitudinal trim angle thereof, passing from a hull hydrostatic displacement phase to an intermediate or temporary phase and finally to a phase wherein a considerable part of the watercraft weight is supported by the hydrodynamic lift of the hull.

[0006] Moreover, at the rated speed, the wake wave is located at a certain distance from the transom, so as not to interfere with or to partially interfere with the propeller.

[0007] In lower speed conditions than the rated speed, wherein the cruise configuration is not assumed by the watercraft yet, the propeller is in a completely submerged configuration or in an intermediate configuration, wherein it does not transfer drive power to the water with the rated efficiency and even it forces the engine to provide a high drive torque at low rpm.

[0008] This strain in the power transmission delays the reaching of an optimal configuration, allowing the propellers to work in a partially submerged condition. This drawback further limits the available speed range of the watercraft to those higher, making the partially submerged propeller-driven watercraft of the known art less manoeuvrable and efficient at the intermediate speeds.

[0009] Further, it is understood that the above difficul-

ties may be only partially obviated, even in an unsatisfactory way, modifying the watercraft hull at the transom. As a matter of fact, such modification, being in addition not adoptable on the existing watercrafts, varies in a substantial manner the wake, regardless the motion condition of the watercraft, in general negatively influencing the performances thereof at the cruise speed and the manoeuvrability thereof.

[0010] The technical problem at the root of the present invention is to devise a marine drive system allowing to obviate to the drawbacks mention with reference to the prior art.

[0011] Such a problem is solved by a partially submerged propeller marine drive systems above specified, comprising, at each drive shaft, a flap between the transom and the propeller, positioned so as to intercept the wake wave when the watercraft travels at speed lower than the rated speed, i.e. in the transition phase between the still watercraft and the rated design condition, wherein the watercraft travels at speed lower than the rated speed.

[0012] The main advantage of the marine drive system according to the present invention lies in the more effective directing of the wake wave, so as to allow the propeller(s) to operate, at lower speeds, in a condition nearer to the optimum, without affecting the propeller(s) operation at the rated cruise speed of the watercraft.

[0013] The present invention will be described hereinafter, according to a preferred embodiment thereof, provided for an exemplifying and not limiting purpose with reference to the annexed drawings wherein:

* Figure 1 shows a perspective view in a partial cross-section of a first embodiment of the marine drive system according to the invention;

* Figure 2 shows a side view of the marine drive system of figure 1;

* Figure 3 shows a bottom view, i.e. astern, of the marine drive system of figure 1;

* Figure 4 shows an elevation view, toward the transom, of the marine drive system of figure 1

* Figure 5 shows a perspective view of a second embodiment of the marine drive system according to the invention; and

* Figures 6A, 6B and 6C illustrate the behaviour of a watercraft having the marine drive system of the preceding figures.

[0014] In the figures, a drive system is only partially depicted with reference to a sole propeller, but it will be apparent how the system may use more propellers, e.g. a pair, mirroring, for each propeller, the structure which will be described hereinafter, so as to apply it on the tran-

som of every watercraft, in particular a displacing or semi-displacing watercraft, possibly with one or more propellers for one or more hulls.

[0015] In such configurations, the propellers are placed so as to be counter rotating, and consequently all the details, which will be described hereinafter, will be mirrored from one propeller to the other.

[0016] With reference to figure 1 to 4, a first embodiment of a partially submerged propeller drive system is indicated as 1. It comprises a propeller 2 and a supporting structure 3 which in turn has a fastening plate 4, apt to be secured to the transom of a watercraft.

[0017] At the fastening plate 4, the system has, in connection with the transmission of the driving torque to the propeller 2, a stern tube 7 housing the drive shaft between said fastening plate 4 and the propeller 2. Said tube simultaneously works as hydraulic sealing, preventing the water leaking inside the watercraft; as thrust bearing, for transferring the thrust generated by the propeller to the lower part of the fastening plate 4; and as possibly structural support for the propeller shaft.

[0018] The tube 7 housing the drive shaft is linked to means for positioning the drive shaft, in the present embodiment of the kind having an active-type hydraulic cylinder 14, able to absorb the thrusts involving the shaft, along any direction, and to actively modify the height of the propeller, e.g. for adjusting the latter in connection with different load or speed conditions of the watercraft.

[0019] In the present embodiment, the means for positioning the drive shaft are placed below a projecting case 10 which will be detailed in the following.

[0020] At the present issue, the drive shaft can be oriented on a vertical plane, achieving the adjustment of the propeller immersion. This typology is suitable for cargos and recreational crafts, having a planing-type bottom hull suitable for medium-high speeds.

[0021] The propeller 2 is mounted to the drive shaft, the propeller being of the type with five blades appropriately shaped for this kind of propeller.

[0022] At the drive shaft, i.e. at the stern tube 7 thereof, the marine drive system 1 according to the present embodiment comprises a flap 100, substantially positioned between the transom, i.e. the fastening plate 4, and the propeller 2.

[0023] As it will become apparent from the following description, the flap 100 is positioned so as to intercept and control the wake wave at every speed, and in particular when the wave tends to excessively submerge the propeller disc.

[0024] In the present embodiment, the flap 100 has a substantially convex shape, with the concavity facing the top side, so as to direct bottomwise a V-shaped camber.

[0025] The flap is positioned just below the drive shaft and it is linked to the latter, i.e. to the stern tube 7 thereof. Due to the presence of the means for positioning the drive shaft, it can suitably adjust the position of the flap 100 too, varying it according to the different cruise conditions.

[0026] In the present embodiment, the flap 100 is delta-shaped, with the apex directed toward the transom of the watercraft, and it comprises a longitudinal centre portion 102, corresponding to the drive shaft section between propeller 2 and fastening plate 4.

[0027] From the centre portion 102, two half-flaps 103 branch away, directed so as to result in said top-open concavity. Further, the flap 100 comprises a rear edge 104 faced to the propeller 2, extending along a width of about 50% of the propeller diameter, preferably equal or greater than the 80% of the propeller diameter, to reach or to slightly overcome the width of the propeller diameter. Such width, and even the flap area, can be modified and adapted according to the features of the single applications and can vary from 20% to 100% of the propeller diameter.

[0028] Due to the shape and to the position, only the wake of part actually involving the propeller is influenced.

[0029] However, it is understood that the shape of the flap 100 can be modified just to adapt itself to peculiar design requirements concerning the watercraft manoeuvrability or the performances thereof.

[0030] In particular, it is understood that the area, the planar shape, the cross-section and the longitudinal section of the flap can be appropriately sized and optimized for each single application.

[0031] Further, it could be possibly provided means (not shown) for modifying the position and/or the configuration of the flap 100 with respect to the drive shaft.

[0032] According to a further alternative, the flap 100 can be positioned just above the drive shaft, i.e. above the tube thereof.

[0033] In the present embodiment, a suitably shaped projecting case 10 extends from the fastening plate 4, overlapping the region of the propeller 2. Such case 10 is sealed on the plate 4, so as to prevent the water leaking inside. It has, at the region of the propeller, a curved surface 11 connecting to the transom, i.e. with the bottom end 12 of the connection plate 4. The curved surface 11 is shaped so as to gradually direct the propulsive flow of the propeller driven in a reverse motion, suitably orienting it in order to maximize its effectiveness at such a speed. Thus, the efficiency of the drive, reverse and in manoeuvring, is significantly improved.

[0034] However, it is understood that the projecting case is not an essential feature of the present invention, i.e. linked to the presence of the flap 100.

[0035] Even in the present embodiment, the system 1 comprises a shroud 20 positioned above the propeller 2 and connected, through a joint 21, to the projecting case 10.

[0036] Such a shroud 20 may be rotated about a substantially vertical axis 22. In the present embodiment the shroud 20 is basically constituted by a curved plate, shaped so as to envelop the region of the propeller 2 along a significant circular sector.

[0037] Therefore, the shroud 20 is positioned so as to intercept the flow generated by the propeller and, thanks

to the peculiar shape of the former, the flow is suitably directed to maximize its effectiveness. Between the shroud 20 and a horizontal plane surface corresponding to the ideal immersion line 9 of the propeller 2 lies a channel 23, extending longitudinally and having a cross-section whose area is decreasing, starting from the transom.

[0038] This shape effect is achieved by assuring that, along said direction of flow, the bottom surface 25 of the shroud 20 varies its position with respect to the axis of the propeller 2.

[0039] Laterally, the shroud 20 extends vertically with a rudder blade 24, positioned so as to remain well-immersed.

[0040] Hence, by rotating the shroud 20 it is achieved the dual effect of directing the propulsive flow, since also the longitudinal axis of the channel 23 is rotated. Concomitantly, the rotation of the shroud 20 actuates the rudder 24.

[0041] Therefore, into the projecting case there will be housed the actuators, e.g. wire-driven, hydraulic, etc., of the shroud 20 and of the rudder 24. The case 10, by being watertight, protects these actuators which accordingly do not need specific details.

[0042] Again, it is understood that the shroud 20 is not an essential feature of the present invention, i.e. linked to the presence of the flap 100.

[0043] In this embodiment, said means for varying the position of the propeller shaft is positioned below the projecting case, in a zone of the curved surface comprised between the shroud 20 and the bottom end 12 of the connection plate 4.

[0044] The functionality of the shroud 20 and of the rudder 24 is identical to that described with reference to the first embodiment.

[0045] However, it is understood that the projecting case 10, apart from housing the actuators of the shroud 20, will contain, shielding them from water, the actuators and the connections required to said means for positioning drive shaft.

[0046] The above-described flap 100 can be applied to a drive shaft of partially submerged propellers regardless the presence of a projecting case 10 overlapping the shaft itself, or with a projecting case having a shape different from that previously disclosed.

[0047] In particular, the projecting case 10 and the drive shaft can be even more elongated with respect to as they are shown in the figures. This typology is suitable for particularly fast crafts, e.g. race crafts.

[0048] Even according to this alternative, means for positioning the drive shaft can be present, located in a manner similar to that previously described.

[0049] In any case, the projecting case can be possibly modelled so as the bottom curved surface 11 of the case 10, in an area located at the propeller, is shaped so as to envelope the propeller, so as to operate as previously described with reference to the shroud 20 but remaining fixed, with the rudder released from it.

[0050] It is noted that, in the embodiment herein de-

scribed, the mutual position between the fastening plate 4, the drive shaft and the flap 100 as well has been already established and adjusted in the manufacture plant, and hence further adjustments in the application of the system 1 to a transom are not required.

[0051] It is understood that the marine drive system 1 disclosed in connection with the above reported embodiment can be applied, with some variants and adjustments not depending upon the inventive core, to any watercraft, of either the displacing or semi-displacing type, or anyhow using partially submerged propellers.

[0052] Similarly, a shorter projecting case 10 and drive shaft may be provided with respect to those depicted in the figures, and possibly without any means for positioning the shaft, as it will be suitable on slower or commercial watercrafts.

[0053] Of course, it is understood that the principle at the root of the present invention can be applied to systems having more elongated drive shafts, designed for greater cruise speeds, e.g. of the kind employed in the field of motorboat races.

[0054] With reference to figure 5, a further embodiment of a marine drive system is indicated as 1, wherein the same reference numerals indicates the same or analogous parts. It comprises a propeller 2 and a supporting structure 3 which in turn has a fastening plate 4, apt to be secured to the transom of a watercraft. Moreover, a stern tube 7 is provided to house the drive shaft between the fastening plate 4 and the propeller 2, similar to that of the preceding embodiment.

[0055] The tube 7 housing the drive shaft is linked to means for positioning the drive shaft, in the present embodiment of the kind having an active-type hydraulic cylinder 14, positioned below the projecting case 10 so as the drive shaft can be oriented on a vertical plane, achieving the adjustment of the propeller immersion.

[0056] At the drive shaft, i.e. at the stern tube 7 thereof, the marine drive system 1 according to the present embodiment comprises a flap 100, substantially positioned between the transom, i.e. the fastening plate 4, and the propeller 2, so as to intercept and control the wake wave at every speed, and in particular when the wave tends to excessively submerge the propeller disc.

[0057] Again, the flap 100 has a substantially convex shape, with the concavity facing the top side, so as to direct bottomwise a V-shaped camber. The flap 100 is delta-shaped, with the apex directed toward the transom of the watercraft, and it comprises a longitudinal centre portion, corresponding to the drive shaft section between propeller 2 and fastening plate 4 and two half-flaps, directed so as to result in said top-open convexity.

[0058] It is understood that the shape of the flap 100 can be modified just to adapt itself to peculiar design requirements concerning the watercraft manoeuvrability or the performances thereof.

[0059] According to a further alternative, the flap 100 can be positioned just above the drive shaft, i.e. above the tube thereof.

[0060] In the present embodiment, the projecting case 10 comprises, at the distal end thereof, i.e. directed astern, a rudder 24 controlled through tie rods 30 driven through the case 10.

[0061] However, it is understood that the projecting case 10, even housing actuators of the rudder 24, will contain, shielding them from the water, the actuators and the connections required to said means for positioning the drive shaft.

[0062] With reference to figures 6A, 6B and 6C, the operation of the above-described marine drive system will be disclosed, e.g. on a planing-type watercraft.

[0063] With reference to figure 6A, a watercraft S is depicted as still, in a condition preceding the start.

[0064] The transom T, and the corresponding portion of hull H as well, are submerged. Accordingly, the propeller 2 and the related drive shaft are also substantially submerged.

[0065] With reference to figure 6B, the watercraft S is depicted in an intermediated or temporary phase, after the start, when the speed thereof has not reached the rated cruise or design speed yet.

[0066] The transom T is still at least partially submerged, while the propeller 2 has not reached the condition of partially submerged operation yet, i.e. with the immersion line corresponding to about the hub of the propeller 2.

[0067] At the propeller region, a relative water flow is present, resulting from the travelling of the watercraft. The flap 100 acts on said flow causing a lowering of the dynamic pressure of the flow at the propeller 2. In such a way, the propeller itself operates at a lower pressure, more similar to the normal working condition partially submerged, with a higher efficiency.

[0068] Further, the flap 100, being totally or partially submerged, generates a lift with respect to the rotation centre C of the watercraft S, located substantially in the middle between stern and stem. The distance between the flap 100 and said rotation centre, with the lift of the flap 100, results in a torque whose entity is relevant considering the width of the lever arm. Such torque opposes the forces mainly acting at the stem and results in a rotation of the watercraft, i.e. a lowering of the stem P with respect to the buoyancy line.

[0069] Hence, this rotation has the effect of promoting the planing, decreasing the longitudinal trim angle and hence the resistance of the hull through the transition to the planing.

[0070] Moreover, the wake wave generated by the watercraft and raising back near the propeller 2, at least when the watercraft moves at a speed lower than the rated one, is substantially deflected and lowered just at the propeller itself, improving the operation efficiency thereof.

[0071] Experimental tests permitted to note that the total efficiency of the propeller, i.e. the ratio between the driving power actually transmitted to the water and actually exploited, and the power at the drive shaft is sub-

stantially improved at low speeds.

[0072] Further, it is understood that, at speeds lower than the rated speed, the position of the drive shaft and therefore the position of the flap 100 can be varied for exploiting its lift.

[0073] Therefore, to promote the planing it can be possible to lower the drive shaft and the flap 100. At high speed, the flap 100 may be raised in order to not interfere with the wake wave W.

[0074] In the same way, the position of the flap 100 may be modified according to the load conditions of the watercraft, influencing the buoyancy line.

[0075] Similar variations may be adopted in the reverse motion or in a deceleration phase of the watercraft.

[0076] With reference to figure 6C, the watercraft is depicted moving at a rated cruise speed. It is planing with the propeller 2 operating partially submerged.

[0077] In this configuration, the wake wave W is located at a certain distance from the transom T, so as to not interfere with the propeller 2, and the flap 2 is in a position substantially corresponding to the propeller immersion line, without affecting the wake and even helping to maintain the transom and the propeller 2 in the correct configuration.

[0078] To the above-described marine drive system a person skilled in the art, in order to satisfy further and contingent needs, could effect several further modifications and variants, all however encompassed in the protective scope of the present invention, as defined by the appended claims.

Claims

1. Partially submerged propeller drive system (1), of the kind having a partially submerged propeller placed at the transom (T) of a watercraft provided with one or more propellers (2) mounted at the lower part of the transom (T) of a watercraft (S), with the drive shaft projecting astern, comprising, at each drive shaft, a flap (100) between the transom (T) and the propeller (2), positioned so as to intercept the wake wave (W), i.e. in the transitory phase between the watercraft still and the optimal design condition wherein the watercraft (S) moves at a speed lower than the rated speed.

2. System (1) according to the claim 1, wherein the flap (100) has a substantially convex shape.

3. System (1) according to the claim 2, wherein the flap (100) has a top opened concavity, so as to direct bottomwise a V-shaped camber.

4. System (1) (1) according to any of the preceding claims, wherein the flap (100) is positioned just below the drive shaft.

5. System (1) according to any of the preceding claims, wherein the flap (100) is connected to the drive shaft, i.e. to the stern tube (7).

6. System (1) according to the claim 5, comprising means for positioning the drive shaft, acting to control also the position of the flap (100), varying it according to the different condition of motion. **7** System (1) according to any of the preceding claims, wherein the flap (100) is delta-shaped, with the apex (101) directed toward the transom (T) of the watercraft (S).

8. System (1) according to any of the preceding claims, wherein the flap (100) comprises a longitudinal centre region (102), corresponding to the drive shaft section between the propeller (2) and the transom (T), and two half-flap (103), directed so as to result in a top open concavity.

10. System (1) according to any of the preceding claims, wherein the flap (100) has a rear edge (104) directed toward the propeller (2), extending on a width equal or greater 20% of the propeller diameter.

11. System (1) (1) according to the claim 10, wherein the flap (100) has a rear edge (104) directed toward the propeller (2), extending on a width equal or greater 80% of the propeller diameter.

12. System (1) according to any of the preceding claims, comprising means for varying the position and/or the configuration of the flap (100) with respect to the drive shaft.

13. System (1) according to the claim 1, wherein the flap (100) is positioned just above the drive shaft, i.e. the stern tube thereof (7).

14. System (1) according to any of the preceding claims, comprising a shroud (20) positioned above the propeller (2), so as to limit, between it and the horizontal plane surface corresponding to the ideal immersion line (9) of the propeller (2), a channel (23) longitudinally extending and having a cross-section whose area decreases starting from the transom (T).

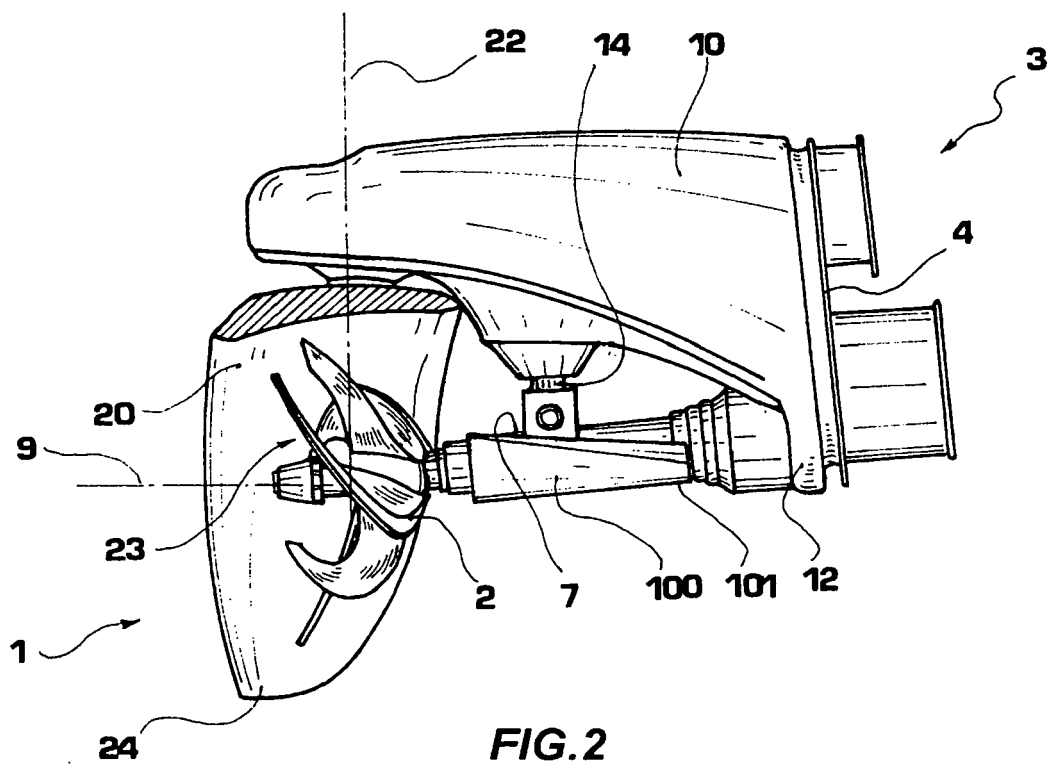
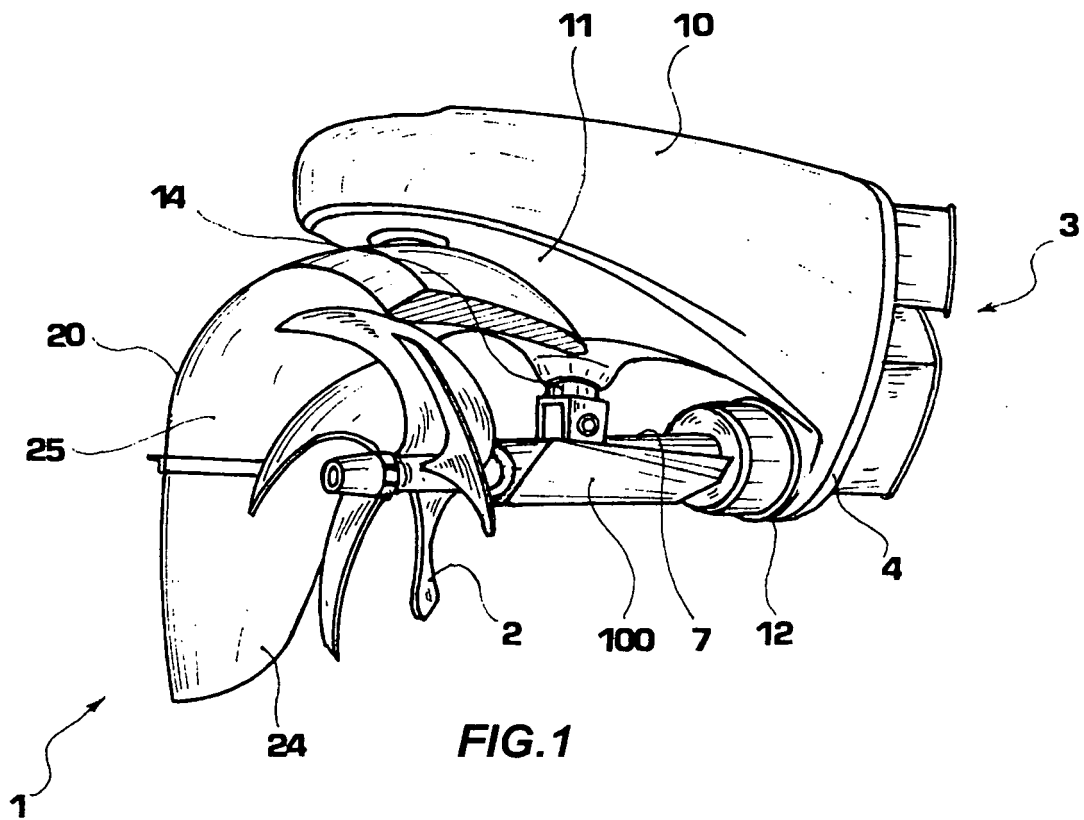
15. System (1) according to any of the preceding claims, comprising a support structure (3) which in turn has a fastening plate (4), apt to be secured to the transom of a watercraft, wherein the mutual position between the fastening plate (4) and the drive shaft of the propeller (2) has been already established in the manufacture plant.

16. System (1) according to any of the preceding claims, comprising a support structure having a fastening plate (4) from which a projecting case (10) extends, overlapping the propeller region, having, at

the region of the propeller, a curved surface (11) shaped so as to gradually direct the propulsive flow of the propeller reverse-driven, below the hull even maintaining a significant horizontal thrust component.

17. System (1) (1) according to the claim 14, wherein the shroud (20) can be rotated around a substantially vertical axis (22).

18. System (1) (1) according to the claim 17, wherein the shroud (20) vertically and laterally extends with a rudder blade (24).



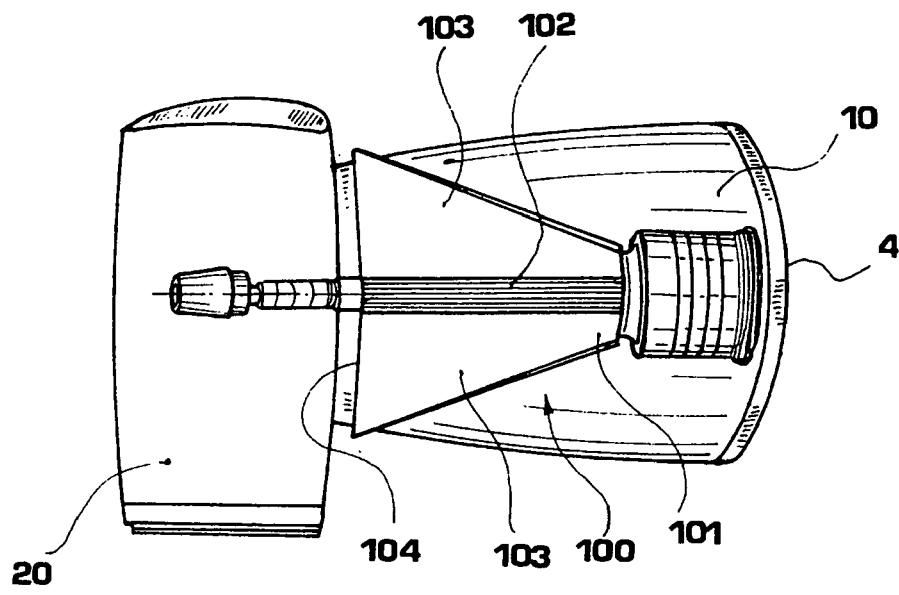


FIG.3

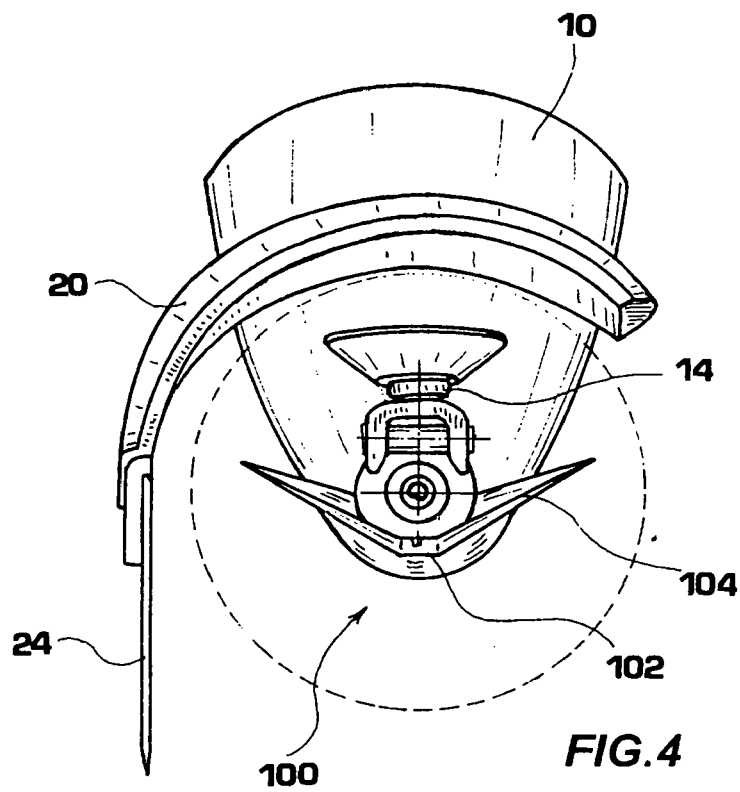


FIG.4

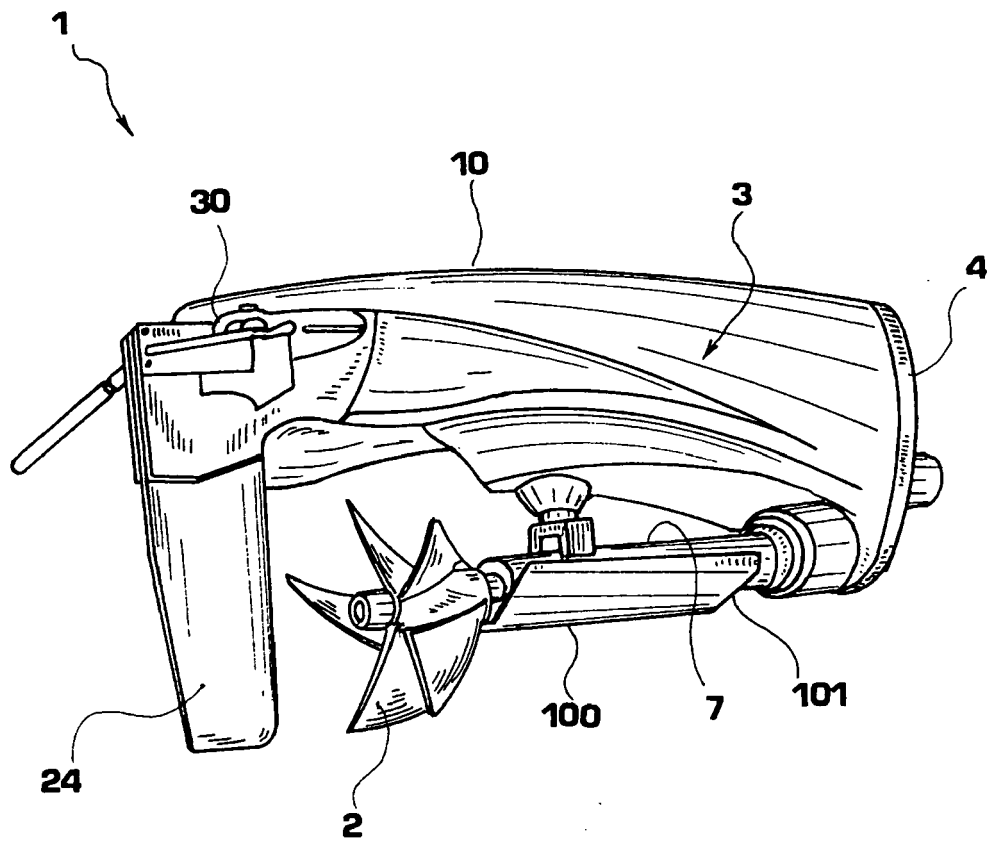


FIG.5

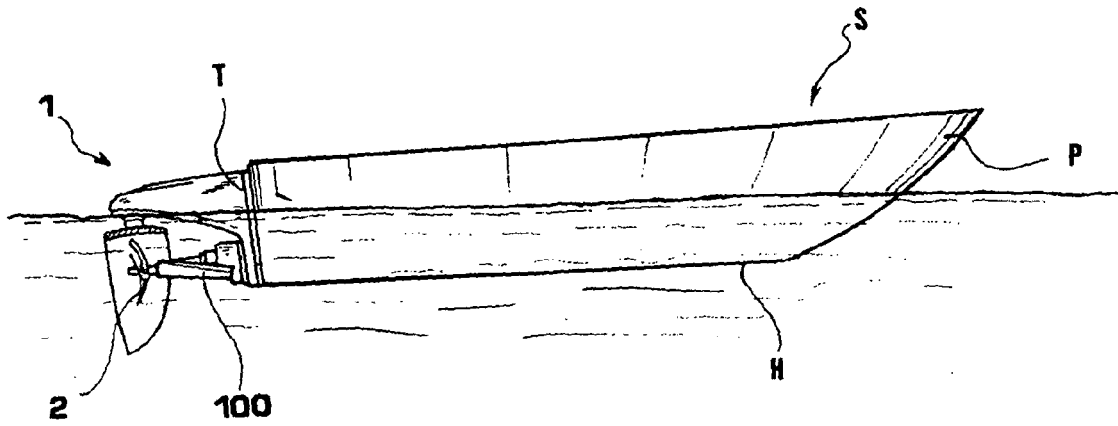


FIG. 6A

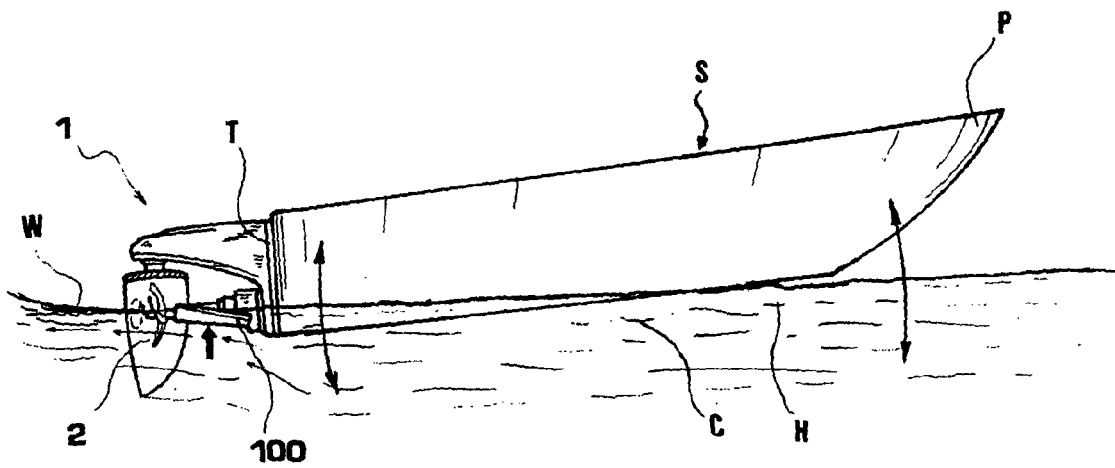


FIG. 6B

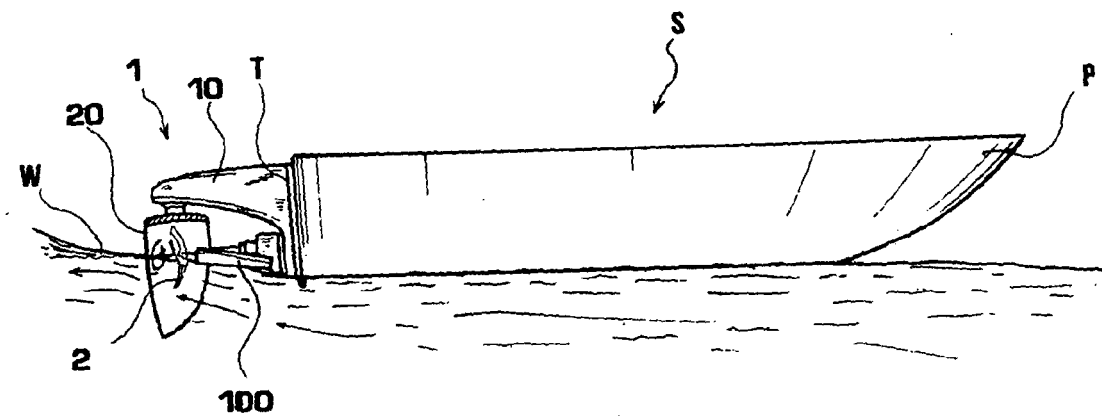


FIG. 6C



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5174

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 793 980 A (SHERMAN P) 26 February 1974 (1974-02-26)	1-5,8, 10-14	INV. B63H1/18
Y	* column 5, line 16 - line 49 * * column 5, line 26 - line 52; figures 1-8 *	16-18	B63H1/16
X	----- US 5 290 182 A (MONDELO J LUIS A [BR]) 1 March 1994 (1994-03-01) * column 3, line 42 - line 58 * * column 4, line 36 - line 47 * * column 5, line 3 - line 11; figures 3,5 *	1,6,7, 10,11,15	
X	----- US 1 553 160 A (ALBERT HICKMAN WILLIAM) 8 September 1925 (1925-09-08) * the whole document *	1-4,8,10	
Y	----- WO 92/06000 A (LEVI RENATO LTD [GB]) 16 April 1992 (1992-04-16) * page 11, paragraph 2; figures 1-10 *	16-18	
			TECHNICAL FIELDS SEARCHED (IPC)
			B63H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 August 2007	Examiner DE SENA HERNANDORENA
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5174

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-08-2007

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3793980	A	26-02-1974	NONE		

US 5290182	A	01-03-1994	NONE		

US 1553160	A	08-09-1925	NONE		

WO 9206000	A	16-04-1992	AU	8644791 A	28-04-1992
			GB	2248433 A	08-04-1992

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT 1184406 [0002]
- WO 9206000 A [0002]
- WO 9640550 A [0002]