United States Patent

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[54] **COMBINED CARRYING AND DRIVING DEVICE FOR WATERCRAFTS**
1 Claim, 3 Drawing Figs.

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[51] Int. Cl. B63h 5/02
[50] Field of Search 170/141, 142; 416/84, 85, 86, 58, 237

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ABSTRACT: A marine craft having frame means and rotary means rotatably supported on the frame means for propelling and providing the sole buoyant support for the marine craft. The rotary means includes a plurality of rotatable drumlike members having a plurality of outwardly extending vanes. The vanes have a volume adjacent the outer ends thereof substantially greater than the volume of the vanes adjacent the inner ends thereof whereby the vanes thus provide maximum buoyancy while permitting propulsion of the vehicle when disposed in water.

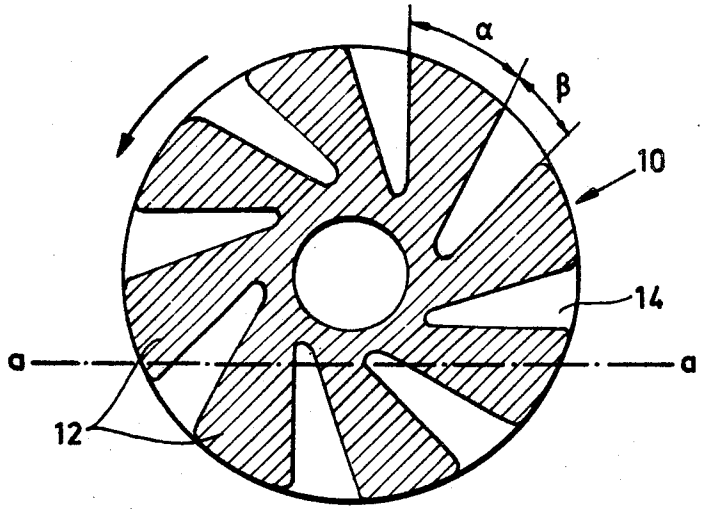

Fig. 3

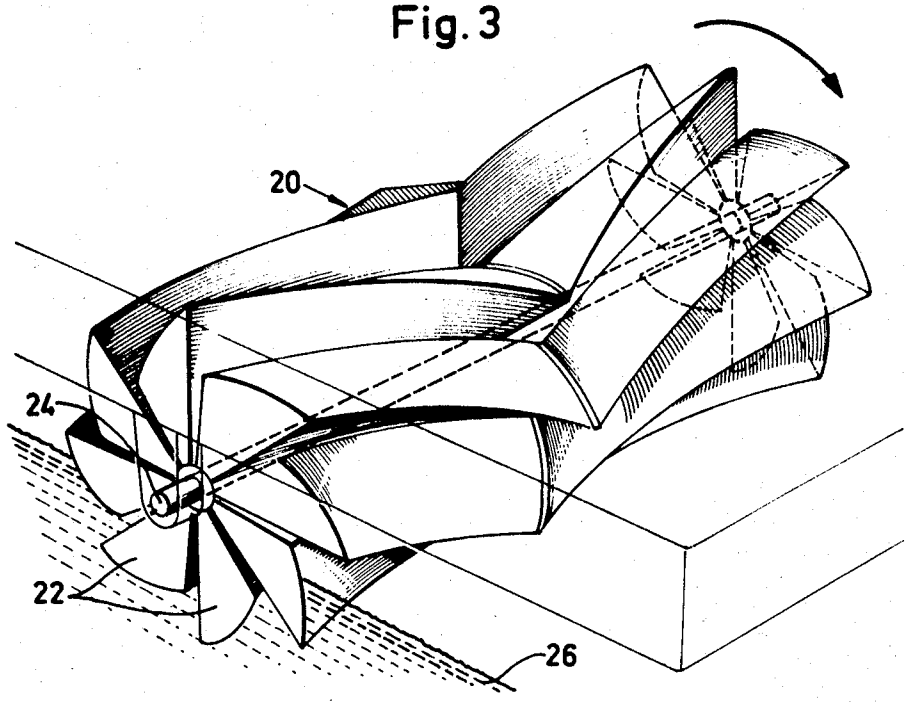

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Fig.1

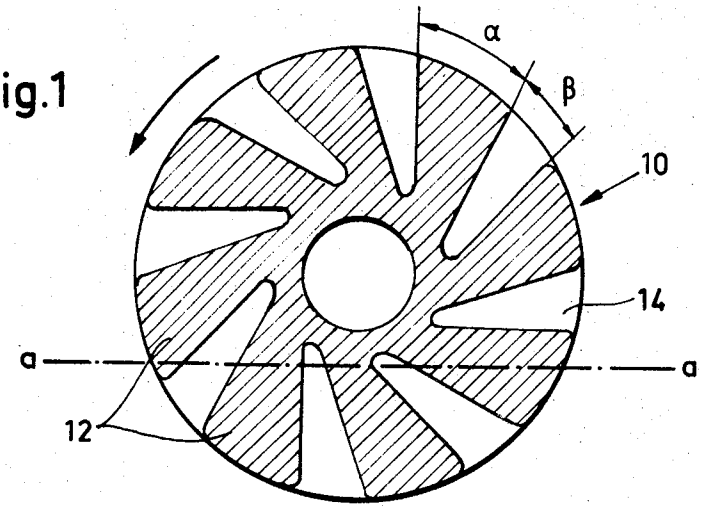
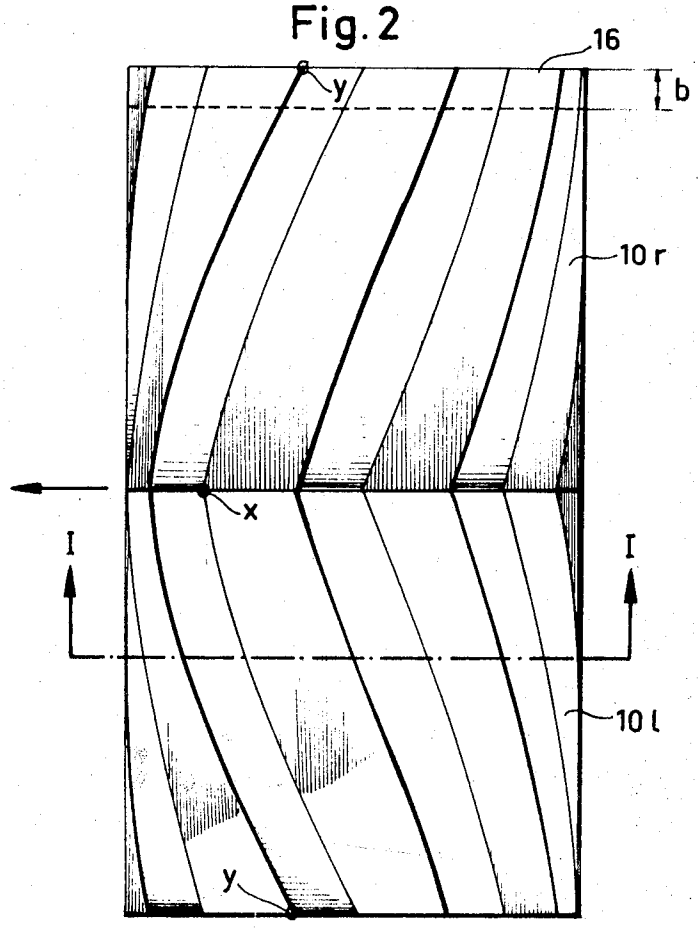


Fig. 2



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COMBINED CARRYING AND DRIVING DEVICE FOR WATERCRAFTS

The present invention considers marine craft of different types and relates to a combined support and propulsion device for such craft.

Conventional craft, such as boats and vessels of different types, always exhibit as is known different means of maintaining the buoyancy and propelling such craft. A conventional boat is provided with a buoyant hull and is propelled by a special motive power plant, preferably a propeller and engine aggregate. However, in later years development has brought about the support system, by this is meant that the support plane system has been introduced, which during travel exerts a dynamic lifting force on craft. A separate motive power plant is, however, still used.

The object of the present invention is to provide support elements for a marine craft, these support elements simultaneously acting as propulsion and steering means. These elements may suitably be designed as "driving displacement wheels" or "supporting vaned wheels" of the type described in the accompanying description. By utilizing such an arrangement, the great advantage of substantially reducing the friction losses caused by the movement of the craft through the water is achieved. This is due to the lack of any static, supporting hull or displacing body, no rudder, which is driven under friction or drawn through the water by, for example, a propeller. The object of the invention and certain advantages, as given in the following description, in relation to effective propulsion are achieved by a device according to the present invention.

The invention will be more closely described in an explanatory manner referring to the appended drawings, of which

FIG. 1 is a cross section through a supporting vaned wheel according to the invention, the section having been drawn along the line I–I in FIG. 2.

FIG. 2 is a plan view of the vaned wheel according to FIG. 1 whilst FIG. 3 is a view in perspective of a vaned drum according to the invention intended for higher revolutions than the vaned wheel according to FIGS. 1 and 2.

The supporting vaned wheel **10** shown in FIGS. 1 and 2 is designed as a fairly long roll or roller, in this case comprised of eight longitudinal, helical vanes **12** commencing from a hub **14**. The vanes may be hollow and consist of a thin, metal sheet shell suitably reinforced internally, or they may also be produced from expanded plastic, for example polyester foam, and covered in a suitable manner, with for example a glass fiber fabric. Using this method each vane will have a certain buoyancy, and if a number of vaned wheels or rollers **10** are mounted on the underside of a boat or other vessel the vessel can be maintained entirely buoyant on the rollers, or more closely defined on the vanes fitted on the rollers. For this purpose the roller system must be so dimensioned that the depth of immersion does not exceed the radial height of the vane from the hub **14** to the outer cover, see FIG. 1, where the water surface *a–a* for the greatest depth of immersion is marked.

The cross-sectional shape of the vanes or profile has been designed giving consideration to the hydrostatic and hydrodynamic conditions in relation to the desired speed of the craft in question, the displacement, utilization, etc. Special attention must be given to the design of the vane and profile with consideration being afforded to the water flow about the profile during motion. However, the profile itself is a hydrodynamic problem, which falls outside the scope of this invention and will not, therefore, be discussed more closely. Taking into consideration the profile form exemplified in FIG. 1, the only special feature for longitudinal vaned wheels or rollers is that it can be advantageous to design the profile, so that the greatest portion possible of the enclosed surface of the profile is positioned adjacent to the periphery of the wheel, signifying that the vane, even when the depth of immersion is small, has a fairly large buoyancy, and that in general the displacement of the vaned wheel has been made as large as possible. As is disclosed by the figure the vanes **12** diverge radially outward at an angle α and the vane intermediate spaces **14** diverges at an angle β, in such a manner that each vane at its extreme end is provided with a portion of a fairly large volume and thereby large buoyancy. However, other vane designs, e.g., with rounded or pointed ends, are also suitable in certain cases and the invention in this context is not limited to any definite form of profile.

As has been previously mentioned and as is apparent in FIG. 2, the vanes are helically formed in a longitudinal direction. Hereby, the object is in the first place to achieve substantially similar buoyancy along the whole of the length of the vaned wheel, for this purpose the pitch of the helix need only be such that the profiles of two adjacent vanes and the ends of the wheels overlap each other, i.e., the foremost point in the direction of rotation on a vane marked *x* in FIG. 2 must extend beyond the rearmost point marked *y* positioned on the rear edge of the forward vane at the ends of the wheel.

It is apparent from the helical form, see FIG. 2, that each vaned wheel **10** must comprise two halves **10***r* and **10**L the vanes being arranged with opposite pitches. The motivation for this is of course that the wheel would otherwise tend to exert a force toward the side during motion and not act in a forward direction. Thus, a vaned wheel assembled in this manner acquires an appearance similar to a herringbone toothed wheel, and the question of whether the wheel should be designed or fitted in such a manner that it rotates with the points of the vanes (of which one is marked by *x*), i.e., that part of the vane which moves first in the direction of rotation, being situated in the center of the wheel as is apparent in the drawings, or at the ends of the wheel or end walls, must be decided according to the circumstances. In the first-mentioned case, that part of a vane intermediate space **14** which lies in the center of the wheel **10** will be the first part to enter the water during rotation of the wheel, and a continuous water flow is initiated in the intermediate space from the center of the wheel toward the ends. In the second case, the portions of the intermediate spaces at the ends of the wheel will enter the water first, and a flow will be initiated from each end toward the center, where both the flows will meet. In this case, the result will be that the vaned wheel will acquire a less active grip on the surface of the water, which can be an advantage in certain cases. Finally, in this connection, it is pointed out that the two wheel portions with opposite pitches need not, of course, be united with each other but can be arranged with intermediate spaces on the same shaft; the essential point being that the traction exerted by the two wheels toward the side should be equalized to a motion with a forward direction. In the case where the wheel portions are separate it is possible, especially with watercraft, to drive them at different speeds and thereby create steering forces. Such steering forces are otherwise obtained by one or more vaned wheels being mounted rotatably in the horizontal plane.

In the embodiment where the vaned wheel is produced from expanded plastic the wheel can suitably be comprised of laminations **16** with the width *b*, these being shaped with the desired helical pitch and in the plane exhibit the desired vane profile, therefore a series of vanes with left-hand and right-hand pitches being required. Subsequently, the laminations are bonded together with a certain displacement between laminations corresponding to the helical pitch, following which the finished wheel is covered with glass fiber fabric or the like. Using this method, a vaned wheel with a suitable length can be produced from case to case. As an example of the buoyancy which can be achieved, a wheel produced from expanded plastic and with a diameter of 1 meter and with the cross-sectional profile shown in FIG. 1, gives at maximum immersion according to the level line *a–a* a buoyancy of the order of 100 kp per meter length.

It is of the greatest importance when constructing craft and utilizing the combined support and propulsion device according to the invention, that the only contact the craft makes with

the water is effected by the support and propulsion elements included in the device. Each surface moistened by the water must support and be included in the motive system simultaneously. Therefore, no unnecessary drag friction must be produced by parts which are drawn through the water. This signifies that a vaned wheel according to the invention, e.g., see FIG. 1, should not be loaded so that it obtains greater immersion that marked by the level line *a–a*, and thus the water should not rise above the hub. Due to the craft being entirely supported by movable elements in this manner, which are immersed in the water during simultaneous propulsion, the craft will move especially easily on the water and can be said to "follow" the surface of the water with a high degree of propulsive effectivity.

In FIG. 3, a perspective view illustrates a further embodiment of the device according to the invention. This has the form of a fairly long vaned wheel **20**, and in this case preferably named a vaned drum, the drum being provided with eight herringbone vanes **22**, commencing from a hub **24** with a fairly small diameter. The drum **20** is designed to run more quickly than the wheel **10** according to FIGS. **1** and **2**, and the cross-sectional profile of the vanes, therefore, is designed with a form which is more "penetrating" but with the wider portions of the cross-sectional profile still situated fairly close to the periphery of the drum. Due to the small diameter hub, the vaned drum **20** has a fairly deep immersion, as may be noticed from the water mass **26**, in which the vanes of the drum are immersed. Even in this case, the roll can be divided at the transition between the portions with the left-hand and right-hand pitches, it being possible to arrange a center bearing with a propulsive coupling. For practical application a number of vaned drums **20** may be mounted with suitable mountings on the underside of a marine craft and connected to a motive power source.

The vaned wheels or drums described above can be produced with end discs to advantage, i.e., circular plates which are fitted at the ends of the drums at right angles to the shaft of the drum, in order to seal the intermediate spaces between the vanes. By so doing, the air in the intermediate space between two vanes, when they are immersed in the water, is sealed in between the vanes and the end discs, and thereby increases the lift or support force obtained. Vaned wheels or drums are distinguished by a rapid acceleration and an even and smooth motion. However, it is pointed out that the invention is in no way limited to the embodiments which have been shown and described in the exemplified object, but that within the scope of the invention as set forth in the appended claims, a plurality of variants and modifications are possible, all being based on the fundamental principle.

I claim:

1. An improved marine craft, comprising frame means and rotary means rotatably supported on said frame means for (1) propelling said marine craft and (2) providing the sole buoyant support for said marine craft, said rotary means including a plurality of rotatable drumlike members constructed of a buoyant plastic material and having a plurality of outwardly extending vanes of helical configuration, each vane includes two similar parts of opposite pitch, said vanes having a circumferential cross section and volume adjacent the outer ends thereof substantially greater than the respective cross section and volume of the vanes adjacent the inner ends thereof whereby the vanes thus provide maximum buoyancy while simultaneously permitting propulsion of the vehicle when disposed in water.