April 4, 1967 F. T. IRGENS 3,312,286

SURFACE PROPELLER

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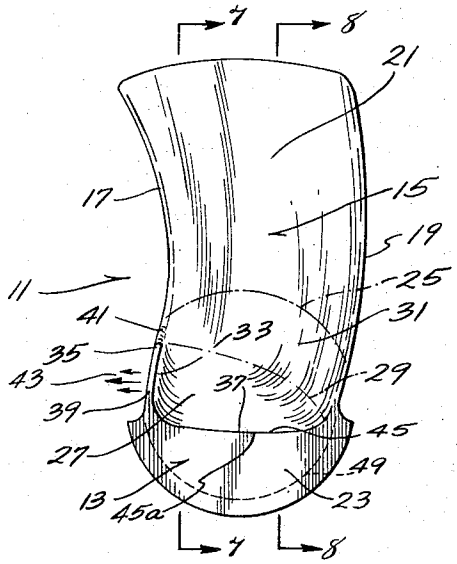


Fig. 1

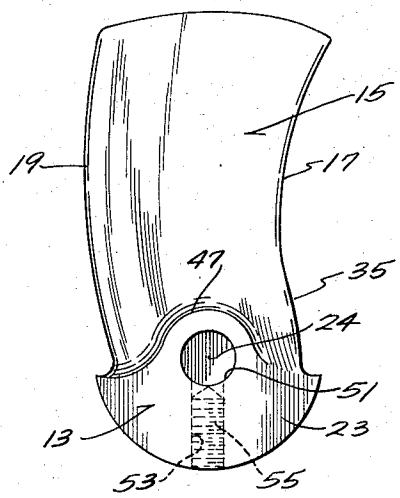


Fig. 3

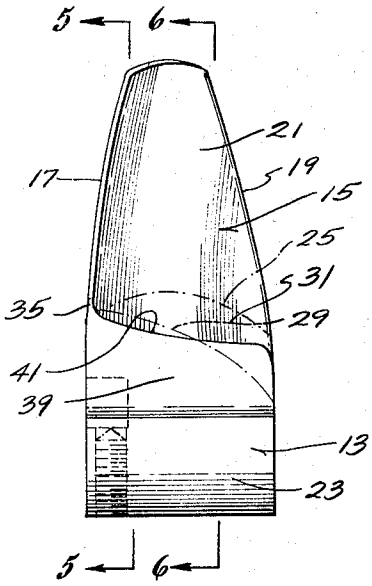


Fig. 2

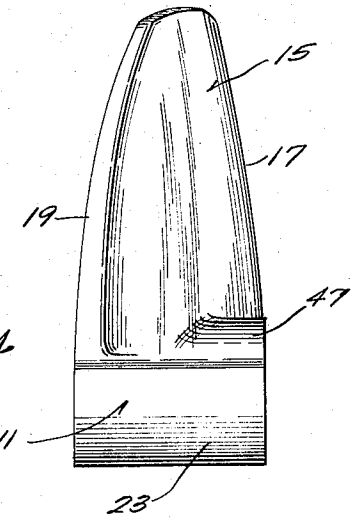


Fig. 4

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SURFACE PROPELLER

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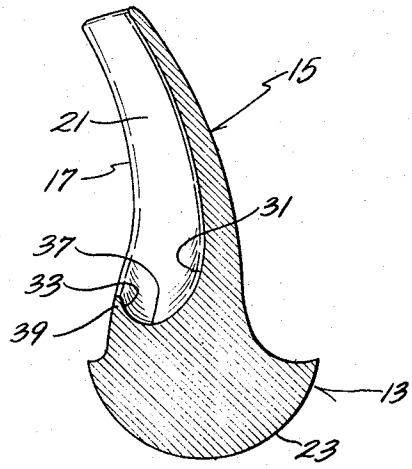


Fig. 5

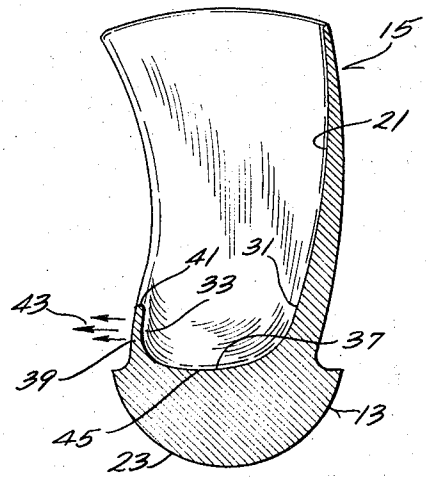
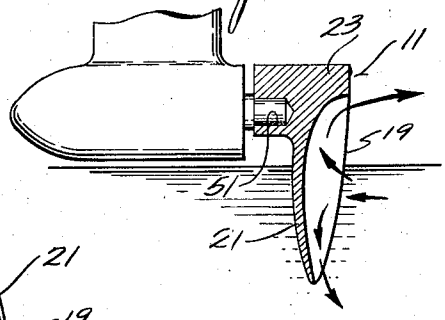


Fig. 6

Fig. 9



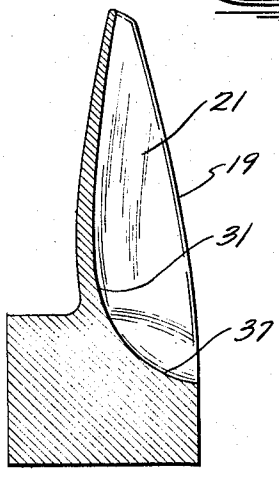
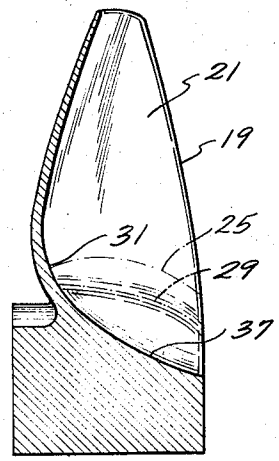


Fig. 8

Fig. 7



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SURFACE PROPELLER

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7 Claims. (Cl. 170—159)

The invention relates generally to propellers. More particularly, the invention relates primarily to surface propellers.

Propellers, including surface propellers, have been commonly manufactured in the past with a generally cylindrical hub and one or more blades extending radially outwardly from the cylindrical outer surface of the hub. As is known, any force or pressure applied to a fluid is, in general, transmitted in all direction through the fluid. Thus, during rotation of such propellers, the pitch of the blade operating in the water tends to displace the water rearwardly, radially outwardly and rearwardly, and radially outwardly and rearwardly in a spiral path. The formation of such propeller hubs and the base of the blade has, in the past, generally precluded utilization of any tendency of the water to move radially inwardly for the purpose of providing forward thrust.

The principal object of the invention is, therefore, the provision of a propeller, and particularly a surface propeller, which is so constructed as to afford radially inward and then rearward movement of water from the base of a propeller blade. In the case of a surface propeller in which the hub is generally located, during operation, above the water level, the water moving radially inwardly toward the hub, i.e., upwardly is redirected rearwardly and discharged above the normal water level to provide increased water thrust.

In accordance with the invention there is provided a propeller having a hub, a blade extending from the hub, and means defining a pocket adjacent to the base of the propeller blade for receiving, in response to rotation of the propeller, radially inwardly directed water and directing said radially inwardly arriving water rearwardly so as to utilize the radially inwardly directed water to obtain increased thrust.

The increased forward thrust obtained by a propeller constructed in accordance with the invention has particular significance in connection with single bladed surface propellers which can be constructed with blades having a relatively flat pitch, i.e., for instance, one-half the pitch of a two-blade propeller, and which can therefore be rotated at twice the normal speed. Thus, increased amounts of thrust can be obtained twice for a given time interval by using a single-bladed surface propeller which is constructed in accordance with the invention and rotated twice as fast as usual.

Directing water rearwardly into the area traversed by the boat, in addition to the beneficial effect of providing increased forward thrust, also advantageously serves, in submerged propellers, to reduce or eliminate the low pressure condition previously found rearwardly of the hub.

Other objects and advantages of the invention will become known by reference to the following description and the accompanying drawings in which:

FIGURE 1 is a rearward end elevational view of a single bladed surface propeller embodying various features of the invention;

FIGURE 2 is a side elevational view of the propeller shown in FIGURE 1;

FIGURE 3 is a front elevational view of the propeller shown in FIGURE 1;

FIGURE 4 is a side elevational view of the propeller shown in FIGURE 1, taken from the opposite side as compared to FIGURE 2;

FIGURE 5 is a sectional view taken along line 5—5 of FIGURE 2;

FIGURE 6 is a sectional view taken along line 6—6 of FIGURE 2;

FIGURE 7 is a sectional view taken along line 7—7 of FIGURE 1;

FIGURE 8 is a sectional view taken along line 8—8 of FIGURE 1; and

FIGURE 9 is a side elevational view partially in section, showing the operation of a surface propeller constructed in accordance with the invention.

Shown in FIGURES 1 through 9 is a single bladed surface propeller 11 which embodies various of the features of the invention and which is illustrative of one form in accordance with the invention. The propeller 11 includes a hub 13 and a blade 15 which extends from the hub 13 and includes leading and trailing edges 17 and 19 respectively at the opposed margins of a blade surface 21. More specifically, the blade surface 21 extends arcuately between the leading and trailing edges 17 and 19 and arcuately radially outwardly from the hub 13.

The hub includes a portion 23 which is diametrically opposed from the blade 15 and which is generally of partial cylindrical formation having a radius extending from the intended axis 24 of rotation. The form and pitch of the blade surface 21 are not a specific part of the invention so long as the surface 21 has an appropriate pitch for developing forward thrust. The blade 15 can be considered as extending from the hub frame 13 along an imaginary base line 25 (see FIGURES 1 and 2), which, except for a pocket 27 to be described, would constitute the intersection or juncture of the arcuate blade 15 and a hub of cylindrical form of radius equal to the radius of portion 23.

In accordance with the invention, the propeller 11 is constructed to utilize radially inwardly directed water pressure to obtain forward thrust by affording streamlined curvilinearly radially inwardly and rearwardly flow from approximately the base line 25. Such flow is afforded by the formation of a rearwardly open scoop, bucket or pocket 27 which is disposed at least partially radially inwardly of the base line 25 and at least partially in the hub 13.

The extent to which the pocket 27 extends into the hub 13 is determined, at least in part, by the number of blades supported from the hub 13 and by the diameter of the hub. As there is only a single blade 15 in the illustrated construction, the pocket 27 extends inwardly of the hub 13 to the other side of the center line or axis 24 of the hub 13.

The extent to which the pocket extends into the blade, i.e., modifies the normal pitch contour of the blade surface 21, also depends in part upon the number of blades in the propeller and on the diameter of the hub. In a propeller having multi blades and a hub size which is relatively small as compared to the blade size, it is possible that a pocket might be formed, in part, from a portion or a part of the blade having a contour other than on pitch. However, in the illustrated construction, due to the presence of only the single blade 15 and a relatively large hub 13 as compared to the blade size, the pocket 27 does not extend into the blade 15. More specifically, in the disclosed construction, the pitch contour of the blade surface 21 is extended radially inwardly of the base line 25 to ap-

proximately the line 29 (see FIG. 2), as if the blade were mounted on a hub having a rearwardly converging taper.

The pocket 27 is defined in the illustrated construction by three surfaces, i.e., a first surface 31 which constitutes an extension of the pitch contour of the blade surface 21 and lies radially outwardly of the line 29, a barrier surface 33 which is spaced from the surface 31 and which extends primarily fore and aft in a plane approximately parallel to a plane extending generally parallel to the propeller axis 24 and containing the radially innermost portion 35 of the leading edge 17 of the blade 15, and a curved central surface 37 which connects the two surfaces 31 and 33 and which is formed by radii which gradually increase rearwardly.

The surface 31 has already been described.

The barrier surface 33 constitutes one face of a wall or lip 39 which extends from the hub 13 in a direction primarily fore and aft, as already noted, and which is bounded, at least in part, by an edge 41 extending rearwardly from the leading edge portion 35 in approximately parallel relation to the axis 24 of hub rotation. The surface 33 constitutes a barrier, acting in a similar manner to the rearward portion of the surface 31 to confine water flow rearwardly rather than radially outwardly in directions generally at right angles to the axis of rotation, i.e., to prevent water flow in the directions indicated by the arrows 43 in FIGURES 1 and 7.

The central or connecting surface 37 is curved along its margins adjacent to the surfaces 31 and 33 as indicated in FIGURES 1 and 5 through 7 so as to redirect rearwardly radially inwardly directed water flow. Adjacent the leading portion of the blade, the arcuate margins of the surface 39 merge into one curve or relatively acute radius. As the connecting surface 37 progresses rearwardly, however, the connecting surface 37 includes a central portion 45 which has a progressively increasing radius. Adjacent to the rearward end, the central portion 45 includes a generally flat segment 45*a*.

As shown particularly in FIGURES 3 and 4, in order to apportion the mass of the hub so as to afford mass distribution such that the propeller is radially balanced about the rotational axis 24, the longitudinally extending half portion 47 (see FIGURES 3 and 4) of the hub 13 on the blade side at the forward end is materially smaller than the longitudinally extending half or portion 23 of the hub which is remote from the blade and which is generally of partial cylindrical form from front to rear. If desired, the mass of the hub could also be reduced by diminishing the diameter of the rearward part of the hub without otherwise affecting the shape of the blade 13 and pocket 27, as shown by the dotted line 49 in FIGURE 1. Additional weighting could be provided by inserts of material of greater density. However, the additional size of the hub portion or half 23 remote from the blade 15 is believed to be desirable from the standpoint of affording added strength at the base of the wall 39 defining the barrier surface 33 and at the base of the trailing edge 19 of the blade 15.

Any suitable arrangement can be provided for connecting the propeller 11 to a propeller shaft. In the disclosed construction as shown in FIGURE 3, there is provided an axial bore 51 for receiving a propeller shaft, together with a radial bore 53 which communicates with the axial bore 51, and includes a set screw 55 operable to fix the propeller on the propeller shaft. Any other suitable means can be employed for attaching the propeller to the propeller shaft.

While the invention has particular utility with respect to surface propellers which are commonly used in racing, i.e. to propellers which are submerged only partially in water during operation, the invention also is applicable to propellers which are intended for wholly or substantially wholly submerged use in water. Moreover, while a single-bladed propeller has been disclosed, it is to be understood that the invention can also be adapted for use in multi-bladed propellers.

Various of the features of the invention are set forth in the following claims:

What is claimed is:

1. A propeller comprising a hub having an axis of intended rotation, a blade extending from said hub, means defining a pocket located at least in one of said hub and said blade adjacent to the juncture of said blade and said hub, said pocket being open rearwardly and radially outwardly in the direction of said blade and being defined, in part, by a first surface which merges with said blade, a second surface extending fore and aft in approximately parallel relation to the intended axis of hub rotation, and a connecting surface joining said first surface and said second surface.

2. A propeller in accordance with claim 1 wherein said blade includes an edge which leads in the direction of rotation and which extends from a forward part of said propeller hub, an edge which trails said leading edge in the direction of rotation and which extends from a rearward part of said propeller hub, and a surface extending arcuately between said leading and trailing edges and arcuately radially outwardly from said hub, and wherein said surface first mentioned comprises a continuation of said blade surface.

3. A propeller comprising a hub having an axis of intended rotation, a blade extending from said hub, means defining a pocket located at least in one of said hub and said blade adjacent to the juncture of said blade and said hub, said pocket being open rearwardly and radially outwardly in the direction of said blade and being defined, in part, by a first surface which merges with said blade, said pocket extending within said hub on the side of said axis remote from said blade.

4. A propeller in accordance with claim 1, said blade including an edge which leads in the direction of rotation and which extends from a forward part of said propeller hub, an edge which trails said leading edge in the direction of rotation and which extends from a rearward part of said propeller hub, and a surface extending arcuately between said leading and trailing edges and arcuately radially outwardly from said hub and wherein said hub includes a portion located remotely from said blade with respect to said axis and which is partially cylindrical in shape and has a radius greater than the radius distance from said axis to the radially innermost portions of said leading and trailing edges.

5. A propeller in accordance with claim 4 wherein said hub includes in forwardly adjacent relation to said blade a partially cylindrical portion with a diameter less than said partially cylindrical portion of said hub remote from said blade.

6. A surface propeller comprising a hub having an axis of intended rotation, a single blade extending from said hub and having an edge which leads in the direction of rotation and which extends from a forward part of said propeller hub, an edge which trails said leading edge in the direction of rotation and which extends from a rearward part of said propeller hub, and a relatively flat blade surface extending arcuately between said leading and trailing edges and arcuately radially outwardly from said hub, and means defining a pocket in said hub adjacent to said blade, said pocket being rearwardly open and being defined, in part, by a first surface which is concavely shaped and merges with said blade surface, a second surface which is located in approximately parallel relation to the intended axis of hub rotation and which is bounded by an edge extending rearwardly from said leading edge, and a third surface smoothly connecting said first and second surfaces and including a rearwardly located generally flat central portion.

7. A propeller in accordance with claim 6 wherein said hub includes a portion located remotely from said blade with respect to said axis and which is partially cylindrical

in shape and has a radius greater than the radius distance from said axis to the radially innermost portions of said leading and trailing edges and wherein said hub includes in forwardly adjacent relation to said blade a partially cylindrical portion with a diameter less than said partially cylindrical portion of said hub remote from said blade.

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