Feb. 10, 1948. H. C. RORDEN 2,435,604

PROPELLER

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FIG. 1

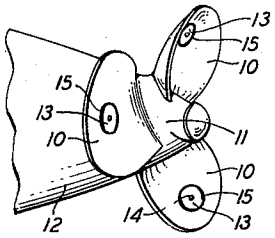

FIG. 2

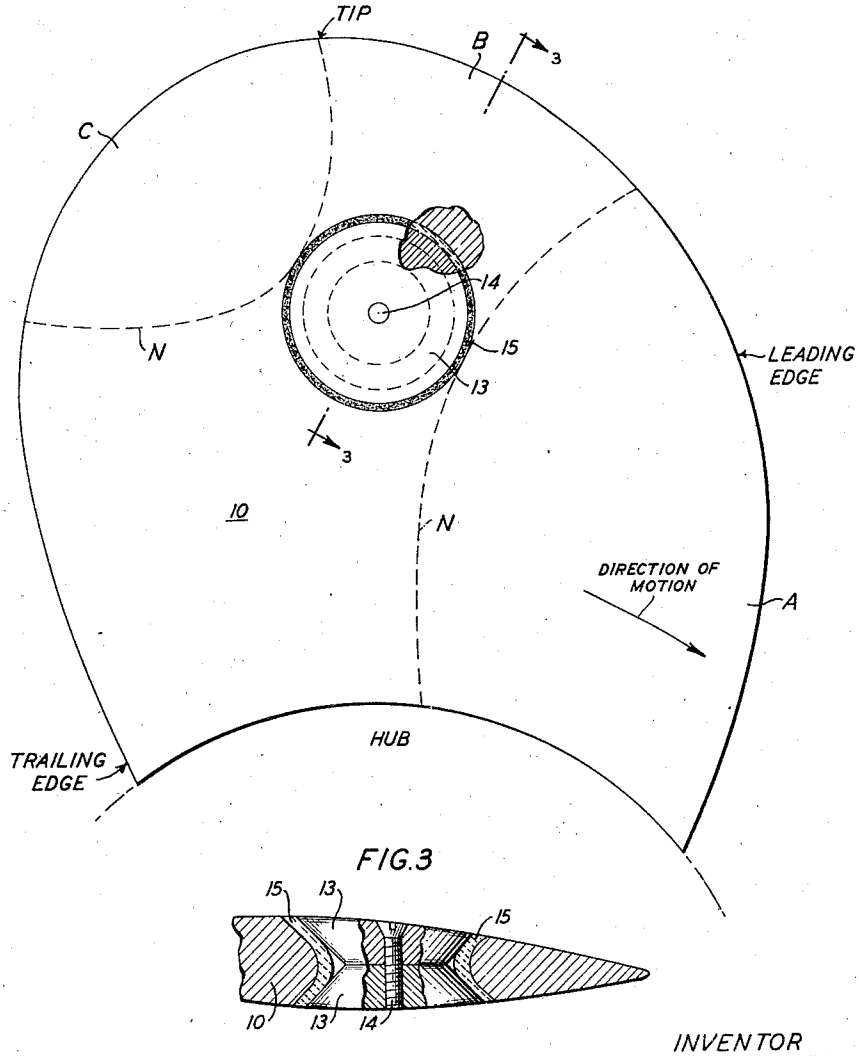

FIG. 3

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PROPELLER

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4 Claims. (Cl. 170—159)

1

This invention relates to propellers and more particularly to marine propellers especially suitable for use on sonically guided torpedoes.

The blades of a propeller, when the propeller is revolving, are subjected to hydrodynamic forces due to the interaction of the blades with the water. As a result of these forces, the blades may be set into vibration to act as generators of signals of frequencies determined largely by the character of the blades considered as vibratory bodies or systems, which signals are maintained by the circulation of water at the blades. Such signals may seriously interfere with or impair the operation of the rudder and elevator control systems of a sonically guided torpedo in that they create disturbances at the detecting hydrophones included in the control systems.

One general object of this invention is to substantially prevent the generation of signals by a marine propeller.

In one illustrative embodiment of this invention, a marine propeller comprises a hub and a group of twisted or screw-type blades secured to the hub.

In accordance with one feature of this invention, vibrational energy dissipating or damping means are provided on the blades to substantially suppress vibrations of the blades. More particularly, in accordance with a specific feature of this invention, each of the blades is provided with an aperture adjacent the principal vibrational nodes thereof and damping elements each composed of a mass member and a highly viscous soft plastic body are inserted in the apertures, the viscous body of each element mounting the associated mass member from the respective blade.

The invention and the afore-noted and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a perspective view of a portion of a torpedo having a propeller constructed in accordance with this invention;

Fig. 2 is a plan view, substantially to scale, of a propeller blade illustrative of one embodiment of this invention, a portion of the blade being broken away to show a part of the damping element; and

Fig. 3 is a view mainly in section along line 3—3 of Fig. 2.

Referring now to the drawing, the propeller illustrated in Fig. 1 comprises three similar twisted or screw-type blades 10, for example of

2

metal, extending from a hub 11 and equally spaced, the hub being mounted rotatably upon the end of the tail section 12 of a torpedo. The peripheral configuration of each blade 10 is as illustrated in Fig. 2 and each blade may taper in section toward the edges thereof as illustrated in Fig. 3.

Each blade can be considered as a vibratory system, the vibrational character of which will be dependent, of course, upon the form and construction of the blade. The vibrating characteristics of any blade can be determined by subjecting the blade submerged in water, to driving forces over a range of frequencies and measuring the vibration of the blade at a plurality of frequencies in this range. For example, the driving forces may be applied to the hub by an actuating element, such as a telephone receiver of suitable construction, having its vibratile element coupled to the hub, and the blade vibration may be measured by a sensitive hydrophone mounted adjacent the blade, whereby the frequency characteristic of the blade is obtained.

The mode of vibration of the blade at its resonance frequency, this frequency being determined from the measurements described above, may be determined by applying driving forces of this frequency to the hub, as by a telephone receiver of suitable construction, and exploring the blade faces with a pick-up element.

For blades of the configuration illustrated in the drawing, it has been found that at the resonant frequency two vibrational nodes exist, these nodes being indicated by the broken lines N in Fig. 2. Maximum vibration of the blade, it has been found, occurs in a region A at the leading edge somewhat nearer the hub than the tip, in a region B at the leading edge near the tip and in a region C at the trailing edge near the tip.

The tendency of the blades to vibrate when the propeller is revolving is substantially reduced in accordance with a feature of this invention, whereby the generation of signals by the propeller is prevented. Specifically, in the construction illustrated in the drawings, each of the blades is provided with an aperture centered on the shortest line connecting the vibrational nodes N and a damping or energy dissipating element is mounted in the aperture. Each damping element, as shown clearly in Fig. 3, comprises a pair of chamfered discs 13 secured together by a screw 14 and having their outer faces conforming to the faces of the blade. The discs, which may be of a metal such as brass, constitute mass members and are held in position in the blade aperture by an an-

nular body 15 of a dissipative material such as a highly viscous soft plastic, for example a thermoplastic cellulose nitrate known commercially as "Pyralin." Advantageously, as illustrated in Fig. 2, each damping element is of a diameter substantially equal to the shortest distance between the nodal lines N.

The damping elements dissipate vibrational energy of the blades and serve to deaden the blades as a whole, considered as vibratory systems.

Although the invention has been disclosed with particular reference to propellers for sonically guided torpedoes, it may be employed in propellers for other devices. For example, it may be utilized in propellers for submarines and ships to substantially reduce generation of submarine tones or signals thereby and thus render the submarines and ships less liable to detection by sonic or supersonic hydrophones. It will be understood that the specific embodiment shown and described is but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A propeller comprising a blade having an opening extending therethrough between the blade faces, said blade having a vibrational node toward the leading edge thereof and a second vibrational node toward the trailing edge thereof, said opening being between the two nodes, a mass member in said opening, and a body of soft, vibrational energy dissipative plastic suspending said mass member in said opening.

2. A propeller comprising a blade having a circular opening extending therethrough between the blade faces, said blade having a vibrational node toward the leading edge thereof and a second vibrational node toward the trailing edge thereof, said opening being between the two nodes, and substantially tangent thereto, a circular mass member in said opening, and an annulus of soft thermoplastic between and in engagement with said mass member and the surrounding wall of said opening, suspending said mass member.

3. A propeller comprising a blade having an opening extending therethrough between the blade faces, said blade having a vibrational node

toward the leading edge thereof and a second vibrational node toward the trailing edge thereof, said opening being between the two nodes, and having its center on the shortest straight line between said nodes and edge portions substantially tangent to said nodes, a mass member in said opening and spaced from the boundary wall thereof, and a body of soft plastic damping material substantially filling the space between said mass member and said wall and suspending said mass member from said blade.

4. A marine propeller comprising a blade having a vibrational node and having also a circular opening extending therethrough adjacent said node, a pair of circular chamfered discs in said opening and coaxial therewith and having their smaller faces in engagement, each of the other faces of said discs conforming to a respective face of said blade, and a ring of soft non-porous material having high vibrational energy dissipative properties, between said discs and the circular bounding wall of said opening, said ring engaging said wall and the chamfered portions of said discs and suspending said dicss in said opening.

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