May 17, 1960 H. KÜTTNER 2,936,729

MARINE PROPULSION MEANS

Filed Nov. 8, 1955

FIG. 1

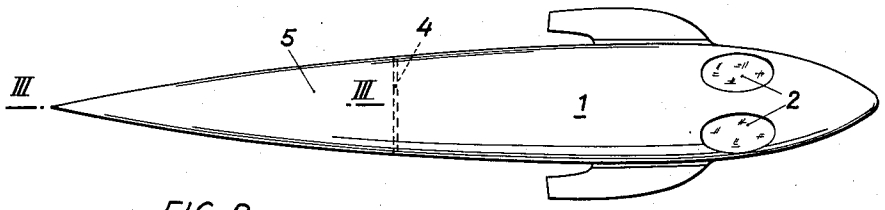


FIG. 2

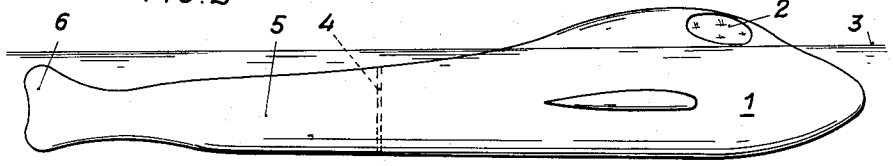


FIG. 3

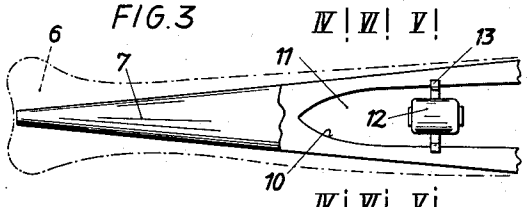


FIG. 4

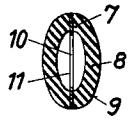


FIG. 5

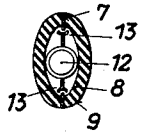


FIG. 7

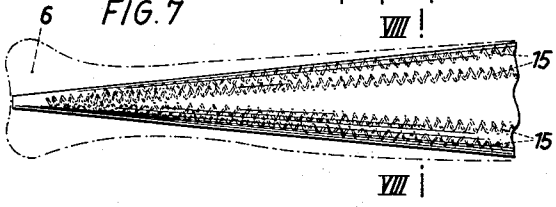


FIG. 8

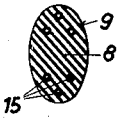


FIG. 6

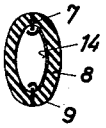


FIG. 9

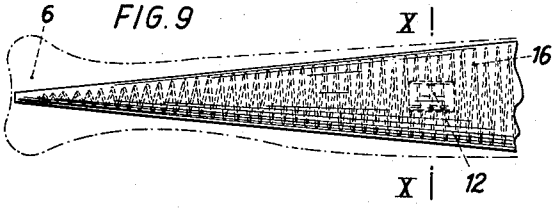


FIG. 10

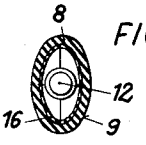


FIG. 8a

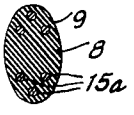
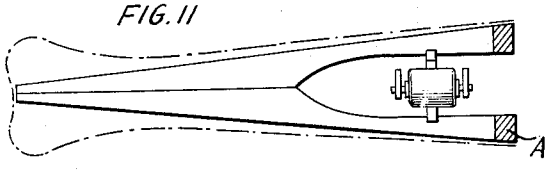


FIG. 11



INVENTOR.

BY

United States Patent Office 2,936,729 Patented May 17, 1960

2,936,729

MARINE PROPULSION MEANS

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Application November 8, 1955, Serial No. 545,651

Claims priority, application Austria November 18, 1954

7 Claims. (Cl. 115—28)

In ships of the usual construction, which are driven either by paddle wheels fitted to the side of the hull or by screws mounted at the stern of the hull, the comparatively big wash forms a considerable component of the resistance to motion. The wash is directed against the direction of motion and acts at the rear portion of the hull i.e. between the point of its largest cross-section and the stern. The effect of the suction force of the wash cannot be materially reduced by appropriately shaping the hull and is caused by the immersed hull which, during motion, tends to move its rear portion away from the water. Since the suction force of the wash increases approximately as the square of the velocity of the ship, it prevents an increase in velocity beyond a certain limit, particularly in submarines and the like.

The invention is based on appreciation of the fact that these disadvantages can be avoided and a considerable increase in velocity can be attained without over dimensioning the motive system if the swinging stern of the ship itself is made in one piece from an elastic material such as rubber and/or has at least one elastic longitudinal member extending throughout its entire length, so that the stern forms an even continuation on all sides of the substantially inflexible remaining portion of the hull, at least under the water line. The longitudinal member can be an extending leaf spring, e.g. a central steel plate, or an ash wood spring. In principle, the elastic stern of the invention acts as does the tail fin of a fish. The efficiency of such a drive is better than that of the usual ship constructions, as evidenced by comparing the high velocities of small fish.

Ships having pliable fins attached to the stern of the hull and which are oscillated by means of a lever, are known, but in these ships, which were mainly used as toys, the pliable tails were made of transverse members and were relatively little elastic. With transverse members special steps must be taken to seal the individual members with one another. The members have to overlap partly or a folding bellows must be provided between them. This necessarily results in an uneven surface which causes the oscillating action of the tail members to be unharmonic. In other known ships only the rudder or a separately attached fin, but not the stern, is formed elastically. Rudders or fins always have a very small thickness. Thus, strong eddies are created and the efficiency is low. According to the invention, however, a smooth, uninterrupted outer surface and an even course of the stern are ensured, which closely resembles the example set by nature and results in an improved efficiency.

Several embodiments of the invention are illustrated in the drawings, wherein Figures 1 and 2 are a plan and side elevation of a speed boat; Fig. 3 is a longitudinal section along line III—III in Figure 1; Figures 4, 5 and 6 are sections along lines IV, V and VI in Fig. 3; Figs. 7 and 8 show modifications of the elastic tail having several springy longitudinal members; Fig. 8*a* is a vertical sectional view similar to Fig. 8 showing a further modification of the invention; Figs. 9 and 10 represent a further modification of the tail; and Fig. 11 is a longitudinal sectional view along the lines of Fig. 3 showing the disposition of the eccentric masses.

According to Figs. 1 and 2, the streamlined hull **1**, the upper portion of which has bullseyes **2** above the water line **3**, is closed at the rear by a transverse wall **4**. The elastic stern **5** is attached to this wall, which stern tapers rearwardly and the outer faces of which are flush with the course of the hull **1**. The stern terminates at the fin **6** whereby a better streamline effect of the flowing liquid is achieved. The stern can be a single piece of an elastic material such as rubber, but is preferably as shown in Figs. 3 to 6, namely, at least one longitudinal leaf spring **7** surrounded by an elastic filler **8**, preferably of soft rubber, and an outer shell **9**. The spring has an opening **10** (Fig. 3) which determines the height of a cavity **11** in which the drive mechanism is mounted, e.g. an electric motor **12**, having a mass rotating about an axis parallel to the direction of motion and not passing through the center of gravity of the mass. The motor **12** is preferably movable longitudinally of the stern and mounted on the extending leaf spring **7** by guide elements **13** (Fig. 3). Several drive mechanisms could be arranged one behind the other. The frequency of oscillations of the eccentric masses preferably equals the natural frequency of the oscillations of the tail fin.

Steel stays **14** preferably are provided to strengthen the cavity, in particular between the points of mounting of the drive mechanisms. These stays are likewise mounted on the leaf spring **7** by guide elements **13**. As shown in Fig. 6, they may be single limbed and arranged oppositely off-set on both sides of the longitudinal member, or they may have two arms.

Figs. 7 and 8 show a different embodiment of the invention, in which the stern comprises several elastic longitudinal members **15** formed from spiral springs, which are embedded in an elastic filler **8**. On the outside, the stern is again surrounded by a tight and smooth shell which forms a continuous, uninterrupted surface. Instead of spiral springs **15**, rubber rolls **15***a* having a particular elasticity may be inserted and embedded in a filler as illustrated in Fig. 8*a*. The elastic stern of this embodiment may also be formed with a central cavity in which an electric motor having a rotating unbalanced mass is mounted on a longitudinal axis which may be embedded during pouring as shown in Fig. 11.

A further modification of the stern is shown in Figs. 9 and 10. A barrel-shaped spiral spring **16** within a filler forms the elastic longitudinal member, which tapers rearwardly and leaves a cavity in the centre for mounting a drive mechanism of the kind indicated. As shown in Fig. 10, the motor is suspended from the turns of the spring and directly transmits the oscillations to the tail. This embodiment is simple and strong. It has the advantage that stays as shown in Fig. 6 are eliminated.

The attachment of the stern to the other part of the hull can be preferably by way of fastening elements embedded or moulded in the stern. The outer shell consists of a tight, wear-resistant rubbery material which is joined to the softer filler e.g. by vulcanizing.

By virtue of the combination of the elastic material with the springy longitudinal members, the elastic stern constructed according to the invention results in a favourable swinging motion which is harmonic i.e. it permits the execution of swinging movements without interruptions.

What I claim is:

1. In a ship structure comprising a hull including a fore part and an oscillatable stern part connected to the fore part, said stern part being of elastic one piece material and having an outer surface decreasing continuously

in area from its forward end aft at least below the water line, and a propelling mechanism associated with the stern part and acting only in the forward part of the stern part.

2. A ship structure as claimed in claim 1 wherein the stern part includes a leaf spring extending within and centrally of the stern part.

3. A ship structure as claimed in claim 1 wherein the stern part includes a plurality of spiral springs extending lengthwise within the stern part.

4. A ship structure as claimed in claim 1 wherein the stern part includes a plurality of rubber rolls extending throughout the entire length of the stern part.

5. A ship structure comprising a hull including a fore part and an oscillatable stern part connected to the fore part, said stern part being of elastic one piece material and having an outer surface decreasing continuously in area from its forward end aft at least below the water line, a propelling mechanism associated with the stern part and acting only in the forward part of the stern part, and a barrel-shaped spiral spring tapering aft within the stern part.

6. A ship structure comprising a hull including a fore part and an oscillatable stern part connected to the fore part, said stern part being of elastic one piece material and having an outer surface decreasing continuously in area from its forward end aft at least below the water line, a propelling mechanism associated with the stern part and having an action only in the forward part of the stern part, and a leaf spring centrally disposed within the stern part having an opening therein and the said propelling mechanism being an electric motor mounted in such opening for movement lengthwise of the opening.

7. A ship structure as claimed in claim 6 further including stays fastened to the said leaf spring and bracing the said opening.

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