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PROPULSION ASSEMBLY FOR TORPEDOES

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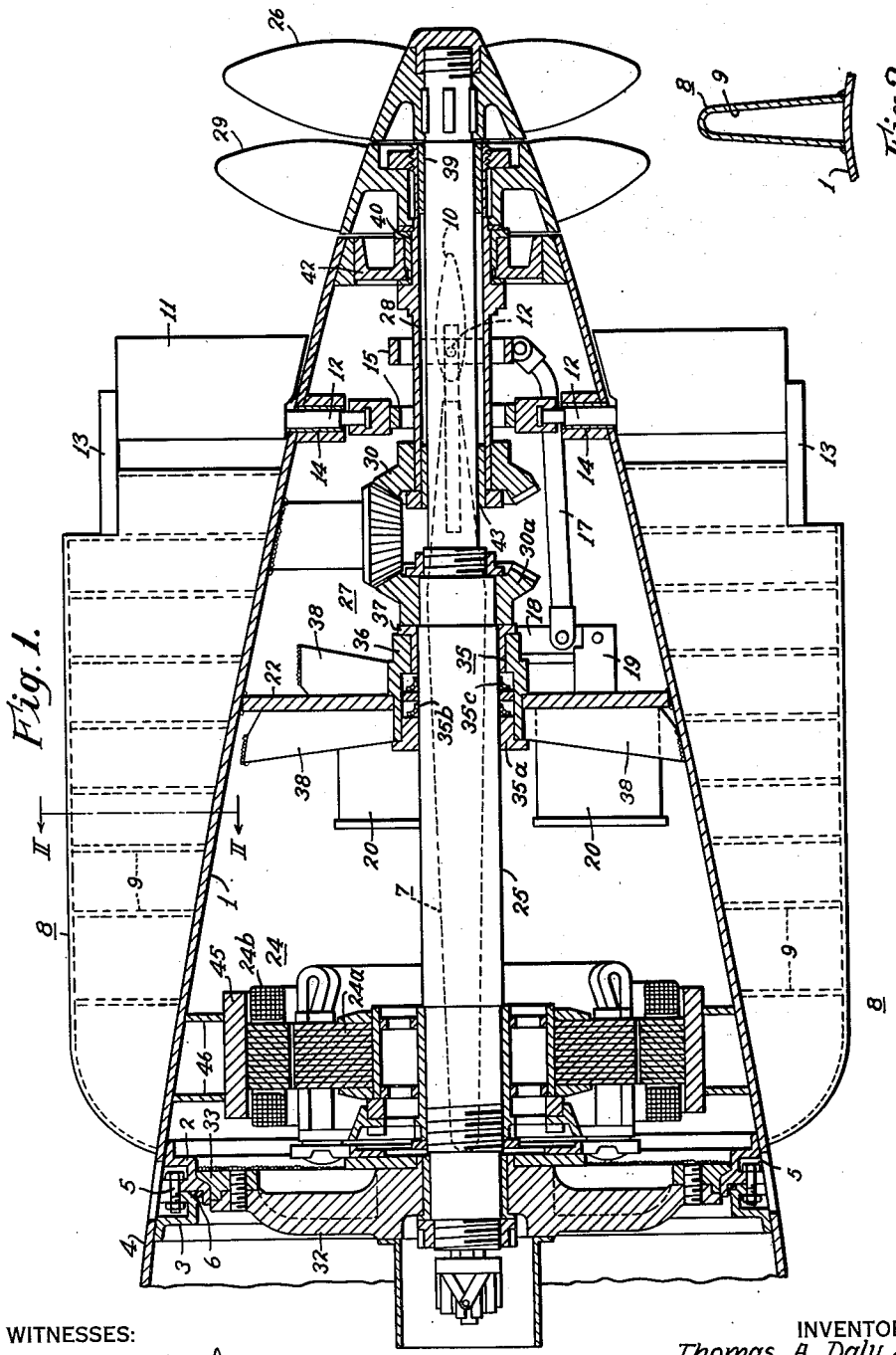


Fig. 1.

Fig. 2.

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PROPULSION ASSEMBLY FOR TORPEDOES

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3 Claims. (Cl. 114—20)

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This invention relates generally to torpedoes and it has particular reference to certain structural features of an aerial torpedo.

In the science of aerial torpedo warfare as presently known, aerial torpedoes are launched from aircraft specifically adapted for this type of operation. The usual practice is for the torpedo carrying plane to traverse a flight path intercepting the path of its target, this maneuver being performed at altitudes usually ranging from 300 to 400 feet. As the plane approaches the desired range of the target, the airspeed is dropped to about 200–250 knots and the torpedo is released.

The impact forces acting on the torpedo incident to water entry are high. Accordingly, special consideration must be made in the structural planning of such a weapon that structural failure will not occur upon water entry. With the advent of the all electric torpedo, this consideration became increasingly important because of the use of heavy battery units for power supply purposes and electric motors, each of which represents a concentrated mass producing high impact forces under conditions of rapidly changing acceleration as occur at water entry. Additionally, all design considerations on the electric torpedo, though the inherent weight is high due to the heavy electrical units, are restricted by established space and weight limitations.

Primarily, because of manufacturing considerations requiring importantly among other things, accessibility of components during assembly, the hull of the torpedo is divided into four longitudinal sectional components which are joined by water-tight clamping rings. These sections, proceeding from fore to aft, are generally designated in the war shot aerial torpedo, the warhead which is the forward extremity, the battery compartment, which, in most instances, in a subdivision thereof, houses certain control components for automatic target tracking, the afterbody section which houses additional control components, and the tail cone which, according to this invention, carries the propulsion motor and associated shafting, the propellers, the horizontal and vertical rudders and fins together wtih the electromagnetic actuators for the rudders. Of the several sections mentioned, this invention is specifically directed to the tail cone.

A principal object of this invention is to provide a tail cone assembly for a torpedo which is inherently strong.

Another object of this invention is to provide

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a tail cone assembly for a torpedo which is compact in construction.

A further object of this invention is to provide a tail cone assembly for a torpedo in which a distribution of forces acting at localized points is effected over the surface of the tail cone.

A still further object of this invention is to provide a tail cone assembly for an aerial torpedo embodying a special construction of fin and rudder assemblies capable of withstanding high forces as occur at water entry and which further houses the propulsion motor and associated shafting for driving the propellers with structural provisions for withstanding the forces exerted by these units at water entry.

The foregoing objects are merely illustrative of the various aims and objects of this invention. Other objects and advantages will become apparent upon a study of the following specification when considered in conjunction with the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of a tail cone assembly for a torpedo constructed in accordance with the principles of this invention, and

Fig. 2 is a sectional detail taken on the line II—II of Fig. 1.

The tail cone assembly is formed of a conical sheet metal section 1 provided with a ring 2 in the forward extremity which mates with a ring 3 secured to the aft extremity of after body section 4. Bolts 5 arranged in radial slots about the rings, clamp the rings together and form a rigid assembly of the sections. The rings are secured to the various sections by continuous welds to form water tight joints, while a gasket 6 disposed between the rings assures a water-tight joint therebetween.

Horizontal and vertical fins, respectively 7 and 8, there being two in each horizontal and vertical group and the pairs of each group being arranged in 180 degree relation are welded longitudinally of the conical section. These are fabricated of a plurality of ribs 9 shaped to the cross sectional configuration of the fins and over which a two piece shaped sheet metal covering butt jointed and welded along the fin edge, is secured. These fins extend over roughly three quarters of the length of the conical section beginning at the forward extremity thereof, and by reason of their secure attachment to the conical section function as ribs imparting both longitudinal and lateral stiffness thereto. The fins are constructed in the manner disclosed to obviate failure thereof upon impact with water. Experience

has shown that fins constructed of a single sheet of metal repeatedly failed at water entry primarily because of their weakness in a lateral direction. The lateral rigidity of the ribs 9 is considerably greater than that of the single sheet construction.

The horizontal and vertical rudders 10 and 11, respectively, are pivotally arranged in bearings at the trailing edge of the fins. These are mounted upon shafts 12 which are journaled at their outer ends in brackets 13 carried by the fins. The inner ends thereof are journalled in bearings 14 internally of the conical section and each pair of the shafts 12 terminate in rings 15 which join the pairs of shafts and provide means for actuating the rudders from within the tail cone section. Rings 15 are connected to pull rods 17 which, in turn connect with a link system 18 actuated by the plungers 19, only one of which appears in the figure, of solenoids 20. Physically, there are two solenoids for each ring and the associated pull rods are connected at diametrically opposite points on the rings. Thus energization of one solenoid pulls the connected ring one direction while energization of the companion solenoid pulls the ring in the opposite direction and the rudder assembly is controlled accordingly. The solenoids 20 are secured upon the bulkhead 22 which closes off and seals the after section of the tail cone from the forward section which houses the motor. Hence, water which may enter the after portion of the tail cone through the rudder bearings and the propeller bearings is prevented from reaching the motor.

The propulsion system of the torpedo includes the electric motor 24, propulsion shaft 25 driven by rotor 24*a* of motor 24 and connected with propeller 26, a reversing gear drive 27 and a tubular shaft 28 concentrically arranged about the propulsion shaft 25 for driving the propeller 29 and, in turn, being driven by the after bevel gear 30 of the reversing gear drive, this assembly of motor shafting and reversing gear drive providing counter rotation of propellers 26 and 29 which, if properly designed, produce oppositely directed reaction torques which result in torsional equilibrium of the system.

In consideration of the forces exerted by the above-described propulsion system on the tail cone at water entry the propulsion shaft 25 is journaled at three points along its length. At the forward extremity thereof, shaft 25 is journalled in a three-armed bracket 32, the bracket mating with lugs 33 fastened by a continuous weld to the clamping ring 2. At approximately its center and adjacent the reversing gear drive 27, the shaft 25 is journalled in a bearing assembly 35 carried in a bulkhead 22. In this assembly a shaft bearing 37 is housed in a sleeve 36 extending through bulkhead 22. The after extremity of sleeve 36 in conjunction with the bearing 37 forms a thrust bearing which receives the forward axial thrust of the shaft 25 through the forward bevel gear 30*a*. A retainer nut 35*a* holds shaft seals 35*b* and 35*c* in place, the latter preventing water entry into the forward section of the tail cone. Since the shaft 25 carries the motor rotor 24*a*, the element 30*a* of the reversing gear drive 27 and the propeller 26, the bulkhead 22 is stiffened with ribs 38 which are radially disposed on each side of the bulkhead and extend from the sleeve 36 to the tail cone shell 1. The after extremity of shaft 25 is journalled in a bearing 39 within shaft 28 and the tubular

shaft 28 which carries the propeller 29 is journalled in a thrust bearing assembly 40 in a ring 42 secured at the after extremity of the tail cone, while the forward extremity of tubular shaft 28 at the point of attachment of output gear 30 of the reversing gear drive 27 is journalled over the propulsion shaft 25 by a bearing 43. Thus the axial thrust of propeller 29, tubular shaft 28 and gear element 30 is applied to the ring 42 at the after extremity of the tail cone.

Stator 24*b* of motor 24 is supported in an annular housing 45. This housing is secured within the conical section at the forward extremity thereof by means of the supports 46 which may encircle the motor housing and which are welded between the housing 45 and the conical shell thereby imparting stiffness to the tail cone in the region of its attachment to the after body section 4.

The foregoing disclosure and the showings made in the drawing are merely illustrative of the principles of this invention and are not to be interpreted in a limiting sense. The only limitations are to be determined from the scope of the appended claims.

We claim as our invention:

1. In a tail cone assembly for a torpedo for housing an electric propulsion motor and a propulsion shaft system including a drive shaft and a tubular shaft journaled over the aft extremity of said drive shaft, the shafts being connected by a gear transmission comprising, in the combination of, a conical shell of sheet material, a plurality of radial fins disposed longitudinally of said conical shell in equally spaced relation thereabout, each of said fins comprising a plurality of ribs having a covering of sheet material disposed thereover, means securely joining said covering of sheet material to said ribs and to said conical shell, an electric motor housing for said propulsion motor arranged within said conical shell adjacent the forward extremity thereof, means securing said housing to said conical shell internally thereof to reinforce said shell, a bearing bracket disposed at the forward extremity of said conical shell, a bulkhead disposed substantially centrally of said conical shell, a bearing arranged in said bracket, a thrust bearing arranged in said bulkhead, a second thrust bearing arranged in the aft extremity of said cone, said drive shaft being journalled in said bearing and said first mentioned thrust bearing, said tubular shaft being jounralled in said second thrust bearing, said first mentioned thrust bearing receiving the thrust of said drive shaft and said second thrust bearing receiving the thrust of said tubular shaft.

2. In a tail cone assembly for a torpedo the combination, of, a motor housed within said tail cone, a propulsion shaft connected with said motor to be driven thereby and extending through the aft extremity of said tail cone, a propeller mounted on the extremity of said propulsion shaft, a tubular shaft disposed for rotation about said propulsion shaft and having a portion thereof extending through the aft extremity of said tail cone, a propeller mounted on the said portion of said tubular shaft, a reversing gear drive connected to the propulsion shaft and said tubular shaft, said reversing gear drive being driven by the propulsion shaft and effecting opposite rotational movement of the tubular shaft with respect to the propulsion shaft, a bulkhead disposed substantially centrally of said tail cone, a

thrust bearing disposed in said bulkhead and constructed to receive the thrust of said propulsion shaft, and a thrust bearing disposed in the aft extremity of said tail cone and constructed to receive the thrust of said tubular shaft.

3. In a tail cone assembly for a torpedo having a propulsion motor and a system of coaxial propulsion shafts mounting propellers for propelling the torpedo, the combination of a bulkhead arranged substantially centrally of said tail cone, a thrust bearing disposed in said bulkhead for receiving the thrust of one of said coaxial propulsion shafts, and a thrust bearing arranged at the aft extremity of said tail cone for receiving the thrust of the other of the coaxial shafts.

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