

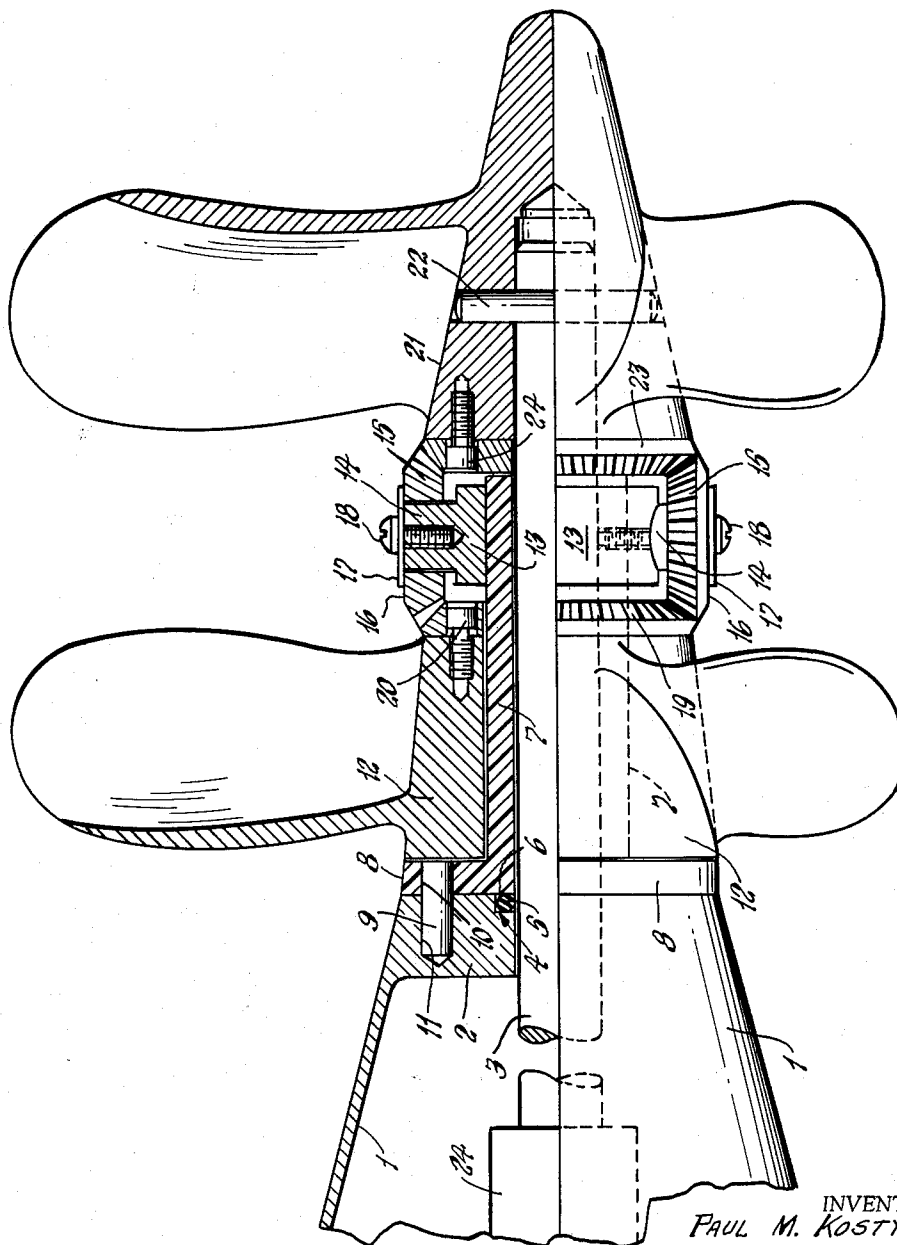
April 30, 1963

P. M. KOSTYUN

3,087,553

COUNTER ROTATING PROPELLER DRIVE

Filed Jan. 23, 1962



INVENTOR.  
PAUL M. KOSTYUN

BY

*Max H. Farmer*

ATTORNEY

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3,087,553

## COUNTER ROTATING PROPELLER DRIVE

Paul M. Kostyun, Pittsfield, Mass., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

Filed Jan. 23, 1962, Ser. No. 168,285

1 Claim. (Cl. 170—135.28)

This invention relates to the propulsion of bodies such as water or aircraft in a fluid medium, of the type where two screw type propellers arranged in tandem and rotating in opposite directions are employed to propel a body through such fluid medium without causing a tendency to rotation of the body so propelled, that is, to cancel out or neutralize the reaction forces of the propellers which tend to rotate the propelled body itself around its longitudinal axis. These reaction forces are of minimum concern in large ships or bodies, but in small ships or bodies, such as torpedos, these reaction forces should be neutralized or cancelled out.

Propulsion means using two oppositely rotating propellers arranged in tandem, have been proposed for this purpose in torpedos, and have employed considerable gearing properly matched and centers chosen, and required considerable design study and execution for properly sealing the shafts and hull against entry of sea-water into the torpedo or propelled body throughout all pressure depths involved in the path of the propelled body. Such proposed propulsion devices usually employed a gear box or other gearing arranged within the hull or propelled body, with two concentric propeller shafts, one of which would be a tube, extending outwardly of the hull and carrying the propellers. Both of such shafts had to be sealed against the entry of sea water into the hull or body, and provision made for bearing and thrust control.

An object of this invention is to simplify the design and reduce the number of parts and their cost of such propulsion devices, so that a relatively inexpensive yet adequate unit can be made for expendability.

Another object is to provide propulsion means which requires only one propeller shaft leaving the hull or body housing, so that a simple but effective sealing against entry of sea water along such shaft into the hull or housing may be employed, which requires no gear boxes or gearing within the hull or housing, in which all moving parts exteriorly of the hull or housing may be water lubricated, which is simpler and more compact and efficient than prior propulsion means of the same type, which offers minimum friction and requires less motive power for operation, which is relatively simple, practical, dependable, and compact in design and inexpensive, and whose parts may be made of less expensive materials than the metallic materials used in prior grease lubricated gear boxes.

Other objects and advantages will appear from the following description of one example of the invention, and the novel features will be particularly pointed out in connection with the appended claim.

The accompanying drawing illustrates in half section and half elevation, the rear end of a hull or torpedo body having attached thereto propulsion means constructed in accordance with this invention and indicating one example of this invention as applied to a torpedo.

In the drawing, the torpedo body has a tail cone or housing 1 converging rearwardly and terminating in an end wall 2 which is disposed crosswise of the longitudinal axis of the tail cone. A propeller shaft 3 extends from within the tail cone 1 exteriorly and axially thereof for a distance substantially beyond the end wall 2. A suitable water seal 4 is provided between the shaft 3 and end wall 2 where the shaft passes through that wall, to pre-

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vent entry of sea water along the shaft into the tail cone 1. Such seals are common in ships and torpedos and any of them may be used. In the illustrated simple form, for example, it is an annular ring 5 of elastomeric or gasket material which is confined in an annular rabbet groove 6 in the outside face of end wall 2 around the opening therein through which the shaft 3 passes to the exterior of the tailcone 1 and bearing under pressure against the shaft and the groove.

A bushing 7 surrounds that part of shaft 3 which extends rearwardly from the tail cone and has a peripheral flange 8 at that end adjacent the tail cone which abuts the end wall 2 of the tail cone. This flange fits flat against the end wall 2 and is fixedly secured to the end wall by a locking pin 9 that passes snugly through an aperture 10 in the flange 8 and fits snugly into a recess 11 in the end wall 2. One screw propeller 12 is rotatably mounted on the bushing 7 adjacent to and abutting the flange 8 thereof, and it extends only part way of the length of the outer end of the shaft 3.

A collar 13 is fixed on the free end of the bushing 7, and at diametrically opposite sides of its periphery it has radially extending bosses 14 which rotatably mount bevel idler pinions 15. Each pinion is confined on its boss 14 against a shoulder 16 by a plate 17 which overlies the face of the idler pinion and is confined to the collar by a headed screw 18 whose shank passes through the plate and is screwed into the outer end of the related boss 13. A bevel gear 19 is secured against the outer end face of the propeller 12, concentric with the axis of shaft 3, such as by screws 20 which are threaded into the end face of the propeller and have heads countersunk in recesses in the gear as shown in the drawing. This gear 19 meshes with the idler bevel pinions 15 on the collar 13.

Another screw propeller 21 is disposed on the free outer end of the shaft 3, beyond the free end of the bushing 7, and is removably fixed thereto for rotation therewith in any suitable manner such as, for example, by passing a tapered pin 22 through aligned passages in the hub of propeller 21 and the shaft 3, until it is wedged tightly therein. Another bevel gear 23 is confined by screws 24, similar to screws 20, to the end face of the hub of the propeller 21, concentric with the axis of shaft 3, and this gear 23 also meshes with the idler pinions 15 on the collar. Thus the two propellers are drivingly coupled together through their bevel gears 19 and 23 and the interposed idler pinions 15. Since the collar that rotatably mounts the idler pinions does not rotate with the shaft, the rotation of propeller 21 with the shaft 3 will be transmitted through the idler pinions to the other propeller 12 to drive it rotatably at the same speed as propeller 21 but in the opposite direction. Thus the propellers will rotate at the same speed but in opposite directions, so that the oppositely rotating propellers will cancel out the rotary torque imposed by each on the tail cone.

The bearings for the propeller 12 and the pinions 15 are water lubricated in a manner which is well known. No oil bearings are needed exteriorly of the tail cone or hull. The rotary parts for water lubrication are usually made of metal and the stator parts are of materials which are lubricated by water. Examples of such materials which are water lubricated are nylon, "Neoprene" and "Teflon." Teflon is the trademark name for a polytetrafluoroethylene polymer, and Neoprene is the trademark name for 2-chlorobutadiene 1,3 which is a synthetic chloroprene rubber. The parts with which the water-lubricated parts have bearing may be made of any suitable material and need not necessarily be of metal. A motor 24 within the housing or tail cone is coupled as usual to the shaft 3 for rotating it.

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It will be noted that with this construction as illustrated and described herein, the placing of the gear box between the propellers and using water lubrication for the moving parts, only one shaft leaving the tail cone is required, which simplifies the sealing against sea water of the shaft as it leaves the tail cone, and the entire construction is exceptionally simple, compact, practical, inexpensive, and employs a minimum number of parts.

It will be understood that various changes in the details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claim.

I claim:

A propelled boat comprising a housing having a wall with a passage therethrough to the exterior thereof, a propelling shaft extending from the interior of said housing outwardly through and rotatably mounted in said wall thereof, a bushing surrounding said shaft on its end outside of said housing and having a flange on the end adjacent said housing abutting and fixed to said wall of said housing, and extending for a portion only of the length of said shaft, one propeller rotatably mounted on said

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bushing adjacent said flange, another propeller fixed on the free, outer end of said shaft for rotation therewith, driving means mounted on the outer end portion of said bushing between said propellers and having a driving coupling between said propellers for driving said one propeller from said another propeller and in the opposite direction from said another propeller, the outer face of said housing wall having a rabbet surrounding and opening into its said passage and also outwardly, and sealing means in said rabbet, engaging said shaft and confined in said rabbet by said flange, enabling access to said sealing means by removal of said bushing from said shaft.

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