F. C. B. PAGE.

DRIVING MECHANISM FOR TORPEDOES.

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1,155,435.

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Fig. 1.

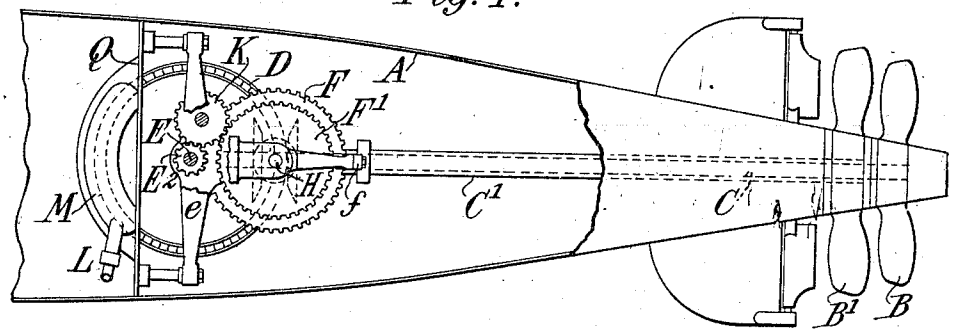
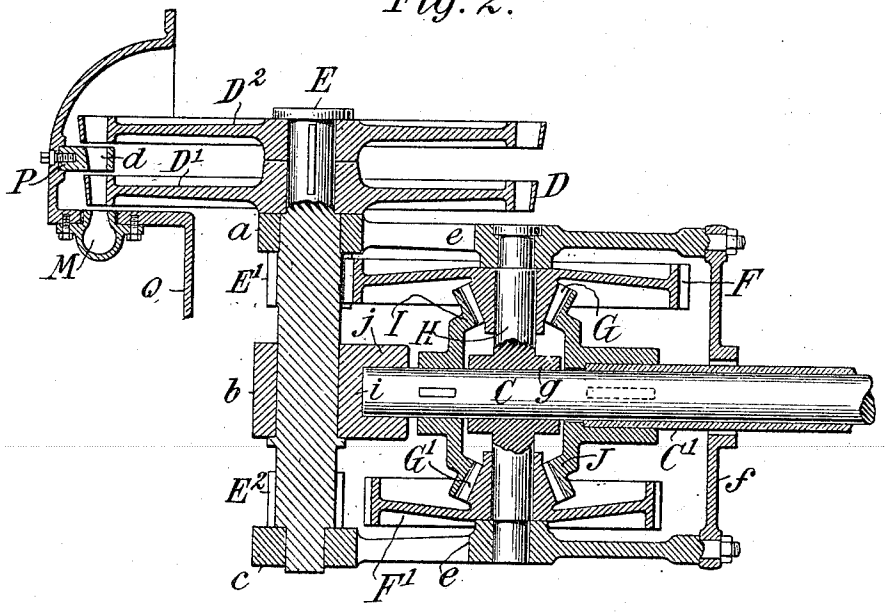


Fig. 2.



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DRIVING MECHANISM FOR TORPEDOES.

1,155,435. Specification of Letters Patent. Patented Oct. 5, 1915.

Application filed January 28, 1913. Serial No. 744,703.

To all whom it may concern:

Be it known that I, FRANK C. B. PAGE, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Driving Mechanism for Torpedoes, of which the following is a specification.

This invention relates to the propulsion of an automobile torpedo by means of a turbine engine.

In turbine-driven automobile torpedoes certain difficulties have been encountered which it is the purpose of this invention to obviate.

The patent to Leavitt No. 748,759 dated January 9, 1904, shows a turbine turning upon a longitudinal axis coincident with the main axis of the torpedo and driving the propeller shaft through reducing gearing. The turbine is an impulse turbine of the two-stage type, that is to say, it has two bucket wheels with an interposed stationary reverser having buckets which receive the exhaust from the buckets of a primary wheel and reverse its direction of flow and direct it against the buckets of the secondary wheel.

Torpedoes having the propelling mechanism shown in this patent operate successfully after launching and when launched under water; but when launched through the air the torpedo before striking the water executes a preliminary twisting or rolling movement, so that it enters the water with a pronounced list, which however corrects itself after the torpedo becomes immersed. This preliminary roll is probably due to the reaction against the impact nozzles due to overcoming the inertia of the turbine wheels and the parts driven from them while bringing them up to speed.

The patent to Davison No. 858,256 dated June 25, 1907, shows a torpedo having two turbine wheels turning likewise around the major axis of the torpedo, but differing from the foregoing in that the two wheels revolve in contrary directions at equal speeds, the respective wheels being connected to the propeller shaft through reversing gearing whereby the oppositely revolving wheels drive the propeller shafts both in the same direction. The two turbine wheels and their connected parts are given similar weights and proportions in order that their opposite moment of inertia shall equalize one another so that the sum thereof shall be zero; the theory being that an unbalanced turbine develops a gyroscopic action which has some tendency to pervert the normal steering of the torpedo, and by balancing the turbines and neutralizing this gyroscopic effect, such disturbance is avoided.

The arrangement last described has the effect of practically eliminating the preliminary roll during an overboard launching, a result which probably is due more to the practical elimination of the nozzle reaction than to the avoidance of any gyroscopic effect. As the latter effect should theoretically result in a precessional tendency which would manifest itself as a disturbance of the normal steering of the torpedo in either the vertical or horizontal plane, and as no such result was noticeable in the operation of the unbalanced turbine according to said Leavitt patent, it seems probable that the gyroscopic action is relatively so slight as to be negliglible.

In the pending application of Leavitt, Serial No. 689,136, filed April 8, 1912, (patented February 24, 1914, No. 1,088,084) balanced turbines are provided which instead of turning on the longitudinal axis of the torpedo are mounted on an axis transverse thereto, preferably a vertical axis; and the gearing is so arranged that it not only insures the contrary rotation of the turbine wheels at equal speeds, but it also serves for driving the respective propeller screws in contrary directions at equal speeds, whereby the nest of reversing gears previously located in the tail section of the torpedo is combined or merged with the gearing incidental to the reversed turbines and located conveniently adjacent thereto. This arrangement has operated with a high degree of success, but has the disadvantage in common with that shown in said Davison patent of involving the use of two concentric turbine shafts the one having bearings within the other, with their attendant complications and difficulty of lubrication.

The present invention aims to simplify the mechanism and avoid the disadvantages last mentioned. To this end essentially a single and therefore unbalanced turbine is employed mounted upon an axis transverse to the torpedo, with balanced reversing gearing interposed between the shaft of said wheel and the respective propeller shafts

whereby to impart to the latter a uniform and balanced torque acting in contrary directions to revolve the propellers at equal speeds. Preferably a turbine of the two-stage type is employed, comprising two bucket wheels with an interposed reverser as in said first named patent. By this means I attain the simplicity incident to an unbalanced turbine and avoid the disadvantage of the preliminary roll in overboard launching which formerly accompanied the use of such unbalanced turbine. Assuming such roll to be due to the nozzle reaction, the latter exerted a torque causing the torpedo to execute a partial rotation around its longitudinal axis, so long as the torpedo, being poised in air, offered little resistance to such movement; but with the arrangement provided by my present invention the torque due to nozzle reaction tends to swing the torpedo about a transverse axis, a tendency which is resisted by a far greater moment of inertia, so that during the brief instant preceding immersion it has no perceptible effect in changing the course of the torpedo, and even if it had the automatic steering mechanism would correct any slight deflection immediately upon entering the water, the disturbances thus occasioned, even if sensible, being minute as compared with other disturbances during launching, and which the steering mechanism is adequate to correct.

The accompanying drawings show the preferred embodiment of my invention.

Figure 1 is a fragmentary longitudinal section of the after portion of a torpedo hull showing the propelling mechanism in elevation (for example in inverted plan); Fig. 2 is a longitudinal section of the turbine engine and gearing on a larger scale. Assuming the turbine to turn on an upright axis this view is a vertical section.

In Fig. 1, A is the hull or shell of a torpedo, B and B′ are the propellers, C is the inner propeller shaft carrying the propeller B, C′ is the outer propeller shaft carrying the propeller B′, and D is the turbine.

Referring to Fig. 2, the turbine D is mounted on a shaft E turning in suitable bearings such as *a b* and *c* (one of which may be omitted, two bearings being sufficient). The shaft E has two pinions E^1 and E^2. The pinion E^1 meshes with a gear F having attached to or formed integrally with it a bevel pinion G, the two turning on an axis parallel with the shaft E and shown as a transverse stud or fixed shaft H. The pinion G meshes with and drives two bevel gears I and J which are thus driven in contrary directions. The gear I is keyed on the inner propeller shaft C and the gear J is keyed on the outer propeller shaft C′; thus the two propellers are driven in contrary directions at equal speeds.

In order to strengthen the gearing and balance the torque imparted by the pinion G to the gears I J, an opposite pinion G′ is provided identical with the pinion G and fixed to or integral with a gear F′, which gear is driven from the pinion E^2 through the intermediation of an idler gear K (Fig. 1). Necessarily the ratio between pinion E^2 and gear G^1 is the same as that between pinion E^1 and gear F. The gear F′ is made enough smaller than the gear F so that it clears the pinion E^2.

The gears being thus correctly proportioned, the turbine communicates an equal and balanced torque through its pinions E^1 and E^2 to and through the gears F and F′, and the pinions G and G′ for driving the gears I and J and the respective propeller shafts and screws in contrary directions at equal speeds.

For driving the turbine, compressed air from the usual source thereof and controlled in the manner well understood in automobile torpedoes, is conducted through a pipe L and nozzle M, whence it impinges upon the buckets of the turbine in the well understood manner. It is preferable to use an impact turbine of the double-effect type, and to this end the two turbine wheels D^1 and D^2 are constructed as in said Leavitt Patent No. 748,759, being spaced somewhat apart and having interposed between them a reversing block P, as is usual in this type of turbine, this block having reversing ports *d* for changing the direction of the fluid leaving the buckets of the primary wheel before directing it against the buckets of the secondary wheel, in order that both buckets may be impelled in the same direction. In the construction shown the torpedo has a transverse bulkhead Q through which the nozzle opens and to which the block P is fastened.

While the mechanical construction is immaterial, the construction shown is suitably adapted for the support and correlation of the respective parts. The transverse shaft H has its ends fastened in frames *e e* which at one end carry the respective bearings *a c*, and at the other end are connected by a yoke *f*. The fixed shaft H has a middle hub *g* which forms a bearing for the inner shaft C, and the latter has a step bearing *i* in a fixed frame *j* which also carries the bearing *b*.

The described construction avoids the complication heretofore due to having the turbine wheels revolving in contrary directions, the one upon an inner shaft and the other upon an outer tubular shaft inclosing the inner one, and involving serious difficulties in the construction of the bearings and in their lubrication. The single shaft E is mounted in external bearings which are readily accessible, and which may be lubricated from the exterior instead of requiring internal lubricating ducts.

The construction herein described avoids all difficulties heretofore encountered in the occurrence of an initial roll during launching, and introduces no perceptible difficulty by reason of gyroscopic disturbance.

I claim as my invention:—

1. In an automobile torpedo, a turbine turning on an axis transverse to the torpedo, inner and outer propeller shafts, opposite bevel gears on said shafts respectively, opposite pinions meshing with both bevel gears, and reducing gears for driving said pinions in contrary directions at equal speeds from said turbine.

2. In an automobile torpedo, a turbine turning in a horizontal plane on a vertical axis, inner and outer propeller shafts, opposite bevel gears on said shafts respectively, opposite pinions meshing with both bevel gears, and reducing gears for driving said pinions in contrary directions at equal speeds from said turbine.

3. In an automobile torpedo, a turbine turning on an axis transverse to the torpedo, a shaft driven thereby having two pinions, inner and outer propeller shafts, opposite bevel gears on said shafts respectively, opposite bevel pinions meshing with both said gears, and reducing gearing between said respective bevel pinions and the pinions on said turbine shaft.

4. In an automobile torpedo, a turbine turning on an axis transverse to the torpedo, a shaft driven thereby having two pinions, inner and outer propeller shafts, opposite bevel gears on said shafts respectively, opposite bevel pinions meshing with both said gears, and gear wheels driving said bevel pinions respectively, one of said gears meshing with one of the pinions on said turbine shaft, and the other of said gears driven from the other pinion on said shaft through an idler gear.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

FRANK C. B. PAGE.

Witnesses:
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