B. H. COFFEY.

VIBRATING PROPELLER.

APPLICATION FILED OCT. 5, 1908. RENEWED FEB. 9, 1910.

972,337. Patented Oct. 11, 1910.

2 SHEETS—SHEET 1.

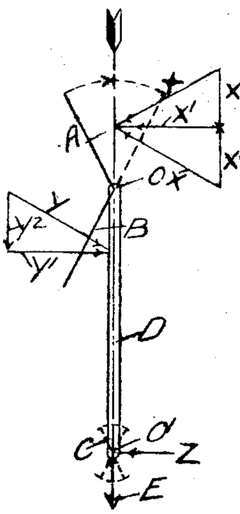

Fig. 1

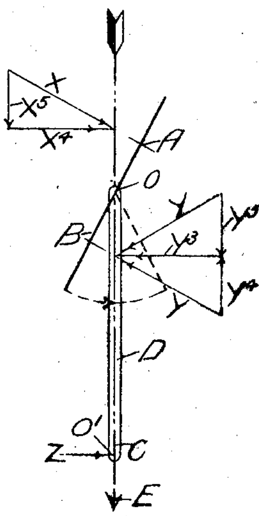

Fig. 2

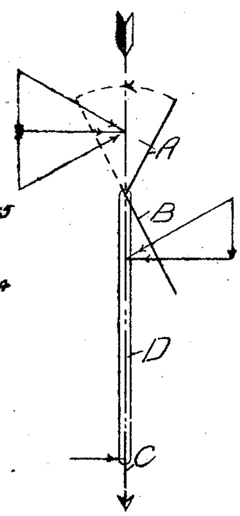

Fig. 3

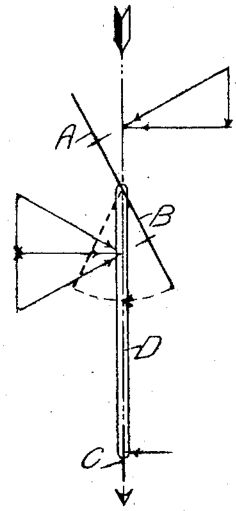

Fig. 4

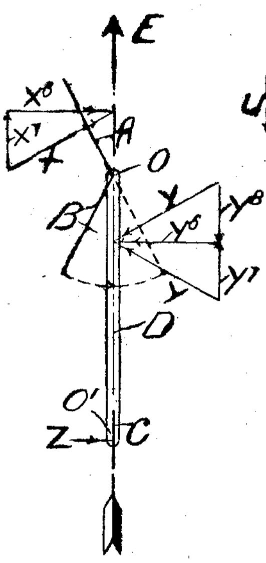

Fig. 5

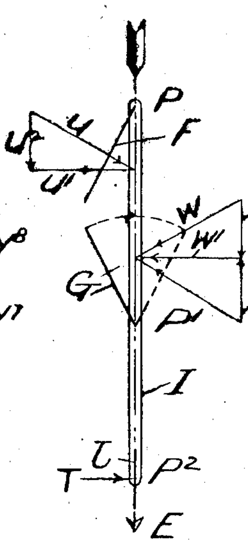

Fig. 6

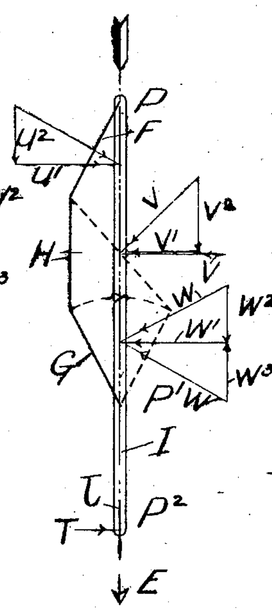

Fig. 7

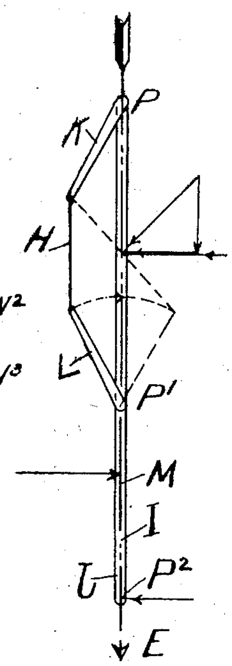

Fig. 7^a.

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Witnesses

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2 SHEETS—SHEET 2.

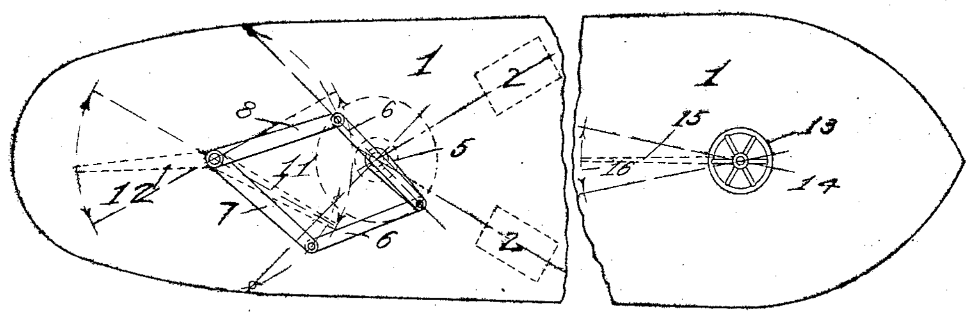

Fig. 8

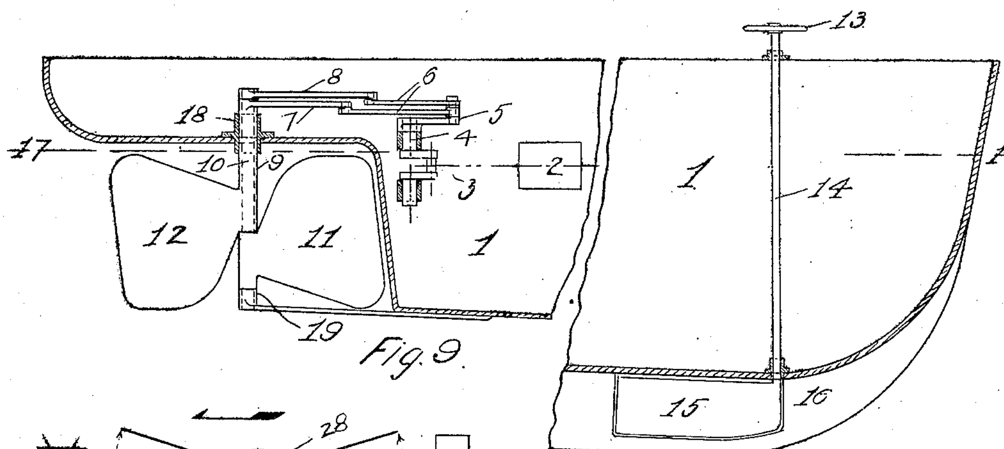

Fig. 9.

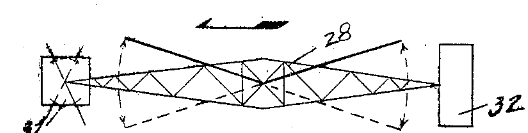

Fig. 11

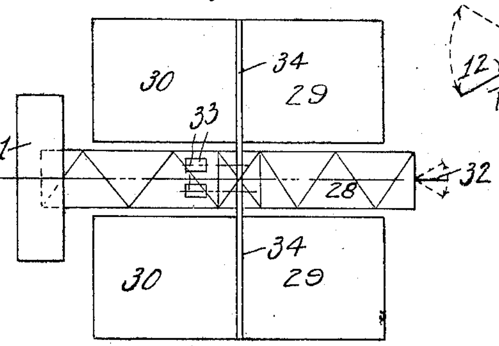

Fig. 12.

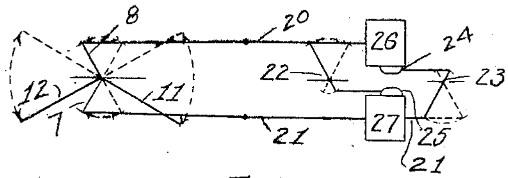

Fig. 10.

Inventor

Witness
Julia S. B. Coffey
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UNITED STATES PATENT OFFICE.

BARTON H. COFFEY, OF BOSTON, MASSACHUSETTS.

VIBRATING PROPELLER.

972,337. Specification of Letters Patent. Patented Oct. 11, 1910.

Application filed October 5, 1908, Serial No. 456,321. Renewed February 9, 1910. Serial No. 542,941.

To all whom it may concern:

Be it known that I, BARTON H. COFFEY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Vibrating Propeller, of which the following is a specification.

My invention relates to propellers adapted to both marine and aerial propulsion and belongs to the class wherein the reaction of vibrating planes against the fluid in which they are immersed, is utilized to produce linear motion.

The objects of my invention are, to produce a propeller of higher efficiency, and that can be operated with less draft than the ordinary screw propeller; and to accomplish these purposes I employ the same reactions utilized by fish to produce motion.

Reference now being had to the drawings, Figures 1 to 7^a are diagrammatic representations of my preferred form of propeller, and two variations; shown in different positions, in order to illustrate the reactions. Fig. 8 is a plan view showing my preferred form of propeller, with one form of driving gear, as applied to a vessel. Fig. 9 is an elevation of Fig. 8, partially in section. Fig. 10, is a diagrammatic plan view of my preferred form of propeller, with an alternate form of driving gear. Figs. 11 and 12 are respectively an elevation and plan of my preferred propeller, as applied to a flying machine.

Figs. 1 to 4 show the four principal positions of my preferred form of propeller, comprising a complete cycle of movement.

A. and B. are two planes rotatable about the axis O. which is in the rigid body D.

C is a third plane either integral with D. or rotatable about the axis O^1 which is within D.

Beginning with Fig. 1, if the planes B and C are held rigidly and the plane A rotated in the path of the dotted arc and direction of the arrow, and bearing in mind that the reaction of any fluid against a moving plane is always normal to that plane; there will be a reaction X against A, which reaction may be resolved into the components X^1 normal to the center-line of D, and X^2 parallel with it. The direction of these forces are indicated by the small arrow heads. The component X^1 forces D to the left and so causes the reaction Y against the plane B which is held from rotating. Y. may be resolved into Y^1 normal to D and Y^2 parallel therewith. It will now be observed that X^1 and Y^1 form a couple tending to revolve D, contra clockwise, which tendency is opposed by the fixed plane C setting up the reaction Z. The reaction X^2 and Y^2 in the same direction and unbalanced cause D to move in the direction of the arrow E. When A has rotated in line with D, it is obvious that X^2 disappears; further rotation causes X^3 to appear in a direction opposite to X^2 and opposed to motion, and when A has come in line with B (shown in hatched lines) X^3 is equal in amount and opposed to Y^2 and the system is in equilibrium. At this point A ceases to rotate and is held rigidly.

Proceeding now to Fig. 2, B commences to rotate in the direction shown, causing the reaction Y to shift to its opposite side, and the horizontal component Y^3 setting up the reaction X on A as indicated. During the first half of B's rotation, Y^4 though opposed to X^5, is less in amount and there is motion in the direction of E, during the second half Y^5 appears, and is in the same direction as X^5. The balancing reaction Z, is reversed.

In Fig. 3, B, is held and A rotated back to its position in Fig. 1, setting up similar reactions producing motion in the direction E: and finally in Fig. 4 A is held and B returned to its position of Fig. 1, thus completing a cycle, which if constantly repeated will produce constant motion in the direction E. The system is perfectly reversible, as shown at Fig. 5. The planes are in the same position as shown on Fig. 1, but on starting, A is held and B rotated, the ensuing sequence of motions, reverses the reactions, obviously reversing the direction of motion. It will be noted that at every position of the system a propelling force exists.

Figs. 6 and 7 show alternate forms of propeller acting on the same general principle, of oscillating and fixed planes. F and G rotate about axes P and P^1 within the rigid body I. H a third plane (in Fig. 7) joins their extremities about which it is rotatable. J, balances the reactions tending to rotate I. The reactions are very similar to those already described in detail and can be readily followed from the diagrams, which show the alternate forms in one position, the reactions and parts being lettered to facilitate correspondence if deemed necessary. If it is desired to change the line of motion, the plane C. may be rotated in either direction as indicated at Fig. 1.

I term the oscillating planes A, B, F, G, and H, "motor planes"; and the fixed planes C, and J, "balancing planes".

In practice the hull and keel of a vessel may offer sufficient resistance to rotation; this equivalent effect rendering a special balancing plane unnecessary. In aviation the special balancing plane would most probably be required. I find, that moderate departures from the strictly theoretical motions and pauses shown on the diagrams, do not materially affect the efficiency of the system, and also the lines of the hull have an effect on the reaction.

In Figs. 8 and 9, 1 is the hull of a vessel partly broken away, showing the bow and stern sections, floating at the water line 17. 2 are reversing engines driving the vertical shaft 4, by the crank 3, 5 is a crank integral with 4. Journaled to 5, are the connecting rods 6, in turn journaled to the cranks 7 and 8, which are integral with the concentric shafts 9 and 10, which are integral with the propeller blades 11 and 12. The shafts 9 and 10 are held by the bearing 18 and the skeg 19. In the keel 16 near the bow, an opening is made for the rudder 15, operated by the shaft 14 and wheel 13. The rudder can be moved in the arc 16 for steering.

In operation it will be obvious that as the crank 5 revolves there will be four points in its path when one of the connecting rods 6 is on a dead center. At this point the connecting rod is stationary, and for a considerable arc on either side of this point the linear motion of the rod is very small. These periods correspond with the four pauses in the diagrams Figs. 1 to 4, and as the propeller blades are driven by the connecting rods, they partake of these periods of slow motion and rest. It will also be noted that where one connecting rod is on a dead center, the other is at its point of greatest motion, corresponding to the four oscillations of the diagrams. Reversing the crank, reverses the propeller thrust. This driving gear gives a fair approximation of the theoretical requirements, and works well in practice. The rudder 15 and keel 16 constitute the requisite balancing plane.

In Fig. 10, 26 and 27 are engine cylinders, having valves 24, 25 operated through the rock-shaft 22—23 from the piston rods 21—20 of the opposite cylinder. This valve gear is in common use upon the ordinary duplex pumping engine, and may be so set that steam is not admitted to one cylinder, until the companion cylinder has completed its stroke, resulting in one cylinder being always at rest while the other one is working, and producing a sequence of movements and pauses that synchronize perfectly with the theoretical requirements of the diagrams. On journaling the piston rods 20 and 21 to the cranks 7 and 8 the above motions are transmitted to the propeller blades 11 and 12.

In Figs. 11 and 12, 28 is the trussed body of an aeroplane carrying the engine 33, which operates the wings 29 and 30 through the shaft 34, and either with gear similar to that of Figs. 8 and 9 or some other form, imparts to them the motions already described. The planes 31 perform the double duty of sustaining longitudinal equilibrium, and balancing the rotative couple developed at the wings. The vertical plane 32 directs motion, in the horizontal plane.

There are many combinations of mutually reacting oscillating and stationary planes giving a propulsive thrust at all positions that will suggest themselves to those skilled in the art, and therefore I do not confine myself to the specific forms shown, as for instance Fig. 7ª a modification of Fig. 7, in which the motor planes F and G are omitted, and the plane H, oscillated by the cranks K and L: a fixed motor plane M being necessary to take the counter reaction.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is,

1. A vibrating propeller consisting of mutually reacting motor-planes, each plane provided with means to oscillate it upon an axis and to hold it substantially motionless at the termination of each oscillation; the several means being so organized that there shall substantially always be planes in motion and planes at rest, for the purposes set forth.

2. A vibrating propeller consisting of mutually reacting motor-planes, each plane provided with means to oscillate it upon an axis and to hold it substantially motionless at the termination of each oscillation, the several means being so organized that there shall substantially always be planes in motion and planes at rest; in combination with a balancing-plane and a rigid connecting body; for the purposes set forth.

3. In a vibrating propeller, two mutually reacting motor-planes adapted to oscillate upon an axis, and means to alternately hold first one and then the other plane substantially at rest and simultaneously to oscillate the companion plane, for the purposes set forth.

4. In a vibrating propeller, two mutually reacting motor-planes adapted to oscillate upon an axis, means to alternately hold first one and then the other plane substantially at rest and simultaneously to oscillate the companion plane; in combination with a balancing-plane and a rigid connecting body for the purposes set forth.

5. A vibrating propeller, consisting of mutually reacting motor-planes, each plane provided with means to oscillate it upon an axis, and to hold it substantially motionless at the termination of each oscillation, the several means being so organized that there shall substantially always be planes in motion and planes at rest; in combination with means to reverse the sequence in which the planes are oscillated and held substantially at rest, in order to reverse the direction of thrust; for the purposes set forth.

6. In a vibrating propeller, a shaft as 4, a crank as 5, integral with said shaft, two links as 6, journaled to said crank, two cranks as 7 and 8 journaled to said links, two concentric shafts as 9 and 10 integral with said cranks, two blades as 11 and 12, integral with said concentric shafts; in combination with means to revolve the shaft first mentioned in either direction, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses, on the 28th day of September 1908.

BARTON H. COFFEY.

In presence of—

DELIA U. CHAPMAN,

JULIA G. B. COFFEY.