May 3, 1938. J. WEICHWALD 2,116,054

PROPELLER

Filed Dec. 29, 1934 2 Sheets-Sheet 1

Fig. 1.

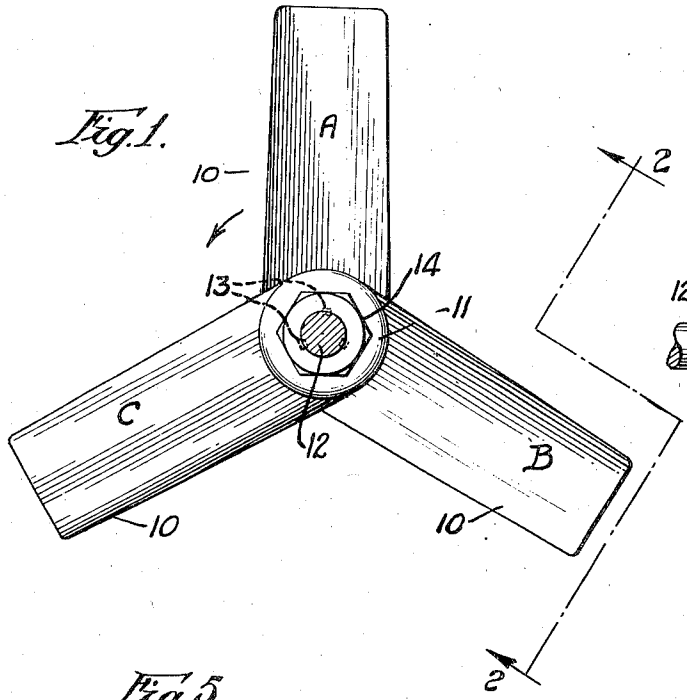

Fig. 2.

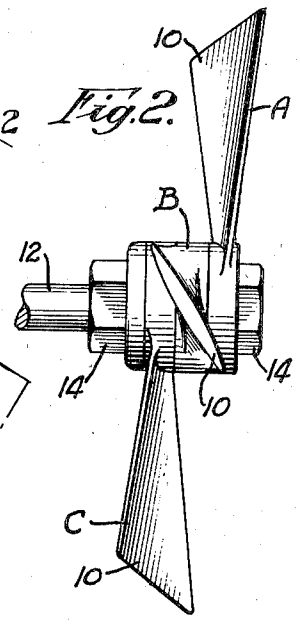

Fig. 5.

Fig. 3.

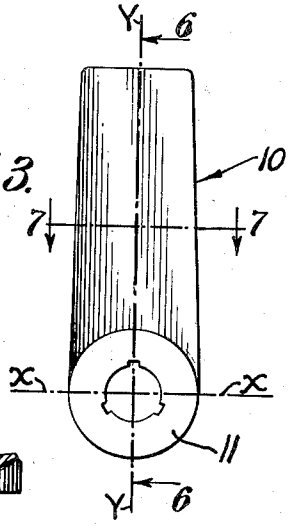

Fig. 7.

Fig. 4.

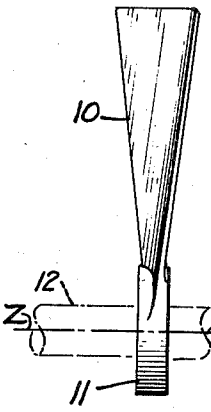

Fig. 6.

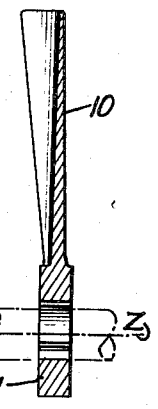

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Fig. 8.

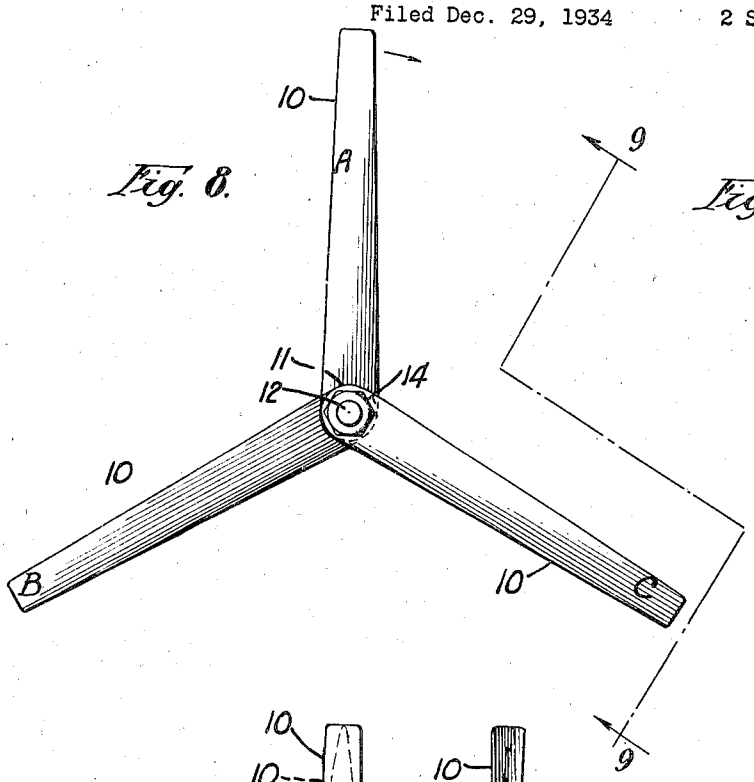


Fig. 9.

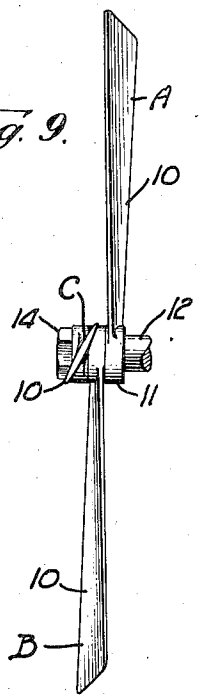


Fig. 10.

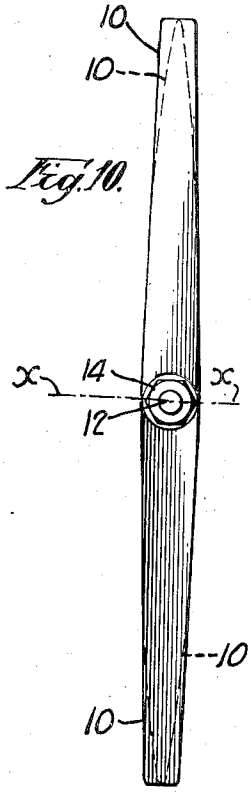
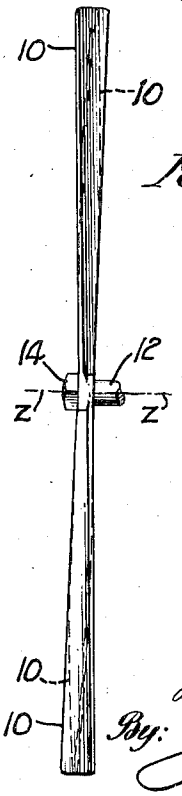


Fig. 11.



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Patented May 3, 1938 2,116,054

UNITED STATES PATENT OFFICE

2,116,054

PROPELLER

John Weichwald, Chicago, Ill.

Application December 29, 1934, Serial No. 759,698

6 Claims. (Cl. 170—165)

This invention relates to propellers and has among its objects to provide a new and useful propeller for aircraft and watercraft which is characterized by a comparatively high propulsive efficiency.

The propeller as shown in the illustrations includes two or three blades each of which is preferably formed integrally with the hub.

An object of my invention is a propeller which includes a multiple of blades, preferably three, which are offset one to the other, or spaced, longitudinally of their supporting drive shaft.

Another object of my invention resides in the relative mounting of the blades on the drive shaft. In a three blade aircraft propeller, such as shown in Figs. 8 and 9, and when viewed from the engine or motor side, or in other words, when viewed in a direction opposite to the movement of the watercraft, the three blades are so mounted that the blade nearest the engine is in its revolution always followed by the intermediate blade, and the intermediate blade by the blade farthest from the engine; whereas, in a three blade watercraft propeller, such as shown in Figs. 1 and 2, and when viewed from the engine or motor side, the three blades are so mounted that the blade nearest the engine is in its revolution always followed by the blade farthest from the engine and the farthest blade by the intermediate blade. In other words, the three blades are so relatively angularly disposed one to the other that their order of succession in their revolution about the drive shaft, when considered in the direction of flight of the aircraft or in the direction of movement of the watercraft, is such that the foremost blade is always followed by the rearmost blade and the rearmost blade by the intermediate blade.

Another object of the invention is found in the provision of a propeller having blades the design of which is based upon the following features:

(*a*) The blades are preferably formed with integral hub portions.

(*b*) The blades are so designed to evolve from a theoretical line intersecting the longitudinal center line of the drive shaft at a right angle.

(*c*) The thickness of the blades decreases gradually and progressively longitudinally of the blades from the longitudinal axis of the hub portion to the tips of the blades.

(*d*) The pitch of each blade evolves from zero at its theoretical center of evolvement on a line of mergence which intersects the longitudinal axis of the hub portion at a right angle thereto.

(*e*) The cross-sectional thickness of each blade decreases from the maximum on the longitudinal center line of the blade to the minimum at the leading and trailing edges.

(*f*) The total combined length of the three hub portions measured longitudinally of the drive shaft does not exceed the maximum face width of a single blade.

(*g*) The total combined length of the three hub portions measured longitudinally of the drive shaft does not exceed the depth of the circular path of revolution defined by the innermost and outermost tip portions of the inner and outer blades.

With the above and other objects in view, my invention consists in the novel form, construction and arrangement of the propeller parts and elements thereof, shown in preferred embodiment in the attached illustrations, described in the following specifications and particularly pointed out in the appended claims.

Referring to the drawings:

Fig. 1 is a view of a propeller for watercraft embodying my invention looking from the engine or motor side;

Fig. 2 is a side view of same taken on line 2—2 of Fig. 1;

Fig. 3 is a face view of a single blade of the propeller;

Fig. 4 is a side view of the blade;

Fig. 5 is an end view of the blade;

Fig. 6 is a longitudinal section taken on line 6—6 of Fig. 3;

Fig. 7 is a cross section taken on line 7—7 of Fig. 3;

Fig. 8 is a view of an aircraft propeller embodying my invention and looking toward the motor;

Fig. 9 is a side view of the aircraft propeller taken on line 9—9 of Fig. 8;

Fig. 10 is a face view of a two blade aircraft propeller embodying my invention; and

Fig. 11 is a side view of same.

The watercraft propeller shown in Figs. 1 to 7 inclusive, includes a plurality of blades and in the present instance, three, which are indicated by letters A, B and C, in Figs. 1 and 2.

Each blade, generally indicated by numeral 10, includes preferably an integral hub portion 11. The blades are securely mounted on the drive shaft 12 in any suitable manner. I have shown securing means, for example, comprising keys 13 and a pair of nuts 14.

From the illustrations, it will be noted that the blades are designed to evolve from a transverse

axis X—X which passes through the center of the hub transversely and right-angularly to the longitudinal axis Z—Z of the drive shaft 12 and the longitudinal center line Y—Y of the blade. The pitch of the blade on its transverse axis X—X is zero and increases gradually and progressively toward and to the tip of the blade. The cross-sectional thickness of the blade also decreases from the maximum on the transverse axis X—X to the minimum at the blade tip. See Figs. 5, 6 and 7.

The cross-sectional thickness of the blade also decreases from the maximum on the longitudinal center line Y—Y of the blade to the minimum at the leading and trailing edges of the blade.

In a three blade aircraft propeller shown generally in Figs. 8 and 9, the design and construction is identical to that above-stated for the watercraft propeller except that the blades are much longer proportionately to their width.

Figs. 10 and 11 show a two-blade aircraft propeller embodying my improved design and construction and having the two blades 10 formed integrally with the hub or hub portion 11.

The aircraft and watercraft blades are preferably made with a uniform face width as shown in Figs. 1 to 9 inclusive, but the aircraft blades could be designed or formed with a face having a maximum width at the hub portion and gradually decreasing in width toward the tip as shown by dot and dash lines in Figs. 10 and 11.

I claim:

1. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades having a uniformly outwardly increasing pitch and being arranged circularly relatively one to the other so that their order of succession in their revolution about the drive shaft, when considered in the direction of movement of the body propelled, is such that the foremost blade is followed by the rearmost blade and the rearmost blade by the intermediate blade, and the total combined length of the hubs of said three blades not exceeding the depth of the circular path of revolution defined by the innermost and outermost tip portions of the inner and outer blades.

2. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades having a uniformly increasing pitch from zero pitch at the hub and being arranged circularly relatively one to the other so that their order of succession about the drive shaft is such that the blade nearest the engine or motor of a watercraft is followed by the farthest blade and the farthest blade by the intermediate blade, and the total combined length of the three hubs being not greater than the maximum face width of a single blade.

3. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades being arranged circularly relatively one to the other so that their order of succession in their revolution about the drive shaft, when considered in the direction of movement of the body propelled, is such that the foremost blade is followed by the rearmost blade and the rearmost blade by the intermediate blade, each of said blades having a pitch which increases uniformly outwardly from the hub portion to the tip of the blade.

4. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades being arranged circularly relatively one to the other so that their order of succession about the drive shaft is such that the blade nearest the engine or motor of a watercraft is followed by the farthest blade and the farthest blade by the intermediate blade.

5. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades being arranged circularly relatively one to the other so that their order of succession in their revolution about the drive shaft, when considered in the direction of movement of the body propelled, is such that the foremost blade is followed by the rearmost blade and the rearmost blade by the intermediate blade, and the total combined length of the hubs of said three blades not exceeding the depth of the circular path of revolution defined by the innermost and outermost tip portions of the inner and outer blades.

6. The combination with a drive shaft, of a propeller comprising three blades having hubs adjacently mounted on said shaft, said blades being arranged circularly relatively one to the other so that their order of succession about the drive shaft is such that the blade nearest the engine or motor of a watercraft is followed by the farthest blade and the farthest blade by the intermediate blade, and the total combined length of the three hubs being not greater than the maximum face width of a single blade.

JOHN WEICHWALD.