2 Sheets--Sheet 1.

F. G. FOWLER.

Marine Propellers.

No. 153 892. Patented Aug. 11, 1874.

Fig. 1.

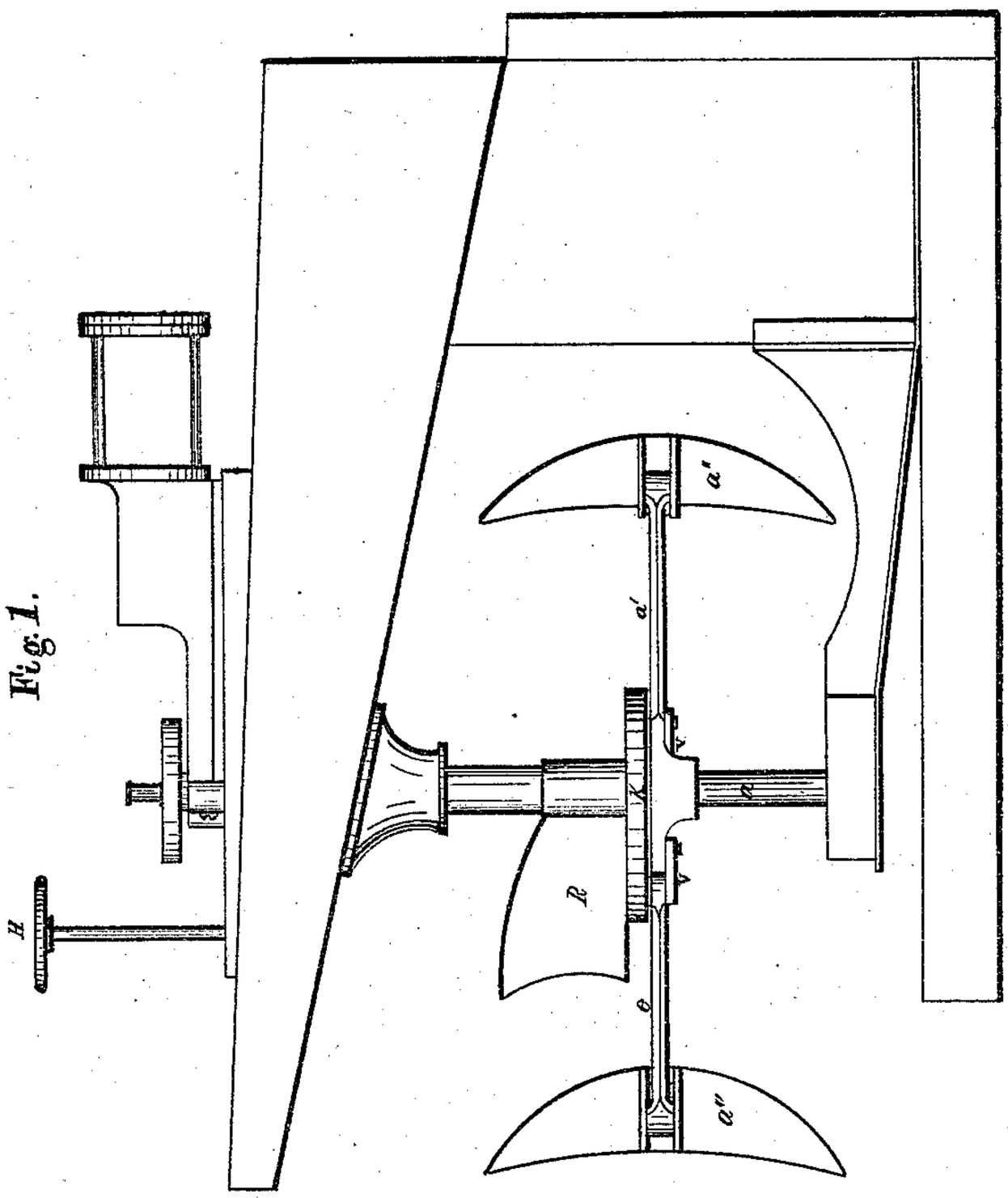
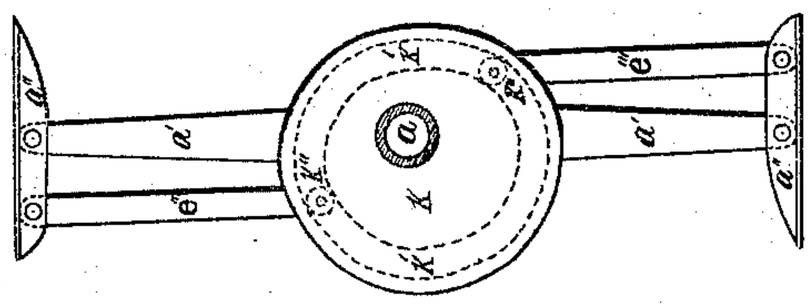


Fig. 2.



WITNESSES:

D. A. Tarbell

W. F. Edwards,

INVENTOR:

Frank G. Fowler

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

2 Sheets--Sheet 2.

F. G. FOWLER.

Marine Propellers.

No. 153,892. Patented Aug. 11, 1874.

Fig. 3.

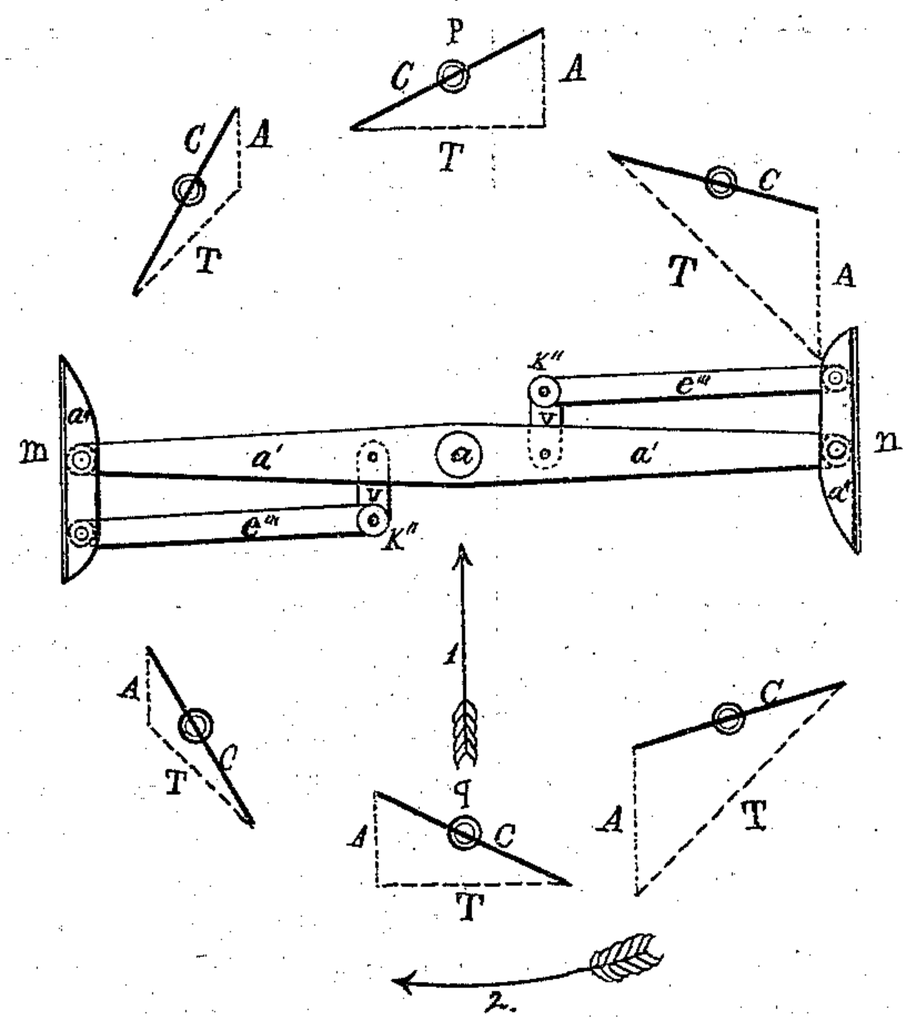


Fig. 4.

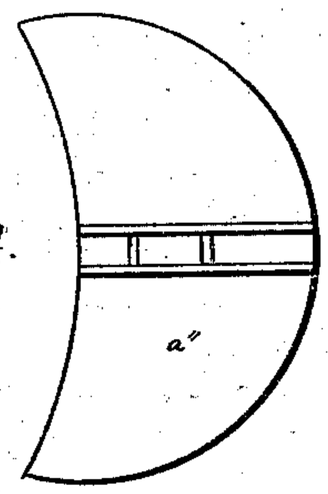


Fig. 5.

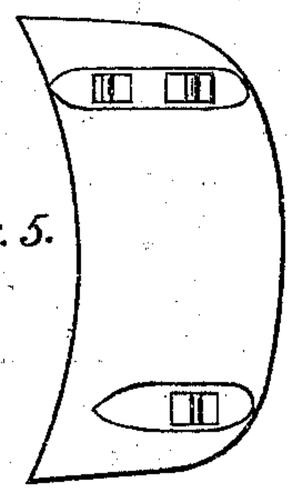


Fig. 6.

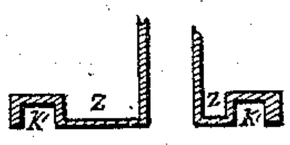
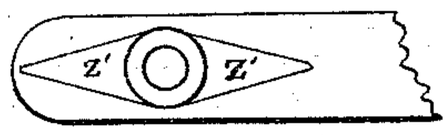


Fig. 7.



WITNESSES:

D. A. Jarbell

J. F. Edwards.

INVENTOR:

Frank G. Fowler

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

FRANK G. FOWLER, OF BRIDGEPORT, CONNECTICUT.

IMPROVEMENT IN MARINE-PROPELLERS.

Specification forming part of Letters Patent No. **153,892**, dated August 11, 1874; application filed October 4, 1873.

To all whom it may concern:

Be it known that I, FRANK G. FOWLER, of Bridgeport, in the county of Fairfield and State of Connecticut, have invented a new and Improved Marine-Propeller; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and letters of reference marked thereon, making a part of this specification, in which—

Figure 1 is a side elevation of my invention. Fig. 2 is a plan view of the same with rudder and sleeve removed. Fig. 3 is a plan view with cam removed, and also gives the different positions assumed by the blades when the propeller is in motion. Figs. 4 and 5 are side elevations of improved blades. Fig. 6 is a vertical longitudinal section of my improved cam. Fig. 7 is a plan view of my improved step.

Similar letters of reference indicate like parts.

This invention relates to improvements in submerged marine-propellers mounted on vertical shafts and having feathering blades. In other propellers, in which the feathering motion is produced by an eccentric, there is a loss of power from the fact that the required angle of the blades essential to perfect propulsion cannot be obtained, the blades having too coarse an angle at some points of their circuit and too fine at others, whereby a "drag" is produced; and this invention consists, first, in the employment of a cam-groove, trucks, connecting-bars, &c., whereby any required angle can be given them at any point of their circuit, whereby perfect propulsion is produced. In other propellers the arms are attached to the blades at their extremities, two arms being used for the same blade; and this invention consists, second, in an improved blade, in which the arm is attached to the center of the blade, a single arm being used, whereby the resistance of an extra arm is saved, and the efficiency of the wheel greatly increased. In other propellers the blades are rectangular in form, having perpendicular cutting-edges. These features are objectionable, for the reason that a perpendicular or parallel cutting-edge does not enter or divide the water so readily as a diagonal cutting-edge; and as the blade passes the stern-post it strikes the dead water simultaneously throughout its entire length, by which a severe shock is produced; and this invention may be constructed with blade having a convex cutting-edge and a concave following-edge. By having the cutting-edge circular it passes through the water with far less resistance, thereby economizing a great amount of power, and in passing through the dead water at the stern-post it enters it so gradually that no shock is produced. This form of blade possesses other advantages. As the forward portion comes in contact with the water, which is thrown off by the pressure of the blade, it again comes in contact with their diagonally-extending extremities, by which the blades obtain a more stable fulcrum than if they were rectangular in form. Other propellers operating in salt water, if constructed of iron, are liable to be corroded and destroyed by the action of salt water; and in forming the journals or bearings of such submerged propellers, it is necessary that they should be run on lignumvitæ, and for this purpose it is necessary to employ brass or copper to run in contact with the lignumvitæ, for, if iron is used, it soon becomes rough by corrosion, and wears or rasps the lignumvitæ rapidly away; and in so employing brass it greatly aggravates the corrosion of the iron above referred to, as a galvanic action takes place between the iron and brass; and this invention consists, third, in casting the eccentric or cam with a recess, and filling the same with zinc, and in attaching a box or boxes containing zinc or other analogous material to the step of the propeller, whereby the corrosive and galvanic action is neutralized, and the iron preserved, as the corrosive and galvanic action of sea water will now be directed to the zinc, it being more easily oxidized than iron.

The steering qualities of my propeller may be improved by attaching a rudder to the sleeve of the propeller, whereby it can be operated with the same helm that serves to steer the boat when steaming, and by which means the boat can be steered when under sail, whereas in other propellers, if a rudder is em-

ployed, it becomes necessary to locate it aft the propeller, and provide a separate helm and steering connections.

Having stated the general nature of my invention, I will now proceed to explain more fully its construction and operation.

The device by which the blades are perfectly feathered will be understood by reference to Figs. 2 and 3.

a represents the vertical shaft of a propeller; *a'*, horizontal arms extending from the same, and *a''* blades attached to the arms by a pivoted joint. *k* is a horizontal cam, attached, by suitable connections, to the helm H. It is traversed by the trucks *k''*, being provided for that purpose with the groove *k'*. These trucks are all sustained by the pivot or bearing at the extremity of the rod *e'''*. This rod is connected, by a pivot at its outer extremity, to the blade *a''*, and at its inner extremity is held in position by the short connecting-bar *v*. This bar is attached at one end to the rod *e'''*, and at the other, by a pivot, to the main arm of the propeller, the arrangement being such that, as the propeller revolves, the trucks will traverse the groove of the cam, giving a vibrating motion to the bar *v*, a reciprocating motion to the rod *e'''*, and an oscillating motion to the blade *a''*. That will cause the blades to exert a propelling force throughout their entire circuit except when passing two dead-points *m* and *n*. The manner in which the groove of the cam is laid off so as to secure a proper angle of the blades, and insure the blades propelling with equal speed throughout an entire revolution, will be understood by reference to Fig. 3. Take, for example, a blade at the point P. Let the dot line A be drawn in the direction of the thrust of the propeller or of the line of the vessel's progress, and the line T be drawn tangent to the propeller. The line C will represent the position of the blades. We shall then have a triangle in which the base is a tangent line; the altitude, the line of the vessel's progress; and the hypotenuse, the line of the blades. If the line T be made to represent the circumference of the propeller, the line A will represent its pitch, and the line C the cycloidal curve that the blade describes when the vessel is under way. The lengths of the lines in the case referred to will be represented by the numbers 10, 5, and 11. Therefore, if the circumference of the propeller is ten feet, the pitch will be five feet and the cycloidal curve eleven feet. But that is true of the blade, so far as the cycloidal curve is concerned, only in passing that point, and represents an instantaneous compensation; but the pitch must be a certain component part of the circumference at all times, and the line A is seen to be one-half the length of the line T throughout an entire revolution.

From the foregoing it will be seen that to properly lay off the groove of the cam it is only necessary that it shall be such that the blade will be held in such a position that the line A will always be a certain component part of the line T when the blades will be propelling with the same speed throughout their entire circuit; but if the blades are feathered with an eccentric the line A will sometimes be longer and sometimes shorter than the line T, in which case the pitch of the blades or their speed of propulsion differ correspondingly, which results in a great loss of power.

My improved single-arm blade will be understood by reference to Fig. 4, which represents a blade with a single attachment for the arm, and that is in the center of the blade. No undue strain is brought to bear on the pivot, as the pressure on the upper half of the blade balances the pressure on the lower half.

An improved form of blade is represented by Figs. 4 and 5, the latter representing a blade with attachments for two arms. By having the cutting-edge convex it enters the water more readily, it being partially drawn instead of being pushed directly forward; and by having the following-edge concave the proper width of the blade is preserved, and by the general configuration which results the blade is rendered a more efficient propelling instrument; but the edges need not, necessarily, be convex and concave, but may be formed by diagonally extending straight lines for the cutting and following edges, with horizontal lines for the ends, and would be represented by two rhomboids with their bases joined together.

My device for the prevention of galvanic action and corrosion will be understood by reference to Figs. 6 and 7. It consists of a box attached to the step of the propeller and filled with zinc-scrap, and is so disposed before and after the shaft as to provide an ample receptacle for the zinc without producing any additional resistance in the water. A similar box may be attached to the sleeve above the propeller. The effect of the zinc is to render the water anti-galvanic and prevent the corrosion of the parts of the wheel composed of iron.

A method for improving the steering qualities of such propellers consists in attaching a rudder to the sleeve of the propeller, and can be used to steer the boat when the engine is not in motion or when the boat is under sail.

What I claim as new and useful, and wish to secure by Letters Patent, is—

1. The combination of means herein described, consisting of the arms *a'* and *e'''* and cam *k*, whereby the blade *a''* is given certain required angles at different points in its revolution, as described and shown in Figs. 2 and 3.

2. The vertically-arranged oscillating blade *a''*, pivoted to, and supported and operated by, the radial revolving arms *a'*, substantially as described and shown in Figs. 1 and 4.

3. Forming a blade with a convex cutting-edge and a concave following-edge, in the manner and for the purpose as shown and described.

4. The combination of an iron propeller with receptacles containing zinc or other analogous material, whereby the destruction of the parts composed of iron by corrosion or galvanic action is prevented without adding to the bulk or resisting area of the propeller, as herein described and shown in Figs. 6 and 7.

FRANK G. FOWLER.

Witnesses:
W. S. EDWARDS,
D. A. TARBELL.