May 20, 1924.

1,494,964

H. M. STOLLER

PROPELLER

Filed May 17, 1919

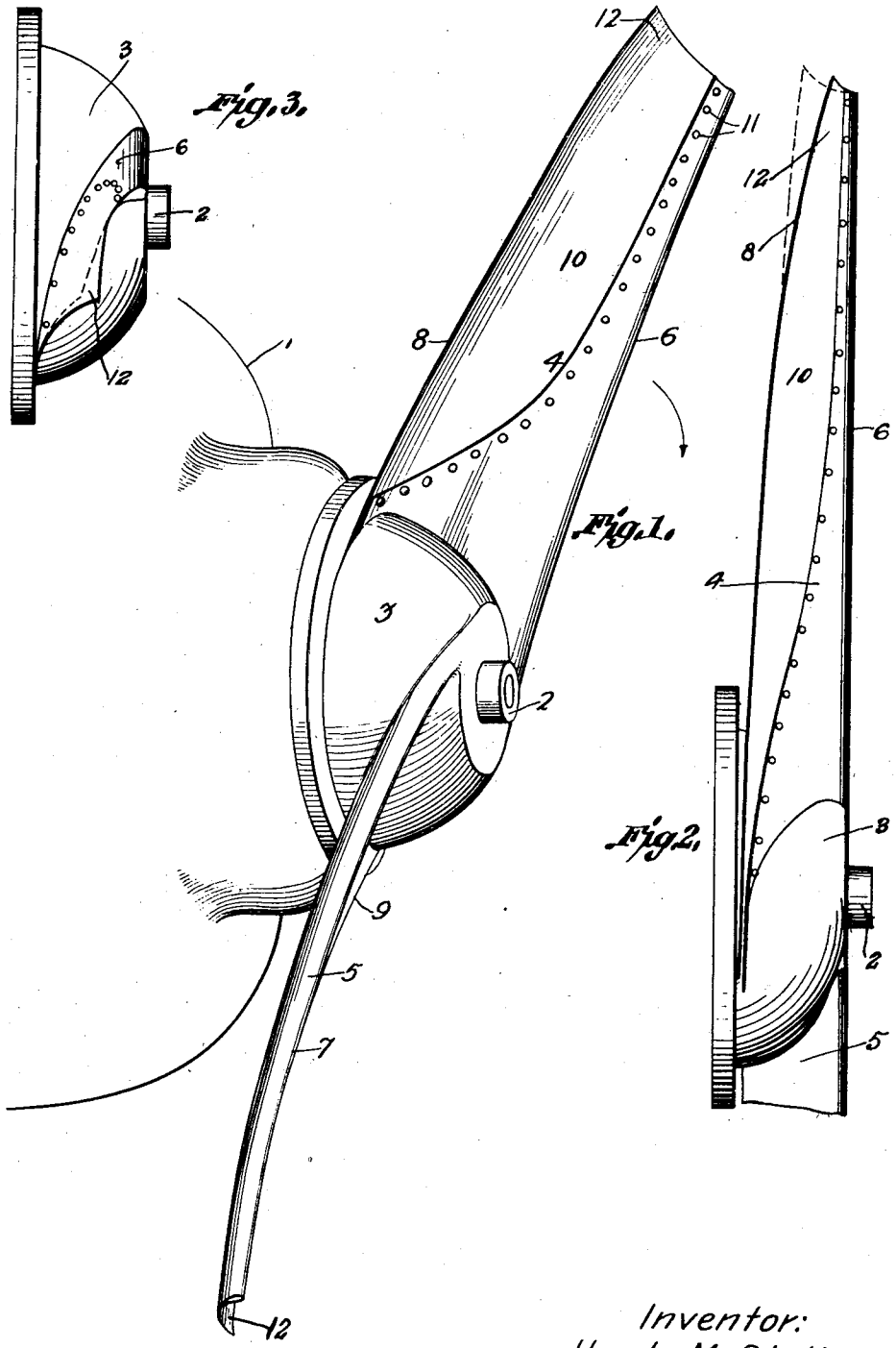


Fig. 3.

Fig. 1.

Fig. 2.

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Att'y.

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UNITED STATES PATENT OFFICE.

HUGH M. STOLLER, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROPELLER.

Application filed May 17, 1919. Serial No. 297,752.

To all whom it may concern:

Be it known that I, HUGH M. STOLLER, a citizen of the United States of America, residing at New York in the county of New York, State of New York, have invented certain new and useful Improvements in Propellers, of which the following is a full, clear, concise, and exact description.

This invention relates to propellers and has particular reference to a fluid driven propeller which may be used to drive small electrical generators, or other similar pieces of apparatus.

Its object is the provision of a propeller in which, when its speed of rotation exceeds a certain amount, an automatic and proportional change of the pitch of the blades will be caused, and thereby restrict variations in its own speed under variations in the velocity of the driving fluid. The speed of operation of the apparatus to which it is attached will thus be more regular than otherwise would be the case.

The invention comprises a propeller having any suitable number of arms, the general surfaces of which are inclined, as usual, both with respect to the longitudinal and transverse axes of the hub. The rear portion of each arm is relatively flexible and is attached to the main body of the arm and inclined rearwardly with respect to the vertical plane and the direction of rotation. When the driving fluid impinges upon the surface of the propeller arm it rotates, and this rotation results in the generation of considerable centrifugal force in the various parts of the arm. The centrifugal force generated in the flexible surface above mentioned, tends, due to the inclination of said surface, to bend the surface toward the vertical plane which would be in a direction tending to increase the pitch of the arm and check its speed, and thereby prevent a rise in the speed of rotation of the propeller. In a preferred form of the propeller, this flexible portion is made of sheet metal having considerable mass, so that the centrifugal force generated is sufficient to produce quite a deflection of the surface, and thereby more effectively control the speed of the propeller.

This invention will be better understood by reference to the following detailed description taken in connection with the accompanying drawing, in which Fig. 1, represents a propeller constructed in accordance with this invention, Fig. 2 represents a side view of the same in which the position of the propeller for high wind velocities is shown in dotted lines, and Fig. 3 represents a top view of the propeller.

The invention is illustrated in Fig. 1 which is a perspective view of the device. As shown, the generator, or other apparatus to be driven, 1, is connected by a shaft 2 to a propeller having a hub 3 and arms 4 and 5. A greater number of arms can, of course, be provided if desired. From an inspection of the figure, the arms will be seen to be inclined with respect to the longitudinal axis of the hub 3, the direction of rotation of the propeller being indicated by an arrow. In accordance with this direction, the edges 6 and 7, respectively, are the forward edges of the arms, 4 and 5, and are formed by bending the metal of the arms back on itself and riveting the line of the overlapping portion as shown, and edges 8 and 9 are the rear edges of the arms 4 and 5. It will thus be seen that the front portions 6 and 7 of each blade are very rigid and formed of two layers of metal and the rear portion 10 is relatively flexible being made of a single layer of material. The overlap is riveted along the edges by rivets 11 as shown.

The flexible portion 10 is inclined as a whole rearwardly from a vertical plane and with respect to the direction of rotation, and thus will be considerably affected by the action of centrifugal force at high speeds. Since this portion 10 is preferably formed of some material having considerable mass, such as metal, when the propeller arms 4 and 5 have attained a certain speed of rotation, the centrifugal force of these outer portions 12, corresponding to the well known law, $F=\frac{MV^2}{R}$, will cause them to flatten out and to more closely conform to the vertical plane which will thereby tend to increase the effective pitch of that portion of the arm and so tend to prevent a rise in the speed of rotation of the arms 4 and 5. The propeller arms proper may be made of any suitable material, so long as such a proper relation is maintained between the mass and the flexibility of the flexible portion as to give the desired degree of regulation.

Fig. 2 illustrates a side view of the propeller of Fig. 1 looking at the propeller in a direction at right angles to its axis of rotation. As shown in this figure, the flexible portion 10 is so riveted to the shaft 6 that it is bent forwardly in the direction of the wind and downwardly in the direction of the axis of rotation. The dotted lines in this figure illustrate the position the upper part 12 of the flexible portion will tend to assume due to centrifugal force when the propeller is rotated at high speed. It is apparent that this change in position of the portion 12 is due to centrifugal force, since the center of mass of portion 12 in moving into the plane shown in dotted lines, will move upwardly and rearwardly so that consequently the center of mass assumes a position farther away from the axis of rotation of the propeller. It will also be apparent from this figure, that when the propeller blade tends to assume the position shown in dotted lines that more of the driving wind will be spilled thereby tending to reduce the speed of rotation of the propeller.

Fig. 3 represents a top view of the propeller of Fig. 1, and shows in full lines the position of the propeller blade at rest, while showing in dotted lines its position for a high speed of rotation.

This invention is particularly applicable to wind driven generators used on high speed vehicles, such as aeroplanes, which attain excessively high speed, a voltage regulation for the generators being provided by the use of this invention.

What is claimed is:

1. A wind driven propeller, comprising a hub, a propeller arm on said hub, the forward portion of said arm with respect to the direction of the wind being rigid, the rear portion of said arm comprising flexible material so joined to the rigid portion that when said propeller arm is at rest the flexible portion is bent forwardly in the direction of the wind and downwardly in the direction of the axis of rotation and such that for high speeds of rotation the center of mass of the flexible portion will be moved rearwardly and farther away from the axis of rotation.

2. A wind driven propeller, comprising a hub, a metallic propeller arm on said hub, the forward part of said propeller arm with respect to the direction of the wind being of sufficient thickness to be rigid, the thickened portion being of greater width near the hub than near the outer end of said arm, the rear portion of said propeller arm being composed of metallic material sufficiently thin to be flexible, the rigid portion and the flexible portion being so joined for the propeller arm at rest that the flexible portion is bent forwardly in the direction of the wind and downwardly in the direction of the axis of rotation and such that for high speeds of rotation the center of mass of the flexible portion will be moved rearwardly and farther away from the axis of rotation.

In witness whereof, I hereunto subscribe my name this 12th day of May A. D., 1919.

HUGH M. STOLLER.