

J. R. LISTON.
PROPELLER.
APPLICATION FILED OCT. 25, 1910.

1,030,900.

Patented July 2, 1912

2 SHEETS—SHEET 1.

Fig. 1.

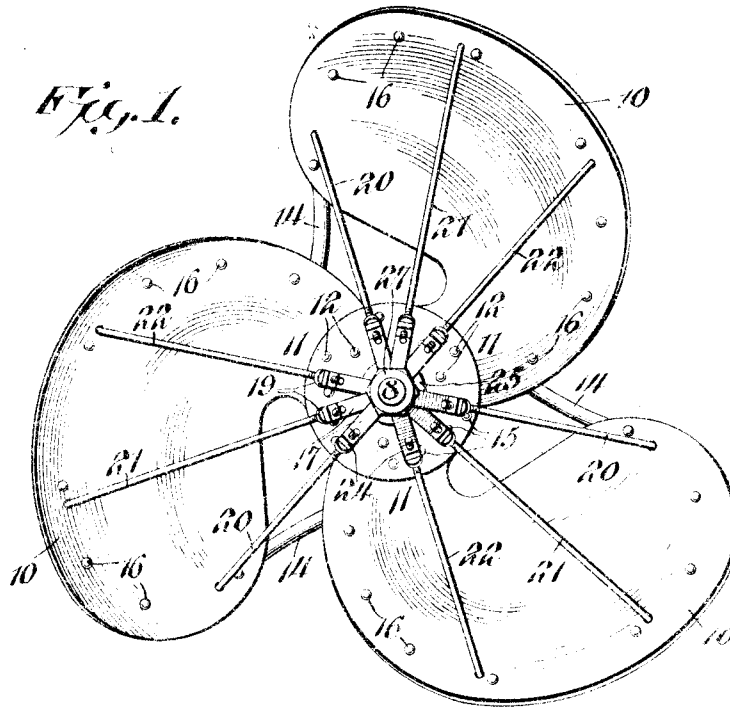


Fig. 3.

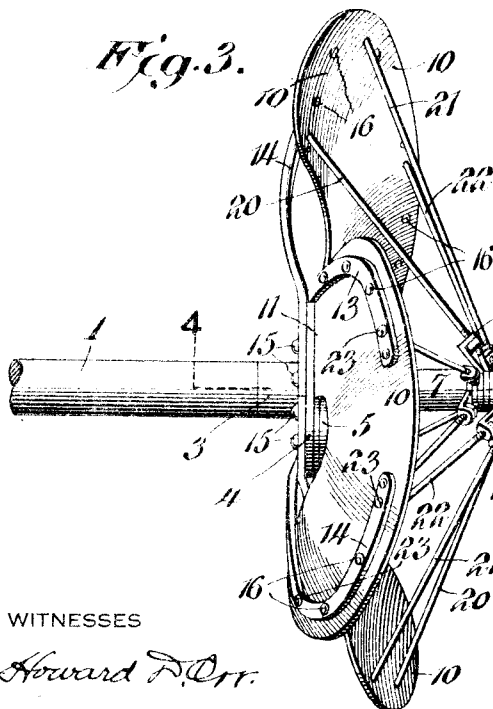
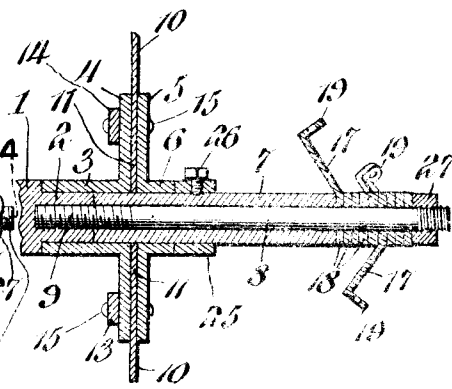


Fig. 4.



WITNESSES

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2 SHEETS-SHEET 2.

Fig. 2.

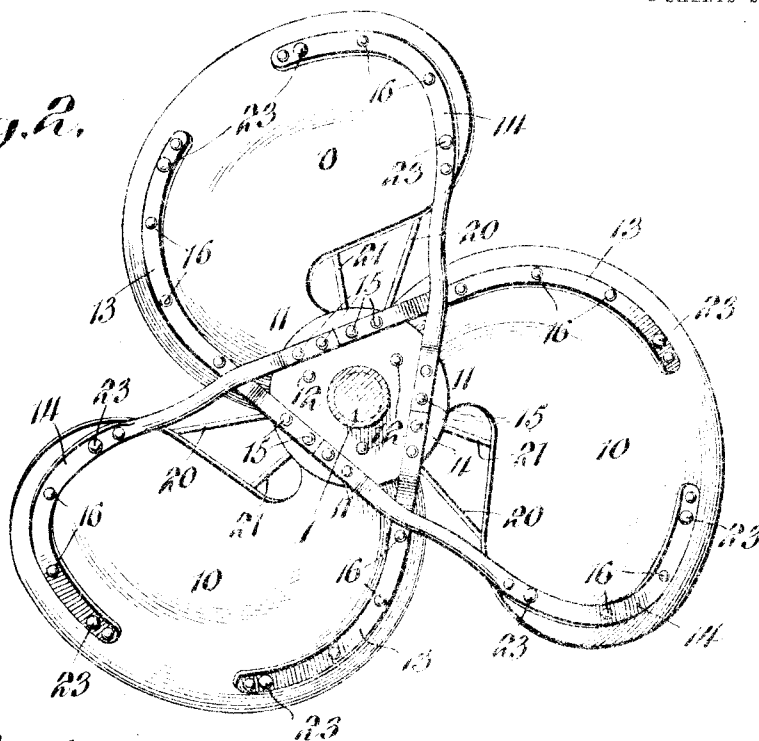


Fig. 5.

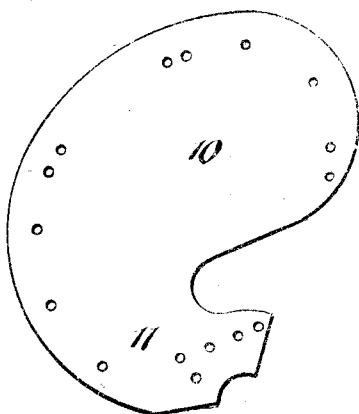


Fig. 6.

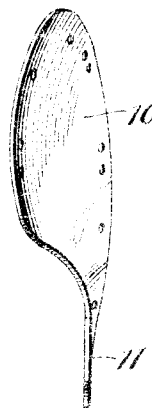
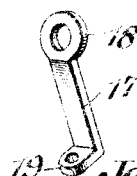


Fig. 7.



WITNESSES

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JAMES R. LISTON, OF PACIFIC BEACH, CALIFORNIA.

PROPELLER.

1,030,900.

Specification of Letters Patent.

Patented July 2, 1912.

Application filed October 25, 1910. Serial No. 589,075.

To all whom it may concern:

Be it known that I, JAMES R. LISTON, a citizen of the United States, residing at Pacific Beach, in the county of San Diego and State of California, have invented a new and useful Propeller, of which the following is a specification.

This invention has reference to improvements in propellers, and its object is to provide a propeller which shall be of sufficiently light construction to be utilizable in connection with air ships, but at the same time shall be sufficiently rigid to resist the strains put thereon in service. Furthermore, the propeller blades may be shaped as desired, or their shape changed from time to time without in any manner affecting the rigidity of the propeller whatever be the use to which it is put.

In accordance with the present invention the propeller blades are made of some light sheet metal such, for instance, as aluminum, although other metals may be used, and these propeller blades are backed up by spring metal arms, such, for instance, as spring steel, and straining rods are carried from these arms through the propeller blades to suitable connections with the propeller shaft, so that by adjustments of the straining rods the shape of the propeller blades may be readily changed as found expedient, such changes being facilitated by the tendency of the propeller blades to return to a normal condition due to the spring metal arms fast to such propeller blades.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the showing of the drawings is largely indicative without attempt to illustrate relative proportions, and, therefore, it follows that various changes and modifications may be made in the practical embodiment of the invention without departure from the scope of the invention, and while still retaining the salient features thereof.

In the drawings:—Figure 1 is an elevation of a propeller constructed in accordance with the present invention looking at the active face thereof. Fig. 2 is an elevation of the other face of the propeller with the propeller shaft in section. Fig. 3 is a side elevation of the propeller as viewed from the

left hand side of Fig. 1. Fig. 4 is a section on the line 4—4 of Fig. 3 drawn to a larger scale and omitting some of the parts. Fig. 5 is a face view of one of the propeller blades. Fig. 6 is an edge view thereof. Fig. 7 is a perspective of a link used in connection with the propeller.

Referring to the drawings, there is shown a propeller shaft 1 which may be of ordinary construction, and in the case of an air ship is usually the crank shaft or a continuation of the crank shaft of an explosion engine. The end of the shaft remote from the engine is reduced in diameter to form a stem 2 to which is applied the sleeve 3 terminating at the end remote from the shaft in a radial flange 4, and matching the flange 4 is another like flange 5 formed of a sleeve 6 which, when the parts are assembled, is in alinement with the sleeve 3. The stem 2 of the shaft 1 stops short of the flange 4, but there is provided a continuing member in the form of a sleeve 7 on a rod 8 having one end 9 threaded and inserted in the reduced end 2 of the shaft 1, so that the sleeve 7 and rod 8 are in effect part of the shaft 1. The flanges 4 and 5 receive between them propeller blades 10, each of which, as indicated in the drawings, has a comparatively narrow neck end 11 extending between the flanges 4 and 5 and there secured by suitable rivets 12, or by any other suitable fastening means, and from these neck ends the blades expand in width and curve in the direction of rotation of the propeller. The blades are, also, given a partial twist and pitch which may be varied within comparatively wide limits, so that the blades are adapted to varying conditions of use. Fast to the flanges 4 are arms 13, 14, rivets 15 or other fastening means being employed for securing these arms to the flange, and where the rivets coincide with the blades they may be utilized as a further fastening means for the blades. These arms 13 and 14 extend from the flange 4 and together conform to a material portion of the marginal part of each fan blade, there being an arm 13 and an arm 14 for each blade. The arm 13 extends along and conforms to the trailing portion of the fan blade, and the arm 14 extends along and conforms to the leading portion of the fan blade. These arms are secured to the fan blades by rivets 16 or other suitable fastening means.

The fan blades are made of sheet metal.

and because of the construction may be quite thin and light, sheet aluminum answering for fan blades of large diameter when designed for use in connection with air ships, the arms 13 and 14 for each blade imparting sufficient rigidity to cause thin metal blades to withstand the strains put upon them in use. The arms 13 and 14 are made of spring metal, such as spring steel and tend constantly to assume a predetermined position, either that in which the blades are flat or in one plane, or in which the blades have a minimum degree of pitch.

The rod 8 extends beyond the sleeve 7 in a direction away from the fan blades, and there receives an appropriate number of links 17, each formed at one end into an eye 18 through which the rod 8 is passed, and at the other end into an angle extension 19 through which there is a perforation, so that the angle extension 19 is also an eye. Each arm 13 and 14 is provided with perforations appropriately spaced, the arm 14 having usually two such perforations and the arm 13 one perforation, and the corresponding blades are similarly perforated to match the perforations in the arms. Extending through these several perforations are straining rods 20, 21, 22 in the particular construction shown in the drawings, wherein three straining rods are provided for each blade. These rods are each provided with a head 23 for engaging the respective arm 13 or 14 as the case may be, and at the other end each rod is threaded and passed through the appropriate eye 19 of a link 17 and there receives a nut 24. While there are indicated three straining rods for each blade, one rod being near the outer end of the arm 13 and the other two rods being so spaced as to include the forward end of the blade, these two rods extending through the arm 14 near its outer end and near the end where the arm passes from the blade toward the flange 4, it will be understood that in large fans more rods may be necessary, so that the invention is not confined to any specific number of straining rods.

The sleeves 3 and 6 are held against the shoulder on the shaft 1 formed by the reduced end 2 by means of a collar 25 secured to a set screw 26, but this does not preclude the direct fastening of the sleeves 3 and 4 to the shaft and to the sleeve 7, respectively. The outer end of the rod 8 is threaded for the reception of a nut 27 which while presenting a preferable construction, is not mandatory.

The links 17 and the propeller hub formed by the sleeves 3 and 6 with the respective flanges 4 and 5 are in substantially fixed relation one to the other. Now by an appropriate manipulation of the nuts 24 any desired pitch of the fan blades may be impart-

ed thereto, since a screwing of the nuts on the rods will tend to draw the outer edge of each fan blade in a direction toward the links 17, thus bending the arms 13 and 14 to a commensurate extent against their normal tendency and imparting a curve or pitch to the blades corresponding to the degree of shortening of the effective length of the rods. Since the inner ends of the fan blades are fast to the hub of the fan, the changing in the length of the straining rods is effective on the outer edge of each fan blade, and since the points of action of the rods on the fan blades are distributed, these blades are readily given the desired curvature, the elasticity of the arms 13 and 14 aiding materially in imparting a regularity of curvature to the portions of the blades acted upon.

Because of the straining rods and the elastic arms 13 and 14, which latter may be made of great strength compared to their weight, the thin metal blades are so reinforced that they will withstand with an ample margin of safety all the stresses and strains put upon them under actual working conditions, as has been demonstrated by practical tests on propellers of large diameter when rotated at high speed for air ship propulsion.

When the propeller is active, the strain is brought upon those faces of the blades toward the links 17, and these strains are withstood by the straining rods, these rods being so distributed as to sustain the blades over practically the entire free edges thereof, and since the strains are in substantially the direction of the length of the rods, the latter may be made quite light without danger of rupture, so as to present but little resistance surface to the air, assuming the propeller to be used for air ship propulsion. Torsional strains are taken care of by the arms 13 and 14, and these arms may be made of ample strength for the purpose without undue weight.

The propeller is of general circular form with the blades each of general spiral shape, widening toward the outer or advanced ends, and the shape is such as to bring the pressure of either air or water, in accordance with the use to which the propeller is put, to bear upon the body of the blades in such manner that the arms 13 and 14 and the stay rods connected thereto will effectually resist such pressure. Because of the shape of the blades they may be expanded without proportionately increasing the radial distance of the outer edges of the blades from the axis of rotation and the width of the blades may also be increased, so that the effect of the propeller may thereby be greatly augmented without necessitating a corresponding increase in diameter.

The construction of the propeller con-

tributes toward making the same a balance wheel, the entire propeller being a balanced structure, and may, therefore, be attached directly to the engine shaft.

5 What is claimed is:—

1. A propeller provided with a suitable hub, sheet metal blades each fast at one end to the hub and extending therefrom with a curvature in the direction of rotation and
10 also widening in the same direction, brace arms for each blade one extending along and conforming to the trailing portion of the blade and the other extending along and conforming to the leading portion of the
15 blade and each at one end secured to the hub, and a plurality of straining rods each connected at one end to a brace arm.

2. A propeller comprising a hub, blades each fast at one end to the hub and extending therefrom with a curvature in the direction of rotation and also widening in the same direction, brace arms each connected at one end to the hub, there being provided a brace arm for each blade fast to said blade
25 along the trailing portion of the blade and another brace arm fast to the blade along the leading portion thereof, and stay rods for each blade engaging the brace arms.

3. A propeller comprising a hub, sheet metal blades each fixed to the hub at one end, elastic reinforcements extending from the hub along the margins of each blade, and a plurality of stay rods for each blade adjustable with relation thereto in opposition
35 to the normal tendency of the elastic reinforcements.

4. A propeller comprising a hub portion,

sheet metal blades each fast at one end to the hub, elastic arms each fast to one end of the hub and at the other end extending
40 along a respective blade adjacent the margin thereof, and stay rods for each blade engaging the elastic arms and adjustable to bend the blades in opposition to the normal tendency of the elastic arms.

5. A propeller comprising a shaft, a suitable hub thereon, sheet metal blades each fast at one end to the hub, a plurality of elastic arms for each blade fast to the hub and to the blade near the margin thereof,
50 a plurality of stay rods engaging the elastic arms of each blade and in adjustable relation to the shaft.

6. A propeller provided with a suitable shaft, a hub mounted on said shaft, sheet metal blades each fast at one end to the hub and extending therefrom with a curvature in the direction of rotation and also widening in the same direction, elastic brace arms extending from the hub along the margins
60 of each blade, a plurality of straining rods each connected at one end to a respective elastic brace arm, and a link individual to each rod and connected to the shaft, the rod being provided with means for varying its
65 effective length to determine the curvature of the respective blade.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

JAMES R. LISTON.

Witnesses:

E. E. HUBBELL,
VERA JUDKINS.