June 23, 1931. S. R. SMITH 1,811,441

AIRPLANE PROPULSION DEVICE

Filed Nov. 13, 1929

Fig. 1.

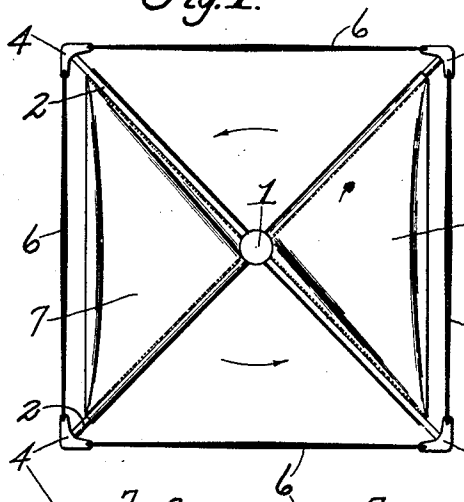


Fig. 2.

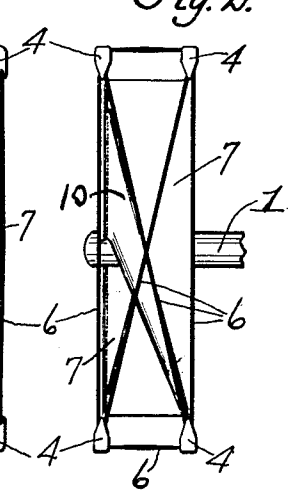


Fig. 3.

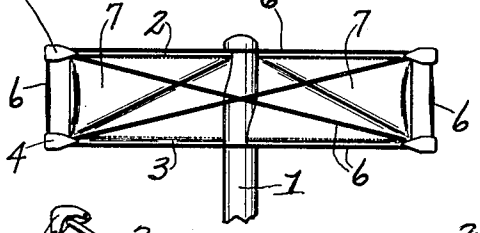
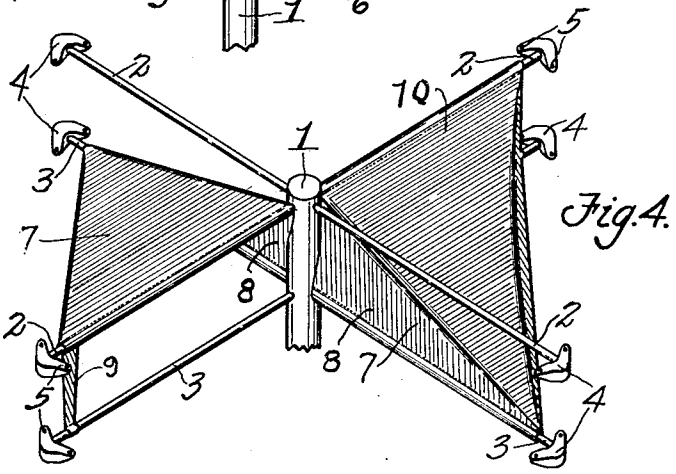


Fig. 4.



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UNITED STATES PATENT OFFICE

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AIRPLANE PROPULSION DEVICE

Application filed November 13, 1929. Serial No. 406,957.

The invention relates to airplane propulsion devices adapted to replace conventional airplane propellers, and has for its object to provide a device of this character having a plurality of air displacing members of U-shaped cross section each having a large dimension leading edge and tapering from the leading edge to the discharge end at a suitable pitch, said members being mounted on the shaft in balanced relation.

A further object is to provide a device of this character with which greater traction per unit of power expended, lower motor speed, and more effective utilization of power is obtained than with conventional screw propellers.

A further object is to provide a device of this character having air displacing members of large area which are constructed to compress the air which they contact in their revolution, whereby great traction is obtained by virtue of the fact that said compressed air forms a heavier and more substantial element against which to push than atmospheric air.

A further object is to provide a device of this character having a plurality of radial arms carrying weights at their outer ends whereby the device will continue to rotate for a period if the motor stalls.

A further object is to provide a device of this character having a rotatable shaft carrying inner and outer sets of radially extending arms on which are mounted in balanced relation a plurality of air displacing members whose leading edges are carried by arms of the outer set and which taper therefrom to the outer end of adjacent arms of the inner set in counter rotation direction to form members of tapering semi-pocket form and of any desired pitch.

With the above and other objects in view, the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawings, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawings:

Figure 1 is a plan view of the device.

Figure 2 is a side view of the device.

Figure 3 is a side view of the device taken at right angles to the view in Figure 2.

Figure 4 is a perspective view of the device in which the bracing members have been eliminated to better show the shape of the air displacing and compressing members.

Referring to the drawings, which illustrate the preferred embodiment of the invention, the numeral 1 designates a rotatable shaft adapted to have a driving connection with an airplane motor in the conventional manner. Carried by the shaft 1 in suitably spaced relation are an outer set 2 and an inner set 3 of radially extending arms, preferably disposed in parallelism and in the axial plane of the shaft, the arms of each set being balanced on the shaft and being preferably four in number disposed perpendicularly with relation to each other. On the outer end of each of the arms in the inner and outer sets are mounted weights 4 for purposes to be hereinafter set forth. The weights 4 are preferably stream-lined and L-shaped in general outline, and are mounted on the arms in balanced relation. Wire brace members 6 are secured to the weights 4 by means of holes 5 formed in the ends of the weights and through which the wires pass, said wires extending between said weights to support and brace the arms in their correct position. As shown, the wire braces preferably extend between the adjacent arms of the same set and diagonally between adjacent arms of both sets, so that the arms of each set are braced with respect to the other arms in the same set and the adjacent arms of the other set.

Two or more air displacing and compressing members 7 formed of a strong heavy grade of canvas or other fabric, or of some strong light metal such as duralumin, are carried by the two sets of arms in balanced relation on the shaft 1 as follows: Beginning at a point at the inner end of an arm of the outer set each member is secured to and extends along said arm to a point adjacent the outer end thereof, thence

the member extends to and is secured to the corresponding arm of the inner set adjacent the outer end thereof, thence the member extends diagonally to a point adjacent the outer end of the adjacent arm of the inner set in counter rotation direction, thence the member is secured to and extends inwardly along said last named arm to the inner end of said arm, thence the member extends to the point of beginning. When so formed the members 7 comprise inner and outer triangular side walls 8 and 9, respectively, and a triangular top wall 10. Each member so constructed is U-shaped in cross section, tapers to a point in counter rotation direction from its U-shaped leading edge in a semi-pocket formation, and has a pitch determined by the spacing of the radial arms of the inner and outer set on the shaft.

This device, with its air displacing and compressing members constructed as above set forth, is very effective in its operation and suitable for its purpose. In its rotation the large dimension U-shaped leading edges of the air displacing members first contact the air, which in the continued rotation of the device is appreciably compressed by the members as their cross sectional dimension progressively decreases in counter rotation direction. The air thus compressed forms a substantially heavier element than mere atmospheric air against which the pitched faces of the members may push in their rotation, and consequently the shape of the members permits a great tractive force to be developed in the revolution of the device. The large area of the pitched faces of the air displacing and compressing members materially enhances the development of tractive force by the device without requiring members of large radius or length, thus making for a more sturdy structure of the device as supported by the shaft thereof. The great traction developed by this device per revolution materially lessens the speed of operation thereof required to produce a given tractive force in comparison with the speed required by conventional propellers, and the device is therefore adapted for use with relatively low speed, long lived motors at consequent greatly reduced operating costs and life risks.

The weights 4 are provided as a safety factor. Obviously the weighted arms of the device will have a great rotational inertia when rotating at full speed, and if the motor of the plane should fail or stall, a continued operation of the air displacing and compressing members under the force of their inertia for a substantial period of time would be of great advantage to a pilot in providing him with some opportunity for maneuvering his plane to make a landing. This would be especially helpful in low altitude flying where the range of mere gliding might be insufficient to enable him to reach a desirable landing place. Naturally the advantage obtained by rotational inertia will be small, but where the weights are streamlined and only a low speed of operation is required the disadvantage of the added air resistance of the weight will be overcome by this advantage.

The invention as shown is susceptible of many modifications. Thus the weights might be eliminated, the bracing of the arms might be altered or eliminated, the specific shape and number of the air displacing members might be changed, and many other similar changes might be made. All of these changes could be made without altering the basic idea of the device, which relates to the use of pitched, tapering, semi-pocket shaped, air displacing and compressing members of large area but small radius. Furthermore the device is adapted for use for propulsion purposes in place of propellers of conventional construction in all devices with which the latter are used, such as speed boats, etc. The device is also adapted for use as the operating means of a helicopter, or in an airplane to permit take off and landing within a small area, by positioning same with its shaft vertically extending.

The invention having been set forth, what is claimed as new and useful is:

1. In a propulsion device, a rotatable shaft, spaced parallel inner and outer sets of radially extending arms carried by said shaft in balanced relation, and air displacing members carried by said shaft, the edges of each of said air displacing members extending from the inner end of an arm of the outer set to the outer end thereof, thence to the outer end of the parallel arm of the inner set, thence diagonally in counter rotation direction to the outer end of an adjacent arm of the inner set, thence to the inner end of said last named arm, and thence to the point of beginning.

2. In a propulsion device, a rotatable shaft, spaced inner and outer sets of perpendicular radial arms, and air displacing and compressing members carried by said arms, the leading edge of each of said members extending from the outer end of an arm of the inner set to the outer end of the adjacent arm of the outer set, thence in contact with said arm to its inner end, and thence to the inner end of an adjacent arm of the inner set, said member tapering from its leading edge to the outer end of said last named arm in counter rotation direction.

3. In a propulsion device, a rotatable shaft, a plurality of radially extending arms carried by said shaft, said arms being arranged to form inner and outer sets of perpendicularly disposed arms, and air displacing and compressing members carried by said arms, each of said members extending

from a leading edge carried by an arm of the outer set to the outer end of an adjacent arm of the inner set in a tapering semi-pocket form.

4. In a propulsion device, a rotatable shaft, spaced sets of radially extending arms carried by said shaft, and air displacing members carried by said arms, each of said members having a U-shaped leading edge carried by an arm of the outer set and secured to the inner and outer ends of adjacent arms of the inner set, said members tapering from the leading edge to the outer end of the adjacent arm of the inner set in counter rotation direction.

5. In a propulsion device, a rotatable shaft, spaced sets of radially extending arms carried by said shaft, and air displacing members carried by said arms and pitched in counter rotation direction, said members having U-shaped leading edges and progressively decreasing cross section in counter rotation direction.

6. In a propulsion device, a rotatable shaft, spaced sets of radially extending arms carried by said shaft, and air displacing members carried by said arms in balanced relation on said shaft, each of said members tapering from a large dimension leading edge carried by an arm of the outer set to the end of an arm of the inner set, each member having angularly disposed side-forming portions extending from the outer to the inner arms and tapering therefrom to the end of said first named inner arm.

7. In a propulsion device, a rotatable shaft, arms carried by said shaft, air displacing and compressing members carried by said arms, weights of streamlined form carried by the outer ends of said arms, and braces carried by and extending between said weights.

8. In a propulsion device, a rotatable shaft, and pitched air displacing members carried by said shaft, said members each having a U-shaped leading edge and tapering therefrom in counter rotation direction.

9. In a propulsion device, a rotatable shaft, and air displacing members carried by said shaft, said members each having a U-shaped leading edge and tapering therefrom in counter rotation direction, the trailing edge of each member being disposed in substantially the same plane as the ends of the U-shaped leading edge to form a pitched semi-pocket-shaped member.

10. In a propulsion device, a rotatable shaft, and air displacing members carried by said shaft, said air displacing members being substantially U-shaped on sections transverse of the line of rotation thereof, the transverse section of said members progressively decreasing in counter rotation direction.

11. The combination in a propulsion device having a rotatable shaft, of radial members carried by said shaft, and weights carried by said members and tapering toward their leading and trailing edges in streamlined form.

In testimony whereof I affix my signature.

SAM R. SMITH.