Oct. 21, 1930. C. A. WRAGG 1,779,026

MULTIPLE BLADE PROPELLER

Filed Oct. 26, 1928

Fig. 1.

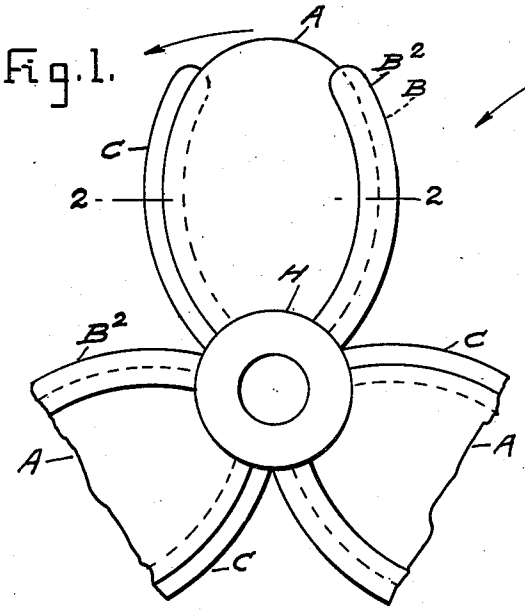



Fig. 4.

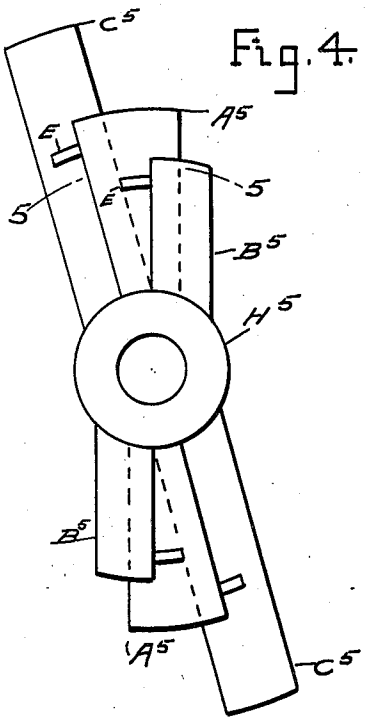



Fig. 2.

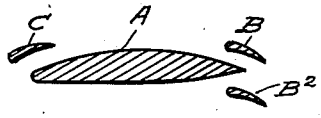



Fig. 3.

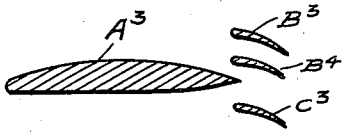



Fig. 5.

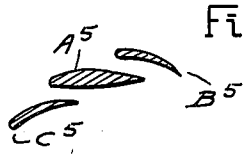
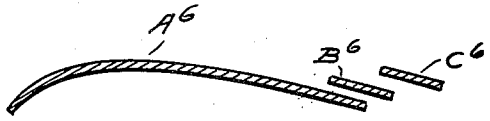



Fig. 6.

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# UNITED STATES PATENT OFFICE

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## MULTIPLE-BLADE PROPELLER

Application filed October 26, 1928, Serial No. 315,254, and in Canada April 12, 1928.

This invention forms in part a continuation of my copending application Ser. No. 78,392, now Patent No. 1,684,567, issued September 18, 1928, and relates to triple or multiple compound blade structures, such as propellers for aerial or marine use as well as for fans, blowers and the like.

The object of the present invention is to provide a structure of this class adapted to reduce energy disturbances, eddy and power losses and similar speed and efficiency reducing factors.

By introducing two or more auxiliary blades or vanes adjacent one or both edges of a main propeller blades and in or near the region of turbulence or cavitation, the effect is to reduce the loss of energy over the entire compounded blade, resulting in increased efficiency under all conditions.

In air propellers it has been difficult to coordinate the revolutionary blade speed giving maximum thrust efficiency with the revolutions per minute of the shaft required for maximum engine efficiency; the usual compromise being to run the propeller with greater, and the engine with fewer number of revolutions per minute than is most desirable in the respective cases. With my compound propeller however this compromise is practically eliminated because the propeller may be rotated at higher velocity without drop in the thrust curve. Furthermore, a higher efficiency can be maintained with my improved construction over a wider range of angles at which the blades meet the air.

A still further advantage of this invention is the reduction of noise from cooling fans of all kinds including exhaustion and compression devices as well as of ordinary propellers.

In the accompanying drawing the invention is illustrated as applied for different uses and

Fig. 1 is a fragmentary face view of marine propeller having compound blades, each consisting of a main and two auxiliary blades or vanes, on the vacuum side and a third on the pressure side near the leading edge of the main blade;

Fig. 2 is a transverse section along line 2—2 of Fig. 1;

Fig. 3 is another cross sectional view of a compound blade having one main blade and three trailing vanes;

Fig. 4 is a face view of triple blade for an air propeller with its main blade between the auxiliary blades or vanes;

Fig. 5 a transverse section along line 5—5 of Fig. 4; and

Fig. 6 a transverse section of a triple blade suitable for a fan and having two auxiliary vanes at the trailing edge of the main blade.

Referring now particularly to Figs. 1 and 2 of the drawing which show my invention as applied to a marine propeller with one main blade and two or three auxiliary vanes. The main blade A is mounted on the hub H symmetrically around the radius of the hub axis and its edges are curved so that it has its greater width about midway between its tip and the axis of the hub. Both the main blade and the vanes are shown cambered but they may take any other suitable shape. The auxiliary vanes B and C are placed, the former near the trailing edge and the latter near the leading edge of the main blade A and on the cambered side thereof. On the chord side of the main blade is shown a third auxiliary vane $B^2$ which may be used in conjunction with the auxiliary vane B or without it. The auxiliary vanes are narrow with substantially parallel edges and are secured on the hub H so that their edges become substantially parallel with the respective edges of the main blade A.

In Fig. 3 is shown a cross section of a compound blade suitable either for a marine or an aerial propeller or wing. The blade members are shown cambered and with one or two auxiliary vanes $B^3$ and $B^4$ on the cambered side of the main blade $A^3$ and a third auxiliary vane $C^3$ adjacent the chord side thereof. All three auxiliary vanes are shown considerably narrower than the main blade and situated in or near the region of turbulence at its trailing edge, it being understood however that any of the auxiliaries may take any of the shapes, positions or orientations shown in the other figures.

In Figs. 4 and 5 is shown a triple blade suitable for an aerial propeller. The main blade $A^5$, integral with the hub $H^5$, is in this case

shown with straight trailing and leading edges, converging centerward with at least one of its edges radial. The auxiliary $B^5$ and $B^6$ are both of substantially rectangular shape and narrower than the main blade and rigidly connected with the common hub $H^5$, all three blade members being preferably cambered, as seen in Fig. 5 but may also be flat. The trailing auxiliary vane $B^5$ is placed in or near the region of turbulence on the cambered side of the main blade $A^5$ and slightly overlapping its trailing edge and with its edges parallel therewith. The vane $B^5$ is shown shorter, while the auxiliary vane $C^5$ is shown longer than the main blade $A^5$ and placed near the leading edge thereof on its chord side. Stream line braces E may be used to still further secure the blade members together.

A blade suitable for a fan is indicated in Fig. 6, where $A^6$ represents a main blade, curved and of substantially uniform thickness. Partly overlapping its trailing edge is shown an auxiliary vane $B^6$ on the convex side of the main blade and a second auxiliary vane $C^6$ is positioned with its leading edge substantially level with the trailing edge of the main blade so as to partly overlap the vane $B^6$. Both the auxiliary vanes $B^6$ and $C^6$ are considerably narrower than the main blade or about one-eighth of the latter's width. The advantage of using this blade construction for fans of all kinds, including compression and exhausting devices, ventilating and cooling fans and the like, is the great reduction or practical elimination of all noise, usually found in such apparatus.

By the use of this invention of auxiliary vanes in compound with a main blade, the "actual angle" of the propeller system is able to vary thru a wide range without the characteristic and hitherto unavoidable drop in efficiency.

It is evident that many changes in the details and construction of the device may be made under the scope of the claims.

I claim:

1. In a structure of the class described, cambered main and auxiliary blades, said auxiliary blades being permanently arranged respectively in front and rear of the main blade and positioned to slightly overlap the corresponding edges of the main blade to compel an unbroken flow of fluid past the structure, the trailing edge of one blade being parallel with the leading edge of the succeeding blade.

2. In a structure of the class described, rigidly interconnected main and auxiliary blades, said auxiliary blades being permanently arranged respectively in front and rear of the main blade and positioned to slightly overlap the corresponding edges of the main blade to compel an unbroken flow of fluid past the structure, the trailing edge of one blade being parallel with the leading edge of the succeeding blade.

3. In a structure of the class described, main and auxiliary blades mounted rigidly on a common hub, said auxiliary blades being arranged respectively in front and rear of the main blade and positioned to partly overlap the corresponding edges of the main blade in order to compel an unbroken flow of fluid past the structure, the trailing edge of one blade being parallel with the leading edge of the succeeding blade.

In testimony whereof I here affix my signature.

CHARLES ARTHUR WRAGG.