Nov. 16, 1948. J. T. McCORMICK 2,453,803

PROPELLER BLADE

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Fig. 1.

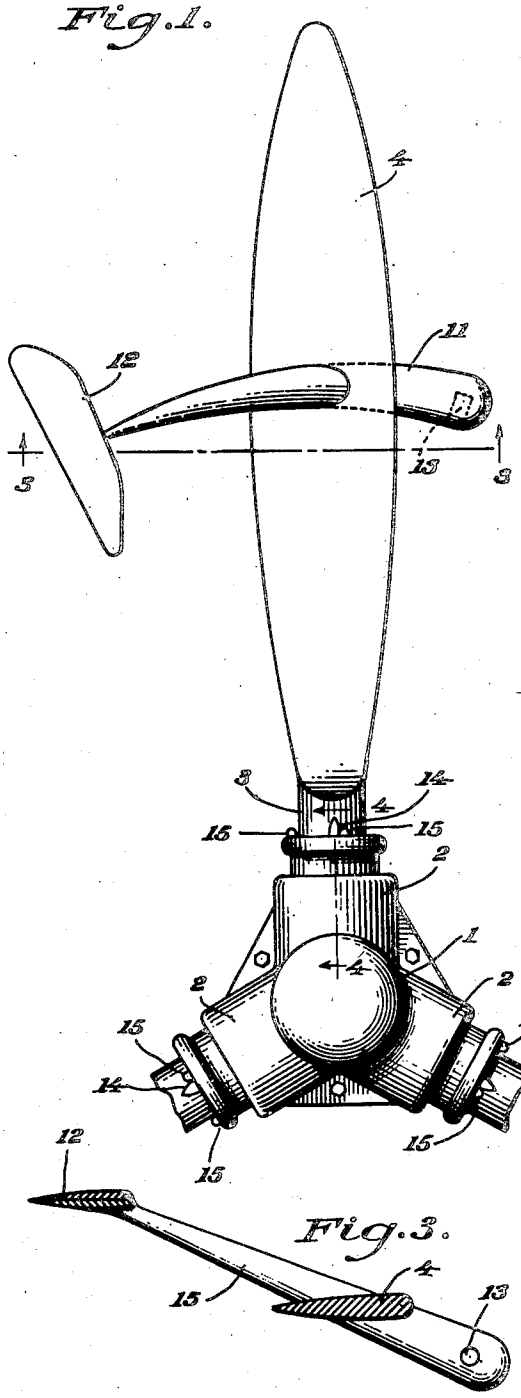


Fig. 2.

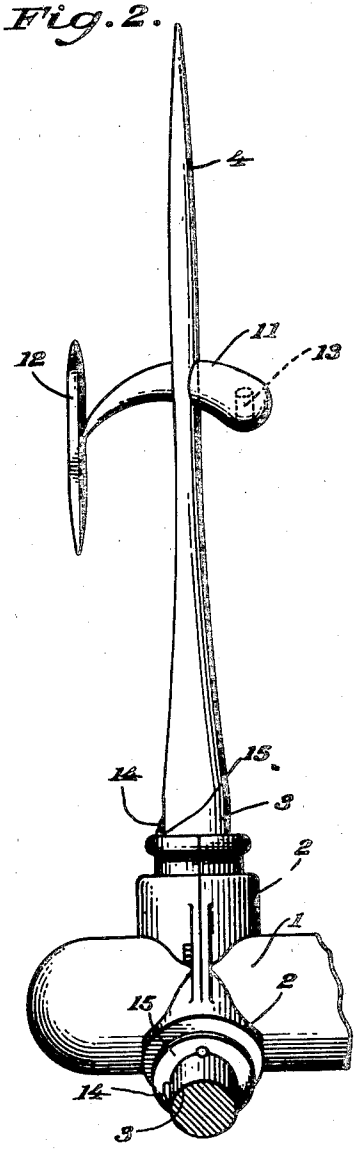


Fig. 3.

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Fig. 4.

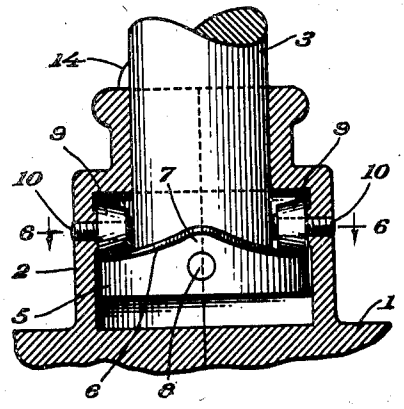


Fig. 5.

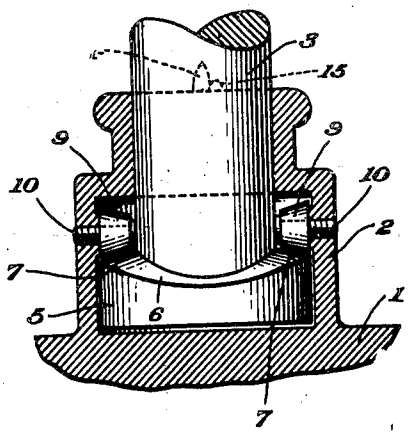
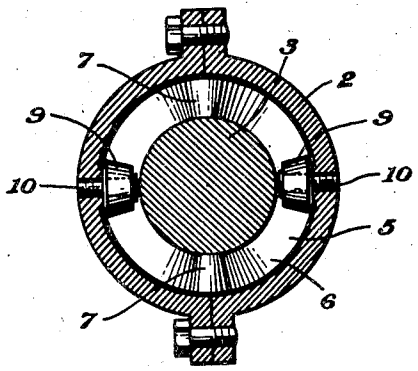


Fig. 6.



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PROPELLER BLADE

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Application December 13, 1943, Serial No. 514,105

2 Claims. (Cl. 170—160)

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This invention relates to a propeller blade and while the improved construction is particularly adapted for the propeller of an airplane it is to be understood that it may be incorporated in a marine screw propeller, helicopter vane, Autogiro vane, windmill blade, fan, blower, or the like.

One object of the invention is to provide the blades of an airplane propeller or similar airfoil with a stabilizer serving to hold the blades at a constant chosen angle of attack to the relative movement of the medium in which it operates.

Another object of the invention is to provide a stabilizer which serves to reduce angular resistance of the blades to a minimum while gliding when the engine has stopped.

Another object of the invention is to provide a stabilizer wherein the stabilizer foil is fixed to a body or support, mounted transversely of the propeller blade with the nose portion of the body or carrier projecting from one side of the blade and the rear portion of the carrier projecting from the opposite side of the blade and supporting the stabilizer foil at its rear end.

Another object of the invention is to provide a stabilizer which serves to cause the vane of a helicopter or Autogiro rotor to assume an effective and predetermined gliding angle in descent.

Another object of the invention is to provide a stabilizer which serves in its application to a marine propeller to cause the blade to assume a gliding angle in reverse direction to its normal rotation and act as a brake against the water whenever the propeller is released from mechanical connection with the engine.

Another object of the invention is to provide a propeller blade in which the component of centrifugal force caused by the weight of the blades entering and trailing edges known as twisting moment has been neutralized or balanced out by an equal and opposite twisting moment at all engine speeds so that the blade is free to be turned to any pitch or angle of attack by an aerial stabilizer or other means of pitch control.

Another object of the invention is to so mount the stabilizer foil that it is disposed in a plane substantially in parallel relation to the propeller blade with which it is associated and in transverse spaced relation thereto.

Another object of the invention is to provide a propeller blade stabilizer which is simple in construction, very effective in operation, and so formed that it retains its proper angular relation to the propeller blade.

The invention is illustrated in the accompanying drawings, wherein:

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Figure 1 is a view in front elevation of a propeller blade having a stabilizer of the improved construction associated therewith.

Figure 2 is a side elevation of Figure 1.

Figure 3 is a fragmentary view taken along the line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view upon an enlarged scale taken along the line 4—4 of Figure 1.

Figure 5 is a sectional view taken at right angles to Figure 4.

Figure 6 is a transverse sectional view taken along the line 6—6 of Figure 4.

The stabilizer constituting the subject-matter of this invention has been illustrated as applied to the propeller of an airplane but it is to be understood that it may be associated with a propeller for a boat, a fan, or the like.

The propeller has a hub 1 carrying a suitable number of radially extending sockets 2 to receive the shanks or butt ends 3 of propeller blades 4 and from an inspection of Figures 4 and 5 it will be seen that these blades are mounted for turning movement in the sockets to angularly adjust the blades. The blades are angularly adjusted according to the direction of attack against the fluid medium in which they move. To make this angular adjustment possible, the normal tendency of the propeller blades to turn to zero pitch because of the centrifugal force of the weight of entering and trailing edges, is opposed in this invention by an equal and opposite moment produced by adding eccentric weight ninety degrees or some portion of ninety degrees removed from the plane of said entering and trailing edges, by shifting existing weight to such an eccentric position, or by allowing the centrifugal weight of the entire blade to act against the surface of a centripetal cam or all three. The cam is formed about the extremity of the root or shank of each blade with a circumferentially extending shoulder 5 having a cam surface 6 including high points 7 spaced circumferentially one hundred and eighty degrees from each other on the shoulder. The shoulder may be formed integral with the propeller blade shank or as a separate ring secured by a pin 8. Rollers 9 are rotatably mounted in the socket upon pins or axles 10 projecting inwardly from the wall of the socket radially thereof and these rollers have overlapping engagement with the cam surface of the shoulder 5. Referring to Figures 4 and 5 it will be seen that the centrifugal force of the weight of the propeller blade will tend to cause the rollers to rest in the valley of the cam shoulder and that this position with the blade angle

at maximum or infinite pitch is ninety degrees removed from the position of zero pitch where the twisting moment of entering and trailing edges tend to bring about a position of rest. It will be seen that when the proper amount of lift or camber is provided in the cam the two twisting moments oppose and neutralize each other. Since the same force, centrifugal force, is the cause of both moments and increases and decreases for both at the same time the moments continue to neutralize each other whether the centrifugal force is large or small, at all propeller speeds.

Each of the blades carry a stabilizing airfoil, and in Figures 1, 2 and 3 a preferred form of stabilizer has been illustrated. The stabilizer has a support 11 which in this form of the invention is carried on forward of the propeller blade to counterbalance the wind resistance of the rear portion of the support and in the stabilizer itself which otherwise would tend to increase pitch of the blade at increased airspeeds. The diagonal disposition of the support as related to the propeller blade is for the purpose of removing the stabilizer from the wake of the blade and advancing it into the racestream and into relatively undisturbed air. An airfoil 12 is carried by the support at the rear end thereof and its weight is counterbalanced by a counterweight 13, mounted adjacent to the front end or nose of the support 11. In practice the stabilizing airfoil trails behind the pivotal point of the blade after the manner of the feathered portion of a weathervane and in so doing holds the angular position of the blade as related to the airstream in whatever fixed position has been predetermined. Attention is called to the fact that as here shown the body or support is curved longitudinally and at its front end is curved hemispherically to reduce wind resistance and is disposed transversely of its companion propeller at a point substantially midway the length of the blade, but in practice the shape of said support and its location or application to the blade may be varied to suit conditions and requirements to produce the most desirable results. While it is desired to permit the blade to have turning adjustment when the propeller is in motion this movement should be limited and in order to do so each blade has its shank provided with an abutment 14 projecting radially therefrom for engaging the abutment lugs 15 carried by the socket 2 in which the blade is mounted and preventing the blade from making more than a quarter turn in the socket.

The stabilizer in this improved propeller blade serves to hold the blade at a constant chosen angle of attack to the relative movement of the fluid medium in which it operates. The action of the stabilizer upon the propeller blade is similar to that of the stabilizers forming a portion of the tail assembly of an airplane. In practice the blade is given a true pitch for some predetermined speed (maximum cruising or climbing speed) and at that speed only will every portion of the blade function at the chosen angle of attack. In case of engine failure the stabilizers, if free, would tend to assume such position that they would be liable to interfere with gliding movement of the airplane by turning backwards and creating a braking force. Therefore, the stops have been provided upon the sockets and the shanks of the blades which limit turning of the blades in the sockets to a feathering position. When the improved construction is embodied in a marine propeller no stops are used and when

the marine propeller is released the blades automatically reverse and act as a brake. If the marine engine is reversed or the propeller put in reverse by reverse gears, the propeller blades also reverse and act very efficiently for pulling a boat rearwardly. It is also not necessary to use stops on helicopter vanes, Autogiro vanes or the vanes of fans and blowers. The resistance of the hemispherical rounded front end or nose of the body 11 serves to counterbalance resistance of the rear end portion and thus prevent increase of the angle of attack as speed increases. If a fan motor is reversed the fan blades reverse thus giving the fan the ability to blow air efficiently in two directions.

Referring to Figures 2 and 3 it will be seen that the weight of the stabilizing assembly which is somewhat removed from the plane of entering and trailing edges assists to some extent in the neutralizing of twisting moment. This assistance in neutralization allows the camber of the cam surface 6 to be reduced. Thus the propeller blade shown in Figures 1, 2 and 3 uses three means to neutralize twisting moment:

The stabilizing assembly is moved a portion of ninety degrees away from the plane of entering and trailing edges, the weight 13 is added also away from the plane of entering and trailing edges, and the remainder of moment is neutralized by the action of the weight of the entire assembly against the cam surface 6.

Having thus described the invention, what is claimed is:

1. In a propeller, a hub, sockets extending radially of said hub, blades having shanks rotatably carried by the sockets in said hub and mounting the blades for balanced variable pitch, a shoulder surrounding the shank of each blade within the socket receiving the same and provided with a cam surface extending about the shank, rollers in the sockets for acting upon the cam of the shank for the production of a turning movement, cooperating abutments exterior of the hub and blades for limiting the turning movement in either direction and stabilizers carried by said blades, each stabilizer consisting of a horn-shaped support carried by the companion blade, said support having a rounded enlarged end extending outwardly of one side of the blade and a small pointed end extending outwardly of the opposite side of the blade in diagonal relation thereto, and an airfoil carried by the small pointed end of said support in transverse spaced relation to the blade, while a weight is mounted in the rounded enlarged end of said support.

2. In a propeller, a hub provided with radial sockets, blades having shanks rotatably carried by said hub and shiftable longitudinally therein and mounting the blades for variable pitch, a shoulder surrounding the shank of each blade within the companion socket and having a cam surface extending circumferentially thereof and provided with high points spaced from each other circumferentially of the shoulder, rollers in said sockets overlying the cam surface of said shoulders for acting upon the cam surface and causing said blades to be unaffected by inherent twisting motion, cooperating abutments exterior of the hub and blades for limiting the turning movement in either direction, and stabilizers carried by said blades, each stabilizer comprising an elongated horn-shaped support having an enlarged curved end and a small pointed end mounted upon the companion blade and an airfoil at the

small pointed end of said support in spaced relation to the blade.

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