April 10, 1945. W. W. EVERTS 2,373,108

PROPELLER

Original Filed March 11, 1939 2 Sheets-Sheet 1

FIG. 1.

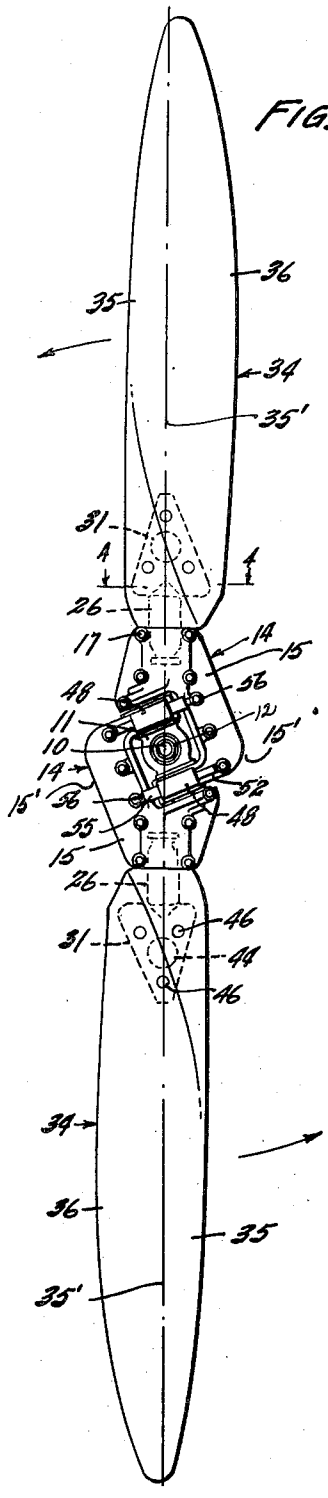


FIG. 2.

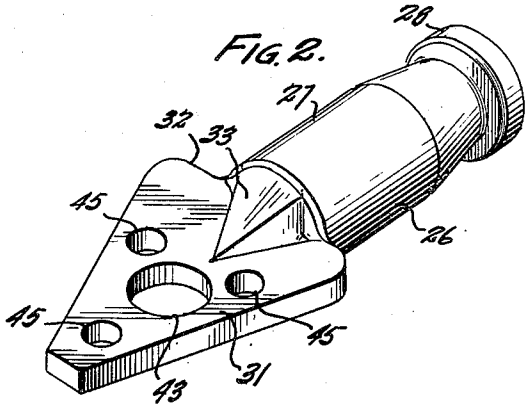


FIG. 3.

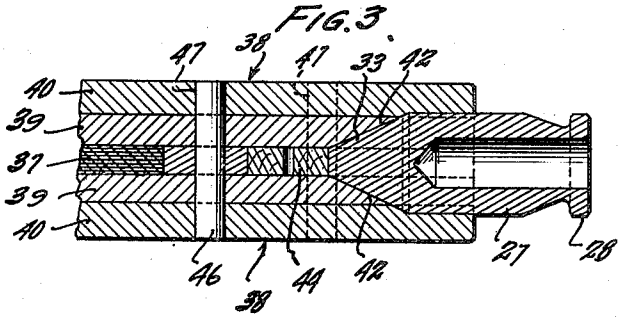
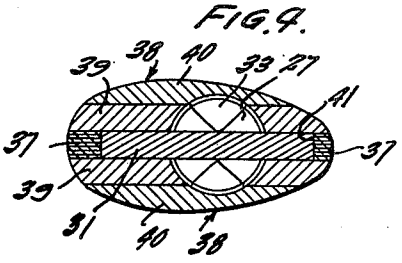


FIG. 4.



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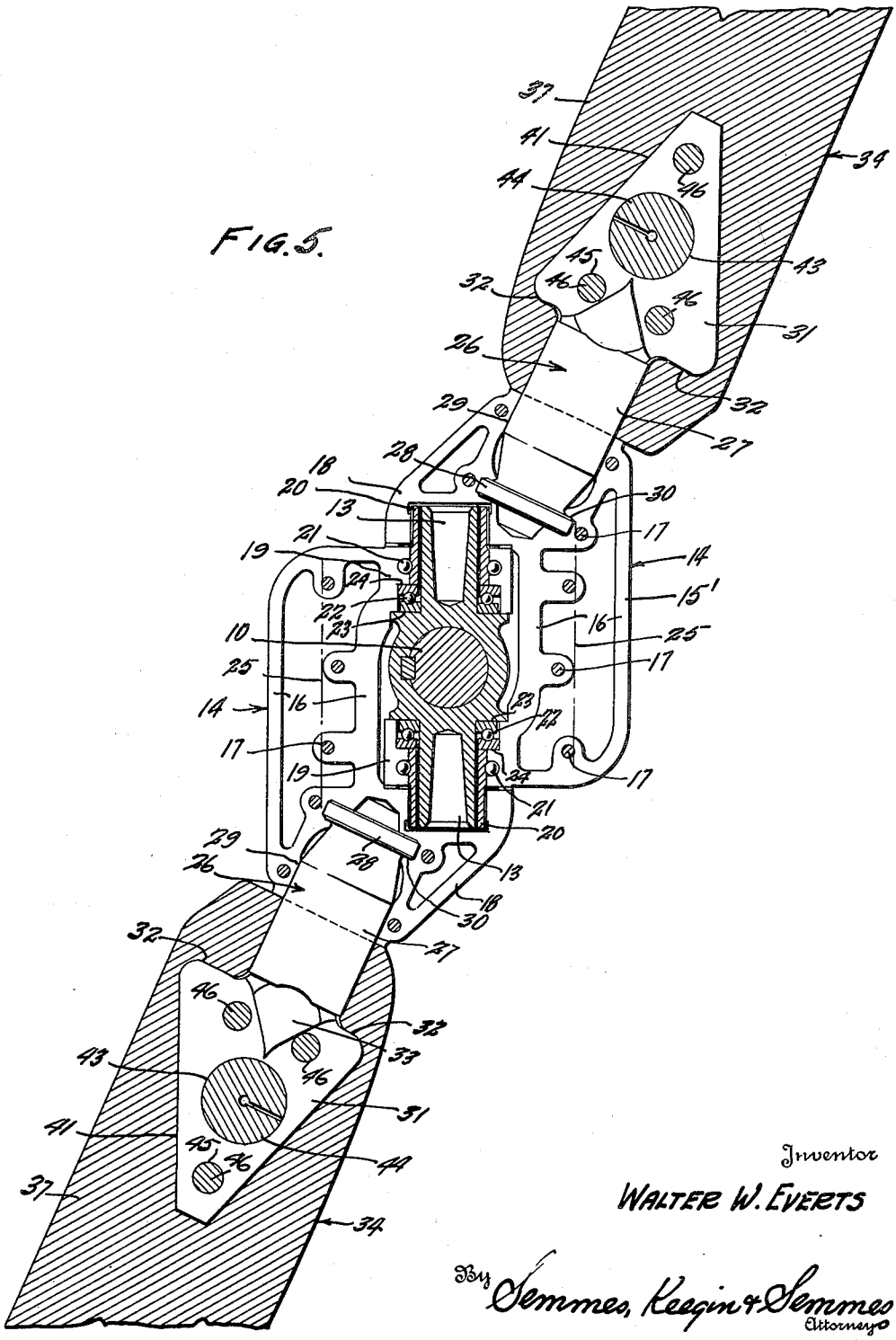
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FIG. 5.



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2,373,108

PROPELLER

Walter W. Everts, Baltimore, Md., assignor to Everel Propeller Corporation, Baltimore, Md., a corporation of Maryland

Original application March 11, 1939, Serial No. 261,323. Divided and this application October 23, 1940, Serial No. 362,442

5 Claims. (Cl. 170—173)

This invention relates to propellers for aircraft, boats, submarines and the like, and more especially to a propeller blade including a means to connect it to the propeller hub assembly. This application is a division of my copending application Serial No. 261,323 filed March 11, 1939, on which Patent No. 2,250,826, issued July 29, 1941.

One of the objects of this invention is to provide means for mounting a non-metallic propeller blade, such as a wooden blade, upon an attaching element in such a manner as to prevent the creeping of the blade upon the attaching element due to centrifugal forces.

Another object of this invention is to provide a laminated wooden blade having the maximum tensile strength in that portion of the blade which receives the anchor element of the connecting unit.

Yet another object of this invention is to provide means for affording the maximum bending strength between the anchor element and the blade against the centrifugal forces generated by the revolving of the blade.

A further object of this invention is to provide an element designed to connect the blade to the hub assembly, said element being designed to prevent the blade from creeping.

With the above and other objects in view, this invention embraces broadly the idea of providing a means to connect the blade of a propeller to a hub which is designed in such a manner that the blade will be securely held without the possibility of blade creep due to radial thrust. This feature of the device is important in view of the fact that one of the disadvantages encountered in the use of wood and other fibrous materials is due to the fact that the roots of the blades tend to creep slightly in the metal sockets in which they are mounted. This action causes the propeller to become unbalanced which is especially undesirable in the case of adjustable airplane propellers.

For purposes of illustration, the connecting device disclosed in the drawings is designed for use with wooden propellers. Moreover, the special construction of the blade described in this application is also especially suited for wooden propellers. However, the connecting device and blade construction can be varied within the scope of this invention if it is desired to use a type of fibrous propeller other than wood. Moreover, although this device is shown used in conjunction with a variable pitch mechanism, it is obvious that it can be employed in any type of hub assembly.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a front elevation of a propeller embodying my invention viewed from the front of the airplane.

Figure 2 is a perspective view of the connecting element.

Figure 3 is a central longitudinal section through the connecting element and associated parts.

Figure 4 is a transverse section taken along line 4—4 of Figure 1, looking in the direction of the arrows.

Figure 5 is a longitudinal section taken transversely through the hub and portions of the blade.

In order to illustrate the connecting device and blade construction which form the principal features of this invention, a propeller assembly is shown in the drawings which consists of a crank shaft 10 for an internal combustion engine mounted upon an airplane to which is keyed a hub 11 which is held against longitudinal displacement by a nut 12. As best shown in Figures 1 and 5, the hub 11 is provided with opposed radial pivot elements or pins 13 which are preferably tubular. A pair of companion coupling members or yokes, designated generally by the numeral 14, are also provided. Each of these coupling members or yokes consists of two companion sections 15 and 15' having flat intersecting faces 16, and these sections are secured together by any suitable means such as the bolts 17.

The opposite extremities of each coupling member 14 is provided with bearing sleeves 18 and 19. These bearing sleeves are designed to receive floating bronze bushings 20 and 20', respectively.

As best shown in Figure 5, the sleeves 18 and 19 of the companion yokes 14 are arranged in aligned position, the sleeve 18 of one yoke being disposed outwardly from the sleeve 19 of the companion yoke. A raceway is provided in each sleeve 19 to receive radial ball bearings 21 which engage the bushings 20, and each pivot or pivot element 13 carries an end thrust ball bearing 22 which is arranged between the shoulder 23 and the shoulder 24 of the sleeve 19.

From the above description it is apparent that the coupling members 14 are pivotally mounted upon the pivot pins 13 but are securely held

against radial displacement in relation thereto. It should also be noted that the coupling members 14 extend radially upon the hub 11 and its axis of rotation and the longitudinal axis 25 of the radially extending portions are disposed upon opposite sides of the hub as shown.

The means to connect the blades to the yokes 14 is generally designated by the numeral 26 and is one of the principal features of this invention. This connecting element comprises a shank 27 which is perfectly tubular as shown in Figure 3. The root of the shank 27 is provided with a flange 28 and the opposite extremity includes a flat anchor element 31 which preferably is an integral part of the root. This flat anchor element 31 is wedge shaped and tapers radially outward and has shoulders 32 at its inner end. The opposite sides of the flat anchor element 31, at their inner ends, are reenforced by tapered webs 33.

As best shown in Figure 5, each connecting shank 27 is designed to be inserted in a socket 29 which is formed in the outer end of each coupling member 14. In this position the flange 28 is held within an annular groove 30. In this position the shank is clamped in the socket 29 against any turning movement.

Each blade is generally designated by the numeral 34 and is provided with a leading edge 35 and a trailing edge 36. These blades are preferably formed of wood although other fibrous material can be employed, and each blade is provided with an inner flat section 37 formed of a number of relatively thin layers or laminations of wood which are held together in any suitable manner, such as by gluing. This flat section 37 is preferably built as a separate unit. It has also been found desirable to form the outer sections 38 of the propeller blade, which is composed of strips 39 and 40, as a separate unit.

The inner laminated section 37 is constructed of relatively thin strips and has approximately the same thickness as the flat anchor element 31. A recess 41 is cut in this inner section 37 and this recess corresponds in shape and size to the anchor element 31. The outer section 38 of the propeller blade is provided with inner recesses 42 which are adapted to receive root portions of the shank 27 and the webs 33.

As best shown in Figures 2 and 3, the anchor element 31 is provided with a relatively large central opening 43 which is adapted to receive a split plug 44 of approximately the same thickness as the element 31. The element 31 is also provided with transverse openings 45 which are arranged in the form of a triangle to receive pins or plugs 46 which have a driving fit. These pins or plugs also pass through openings 47 formed in the outer section 38. The plug 44 is split to render it resilient and provide a relatively tight fit when it is inserted in the opening 43 in the anchor element 31. The oppositely disposed flat faces of the plug 44 are relatively large and when the outer sections 39—40 of the blade are joined to the inner section of the blade by gluing, these faces provide a greater bonding surface.

In securing the connecting element 27 with the propeller blade, one section 38 is arranged lowermost and the laminated section 37 is arranged thereon, and the anchor element 31 is then placed within the opening 41 of the inner laminated section 37. The upper section 38 is now placed upon the intermediate laminated section 37, these parts being arranged in such a manner that the openings 47 and 45 register. At the same time the wooden plug 44 is also placed within the opening 43. Finally the inner connecting surfaces of the section 38, the laminated section 37 and the plug 44 are suitably coated with glue and the assembled sections are then subjected to suitable pressure and maintained under this pressure until the glue has thoroughly dried. After drying, the outer sections are properly cut to produce a propeller blade of the desired shape. The pins 46 are then driven into the openings 45.

The coupling members 14 are connected by damping devices 48 which in the preferred form consist of a cylinder and piston construction in which a fluid such as a gas or a liquid is present to cushion the relative movement of the members 14. These damping devices cause the blade to move as a unit when one blade is suddenly subjected to pressure and permit the blades to move separately and vary their pitch when this pressure is removed. The function of this damping device and the remainder of the variable hub assembly is more fully discussed in the previously mentioned patent.

From the above disclosure it is believed apparent that a means for connecting a propeller blade to a hub assembly and a propeller blade construction has been provided which will prevent a creep of the blade due to forces acting upon the propeller. It is to be understood, however, that various mechanical changes can be made in this connecting means and blade construction without departing from the spirit of this invention.

The invention disclosed in this application is, therefore, only to be limited by the prior art and the scope of the appended claims.

I claim:

1. In a propeller, a blade including an inner laminated section and outer laminated sections having flat contacting faces, the inner section having a recess provided with shoulders, the recess extending through the opposite flat faces of the inner section, a connecting element comprising an anchor member provided with shoulders and inserted within the recess, the anchor member having an opening and having a thickness substantially the same as the thickness of the inner section, and a wooden plug within the opening and having its opposite faces glued to the inner faces of the outer sections.

2. In a propeller having a hub and a blade, said blade comprising a plurality of laminated sections, an inner section of said blade being provided with a substantially triangular recess having its base positioned adjacent the root of the blade and lying in a plane perpendicular to the blade axis to provide abutment shoulder portions, means for connecting said blade to the hub, said connecting means including an anchor element positioned in said recess, said element having a thickness and shape substantially equal to that of the recess, and provided with laterally extending shoulder portions engaging the shoulder portions of said recess and having a stem extendtending axially of the blade through the base of said recess and beyond the root of the blade.

3. In a propeller, a laminated wooden blade having inner and outer sections, said inner section having a recess provided therein, an anchor in said recess provided with an opening extending transversely thereto, and a wooden plug in said opening, said anchor and the wooden plug therein having surfaces substantially flush with the surfaces of said inner section and said surfaces of the wooden plug being bonded to the adjacent surfaces of the outer sections.

4. In a propeller, a blade including inner and

outer sections having flat contacting surfaces, the inner section having a recess extending through the opposite flat surfaces thereof, a connecting element having an anchor portion inserted within the recess, said anchor portion having an opening and a thickness substantially the same as the thickness of the inner section, and a wooden plug within the opening and having its opposite faces bonded to the inner surfaces of the outer sections.

5. In a propeller having a hub and a laminated blade, a blade anchoring means comprising a substantially triangular member disposed within a recess formed in the laminations of said propeller blade with the base of said member lying adjacent the root of said blade, a tubular shank formed on the base marginal edge of said member and projecting beyond the root of said blade, reinforcing means formed on said member adjacent said marginal edge and secured to the end of said tubular shank, means for attaching said member to said blade and means formed on the free end of said shank for connecting the same in the hub.

WALTER W. EVERTS.