

Feb. 23, 1932.

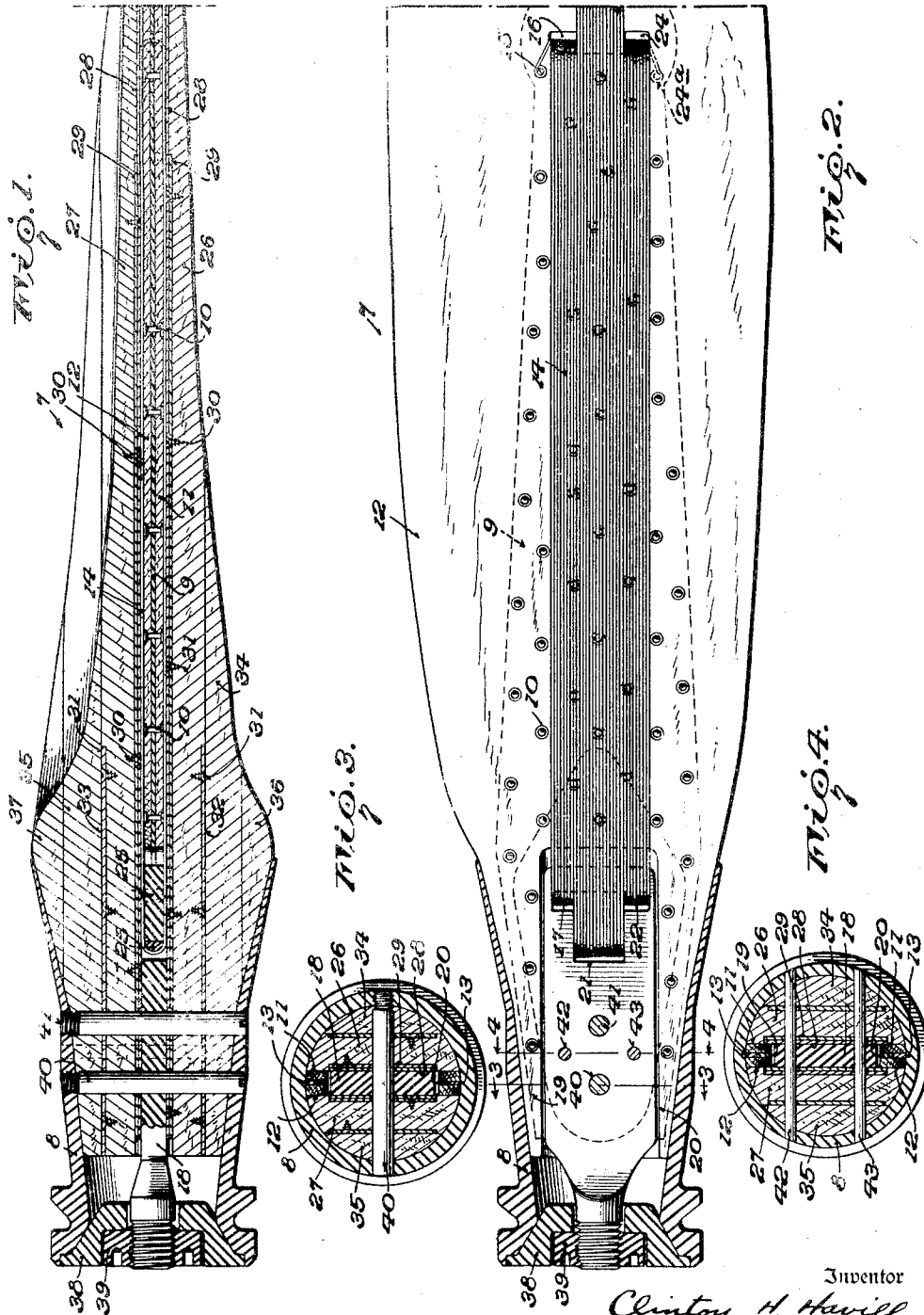
C. H. HAVILL

1,846,256

PROPELLER

Filed April 17, 1930

2 Sheets-Sheet 1



Inventor
Clinton H. Havill

A. B. Smith

Attorney

Feb. 23, 1932.

C. H. HAVILL

1,846,256

PROPELLER

Filed April 17, 1930

2 Sheets-Sheet 2

Fig. 1a

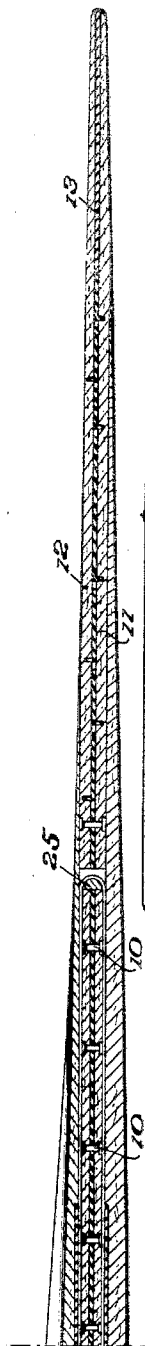


Fig. 5.

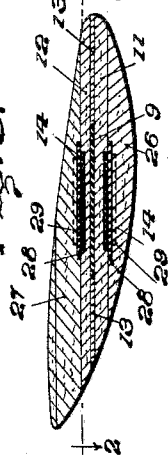


Fig. 6.

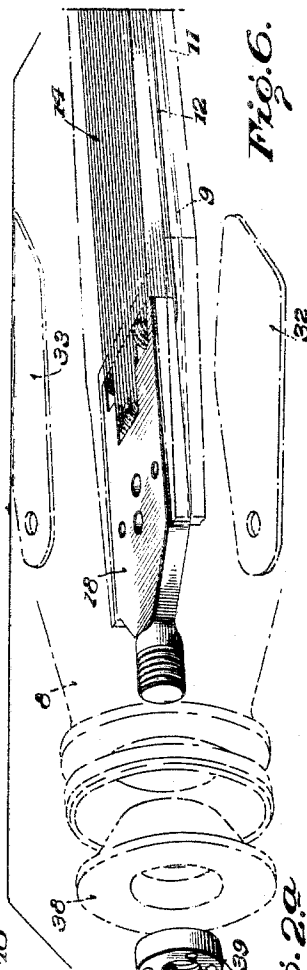
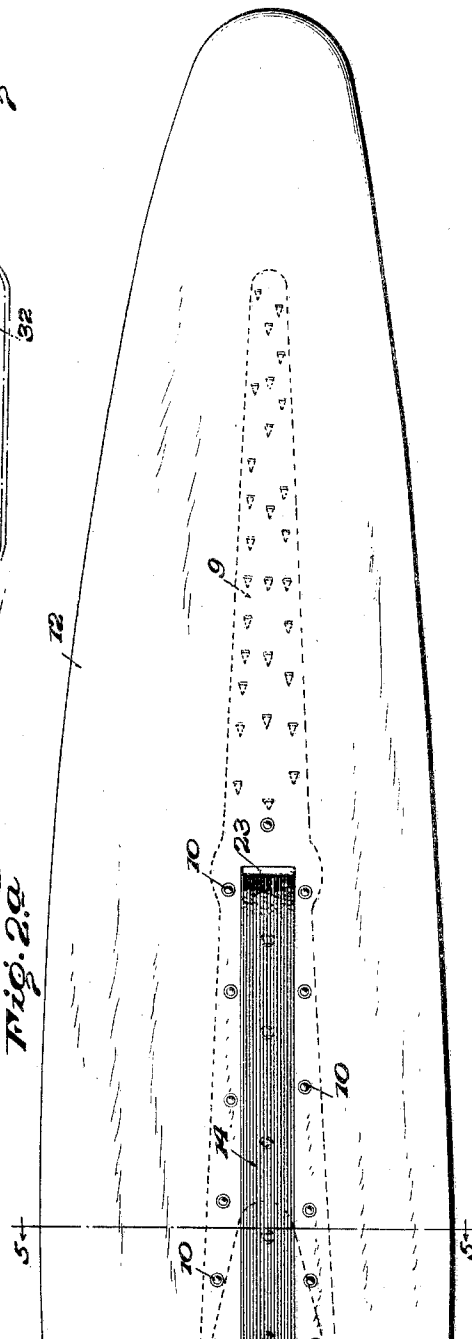


Fig. 2a



Inventor

Clinton H. Havill

F. B. Smith

Attorney

UNITED STATES PATENT OFFICE

CLINTON H. HAVILL, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO ECLIPSE AVIATION CORPORATION, OF EAST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY

PROPELLER

Application filed April 17, 1930. Serial No. 445,134.

This invention relates to propellers, and more particularly to propellers of the type adaptable for use on aircraft.

Aircraft propellers of the wooden type heretofore provided have, for the most part, been characterized by structures wherein a hub portion is integral with the blades, the propeller being secured to the engine shaft by means of a special type of hub utilizing a plurality of bolts that pass through the propeller. However, in certain instances, as for example, installations wherein the pitch of the propeller blades may be varied during flight, it has been necessary to employ separate wood blades fitted with specially formed metal sleeves that are adapted to be embraced by a hub drivably connected with the engine. It is desirable in many instances to employ wood propellers of the last mentioned type, yet the problems relating to the design of such propellers have always presented serious difficulties primarily because of the low shearing strength of the blade root, and the consequent danger of shearing of the blade from the hub at a point where the blade root enters the socket.

It is accordingly one of the objects of the present invention to provide a propeller of the non-metal type and comprising a plurality of separate blades which is so constructed as to overcome the difficulties referred to above.

Another object of the invention is to provide a novel wood propeller blade interiorly reinforced in such a manner as to secure increased strength and durability together with lightness in weight.

A further object is to provide a propeller blade having novel internal reinforcing members adapted to be placed under initial tension during assembly of the blade.

Still another object is to provide, in a wood propeller, a plurality of metal reinforcing members the initial tension of which may be adjusted to such a value that the fibre stress in the wood, during operation of the propeller, will be within a safe working limit.

A still further object is to provide in a propeller, a blade built up of a plurality of

wood laminations and metal reinforcing members, together with a novel root structure.

The above and other objects will appear more fully from the detailed description which follows when taken in connection with the accompanying drawings. One embodiment of the invention is illustrated in the drawings but it is to be expressly understood that the latter are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings wherein like reference characters refer to like parts throughout the several views,

Figs. 1 and 1^a are vertical longitudinal sectional views of a propeller blade constructed in accordance with the present invention;

Figs. 2 and 2^a are horizontal longitudinal sectional views of the blade shown in Figs. 1 and 1^a;

Figs. 3 and 4 are sections taken on lines 3—3 and 4—4 respectively of Fig. 2;

Fig. 5 is a section of the blade taken on line 5—5 of Fig. 2^a; and

Fig. 6 is a drawn out perspective of some of the parts adjacent the root end of the blade.

Referring to the drawings and more particularly to Figs. 1 and 1^a, a propeller blade embodying the principles of the present invention is illustrated as comprising a blade indicated generally at 7, the root end of which is adapted to be received by a sleeve or socket 8 having an exterior contour similar to the sleeves or sockets employed with metal blades and which sleeves may be embraced by a split hub of well-known design.

The propeller blade 7 preferably comprises a plurality of metal reinforcing members or laminations to which the usual wood laminations are secured in a manner to be more specifically pointed out hereinafter. As shown, a metal plate 9, extending substantially the full length of the blade has secured to either side thereof as by rivets 10, a pair of wood laminations 11 and 12 extending the entire

width of the blade, Fig. 5, there being provided a filler lamination 13 between the exterior contour of plate 9 and the perimeter of the blade in order to secure a uniform thickness.

Each of the laminations 11 and 12 are channeled or grooved, Fig. 5, in order to accommodate a series of reinforcing members such as wires 14. In the form shown, such reinforcing members are constituted by a single wire, one end of which may be fastened under a rivet 15, Fig. 2, and looped successively through slots 16 and 17 provided in member 9 and a bolt member 18 respectively. The last named member is positioned adjacent the root end of the blade in the gap formed by the spaced ends 19 and 20 of member 9 and laminations 11 and 12 and is also provided with slots 21 and 22 which are adapted to receive the looped ends of the wire 14 in connection with slots 23 and 24 in the member 9. It is pointed out that each of the laminations 11 and 12 are provided with slots adapted to register with the slots 16, 23 and 24 in order to permit the threading of wire 14 therethrough. After the winding of the wire has been completed the end is fastened beneath a rivet 24^a, Fig. 2. A plurality of half round filler blocks 25 may be placed within each of the above-mentioned slots, if desired, in order to prevent any sharp bends in the loops of wire 4.

On either side of laminations 11 and 12, additional wood laminations 26 and 27 are disposed, each of these last named laminations having embedded therein, in order to form a flat surface, a pair of reinforcing plates 28 and 29 of unequal length and preferably secured together by any suitable means such as spot welding. These plates may be attached to the laminations as by means of screws 30. In accordance with well known practice, each of the laminations above referred to, is coated with a layer of suitable adhesive before being pressed together.

Also embedded within laminations 26 and 27 and secured thereto as by means of screws 31, are metal plates 32 and 33 respectively, of less length than the reinforcing plates referred to heretofore. The propeller blade may thereafter be built up with further laminations 34, 35, 36 and 37 and the root end of the resultant structure turned down to the proper shape and size by methods and means well known in the art.

Means are provided for rendering the contour of the root end of the blade such that the blade may be secured in the usual type of split hub and preferably there is associated therewith, means for placing the wires 14 under initial tension and the other reinforcing members or laminations under initial compression. In the form of the invention illustrated, the first means referred to above is constituted by the socket or sleeve 8 which

is slipped over the turned down root end of the blade. A plug washer 38 is fitted into the end of the sleeve and the parts are secured in place by means of a nut 39 adjustably threaded on the protruding end of the bolt 18. It is here pointed out that as the nut 39 is tightened, the bolt 18 will move to the left, as viewed in Fig. 2, thus simultaneously placing the wires 14 under tension and forcing the root end of the blade securely within the sleeve. By placing the wires 14 under tension it will be seen that the other metal reinforcing plates within the propeller will be placed under an initial compression which will ensure the tension load due to centrifugal force, during rotation of the propeller, to be first taken by the reinforcing members.

After the tension and compression of the internal members has been adjusted to a suitable value, the sleeve 8 and root end of the blade are drilled for the reception of shear bolts 40, 41, 42 and 43 which serve to securely maintain the parts in assembled position. The nut 39 may now be tightened without affecting the initial tension and compression existing in the reinforcing members and may be locked in position by any suitable means. After the blade has thus been completely assembled the external contour thereof may be cut to the desired blade shape in any suitable manner, and may be coated with metal as by spraying or electro-deposition, if desired.

There is thus provided by the present invention a wood propeller blade of novel construction wherein the constituent parts of the blade are assembled in such a manner as to result in a blade of increased strength and durability and yet possessing the chief advantage of wooden type propellers, namely, lightness in weight. By employing the internal strengthening members under initial tension and compression, the blade is rendered capable of use with the usual type of sleeve or socket utilized with metal blades, so that propeller blades constructed in accordance with the present invention may be readily substituted for the present type of metal blades. The internal reinforcing members moreover sufficiently strengthen the blade, especially adjacent the root end, that all danger of the blade shearing off where the same enters the hub sleeve is substantially eliminated. It is here pointed out that by initially placing the internal supporting members under initial compression, the latter will take a portion of the tension load due to centrifugal force during operation of the propeller, thus relieving the wood portions of the blades of a portion of the tension load which would be borne by such portions were the internal members omitted. By this arrangement a propeller having such reinforced blades may be operated at high speeds without increasing the stress in the fibres of the

wood portions thereof to a dangerously high value.

Though there has been illustrated and described only one embodiment of the invention, it is to be understood that the same is not limited thereto but may be embodied in various constructional forms. For example, small metal rods may be substituted for the reinforcing wires, or a plurality of internal wires may be employed instead of the single wire illustrated. While reference has been made in several instances throughout the description that the interior reinforcing members and the means for applying compression to same may be particularly adaptable to propeller blades of the wood type, it is to be understood that these members may also be employed in propeller blades made of metal or other suitable material and which may be either solid or hollow. Various other changes may be made in the manner of constructing and arranging the component parts of the propeller blade as will now be apparent to those skilled in the art without departing from the spirit of the invention. Reference will therefore be had to the appended claims for a definition of the limits thereof.

What is claimed is:

1. A wood propeller blade having interiorly disposed metal reinforcing members, said members being of variable length, and means comprising a plurality of tension members for initially causing a compression in said reinforcing members.

2. A solid propeller having internal members initially under tension, and a plurality of internal reinforcing members initially in compression.

3. A propeller blade having a plurality of tension members, and means including a threaded single member for adjusting the tension of all of said first named members.

4. A propeller blade comprising a plurality of wood laminations, a plurality of looped members disposed interiorly of said blade, and means including a single member for placing all of said members under initial tension.

5. A device of the class described comprising in combination a plurality of wood laminations, a metal reinforcing member disposed between two of said wood laminations, and means for placing said metal member initially in compression.

6. A wood propeller blade comprising in combination a plurality of wood laminations, metal reinforcing members located between some of said laminations, a metal sleeve for receiving the root end of said blade, and means for securing said laminations and said members to said sleeve.

7. A wood propeller blade having a plurality of internal reinforcing members under initial compression, a metal sleeve adapted to receive the root end of said blade, and

means for securing said blade and members to said sleeve.

8. A propeller blade comprising in combination a plurality of laminations, reinforcing members located between some of said laminations, a sleeve for receiving the root end of said blade, means for placing said reinforcing members initially in compression, and means for securing the reinforcing members to said sleeve.

9. A propeller blade comprising in combination a plurality of wood laminations, a plurality of metal reinforcing members, a metal sleeve for receiving the root end of said blade, means associated with said sleeve for placing said reinforcing members under initial compression, and means for securing said laminations and reinforcing members to said sleeve.

10. A propeller comprising in combination a wood blade, a plurality of metal reinforcing plates disposed interiorly of said blade, a metal sleeve, and means for securing said blade in said sleeve.

11. In a propeller blade, a longitudinally extending internal member secured to said blade at spaced intervals, a sleeve for receiving the root end of said blade, a member extending into said sleeve and adjustably secured thereto, a plurality of looped members interconnecting said first and second named members, and means for adjusting said second named member to place said looped members under tension.

12. In combination with a propeller blade, a tension member disposed interiorly of said blade and secured thereto, a sleeve, and common means for drawing the root end of said blade into said sleeve and for placing said member under tension.

13. A propeller having a wood blade, a metal sleeve, an internal reinforcing plate extending substantially throughout the length of said blade, means for connecting said blade and plate at spaced intervals and means for securing the root end of said blade in said sleeve.

14. The method of constructing a propeller blade of the type having a central reinforcing member which comprises laminating the central member on either side thereof, applying a force in tension to effect compression of said central member, connecting the central member and laminations while maintaining the tension force and shaping the exterior contour of the blade.

15. In a wood propeller blade having an internal reinforcing member and a sleeve adapted to receive the root end of the blade, the method which comprises, applying a force in tension to effect compression in the internal member and securing the root end of the blade within said sleeve while maintaining said tension.

16. In a laminated wood propeller blade, a plurality of interiorly disposed metal plates,

a plurality of wires operatively connected with one of said plates intermediate its ends, a sleeve for receiving the root end of the blade, and a member associated with said sleeve for adjusting the initial tension of all
5 of said wires.

17. In a propeller blade having a hollow root portion, a plurality of tension members the outer end portions of which are operatively connected with the blade, a member
10 disposed in said hollow root portion for securing the inner end portions of said tension members, and means associated with said member for varying the axial position thereof to adjust the initial tension of all of said
15 tension members.

In testimony whereof I have signed this specification.

CLINTON H. HAVILL.

20

25

30

35

40

45

50

55

60

65