T. S. HARRIS.

PROPELLER FOR AEROPLANES.

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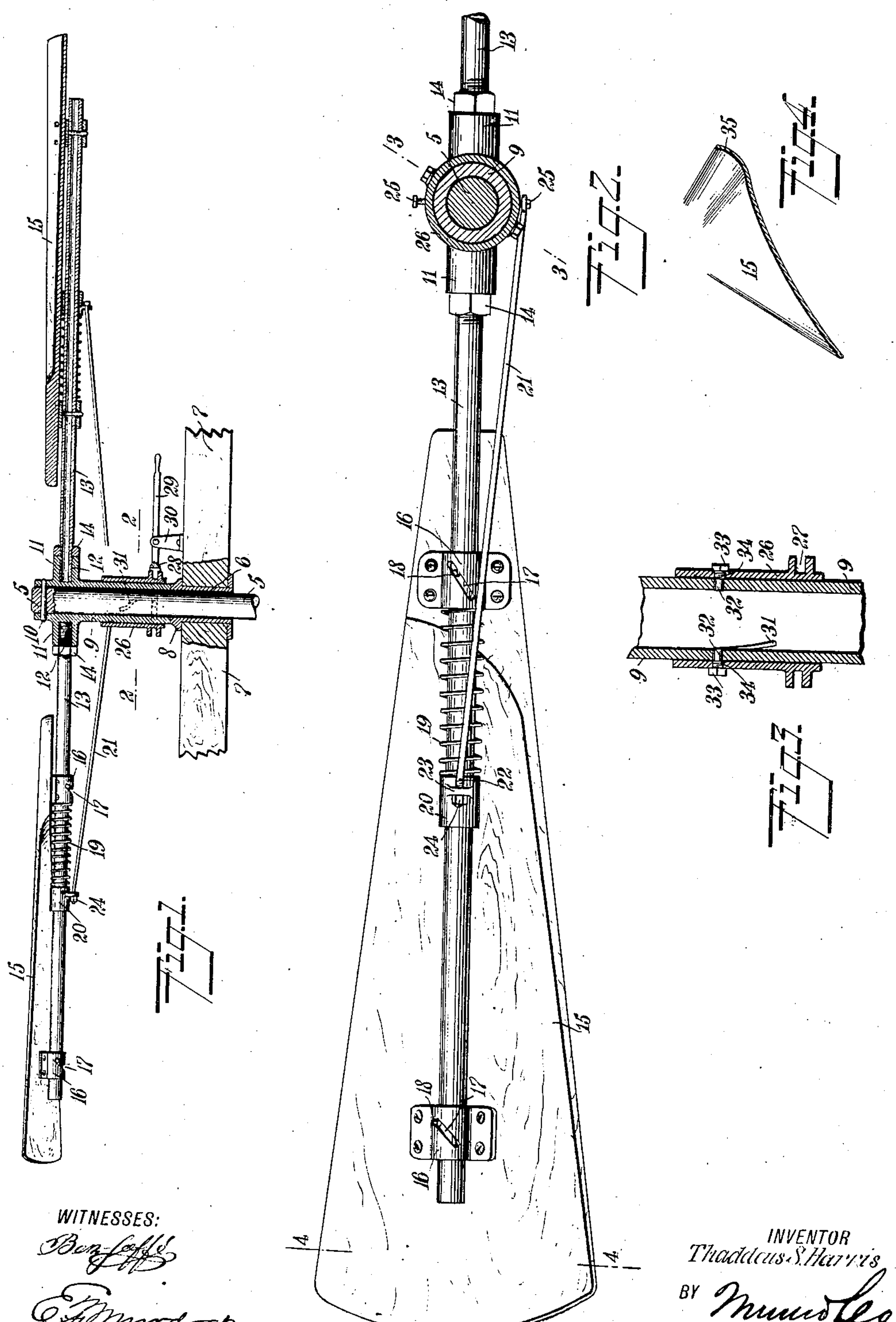

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PROPELLER FOR AEROPLANES.

999,992. Specification of Letters Patent. **Patented Aug. 8, 1911.**

Application filed May 14, 1910. Serial No. 561,287.

To all whom it may concern:

Be it known that I, THADDEUS S. HARRIS, a citizen of the United States, and a resident of Waverly, in the county of Morgan and State of Illinois, have invented a new and Improved Propeller for Aeroplanes, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide a propeller wherein the rotation of the same is automatically governed; to provide means for manually controlling the adjustment of the governor; and to provide a simplified, efficient and durable construction for a propeller of the character specified.

One embodiment of the present invention is disclosed in the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a longitudinal section of a propeller constructed in accordance with the present invention; Fig. 2 is a cross section taken on the line 2—2 in Fig. 1, of the driving shaft, showing in rear elevation one of the propeller blades, and supporting and operating means connected therewith; Fig. 3 is a longitudinal section of the driving shaft and of the sleeve and thimble forming the bearing for the control of the propeller, taken on the line 3—3 in Fig. 2, and Fig. 4 is a cross section of one of the propeller blades taken on the line 4—4 in Fig. 2.

A driving shaft 5 is suitably mounted in a bearing collar 6, mounted in a frame work 7 of any usual type of aeroplane. The collar 6 is provided with a head 8, which forms a thrust bearing at the end for a sleeve 9 forming the hub of the wheel-like arrangement of the propeller. The sleeve 9 is provided at or near the outer end thereof with perforations tapered and alined to receive a taper pin 10. The taper pin 10 is driven through the said perforations in the end of the sleeve 9, and through the shaft 5 in a suitable perforation formed in the end thereof, as seen in Fig. 1 of the drawings.

The sleeve 9 is provided with two or more boss-like extensions 11, 11. The extensions 11, 11 are provided with holes screw tapped to receive the threaded ends 12, 12 of spoke rods 13, 13. The rods 13, 13 are adjusted in the extensions 11, 11 by lock nuts 14, 14. The spoke rods 13 are constructed from hollow tubing of light but strong construction adapted to stand the propelling strain to which the propeller is subjected. Slidably mounted upon the rods 13, 13 are molded or carved blades 15, 15. The blades 15, 15 are provided with sockets 16, 16 fixedly secured on the back of the said blades. The sockets 16, 16 are provided with inclined grooves 17, 17, said grooves being equally disposed with regard to the rotary radial disposition. The sockets 16 are arranged on the median line of the blades 15. The spoke rods 13 are inserted through the sockets 16 and secured thereto by pins 18, 18, which are driven into the rods 13 after the same have been extended through the sockets 16.

Having a construction such as shown in the accompanying drawings and herein above described, it is obvious that if the blades 15, 15 are shifted lengthwise of the extension of the rods 13 they are caused to rotate about the said rods. The grooves 17, 17 are disposed in inclined relation to the rods 13, the inclination being such that the pin 18 by its engagement with the said grooves, compels the sockets 16 in which the grooves are formed, and the blades 15, 15 connected with the said sockets, to rotate about the sockets of the said rods as the sockets and blades are moved lengthwise of the said rods. The angle of the grooves is such that as the blades are shifted outward on the rods, the said blades are turned across the rotary path of the rods 13 or propeller.

In the operation of the propeller the centrifugal force due to the rotation of the propeller shifts the blades outwardly. The blades are shifted inwardly by spiral springs 19, 19. The compression of the springs 19, 19 sets the governing strain for the shift of the blades 15, 15. The compression of the springs 19 is set and regulated by collars 20, 20. The collars 20, 20 are held in position by connecting rods 21, 21. The connecting rods 21, 21 are provided with outer screw threaded ends 22, 22, which are extended through perforated ears 23, 23 and there provided with set nuts 24, 24, the screwing up of which lengthens or shortens the distance between the ears 23, 23 on the collars 20, 20, and the pins 25, 25 which are fixedly secured to thimbles 26. By manipulating the screw nuts 24, 24 the compression of the springs 19 is regulated so that the force necessary for starting the shift of the blades 15, 15 is varied. It is evident that the rotation of the thimble 26 would have a similar

result, extending as it would the rods 21, 21 and the collars 20, 20 radially, the latter sliding outward on the rods 13, relieving thereby the pressure on the springs 19. The relief of the pressure on the springs 19 would result in an increase of the centrifugal effect on the blades 15, 15, with the consequent result that the rotation of said blades, whereby the angle of the same to the rotary path is increased, commences at a reduced propeller and motor speed. The increased pitch of the blades 15, 15 increases the load on the shaft 5 and motor connected therewith, thereby checking the speed of the motor. At the same time, the pitch velocity of the propeller is increased, which results in a practically constant propeller thrust as the velocity of the aeroplane approaches the pitch velocity of the propeller. This is equivalent to increasing the load on the shaft 5 and motor connected therewith.

In some forms of aeroplanes I prefer to vary the governing effect, as just above described, and to do so manually at the will of the aviator. For this purpose I have provided the thimble 26 with an annular groove 27, in which are extended the yoke fingers of a clutch collar 28. The clutch collar 28 is shown in Fig. 1 of the drawings as being directly connected on the end of a lever 29, which is fulcrumed in a standard 30. It will be understood that the arrangement and mounting of the lever 29 in the said Fig. 1 of the drawings is in nature diagrammatic or illustrative of the method by which the connection between the manually controlled mechanism and the automatic mechanism is made. In practice the controlling lever 29 may be somewhat distant from the thimble 26 and its annular groove and the clutch collar 28. In this case, any usual and acceptable form of transmission devices would be substituted for the direct connection illustrated.

Whether directly connected, as illustrated in the drawings, or indirectly, as above stated, it is evident that the manipulation of the lever 29 results in shifting the thimble 26 longitudinally on the sleeve 9. The sleeve 9 is provided with inclined slots 31, 31, into which the bearing extensions 32, 32 of screw pins 33, 33 are extended. The screw pins 33, 33 are provided with a screw threaded portion 34, 34 by which the said pins are held in screw tapped perforations formed in the thimble 26. The inclination of the slots 31 is such that the upward movement of the thimble 26 compels the bearing extension 32 to ride up the inclined side of said slots, which action results in a rotation of the thimble 26 relative to the sleeve 9. This rotation, when the said thimble is projected outwardly, is that which projects the pins 25, 25 toward the blades 15, 15 with which each of the said pins is connected, resulting in the extension of the collars 20, 20 outward from the shaft 5. The opposite movement of the thimble 26 results in a reverse of the above described action.

With a propeller constructed as herein described, the operation of governing within certain points is automatic. The governing effect herein described prevents in a similar manner the raising the speed of rotation of the propeller and the engine connected therewith beyond a desired limit, eliminating the need for intricate, cumbersome and weighty controlling devices. At the same time, by means of the manual control, the aviator may vary the speed of the engine or the propeller mechanism, by varying the tension of the spring member 19 and thereby determining the speed of rotation at which the blades begin to move outward.

In Fig. 4 of the drawings is shown the curvilinear shape in cross section of the blades provided by me. The convex faces or pressure surfaces of the blades are at the rearwardly disposed edges of the blades, are provided to grip the air for a longer period of time, and to prevent the formation of a vacuum in the trail thereof. The pitch of the convex trailer portion 35 of the said blades is varied according as the requirement for speed in the aeroplane is desired, the greater speed being attained by the use of blades having a propeller operating at a high rate of speed with the upper or trailing section 35 of the blade pitched backward to avoid the vacuum formation above described.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A propeller for aeroplanes, comprising a plurality of radially extended arms; blades pivotally and slidably mounted on said arms; connections between said arms and said blades arranged to rotate said blades when moved lengthwise on said arms; spiral springs disposed on said arms to retract the said blades thereon; anchoring collars for said springs slidably disposed on said arms; a rotary member mounted concentrically with the driving shaft of said propeller; rods connecting the said collars and said rotary member; and means for shifting the said rotary member to extend said rods and collars connected therewith.

2. A propeller for aeroplanes, comprising a plurality of radially extended arms; blades pivotally and slidably mounted on said arms; connections between said arms and said blades arranged to rotate said blades when moved lengthwise on said arms; spiral springs disposed on said arms to retract the said blades thereon; anchoring collars for said springs slidably disposed on said arms; a thimble rotatively and slidably mounted

on the hub of said propeller; connecting rods pivotally attached to said collars and said thimble, disposed on said thimble in such a manner as to extend said rods when said thimble is rotated; cam actuating means disposed between said hub and said thimble to rotate the latter when moved lengthwise on the former; and manually operative means for shifting said thimble.

3. A propeller for aeroplanes comprising a plurality of radially extended spoke rods; a hub for said spoke rods rigidly connected thereto; a plurality of rigid propeller blades pivotally and slidably mounted on said spoke rods; means embodying cam members interposed between the said spoke rods and blades and arranged to rotate the said blades to extend the same transversely across the path of rotation of said propeller when the said blades are moved centrifugally on said spoke rods; and resilient members operatively connecting said slidable blades and the fixed members of said propeller to normally move said blades centripetally.

4. A propeller for aeroplanes comprising a plurality of radially extended spoke rods; a hub for said spoke rods rigidly connected thereto; a plurality of rigid propeller blades pivotally and slidably mounted on said spoke rods; means embodying cam members interposed between the said spoke rods and blades and arranged to rotate the said blades to extend the same transversely across the path of rotation of said propeller when the said blades are moved centrifugally on said spoke rods; resilient members operatively connecting said slidable blades and the fixed members of said propeller to normally move said blades centripetally; and manually operable means for varying the tension of said resilient members.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THADDEUS SIDNEY HARRIS.

Witnesses:

A. C. MOFFET,

WM. A. DENNIS.