

A. BOERNER,
PROPELLER.
APPLICATION FILED OCT. 20, 1920.

1,386,490.

Patented Aug. 2, 1921.

Fig. 1.

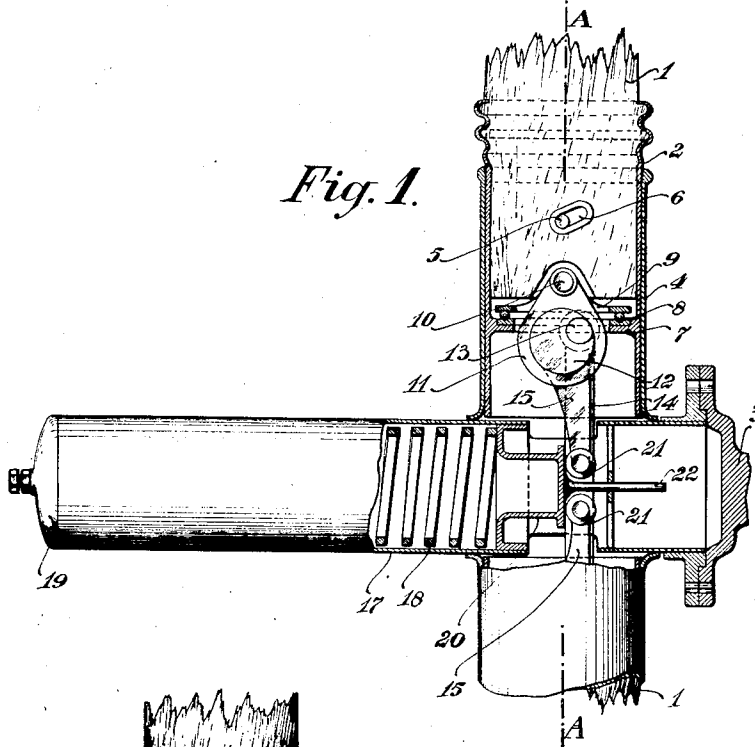
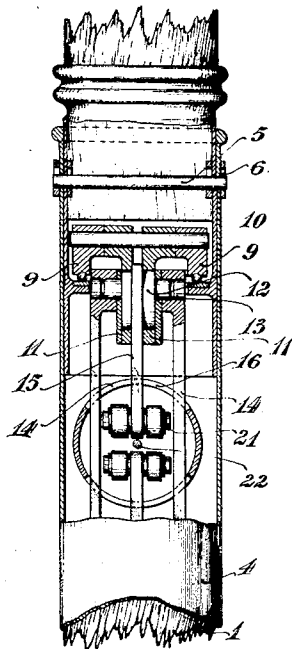


Fig. 2.



Inventor.
Arno Boerner.

by *[Signature]* Atty.

UNITED STATES PATENT OFFICE.

ARNO BOERNER, OF SCHEVENINGEN, NETHERLANDS.

PROPELLER.

1,386,490.

Specification of Letters Patent.

Patented Aug. 2, 1921.

Application filed October 20, 1920. Serial No. 418,272.

To all whom it may concern:

Be it known that I, ARNO BOERNER, having no nationality, residing at Scheveningen, Netherlands, have invented certain new and useful Improvements in Propellers, of which the following is a specification.

As is well known, the number of revolutions of an aircraft engine is limited to a definite amount so long as the propeller is directly connected with the engine shaft. In operation, the resistance of the propeller consumes the motive power supplied with a certain number of revolutions. The resistance depends, however, on the density of the medium in which the propeller operates. With increasing altitude the atmospheric pressure decreases and likewise the density of the air decreases, so that the propeller is no longer able to balance the generation of motive power. In consequence, the number of revolutions is prejudicially increased, to avoid which throttling is necessary with loss of efficiency.

So long as the engines were themselves under the influence of fluctuations of atmospheric pressure, while the induction of rarefied mixture gave at greater altitudes an efficiency less than normal, this drawback was not so serious. Inasmuch, however, as in recent times the practice has come to be to supply the engines with compressed air, thus insuring that the efficiency of the engine will be maintained constant independently of the elevation of the craft, the capacity of the propeller to consume the power supplied has not increased in proportion and balance is only restored with an excessive number of revolutions.

It has already been proposed, for the purpose of maintaining approximately constant the number of revolutions of aircraft engines, to construct the driven propeller as an automatic governor. In this construction the propeller blades are radially movable outward in relation to the propeller shaft in bosses on the shaft under the influence of centrifugal force and in opposition to the action of springs in such wise that the springs receive the entire radial pressure of the blades. This construction suffers from the drawback that the springs must be disproportionately heavy. Further, in such prior construction the spring pressure was in radial direction so that the stress of the springs was itself dependent on the centrifugal force.

The present invention has for its object to obviate these drawbacks and is characterized primarily by the feature that the outwardly directed movement of the propeller blades is transmitted by levers in reduced ratio to the spring so that a very much lighter spring can be used. Further, the invention permits of an axial arrangement of the spring so that the spring is not acted on by centrifugal force.

The accompanying drawing illustrates by way of example one embodiment of the invention; Figure 1 is a longitudinal section partly in elevation and Fig. 2 is a section on the line A—A of Fig. 1.

Referring to the drawing, the propeller blades 1 are each secured at the inner end within a sleeve 2 which is slidably fitted in a radial boss 4 rigidly connected with the propeller shaft 3. A pin 5 extending through the blade and sleeve projects at both ends into helical slots 6 of the boss 4 so that outwardly directed movement of the blade involves also an increase of pitch. The sleeve 2 is formed with an internal ledge 7 supporting one race ring of a ball bearing 8, the other ring of which is provided with two lugs 9 in which is mounted a pin 10. The pin 10 is embraced by eccentric straps 11 embracing an eccentric 12 on a second pin 13. The pins 13 of the two propeller blades are connected by tension members 14 in the annular ends of which they are rotatable.

The eccentric 12 is rigidly connected with a lever arm 15, the free end of which passes through a slot 16 of an axial sleeve 17 fixedly connected with the shaft 3 and carrying the boss 4. Located within the sleeve 17 is a helical spring 18, the initial stress of which may be regulated in known manner, one end of said spring abutting against a cap 19 and the other against a plate 20 forming a piston. The plate 20 presses against the free end of the lever arm 15 which for this purpose is provided with rollers 21. A rod 22 secured to the plate 20 serves to guide the latter.

The pressure of the spring 18 against the lever 15 tends to hold the pins 10 and thereby the propeller blades in their innermost position even when the propeller rotates at normal speed. As soon, however, as the number of revolutions exceeds a certain limit in flying at a high altitude in consequence of the diminished resistance of the air, the blades move outward under the

action of centrifugal force, shifting the eccentric 12 and compressing the spring 18, the pitch of the blades being simultaneously increased by the cooperation of the pin 5 with the slot 6.

In the example illustrated the blade pressure is transmitted by means of eccentrics to the spring 18. It is evident, however, that any other system of levers may be employed, although the illustrated arrangement has been found excellent for the purpose on account of its compact construction. Further, an air cushion or buffer may be substituted for the spring 18, the stress of which cushion may be regulated during operation.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A propeller having the blades thereof movable radially under centrifugal force, a spring resisting said movement, and levers intermediate the blades and spring to transmit the outward movement of the blades to the spring in reduced power ratio.

2. A propeller having the blades movable radially under centrifugal force, a spring acting in line with the propeller shaft, and levers intermediate the blades and spring serving to transmit the outward movement of the blades to the spring in reduced power ratio.

3. A propeller for aircraft having the blades thereof movable radially, a resisting spring, levers cooperating at one end with the spring, eccentrics carried by the opposite ends of the levers, and means for shifting eccentrics in the outward movement of the blades to transmit the blade movement to the spring through said levers.

4. An aircraft propeller having the blades thereof movable outwardly under centrifugal force, a resisting means for said blade movement including a spring arranged at right angles to said movement and a series of levers intermediate the blades and spring.

5. An aircraft propeller having the blades thereof movable outwardly under centrifugal force, a resisting means for said blade movement including a spring arranged at right angles to said movement and a series of levers intermediate the blades and spring, said levers being respectively connected through eccentrics to the blades.

6. An aircraft propeller having the blades thereof movable outwardly under centrifugal force, a resisting means for said blade movement including a spring arranged at right angles to said movement and a series of levers intermediate the blades and spring, the blades being turned in their movement under centrifugal force to vary their pitch.

7. An aircraft propeller having the blades thereof movable outwardly under centrifugal force, a resisting means for said blade movement including a rotating member mounted in the blade, pins eccentric with relation to said member, means connecting the pins of opposed blades, and spring means to resist the movement of said rotating member.

8. An aircraft propeller having the blades thereof movable outwardly under centrifugal force, a resisting means for said blade movement including a rotating member mounted in the blade, pins eccentric with relation to said member, means connecting the pins of opposed blades, and spring means to resist the movement of said rotating member, and means whereby the blades change their pitch during their movement under centrifugal force.

In testimony whereof I affix my signature.
ARNO BOERNER.