S. S. WILLIAMS.

GYROSCOPIC AEROPLANE.

APPLICATION FILED JULY 1, 1907.

942,691. Patented Dec. 7, 1909.

Fig. 1

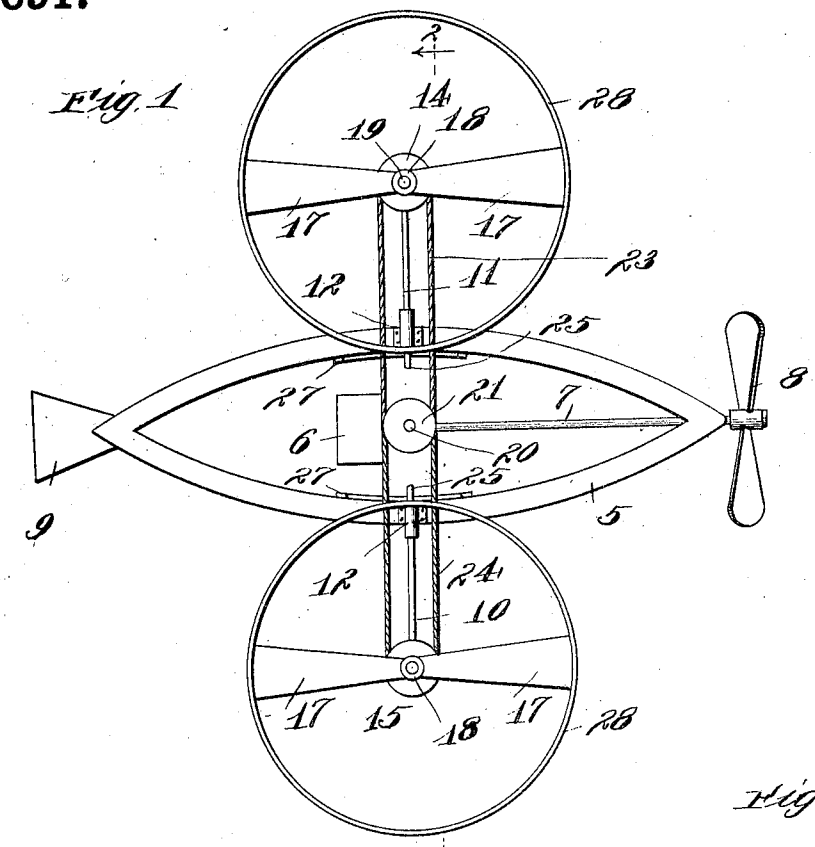


Fig. 2.

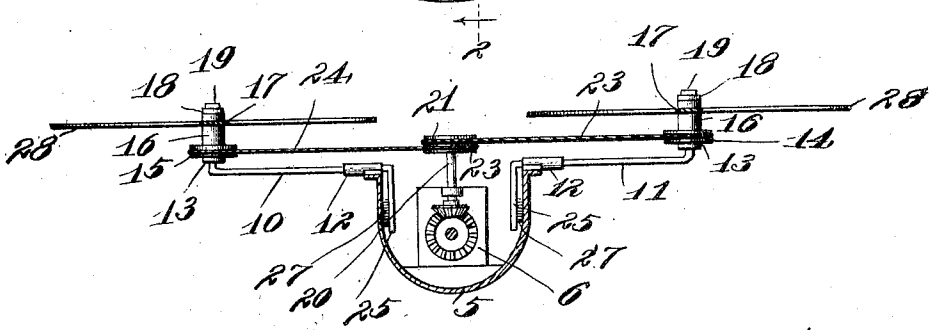
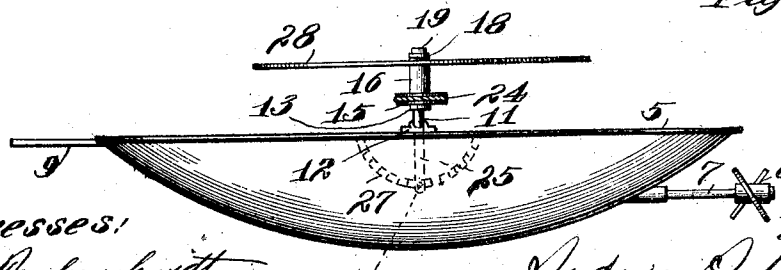


Fig. 3.



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UNITED STATES PATENT OFFICE.

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GYROSCOPIC AEROPLANE.

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To all whom it may concern:

Be it known that I, SYDNEY S. WILLIAMS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gyroscopic Aeroplanes, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates primarily to flying-machines but more particularly to a gyroscopic aeroplane for supporting them while propelled through the air.

One object of my invention is to produce a very strong supporting surface for a flying-machine with a minimum of weight.

Another object of my invention is to provide a means to automatically balance a flying-machine while propelled through the air.

The invention consists in the combinations and arrangements of parts hereinafter described and then pointed out in the appended claims.

In the accompanying drawing in which the same reference numerals refer to the same parts: Figure 1 is a plan view of a flying-machine showing my invention; Fig. 2 is a cross-sectional view on the line 2—2 of Fig. 1. Fig. 3 is a side view of Fig. 1.

To better illustrate my invention I have shown it in connection with a flying machine 5 which forming no part of the same may be of any suitable type and need not be more particularly described. An engine 6 of any preferred kind may be located in the central portion of the machine and furnishes power to a longitudinal shaft 7 operatively connected thereto in any suitable manner. This shaft carries at its outer end which passes beyond one end of the machine a propeller 8 of the ordinary type and the other end of the machine is provided with a suitable tail or rudder 9.

It is to be understood that all of the parts hereinafter described are constructed of steel or other suitable metal.

Rods 10 and 11 project from each side of the machine and are journaled in boxes 12, which are secured to the sides of the machine and permit of a slight rotary movement of the rods for a purpose to be hereinafter made plain. Each rod is upturned at its outer end and carries thereon collars 13 which engage the pulleys 14 and 15 adapted to revolve on the upturned portions of the rod; the collars preventing the pulleys from slipping down on the rods. Hubs 16 are also adapted to revolve on the upturned portions of the rods and are formed integral with the pulleys and provide seats in which are secured blades or sectors 17. The hubs and pulleys are held on the rod by the collars 18 and nuts 19.

A vertical shaft 20 is operatively connected to the engine in any preferred manner and carries at its upper end pulleys 21 and 22, located one above the other, which are connected to the pulleys 14 and 15, respectively, by means of chains 23 and 24, respectively.

Depending rods 25 are rigidly secured to the rods 10 and 11 each depending rod being provided near its free end with a pin 26 adapted to engage the teeth of a curved rack 27 secured to each side of the machine longitudinally thereof in any suitable manner. By reason of the slight rotary motion of which the rods 10 and 11 are capable it is obvious that the inclination of the plane or figure of rotation of the sectors, whose axis is substantially perpendicular to the longitudinal axis of the machines, may be varied by movement of the rods 25.

The sectors have their inner ends broadened to give sufficient strength and somewhat resemble the blades of a propeller but without pitch; their thickness being commensurate with the strength required. It is to be understood, however, that the sectors may be of any form substantially the same as that shown in the drawings. The size of the sectors is determined by the weight of the machine and connected parts, it being understood that the sectors perform the same function as that of aeroplanes employed with many types of flying machines to give them support in the air.

As is well understood, the greater the number of square feet of air a kite passes over in a given length of time the greater is its supporting or lifting power per unit of surface, since the cushion of air beneath the kite forms its actual support, and the more air passing beneath it in a given length of time the larger is this supporting cushion per unit of surface, the effect being to practically increase the supporting surface of the kite in proportion to the increase in the speed of the supporting air moving past it,

and the greater its angle of inclination from the horizontal while passing over the air during the same period of time the greater still is its supporting or lifting power. It is also understood that the faster a kite of a given area and inclination passes over the air in a given period of time the greater the area of the kite it equals in supporting power which passes over a less number of square feet of air in the same time and at the same inclination. In other words this device operates upon the principles stated on pages 26-48 of a work entitled *Experiments in Aerodynamics* by D. P. Langley, in which it is shown that if a thin plane be projected in its own plane substantially horizontally it will have a conspicuously different time of falling according to the velocity of its lateral translation, and that this time may be so great that it will settle slowly through the air as it might do if almost deprived of weight or as if the air were a highly viscous medium. In other words the principle is that increased support is afforded by the air to a plane translated in its own plane substantially horizontally through the air, beyond what is afforded by the air to the same plane when deprived of its horizontal velocity and also that the support afforded by the air from its inertia increases very rapidly with the increase in speed of translation of the plane. In my device the more rapidly the sectors are revolved about their common axis the greater is the number of square feet of air they pass over in a given length of time, and since the supporting cushion of air beneath the sectors increases in size with the speed of rotation, the more rapidly they are revolved the nearer their supporting surface or power approaches that of a disk whose circumference is equal to the line described by the outer ends of the sectors, or that of the rim 28. By this construction I obtain a maximum of supporting surface with a minimum of actual surface and therefore may use heavier and stronger material in the construction of my device than would be possible were it necessary to form the supporting surface as large as the area traversed by the sectors. The amount of resistance offered by the revolution of the sectors is very slight as it consists of only the friction about the points of revolution and the skin friction on the surface of the sectors; the resistance to the edges of the sectors, which may be beveled to provide a sharp edge, being almost negligible. It is obvious however that the greater the inclination of the axis of the plane or figure of rotation of the sectors from perpendicularity with the longitudinal axis of the machine the greater the resistance offered by the air to their translation through it; therefore since they form in effect an inclined supporting aeroplane the greater is the supporting power of the sectors in proportion to the speed of the machine. Primarily the function of the sectors is to support the machine while propelled through the air, though it may be readily seen that any increase of angle in the axis of the plane or figure of rotation of the sectors from perpendicularity with the longitudinal axis of the machine, beyond that necessary to merely support the machine, will also raise the machine, and any decrease in this angle will cause the machine to descend.

It is to be understood that each hub may carry a plurality of sectors and that when they are revolved rapidly they serve very materially to assist in maintaining the balance of the machine by reason of their gyroscopic action which tends to resist any sudden change in the plane or figure of rotation of the blades or sectors. To increase this gyroscopic action the outer ends of the sectors may be secured to a rim 28 which may also act as the fly wheel.

It is to be understood that when "blades without pitch" are referred to it is meant substantially without pitch, for while the device would be operative even if the blades had a slight pitch, they are preferably and theoretically without pitch. Also that while the blades would preferably be within their plane of rotation so as to offer as little resistance as possible to the air in their translation edgewise, for purposes of strength or other reasons, they might lie wholly or partly without a plane of rotation without departing from the scope of my invention. It is of course to be also understood that while I have shown in drawing but two hubs provided with blades, one or more may be used.

Having described my invention I claim:

1. The combination with a flying machine, means to propel the machine, of a plurality of blades without pitch mounted on a common hub about whose axis they are adapted to be rotated, and means to rotate the blades.

2. The combination with a flying machine, means to propel the machine, of a plurality of hubs each provided with blades whose surface lies within their plane of rotation and which are adapted to be rotated about the axis of their common hub, and means to rotate the blades.

3. The combination with a flying machine, means to propel the machine, of a plurality of hubs each provided with blades whose surface lies within their plane of rotation and which are adapted to be rotated about the axis of their common hub, means to incline the axis of the hub to vary the inclination of the plane or figure of rotation of the blades, and means to rotate the blades.

4. The combination with a flying machine, means to propel the machine, of one or more hubs each provided with a plurality of

blades without pitch and adapted to be rotated about their common axis, a circumferential rim mounted on the outer ends of the blades, means to incline the axis of the hub to vary the inclination of the plane or figure of rotation of the blades, and means to rotate the blades.

In testimony whereof I affix my signature in presence of two witnesses.

SYDNEY S. WILLIAMS.

Witnesses:
C. G. McRoberts,
Elizabeth Molitor.