A. S. GREENAMYER & A. HALLETT.

AEROPLANE.

APPLICATION FILED AUG. 15, 1910.

1,008,258.

Patented Nov. 7, 1911.

2 SHEETS—SHEET 1.

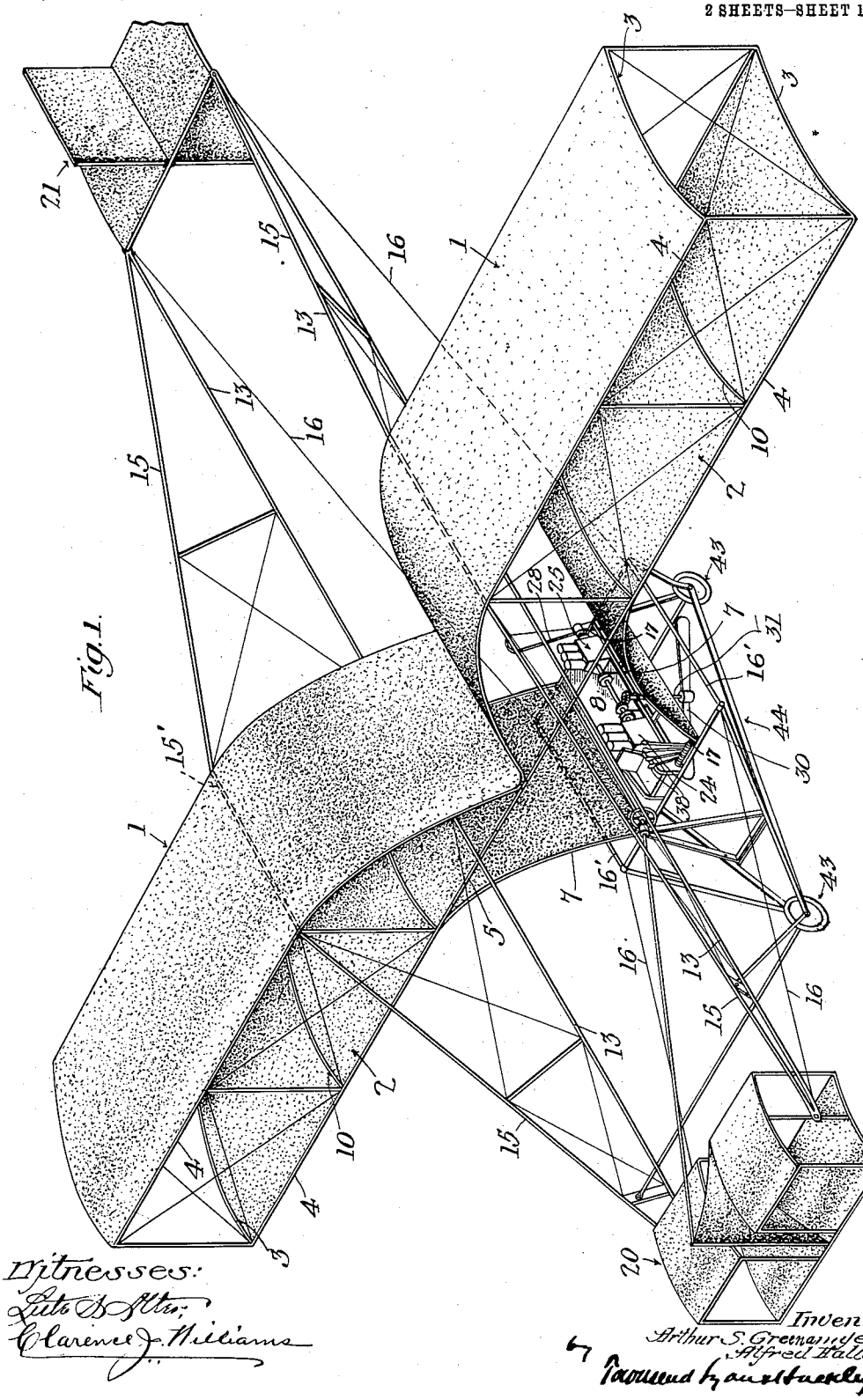

Fig. 1.

Witnesses:
Lulu A. Stur;
Clarence J. Williams

Inventors:
Arthur S. Greenamyer
Alfred Hallett
by Townsend & Townsend, Attys

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2 SHEETS—SHEET 2.

Fig. 2.

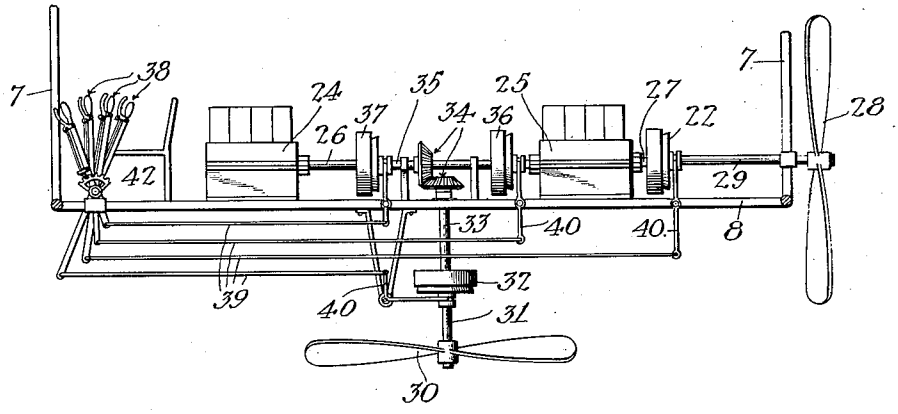
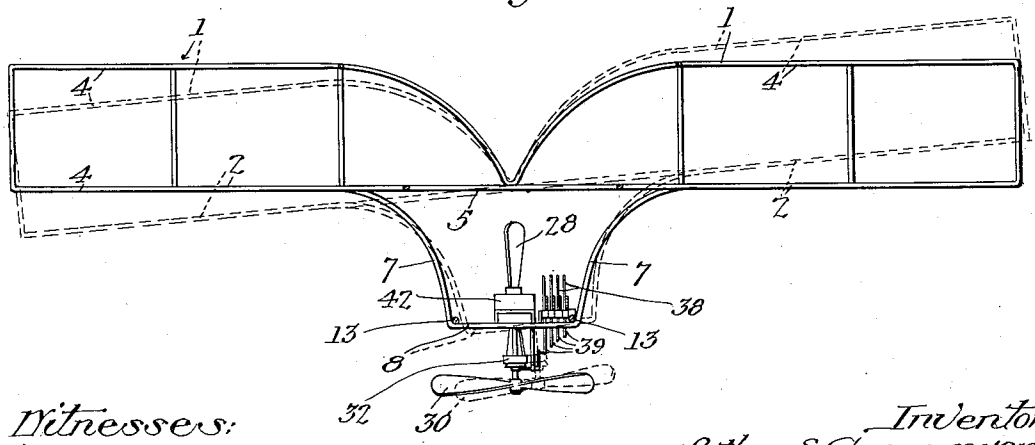


Fig. 3.



Witnesses:

Lulu D. Alter

Clarence J. Williams

Inventors:

Arthur S. Greenamyer,

Alfred Hallett,

by Lawrence Hallett

Attys.

UNITED STATES PATENT OFFICE.

ARTHUR S. GREENAMYER AND ALFRED HALLETT, OF LOS ANGELES, CALIFORNIA.

AEROPLANE.

1,008,258. Specification of Letters Patent. Patented Nov. 7, 1911.

Application filed August 15, 1910. Serial No. 577,309.

To all whom it may concern:

Be it known that we, ARTHUR S. GREENAMYER and ALFRED HALLETT, both citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Aeroplane, of which the following is a specification.

This invention relates to the class of aeroplanes known as biplanes, and the main object of the present invention is to provide in such an aeroplane, means for giving lateral stability in an automatic manner without requiring the attention of the operator or the operation of moving parts. All such operations require an appreciable time, and an advantage of the construction hereinafter described is that it provides means tending to restore the machine to horizontal position by forces brought into action immediately upon the occurrence of any lateral tilting. This we accomplish by providing aeroplane surfaces of such character that upon lateral tilting thereof the surfaces are presented in such manner as to produce a greater upward pressure on the lower end of the machine, thus tending to right the machine.

Another object of the invention is to provide improved driving means for operating the aeroplane, such driving means providing for vertical as well as longitudinal effect.

Other objects of the invention will appear hereinafter.

The accompanying drawings illustrate the invention, and referring thereto:—Figure 1 is a perspective of the machine. Fig. 2 is a side view of the platform with the driving mechanism thereon. Fig. 3 is a front view of the machine.

The machine comprises upper and lower aeroplane members 1 and 2 on each side of the machine, each of said members comprising a frame having a rectangular end portion with end bars 3 and side bars 4, said side bars being bent downwardly at the midwidth of the machine to about the level of the outer ends of the lower aeroplane members, so that they form a passage of uniform height extending in both a longitudinal and transverse direction, so that the air may pass through the same in either direction and without obstruction except that due to the curvature of the passage. Horizontal bars 5 extend from side to side of the machine and connect the side bars 4 of the lower frame with the inner and outer ends of the upper frame. The inner end portion 7 of the lower aeroplane frame extends downwardly to a similar distance, so that the distance between the upper and lower aeroplanes remains approximately constant and the inner ends of the said downwardly bent portions 7 are connected to and support the platform 8. The motor, driving gear, and other heavy parts are supported on said platform, so that the center of gravity is below the level of the lower aeroplane member 2, this being an essential requisite in connection with the means for lateral stability, as hereinafter described, said means comprising the downward curvature of the inner ends of the aeroplanes, as above set forth.

The above described aeroplane members 1 and 2 are further braced and supported by cross members 10 extending fore and aft between the side bars 4 of their frames.

Frame means are provided extending fore and aft of the aeroplanes for supporting the horizontal and vertical rudder means respectively, said frame means comprising longitudinal bars 13 secured to the cross bars 5, struts 15 extending from the front and rear ends of the said longitudinal bars to the frame of the upper aeroplane, and tie rods or wires 16 extending from said front and rear ends of the bars 13 to cross bars 17 of the platform 8, said thrust bars 15 being connected by horizontal bars 15′ and said tie rods 16 being connected by or continuous with rods or wires 16′, so as to form a truss in connection with the frames of the aeroplanes. The horizontal rudder means 20 at the forward end of the machine is supported by the bars 13 aforesaid and the vertical rudder means 21 is supported on the bars 13 at the rear end of the machine, said rudders 20 and 21 being of any usual or suitable construction and operated in any usual or suitable manner, the operating means not being herein shown as they form no part of the present invention.

Two motors or engines 24, 25 are mounted on the platform 8 with their shafts 26, 27 in alinement and means are provided whereby these motors may be used conjointly or separately in operating the propeller means. Said propeller means comprise a driving propeller 28 mounted on a horizontal shaft 29, and a lifting propeller 30 mounted on a vertical shaft 31, both of said shafts be-

ing journaled in suitable bearings on the platform 8. A clutch 22 is provided between the motor shaft 27 and the shaft 29 for the driving propeller. The shaft 31 for the lifting propeller is connected through a clutch 32 with a shaft 33 connected by beveled gearing 34 with a horizontal shaft 35. Clutches 36, 37 are provided for connecting the shaft 35 respectively to the shaft 27 and to the shaft 26. Said clutches may be of any usual or suitable construction, and are operated by any suitable means, for example, by levers 38, rods 39 and levers 40 operated by said rods and controlling the clutches to move them into or out of clutching relation. By throwing all of said clutches into engaging relation, both of the motors 24 and 25 are brought into driving connection with both of the propellers 28 and 30. By disconnecting clutch 32, the propeller 30 may be thrown out of operation or by disconnecting clutch 22, the driving propeller 28 may be thrown out of operation leaving the machine under the control of the lifting propeller 30. By disconnecting clutch 36, the forward motor 24 may be used for driving the lifting propeller 30 and the rear motor 25 may be used for driving the driving propeller 28. In case of accident to the forward motor, the other motor may be used for driving either or both of the propellers, and in case the rear motor is disabled, the forward motor may still be used to drive the lifting propeller. An operator's seat, indicated at 42, is provided on the platform 8, for example, directly in front of the motors. Running wheels 43 may be provided, connected by frame means 44 to the main framing of the machine.

The operation of the aeroplane is as follows: In starting both of the propellers 28 and 30 will generally be brought into operation, the lifting propeller producing an upward pressure acting in conjunction with the pressure produced by reaction of the aeroplanes on the air in their forward motion through the air to lift the machine from the ground. After the desired height has been attained, the lifting propeller may be disconnected or it may be left in connection in case it is desired to maintain a given height with decreased forward velocity.

The control of the machine for fore and aft inclination in ascending or descending is by means of the horizontal rudder in the usual manner and the vertical rudder provides in the usual manner for horizontal steering, the dip of the center portion of the upper aeroplane being however important in this connection, as it allows of free passage of air above the center of the machine to the rudder, thereby enabling effective reaction of the rudder on the air. This dip or downward curve of the inner portion of the aeroplanes also provides for lateral stability in the following manner:— If the machine tips laterally to one side, for example, to the position shown in dotted lines in Fig. 3, so that the right side, looking in the direction of the operator, is tipped downwardly and the left hand side is tipped upwardly, the upward pressure of the air on the aeroplanes due to the movement through the air is greater on the down-tipped side than on the up-tipped side. It will be understood that this pressure is due to a slight upward inclination of the aeroplanes as a whole in the normal flight of the machine, so that in the motion of the aeroplanes through the air there is compression of the air beneath the planes and on the down-tipped side the air so compressed is more or less confined between the body portion of the aeroplanes and the downwardly curved inner portion thereof, such confinement increasing its upward reaction on that side of the machine. On the other hand, the air compressed by the aeroplane at the other side of the machine is allowed more or less escape in a lateral direction owing to the upward tilting thereof, thereby diminishing the upward reaction produced on the machine at that side. The effect of the stated curvature of the aeroplane members is thus to produce forces tending to restore the aeroplane to horizontal position and this effect takes place automatically and instantaneously without requiring the operation of moving parts and without the loss of time incident to the overcoming of the inertia of such parts or for the action of the attendant or operator.

The platform 8 with the comparatively heavy parts carried thereby being beneath the level of the lower aeroplane member 2, it follows that the center of gravity of the machine is somewhat below the level of the said aeroplane member, this location of the center of gravity contributing to the stability of the machine as it results in a restoring force due to displacement of the center of gravity when the machine is tipped to one side. It will be noted, however, that if the planes were flat, the effect of gravity on the machine would, in addition to such restoring force, tend to make the machine glide laterally. For example, if the machine were tipped as indicated in dotted lines in Fig. 3, the tendency would be for the machine to glide toward the right of the operator and if the tilting is very severe, this would result in dangerously rapid descent, the provision of the curved or downwardly bent portions at the inner or middle portions of the aeroplane members arrests such gliding movement as it offers a surface transverse to such movement, and the reaction due to the obstruction offered by such surface increases the uplift on the de-

pressed side of the machine, and conduces to the self-righting effect.

It will be understood that the aeroplane members 1 and 2 will preferably be of the usual curvature, so as to be concave on their lower faces, thereby presenting the most advantageous surface for passage through the air and reaction on the air.

What we claim is:

An aeroplane comprising upper and lower aeroplane members, the outer end portions of the upper aeroplane member extending horizontally and said upper aeroplane member being bent downwardly at its middle portion to substantially the level of the outer ends of the lower aeroplane member and the lower aeroplane member extending horizontally at its outer portions and parallel to the upper aeroplane member and having portions extending downwardly and inwardly from such horizontal portions beneath the downwardly bent portions of the upper aeroplane member, and a horizontal platform connecting such downwardly extending portions of the lower aeroplane member, the upper and lower aeroplane members being spaced apart a uniform distance from front to back and from the outer ends to the middle providing a passage of uniform width transversely and longitudinally of the machine.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 6th day of August, 1910.

ARTHUR S. GREENAMYER.
ALFRED HALLETT.

In presence of—
ARTHUR P. KNIGHT,
FRANK L. A. GRAHAM.