T. L. WHITE.

STABILIZING MEANS FOR AEROPLANES.

APPLICATION FILED NOV. 9, 1911.

1,018,400.

Patented Feb. 20, 1912.

2 SHEETS—SHEET 1.

Fig. 4.

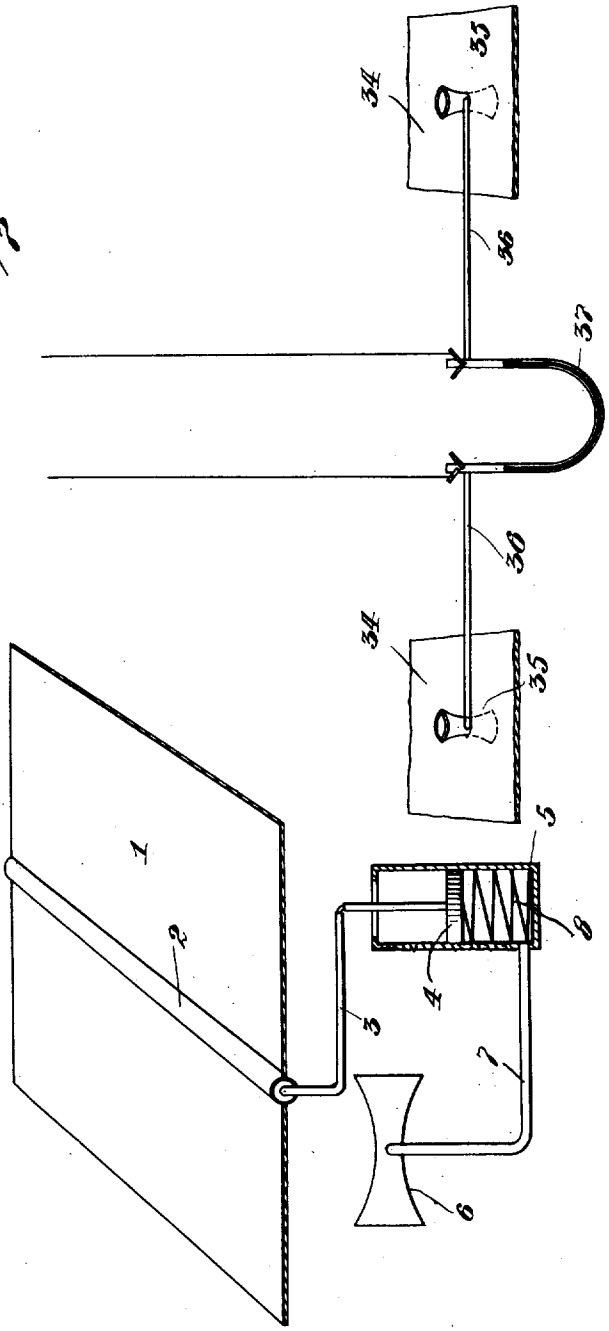

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

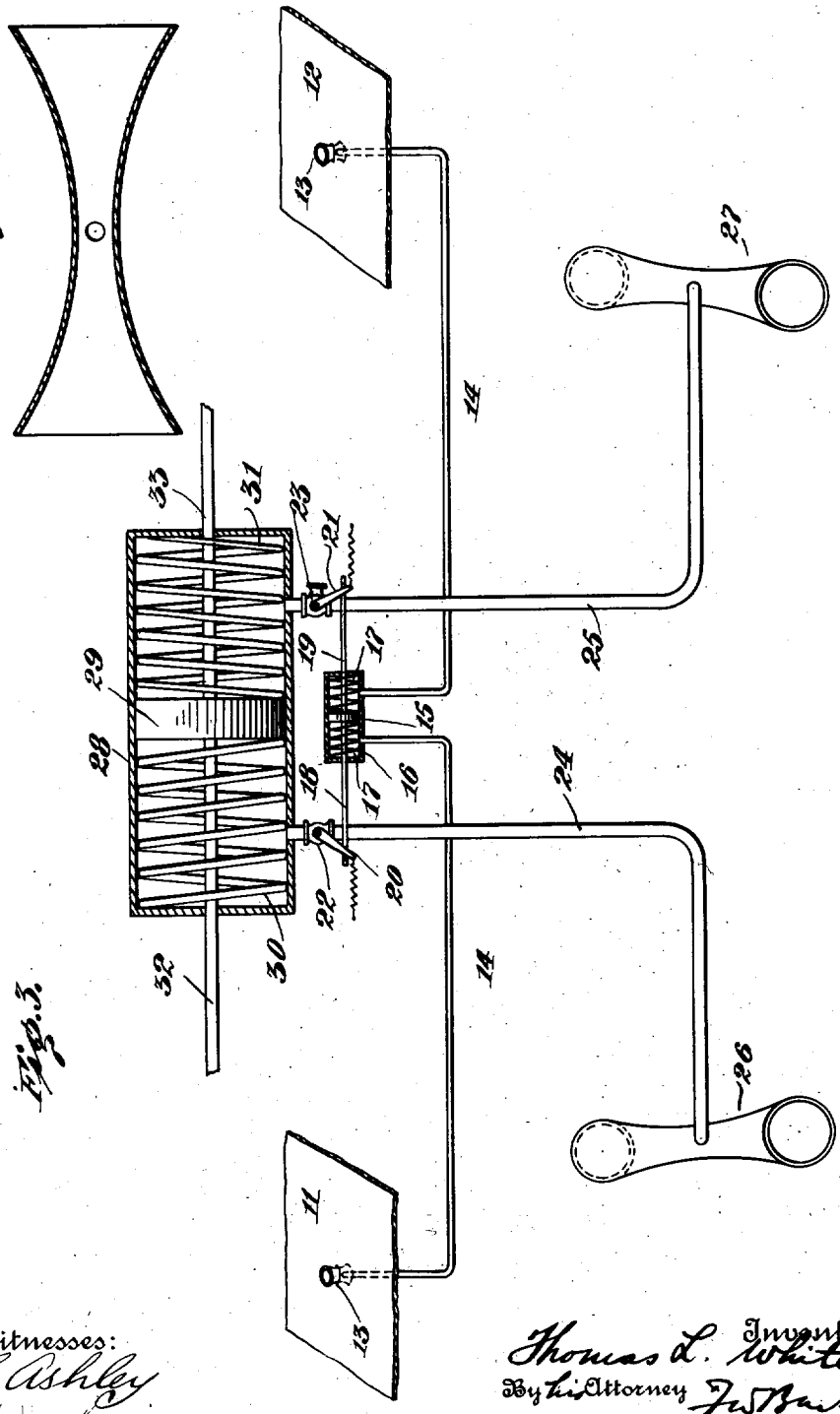

Fig. 3.

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UNITED STATES PATENT OFFICE.

THOMAS LOUGH WHITE, OF NEW YORK, N. Y.

STABILIZING MEANS FOR AEROPLANES.

1,018,400. Specification of Letters Patent. Patented Feb. 20, 1912.

Application filed November 9, 1911. Serial No. 659,807.

To all whom it may concern:

Be it known that I, THOMAS LOUGH WHITE, a subject of King George V, and resident of 50 Church street, New York city, county of New York, State of New York, have invented certain new and useful Improvements in Stabilizing Means for Aeroplanes, of which the following is a specification.

The essence of the art of aviation so far as heavier than air flying machines are concerned, and in its present state of development, lies in the employment of reliable, automatic means functioning to regulate or to prevent sudden tilting of the apparatus; and the purpose of my invention is to provide instrumentalities whereby the very conditions which themselves constitute a tendency toward the loss of equilibrium during flight, themselves operate to offset such tendency and maintain poise.

With these and other coördinate ends in view I have adopted the principle involved in suction producing devices, such for example as the Venturi tube, truncated cones arranged co-axially in series, or any equivalent injector or ejector device; wherein, by constriction of the interior diameter of such device, the velocity of moving air therein is increased and its internal fluid pressure decreased. Taking the Venturi tube as a practical example of this class of apparatus, and arranging these tubes in manner to engage a current of air in the direction opposed to that of flight, I am enabled, through the suction force created, to automatically control the deflection of the elevating plane of aeroplanes, and to maintain forward flight either with or without the power of the motor. Similarly, by the utilization of Venturi tubes, arranged at right angles to the lateral or supporting planes, and conveniently disposed in or near the locus of the centers of pressure thereof, I am enabled, due to the difference in pressures exerted upon the upper and lower surfaces of the planes, to utilize the suction force created by said Venturi tubes, and, through said difference in pressure, in conjunction with other interconnecting actuating means, to adjust the ailerons or wings in counteracting the tilting influence due to local variations of the net upwardly directed pressure which supports the planes.

In the drawings, which are diagrammatic in character,—Figure 1 indicates, in perspective, a part of an elevating plane, a Venturi tube, dash pot, and interconnecting members enabling the control of the plane through the suction force of said tube; Fig. 2 is a longitudinal section of a Venturi tube; Fig. 3 is a diagrammatic layout of supporting planes, Venturi tubes therefor actuating a trigger-valve control cylinder, a cylinder with piston connections to actuate the supporting planes or ailerons thereof, and Venturi tubes disposed in the direction of flight to operate said piston through said trigger-valve means; and Fig. 4 indicates supporting planes with Venturi tubes, an intermediate U-shaped tube containing mercury, and electrical connections, the mercury closing an electrical circuit as it rises in either leg of the tube.

Dealing first with the control of the elevating plane or planes, we find, in Fig. 1, a partial view of a plane, as 1, disposed horizontally, as for horizontal forward flight. For descriptive purposes the axis of this plane is indicated at 2, and said plane may there be provided with a spring, whose tension is exerted to tilt downwardly the forward edge of said plane. A connector or connectors 3 between said plane or spring, and a piston 4 in dash-pot or cylinder 5, moves said piston outwardly with the downward tilt of the plane as is obvious. A Venturi tube, as 6 (or a plurality thereof), is disposed and supported by the aeroplane in any suitable manner axially in the direction of flight, and hence axially in parallelism with the elevating plane when the latter is set for horizontal motion; or said Venturi tube may be pivotally supported and connected with the elevating plane to remain always in parallelism therewith. A pipe, as 7, connects the neck of the Venturi tube with cylinder 5, behind the piston, and a spring, as 8, within said cylinder, serves as a seat for the piston.

Assuming a developed speed of 30 miles an hour to be requisite to sustain horizontal flight, and assuming the various parts of the apparatus to be suitably proportioned and arranged, the result will be as follows: At the stated speed the air pressure through the Venturi tube will create a suction force at the constricted portion of said tube, which force, operating through pipe 7, will pull piston 5 to its seat upon spring 8, said piston, in that position, holding the plane horizontally against the tension of the plane

spring. When, through any cause, as the slackening or stopping of the motor; or, that the suction force exerted at the neck of the Venturi tube is lessened, then the piston, thus released, rises in its cylinder under the tension of the plane spring, which of course at the same time tilts the plane downwardly. In the acceleration of speed of the aeroplane while falling, the suction exerted at the neck of the Venturi tube increases proportionately, thus drawing the piston to its spring seat in the cylinder, the plane in consequence coming back to the horizontal direction of flight; or, if the speed of descent has developed beyond 30 miles an hour, the suction effect will be greater and will cause the plane to be upwardly tilted, the piston in that act descending farther into its cylinder and retracting the spring seat therein. Stabilization follows under a resumption of the normal engine speed of 30 miles an hour with the plane again horizontal; or, in the case of a glider, the apparatus makes a series of gradual downward and upward steps. The operator, also using his hand control to tilt upwardly the elevating plane, thus depressing the piston against its spring seat, may enter different atmospheric strata and thereby prolong flight.

In considering the adaptability of my invention to the automatic control of the ailerons or supporting planes, reference is directed to the layout in Fig. 3, wherein 11, 12 respectively indicate opposite portions of the lateral supporting surface or surfaces, oppositely disposed with respect to the situation of the power cylinder. One or a number of Venturi tubes 13 are placed with their axes at right angles to said planes, conveniently disposed in or near loci of centers of pressure, whereby the potential difference in pressure in the upwardly and downwardly exerted pressures acting on said lateral planes or plane parts, is effective toward the performance of a certain function, to wit: Piping 14 connects the necks of said Venturi tubes with opposite sides of a piston 15 in a cylinder 16, springs 17, at each side of said piston balancing it normally centrally within said cylinder. Piston rods 18, 19, extending from opposite sides of the piston, actuate, each when moving in an opposite direction, the triggers 20, 21, respectively, said triggers serving to open and close three-way valves 22, 23, respectively, to control communication, through pipes 24, 25, between Venturi tubes 26, 27, and opposite ends of a cylinder 28, by cutting out from either side of piston 29 communication with the corresponding Venturi tube, and at the same time opening direct communication with the atmosphere, through an outlet which is wholly or partially open when the pipe 24 or 25 is wholly or partially closed, and vice versa. Said piston 29 is centrally balanced by springs 30, 31 and has oppositely extending rods 32, 33, which, respectively, operate by means (not shown) ailerons or flexible individual wing portions (not shown). The Venturi tubes 26, 27 are arranged axially in the direction of flight, and, respectively, through their pipes 24, 25, with the opening of valves 22, 23, serve by their suction force to exhaust the air from both sides of piston 29. For example, if the effective pressure supporting plane 12 is from any cause diminished, the corresponding rate of flow through Venturi tube 13 is lessened, as also the suction exerted along pipe 14. There is a rise of pressure on one side the piston 15 which is effective in moving over said piston away from the region where the effective wing supporting pressure is lower. Valve 21 is thereby operated to cut out pipe 25 and to admit atmospheric air directly to the side of piston 29 on which it is located. The excess of pressure forces over piston 29, which movement is effective, through rods 32, 33 and the intervening mechanism, (not shown) in operating the ailerons. The operation is repeated, reversely, when the effective pressure under plane 11 is diminished. The essential feature of the mechanism is that it functions in response to any difference between the wing supporting effective pressures under the oppositely disposed wing surfaces 11 and 12. It is therefore immaterial whether the actual cause of a difference in these effective pressures be an excess or a defect in either of them.

In Fig. 4 I show supporting planes 34, having Venturi tubes 35, connecting, as by pipes 36, with a U-shaped tube 37, containing mercury. An increase or defect in pressure at one plane will render unequal the pressures acting on the mercury. The mercury will rise in one leg of the tube and fall in the other and will thus become instrumental in closing an electrical circuit, whereby, through a source of energy, (not shown) the control may be governed. Obviously, gravity in the flow of the mercury will be an assisting factor in making contacts in the respective legs of the U tube as said tube tips with the lateral tilting of the aeroplane.

In the practice of my invention, I do not wish to be limited to the particular mechanical devices referred to as intermediate the source of suction force and the moving plane members, believing it to be broadly new with me to employ suction devices for creating the force with which to automatically control or stabilize aeroplanes in flight. I therefore reserve the right to modify or rearrange said mechanical devices, or to substitute equivalent means therefor, all within the spirit and scope of my invention to adapt

it to the various types and constructions of aeroplanes, where practicable. Also I wish it understood that where I refer to Venturi tubes in the subjoined claims I intend arbitrarily to include any equivalent or suitable suction producing device.

I claim:

1. In an aeroplane having an independently movable part, a Venturi tube disposed axially in manner to create a suction force during flight, and means utilizing said force in the control of said movable part.

2. In an aeroplane, a Venturi tube disposed axially in the direction of flight, and means utilizing the suction force thereof in controlling the elevating plane.

3. In an aeroplane, an elevating plane, tensional means to normally deflect said plane downwardly, a Venturi tube disposed axially in the direction of flight, and means directing the suction force of said Venturi tube to counteract the influence of said tensional means.

4. In an aeroplane, an elevating plane, tensional means to normally deflect said plane downwardly, a cylinder having a piston connected with said plane, a Venturi tube disposed axially in the line of flight, means between said cylinder and the Venturi tube permitting the suction force from the latter to counteract the influence of the tensional means upon the plane, and means whereby the suction force may overcome said tensional means and deflect the plane upwardly.

5. In an aeroplane, an elevating plane, tensional means to normally deflect said plane downwardly, a Venturi tube disposed axially in the line of flight, a cylinder, a piston therein having connection with said plane, whereby the suction force of said Venturi tube counteracts the influence of said tensional means, and a spring seat in said cylinder for said piston, in use under conditions of normal flight, increased suction at higher speed causing the piston to depress its seat and deflect the plane upwardly.

6. In an aeroplane, a supporting plane therefor, a Venturi tube disposed transversely thereto in the locus of the center of pressure, an aileron, and means utilizing the suction force from said Venturi tube to control operating means to adjust said aileron.

7. In an aeroplane, a supporting plane having ailerons and warping connections therefor, a cylinder, a piston balanced therein, and connections between said piston and said warping connections, a pair of Venturi tubes disposed axially in the direction of flight, and pipes connecting said Venturi tubes respectively with said cylinder at opposite sides of its piston; together with three-way valves in said pipes and means for operating said valves separately to close said pipes and admit atmospheric air to said cylinder, said means comprising a piston balanced in a cylinder, valve triggers, and connections from said piston to actuate said triggers separately, Venturi tubes disposed transversely in said supporting plane, and pipes connecting said Venturi tubes with said cylinder at opposite sides of the piston.

8. In an aeroplane, lateral supporting planes, a Venturi tube disposed transversely in each plane, a source of energy, connections between the source of energy and the plane ailerons, and means enabling the suction force in either Venturi tube to cause said source of energy to adjust the ailerons to stabilize the aeroplane laterally.

Signed at the borough of Manhattan, in the city, county and State of New York this 8th day of November, A. D. 1911.

THOMAS LOUGH WHITE.

Witnesses:

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