J. C. TEN EYCK.

AUTOMATIC AEROPLANE EQUILIBRATOR.

APPLICATION FILED SEPT. 12, 1908.

1,025,548.

Patented May 7, 1912.

2 SHEETS—SHEET 1.

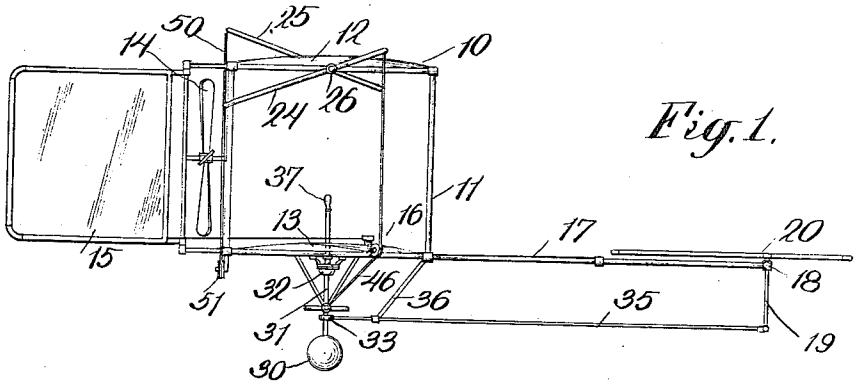

Fig. 1.

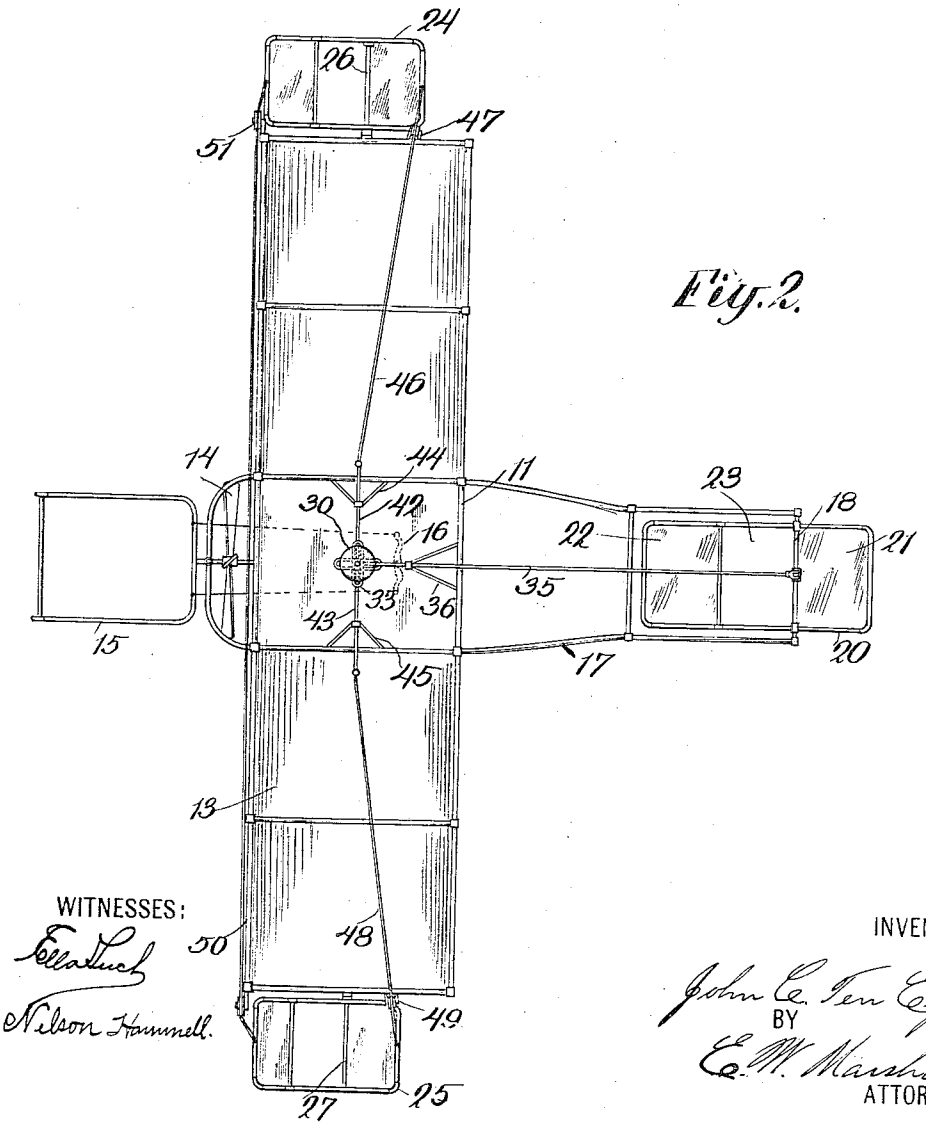

Fig. 2.

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Fig. 3.

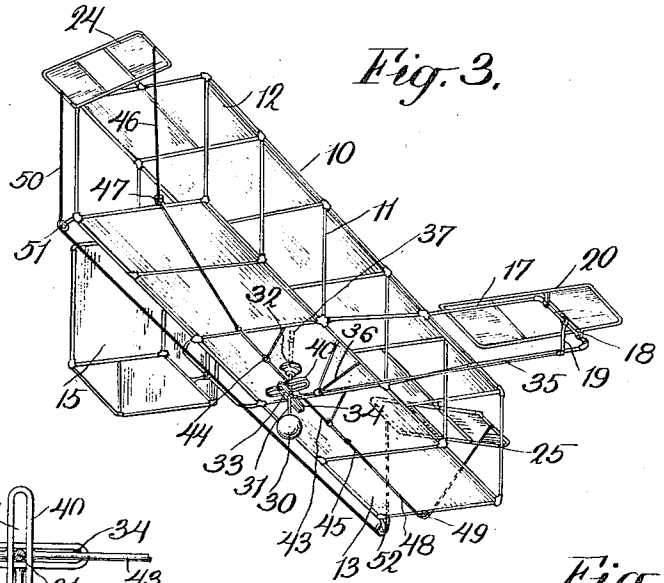


Fig. 5.

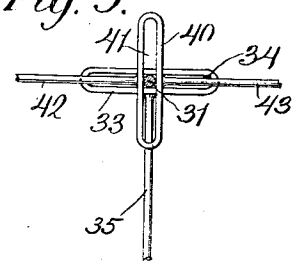


Fig. 6.

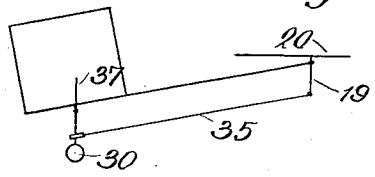


Fig. 4.

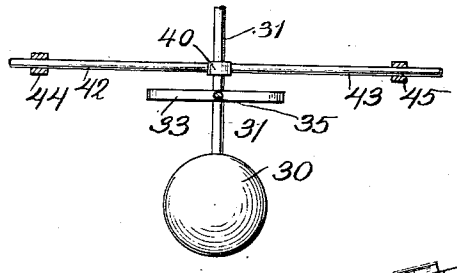


Fig. 7.

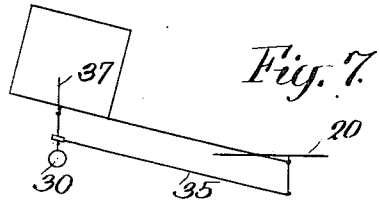
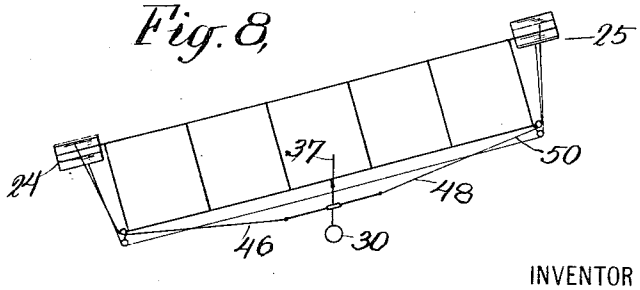


Fig. 8.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC AEROPLANE-EQUILIBRATOR.

1,025,548. Specification of Letters Patent. Patented May 7, 1912.

Application filed September 12, 1908. Serial No. 452,774.

To all whom it may concern:

Be it known that I, JOHN C. TEN EYCK, a citizen of the United States, and a resident of the city of Yonkers, in the county of Westchester and State of New York, United States of America, have invented certain new and useful Improvements in Automatic Aeroplane-Equilibrators, of which the following is a specification.

My invention relates to aeroplanes and other self-sustaining bodies, and its object is to increase the efficiency and ease of operating such structures by providing therefor a simple device by means of which their equilibrium will be automatically maintained.

I will describe my invention in the following specification and point out the novel features thereof in the appended claim.

Referring to the drawings, Figure 1 is a side elevation of an aeroplane with my invention applied thereto. Fig. 2 is a bottom plan view of the same structure. In Fig. 3 an aeroplane with my improvement thereon is shown in perspective, the view being taken from the ground from the front of the aeroplane and showing the apparatus in flight. Fig. 4 shows in front elevation a portion of the actuating mechanism. Fig. 5 is a plan view of the parts shown in Fig. 4. Figs. 6, 7 and 8 are diagrammatic representations of an aeroplane in flight showing different positions it may assume and illustrating the operation of my invention.

Like characters of reference designate corresponding parts in all of the figures.

10 designates an aeroplane which comprises a frame 11 supporting a pair of parallel planes 12 and 13.

14 is its propeller, and 15 the rudder. The rudder may be actuated by a foot-steering gear 16 so as to leave the operator's hands free.

I will not further describe the parts and construction of the aeroplane itself as it forms no part of my invention which is applicable to many forms of such devices other than those which are made according to the well-known construction which is shown in the drawings to illustrate the manner in which my invention is used.

The lower portion of the frame 11 is carried forward as shown at 17 to provide a pivotal support 18 for a vane or wing 20. This vane or wing is preferably constructed as shown in the drawings with two surfaces 21 and 22 of approximately equal area in a single plane with an air space 23 left between them.

24 and 25 are similar vanes or wings pivotally supported at 26 and 27 on horizontal pivots projecting laterally from the opposite sides of the frame. These pivots are shown in alinement with the upper plane 12, but they may be in other positions so long as they are on opposite sides of the structure.

30 is a weight swung by an arm 31 from a universal joint support 32, which is preferably placed on the frame 11 at the center of the lower plane 13. Obviously, no extra weight must be added to an apparatus of this character, so it is my intention to utilize some necessary part of the aeroplane or its driving machinery for this purpose. For example, when an internal combustion engine is used as the means of propulsion, its fuel tank may be suspended from the frame by the universal joint.

The weight 30 will, of course, under the action of gravity, sway or swing relative to the frame 11 whenever the latter moves out of a perfectly horizontal position. It will also move relative to the frame by centrifugal force when the aeroplane is in flight whenever it deviates from a straight course. The mechanism which I am about to describe is arranged to transmit this relative movement of the weight 30 to the vanes or wings 20, 24 and 25.

Below the plane 13 is a movable yoke 33 which is provided with a straight slot 34 through which the arm 31 extends. This slot is disposed transversely to the direction of flight of the apparatus. A rod 35 connects this yoke with an arm 19 which is rigidly connected with the vane or wing 20 near its pivot 18.

36 is a bracket depending from the frame 11 and supporting the rod 35. By this mechanical connection the weighted arm may be swung from side to side through the slot without affecting the blade or vane, but any movement which it may have back and forth will be imparted to the arm 19 and through the latter will move the vane 20 out of its horizontal position about its pivot. This mechanism is so arranged that when the weight swings forward relative to the frame 11, it will push the forward edge of vane 20 up into the position in which it is shown in Fig. 7, and conversely, when it swings back,

it will pull the forward end of the vane down into some such position as that shown in Fig. 6.

The vanes or wings 24 and 25 are also actuated by the suspended weight 30. In the drawings, a yoke 40 is shown directly above the yoke 33. It is provided with a slot 41 through which the arm 31 extends. This yoke with its slot is placed at right-angles to the slot in yoke 33 so that it will only be moved by a sidewise movement of the weighted arm 31 as its slot 41 will allow the arm to swing freely back and forth.

42 and 43 are sliding rods affixed to the ends of yoke 40 or integral parts thereof as shown in the drawings. They are supported in brackets 44 and 45 which depend from the lower part of frame 11. From the outer end of rod 42 a cord or cable 46 extends under a pulley 47 on frame 11 to the front edge of the vane or wing 24. Similarly, another cord or cable 48 which passes under a pulley 49 connects the end of rod 43 with the front edge of the vane or wing 25. The rear ends of these two vanes are connected together by another cord or cable 50 which passes under pulleys 51 and 52 on the lower rear corners of the frame 11.

It may be seen that when the weight 30 sways to the left as one faces the machine, it will pull the cord 48 and move the wing 25 out of its horizontal plane with its front edge down. The connection between the rear end of the wing 25 and the rear end of wing 24 will cause the latter to be pulled downward, and as the weight 30 has at the same time let out the cord 46 it will allow the front edge of wing 24 to be moved upward. The positions which the parts may assume as above described are illustrated in Fig. 8. Obviously, this operation will be reversed when the weight 30 sways to the right.

The way in which the vanes or wings are automatically actuated has been described, and I will proceed to show the effect this has upon an aeroplane in flight. If the aeroplane is tilted forward for any reason, such as the shifting of a weight, or a sudden air current, the weight 30 will move forward relative to the other parts of the structure under the action of gravity, and the parts will assume the position in which they are shown in Fig. 7. As the aeroplane has a tendency to move in a direction substantially parallel to the planes 12 and 13, it will then start moving downward. The vane or wing 20 is now set in a position oblique to the direction of movement of the apparatus and in such a position that the air acting upon it will raise the forward end of the aeroplane until it regains its equilibrium and again assumes a horizontal position. Or, if the front end of the apparatus is moved up, the vane will assume some such position as that in which it is shown in Fig. 6, when it will have a tendency to push the forward end down into its normal or horizontal position. I have shown the angular movement of the arm 19 which actuates vane 20 as equal to that of the arm 31, but it may, of course, be made greater or less, according to the requirements of the particular structure to which it is applied, by merely shortening or lengthening the distance between the pivot 18 and the point at which the rod 35 in connected.

The side wings 24 and 25 are actuated together but in opposite directions, and are so arranged that when the aeroplane loses its horizontal balance the wing on the low side will tend to push its side up, and the wing on the high side will tend to push its side down. Thus they work together to bring the structure back to a level position. In this connection I will point out an important feature of my invention. When the aeroplane is moving on a curved course the pendent weight 30 will be acted upon by centrifugal force and the result of this will be to move the wing which is on that side of the structure which is on the outside of the curved path being traveled, into such a position as to raise that end of the device. At the same time the wing on that side of the structure which is on the inner side of the course will depress its side; consequently, the frame will be tilted in rounding curves into the proper position to maintain its equilibrium and prevent capsizing. The result is that the aeroplane or other structure to which my invention is applied may be steered around shorter curves than has heretofore been possible.

As I previously stated, the invention herein disclosed is applicable to nearly any form of aeroplane now known. It will doubtless be of use in connection with other apparatus of this character which may hereafter be devised as this art is developed. It may be applied with good effect to dirigible balloons as well as aeroplanes.

The drawings are more or less diagrammatic as my invention is in the principle of increasing the stability of the structure to which it is applied and maintaining its equilibrium automatically by a pendent weight and not in the mechanism which is shown as an example of one way by which this invention may be carried into effect.

37 designates a lever which is a continuation of the arm 31 and extends up above the plane 13 to a place within easy reach of the operator. This is an important feature for, by means of this single lever the operator may steer the course of his apparatus up or down, or may tilt it from side to side at will. Devices for manipulating such vanes or wings have heretofore been known,

but in this case the manually operated device is used to modify, counteract, or increase the effect of the automatic arrangement which I have fully set forth and described.

When a self-sustaining body is equipped with my automatic equilibrating device it will leave the operator free to attend to other parts of his mechanism, and will even allow considerable latitude of movement on his part, for, if the center of gravity of the device is changed by the operator, thus creating a tendency to throw the device out of balance, the apparatus herein described will overcome this tendency and bring the structure back into a state of balance.

What I claim is:—

An aeroplane, a horizontally disposed vane pivotally supported in front of said aeroplane and arranged to affect the upward or downward direction of travel thereof, a horizontally disposed pivoted vane at either side of said aeroplane arranged to affect the horizontal position thereof, a swinging arm depending from said aeroplane, a weight supported on said arm, a horizontal frame provided with a slot disposed transversely to the direction of travel of the aeroplane, surrounding said arm, a connection between said frame and the vane at the front of the aeroplane arranged to move the front vane about its pivot in proportion to the movement of the arm in one plane, a second frame provided with a slot disposed at right-angles to the slot in said first frame, and connections between said second frame and the side vanes arranged to actuate said vanes in opposite directions in proportion to the movement of the arm in a plane at right-angles to said first plane.

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

JOHN C. TEN EYCK.

Witnesses:
ERNEST W. MARSHALL,
ELLA TUCH.