

1,009,200.

Patented Nov. 21, 1911.

3 SHEETS—SHEET 1.

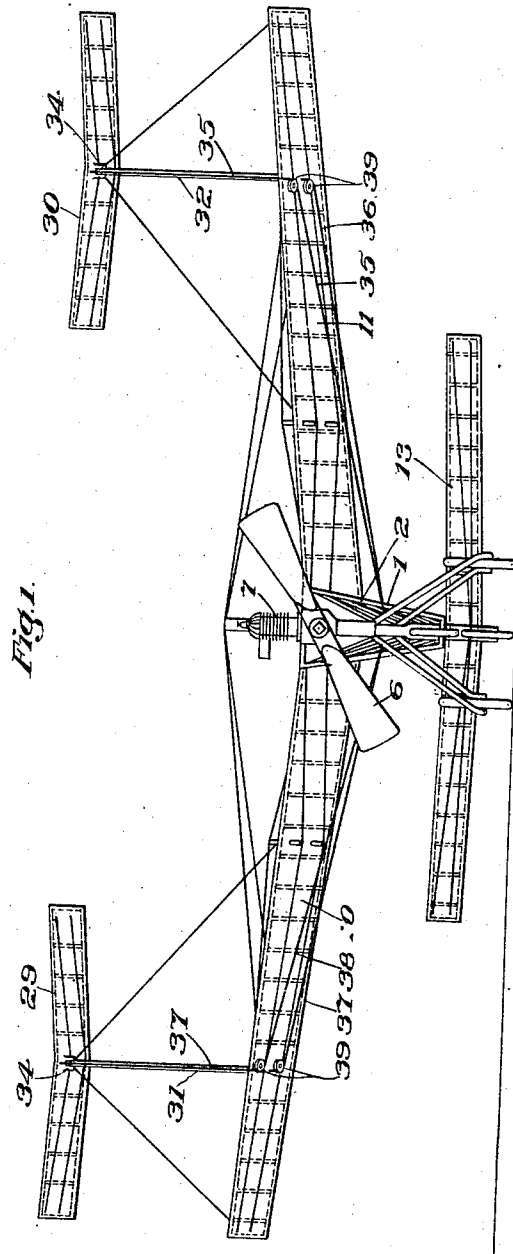


Fig. 1.

Witnesses
Edward Maxwell
Adolph C. Kaiser.

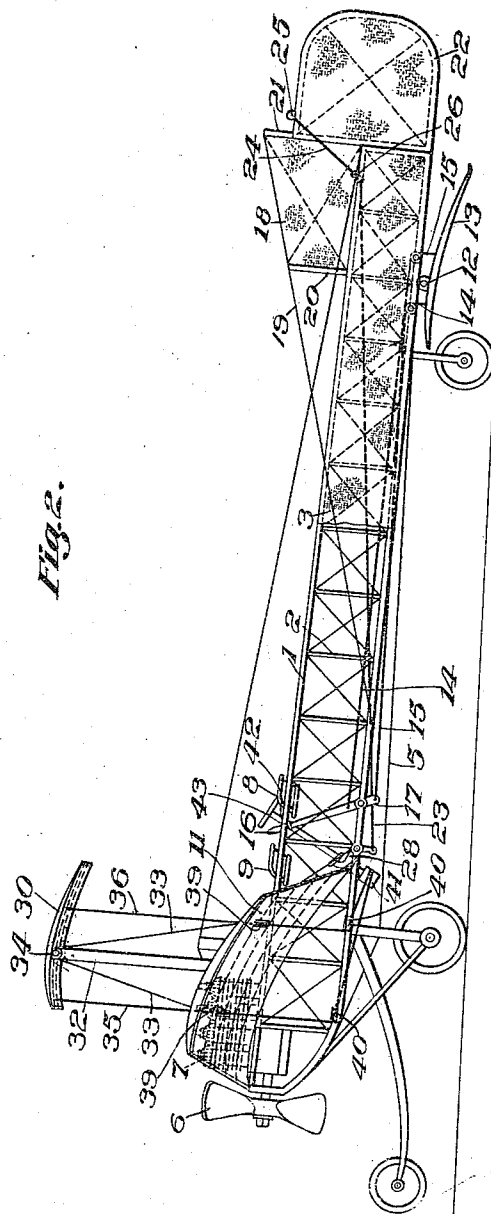
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AEROPLANE.
APPLICATION FILED APR. 14, 1910.

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3 SHEETS-SHEET 2.

Fig. 2.



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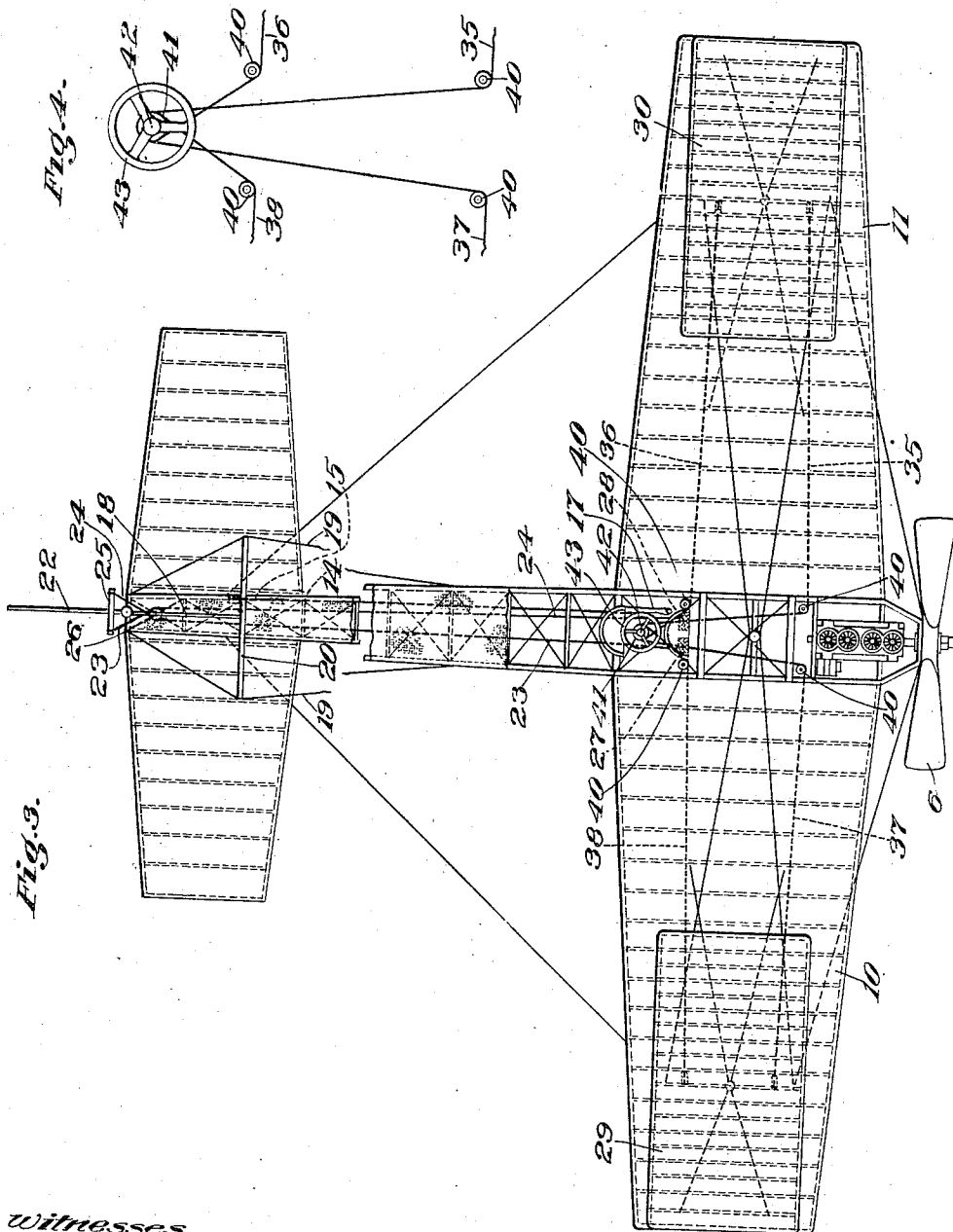
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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

WALLACE E. TILLINGHAST, OF WORCESTER, MASSACHUSETTS.

AEROPLANE.

1,009,200.

Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed April 14, 1910. Serial No. 555,412.

To all whom it may concern:

Be it known that I, WALLACE E. TILLINGHAST, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented an Improvement in Aeroplanes, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention aims to increase the serviceableness and responsiveness of the aeroplane or heavier-than-air flying machine, by providing, in connection with rigid planes, not susceptible of any distortion or deformation, a rigid elevating plane, and rigid auxiliary planes or stabilizers.

One of the objects of my invention is to eliminate the so-called "wing-warping" and the attendant complications of mechanism and operation, and also to avoid the necessity, heretofore common, of using the rudder to establish horizontal equilibrium.

In carrying out my invention I provide the machine with two auxiliary planes, one adjacent, and preferably above, each lateral end of the main lifting plane or planes, said auxiliary planes being pivotally mounted on pivots extending transversely to the length of the machine, so that the auxiliary planes turn in a substantially vertical plane extending in the direction of flying movement, to vary the angle of incidence of said respective planes, said planes being preferably operated to increase the angle of incidence of one thereof and simultaneously decrease the angle of incidence of the other thereof, whenever the main plane requires to be brought back to its normal or horizontal position.

A further feature resides in providing an independently acting rudder of rigid construction, which, combined with the other features of my invention, does not require operation to establish the horizontal equilibrium of the machine.

Also in connection with the main or supporting plane or planes at the front end of the machine, I provide a rigid elevating plane pivotally mounted on the lower side of the rear of the aeroplane body, in connection with a vertical rigid fin on the upper side of the body and its rear end.

The further novel features and the advantages thereof will be pointed out in connection with the following detailed descrip-

tion of my invention, and further defined in the claims.

In the drawings, Figure 1 is a front view of the machine substantially as it would appear to a spectator standing on the ground in front of it; Fig. 2 is a view thereof in side elevation; Fig. 3 is a top plan view thereof; and Fig. 4 is a substantially diagrammatic view showing the arrangement of the operating cables.

The body or fuselage 1 of the aeroplane, comprises any convenient form of strong frame-work 2 covered with canvas 3 and braced with suitable stay wires 4, 5.

Any suitable propelling power is used, herein shown as a propeller 6 driven by a gas engine or motor 7 mounted on the body 1 in front of the aviator's seat 8 and passenger's seat 9.

As herein shown, my invention is applied to a monoplane type of machine, the main lifting plane being mounted at the front end of the body 1 and having its two end portions 10, 11, which constitute the main lifting plane, arranged at a dihedral angle to each other, and each parabolic in cross section, and extending out laterally rigidly at all points, being trussed and braced in any well known manner and hence not needing further description of details. The body is not less than two-thirds the total length of this main lifting plane. Pivoted at 12 to the under side of the rear end of the body 1 I mount an elevating plane 13, from which extend operating cables or wires 14, 15, which extend to a hand lever 16 or any other suitable operating device, being connected thereto respectively above and below the pivot 17 of said lever, whereby the angle of the elevating plane may be varied by turning the same on its transverse horizontal pivot 12. Centrally above the plane 13 I provide a vertical fin 18, herein shown as made of canvas and extending from the longitudinal middle of the top of the body 1 to a truss wire 19 and supported by vertical struts 20, 21. The latter constitutes also the pivot post of an inflexible or rigid rudder 22 operated by cables or wires 23, 24, secured to the extremities of a cross bar 25 and thence passing over pulleys 26 to pivoted foot treadles 27, 28, or any other suitable operating mechanism.

Coöperating with the main lifting plane 10, 11, I provide auxiliary planes 29, 30, which are preferably mounted above the

main lifting plane. These auxiliary planes are located at the opposite ends of the main lifting plane and are rigid and built on a dihedral angle and are not parallel to the adjacent portion of the main lifting plane. Suitable supports for these auxiliary planes are provided, herein shown as comprising central posts 31, 32, and brace wires or trusses 33. The planes 29 and 30 are pivoted to the supporting posts on the center of the line of lift or at the point of equilibrium of the upward thrust, their said pivots extending horizontally transversely of the machine, as indicated at 34, and the said pivotal point or center of equilibrium of upward thrust being approximately one quarter of the distance from the advancing edge of the rear or following edge. Suitable operating means, herein shown as cables or wires 35, 36, 37, 38, are provided for turning these auxiliary planes on their pivots, said operating wires or cables leading down to directing pulleys 39, carried, for convenience, by the main lifting plane; and thence over pulleys 40, see Fig. 4, to a drum 41 on the lower end of a steering wheel shaft 42 operated by a steering wheel 43. The cables 35, 36, pass around the drum 41 in opposite directions so that when the drum is turned, one of said cables is slackened and the other tightened, and the cables 37, 38 also pass around the drum in opposite directions but reversely to the preceding cables, so that when the drum is turned to tighten the cable 35 it slackens the cable 37 and tightens the cable 38. I prefer to operate the two auxiliary planes together in this manner although I do not intend to restrict myself thereto as I believe that the provision of these rigid, pivoted auxiliary planes as described is new irrespective of whether they are operated together or separately from each other and from the rest of the machine. Also while these auxiliary planes may be used with any of the well-known kinds of aeroplanes, one of my objects is to devise a practical, superior machine in which there shall be no wing-warpage or distortion or deformation of the various planes, and accordingly in my preferred construction all the planes are rigid and incapable of any distortion during flight.

One of the main features of my invention resides in providing an auxiliary plane at a great distance from the center of the lifting plane for establishing balance, which can be controlled and made to lift a minimum or maximum, preferably both operating in unison, at the will of the operator. The two auxiliary planes have the well-known dihedral angle, shape or construction, and lie in substantially one and the same horizontal plane, so that each diverges from the plane of the adjacent wing or end portion of the main lifting plane, and being

pivottally connected one above each end of this forward or main lifting plane, it will be evident that by turning said auxiliary planes on their pivots their angles of incidence may be varied to provide exactly the balancing control required for maintaining the horizontal stability of the aeroplane in flight. Normally the auxiliary planes 29, 30, have the same relative angle of incidence as the main plane and will each lift or develop the same proportional upward thrust. If however the aeroplane tips, the operator, by his controlling lever or levers, herein shown as the hand wheel lever 42, in the body of the aeroplane, increases the angle of incidence of the auxiliary plane on the lower tipped side and decreases the angle of incidence of the auxiliary plane on the higher tipped side, thereby increasing the lifting or upward thrust on the outer end of the main lifting plane at the lower tipped side of the machine, and decreasing the lifting or upward thrust on the opposite outer end of the main plane at the higher tipped side of the machine. The result is that the aeroplane is at once brought back to its normal or horizontal position. The rear or elevating plane 13 is likewise rigid or incapable of any distortion in flight, and by moving the lever 16, its angle of incidence is changed in obvious manner for the purpose of raising or lowering the rear end of the body or fuselage and thereby alter the angle of incidence of the main lifting plane and thereby elevate or lower the entire aeroplane while in flight. The vertical rudder 22 is also rigid at the extreme rear end of the body immediately at the rear of the vertical rigid fin 18, the latter giving stability in a horizontal direction and preventing the swinging of the rear end of the aeroplane while in flight.

All of the parts thus far described cooperate in permitting the rudder to act independently under the control of the foot levers 27, 28, for the purpose of controlling the lateral direction of the flight.

It will be understood that I have purposely omitted a multitude of constructional details, my drawings and this description being confined to those features which constitute my invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is,

1. An aeroplane, comprising a main lifting plane, an auxiliary plane pivottally mounted back from its advancing edge above each end of said main plane at a distance therefrom and extending as a whole at an angle to the adjacent end of the main plane, and means under the control of the operator for increasing the angle of incidence of one of said auxiliary planes and simultaneously decreasing the angle of inci-

dence of the other auxiliary plane for establishing the horizontal position of the aeroplane.

2. An aeroplane, comprising a main lifting plane; an auxiliary plane pivotally mounted above each end of said main plane at a distance therefrom, and means under the control of the operator for increasing the angle of incidence of one of said auxiliary planes and simultaneously decreasing the angle of incidence of the other auxiliary plane for establishing the horizontal position of the aeroplane, each auxiliary plane having a dihedral angle shape and extending as a whole at an angle to the adjacent end of the main lifting plane.

3. An aeroplane, comprising a permanently rigid lifting plane having its end portions downwardly curved in the direction of the length of the machine and at a dihedral angle with relation to each other transversely of the machine, and a permanently rigid auxiliary plane above each outer end of said lifting plane, each auxiliary plane being downwardly curved in the direction of the length of the machine and having the shape of a dihedral angle viewed transversely of the machine and extending as a whole divergently from the adjacent end portion of said lifting plane, the outer end of the auxiliary plane being nearer the lifting plane than the inner end thereof, each auxiliary plane being pivotally mounted back from its advancing edge at approximately the center of the line of lift thereof on a pivot extending transversely of the length of the machine.

4. An aeroplane, comprising a permanently rigid lifting plane having its end portions downwardly curved in the direction of the length of the machine and at a dihedral angle with relation to each other transversely of the machine, a permanently rigid auxiliary plane above each outer end of said lifting plane, each auxiliary plane being downwardly curved in the direction

of the length of the machine and having the shape of a dihedral angle viewed transversely of the machine and extending as a whole divergently from the adjacent end portion of said lifting plane, the outer end of the auxiliary plane being nearer the lifting plane than the inner end thereof, each auxiliary plane being pivotally mounted back from its advancing edge at approximately the center of the line of lift thereof on a pivot extending transversely of the length of the machine, and means for simultaneously turning said two auxiliary planes in opposite directions on their respective pivots.

5. An aeroplane, comprising a permanently rigid lifting plane having its end portions downwardly curved in the direction of the length of the machine and at a dihedral angle with relation to each other transversely of the machine, and a permanently rigid auxiliary plane above each outer end of said lifting plane, each auxiliary plane being downwardly curved in the direction of the length of the machine and having the shape of a dihedral angle viewed transversely of the machine and extending as a whole divergently from the adjacent end portion of said lifting plane, the outer end of the auxiliary plane being nearer the lifting plane than the inner end thereof, each auxiliary plane being pivotally mounted back from its advancing edge at approximately the center of the line of lift thereof, the two pivots of said two auxiliary planes being approximately in alinement with each other, and operating mechanism under the control of the operator for operating the said auxiliary planes.

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

WALLACE E. TILLINGHAST.

Witnesses:

MINNA S. TILLINGHAST,
THOMAS J. CLARKE.