G. JOHNSTON.

AEROPLANE.

APPLICATION FILED JAN. 17, 1911.

1,063,802.

Patented June 3, 1913.

4 SHEETS—SHEET 1.

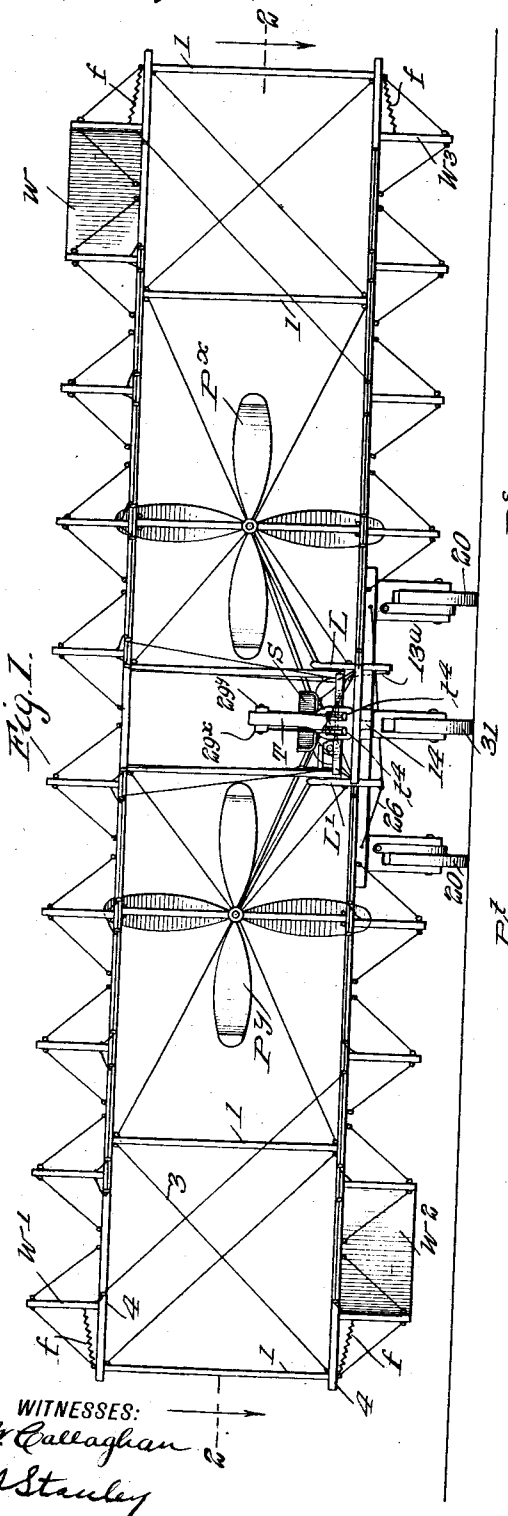

Fig. 1.

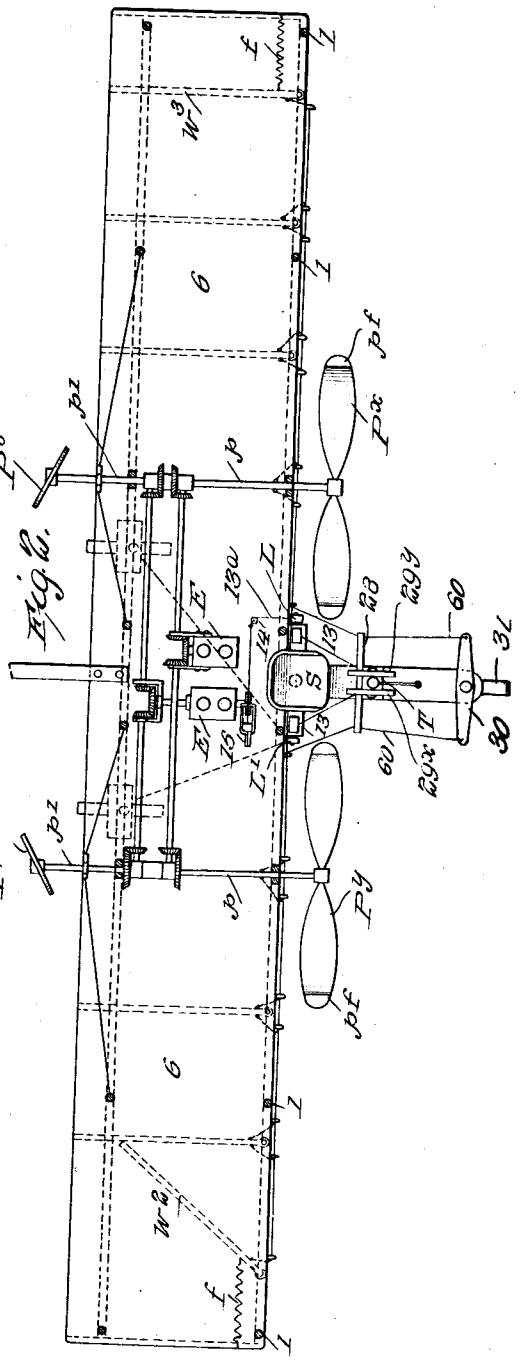

Fig. 2.

WITNESSES:

E. M. Callaghan

L. A. Stanley

INVENTOR

GREENHOW JOHNSTON

BY Munn & Co.

ATTORNEYS

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Fig. 3.

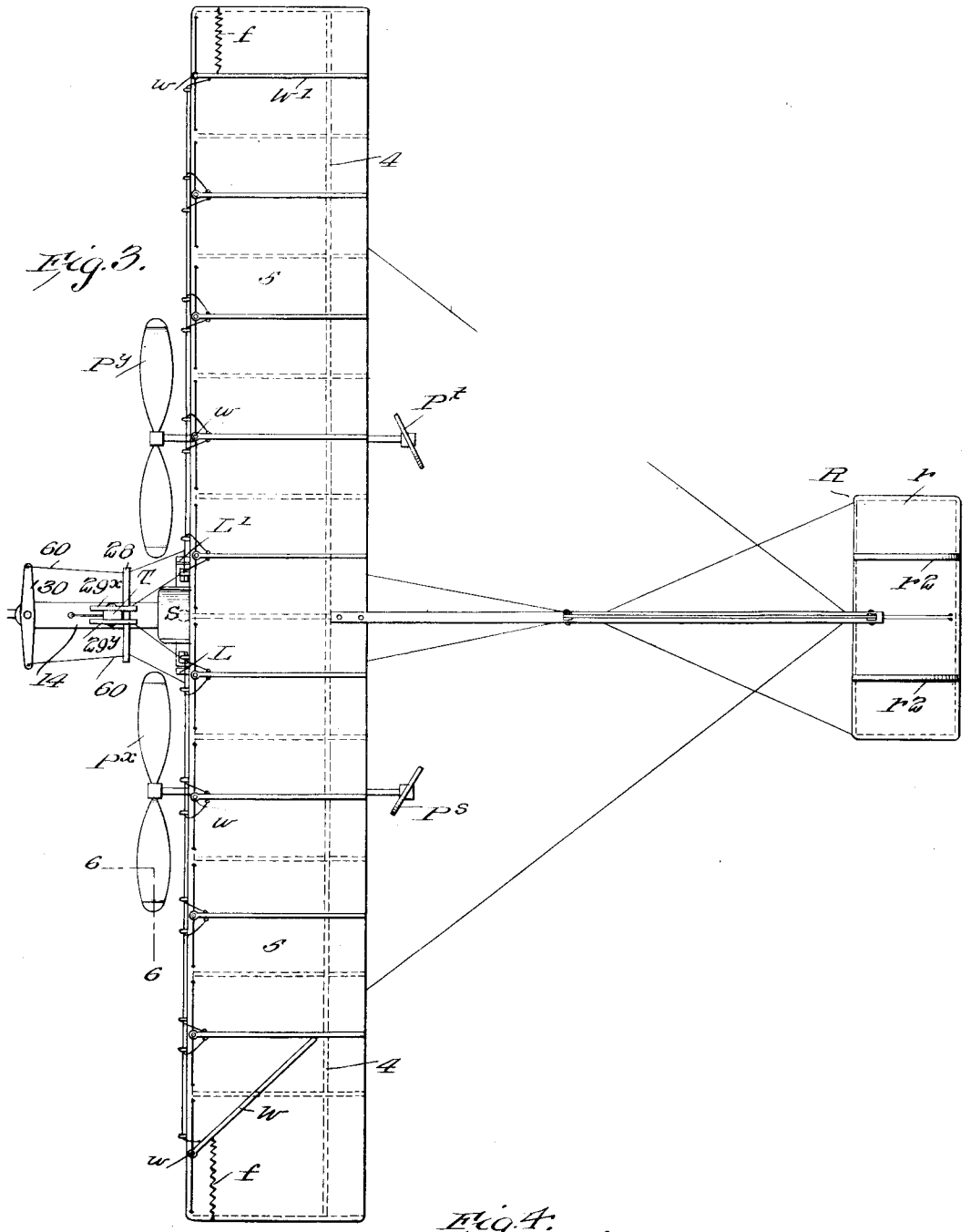
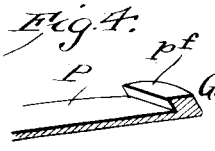


Fig. 4.



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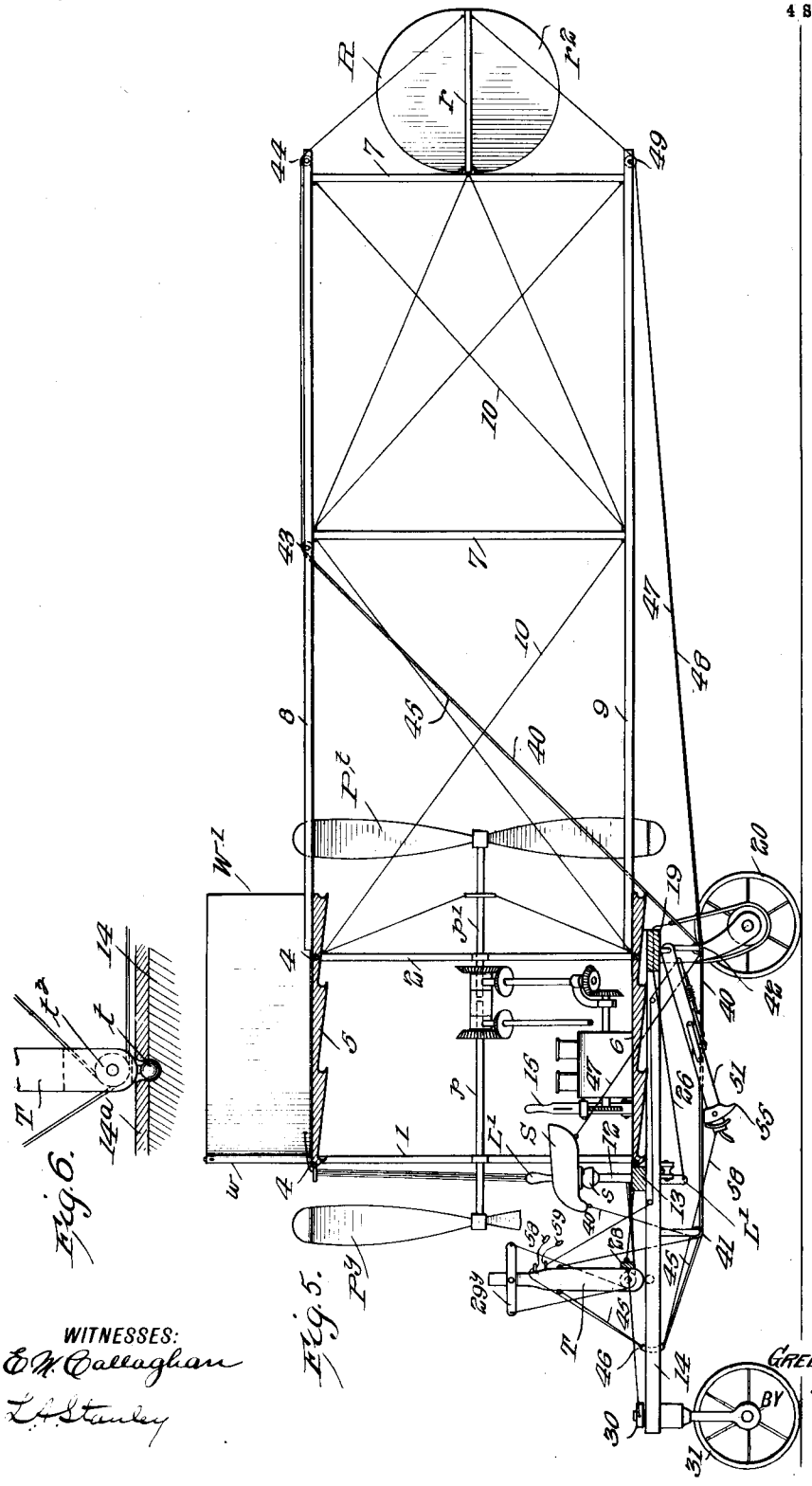

Fig. 5.

Fig. 6.

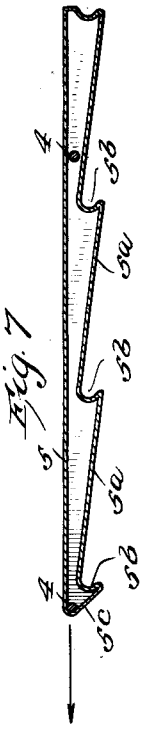

Fig. 7.

WITNESSES:

E. M. Callaghan

L. L. Stanley

INVENTOR

GREENHOW JOHNSTON

BY Munn & Co

ATTORNEYS

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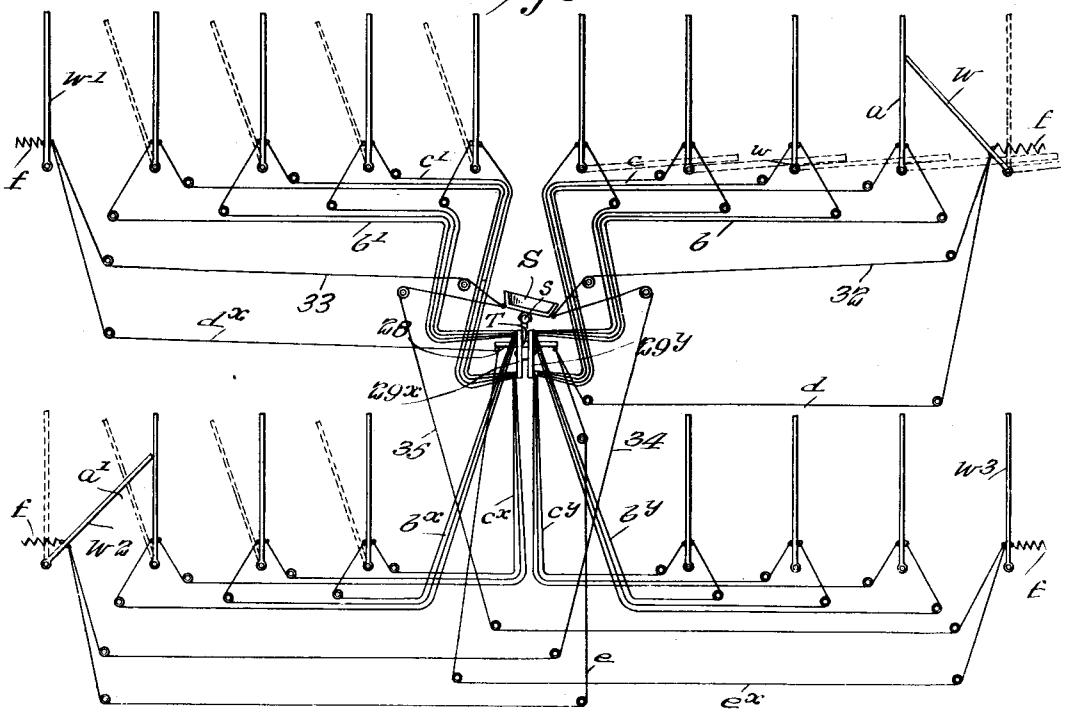
4 SHEETS—SHEET 4.

Fig. 8.



WITNESSES.

E. M. Callaghan

L. A. Stanley

INVENTOR

GREENHOW JOHNSTON

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

GREENHOW JOHNSTON, OF RICHMOND, VIRGINIA, ASSIGNOR TO VIRGINIA AERIAL MANUFACTURING COMPANY, INCORPORATED, OF RICHMOND, VIRGINIA.

AEROPLANE.

1,063,802. Specification of Letters Patent. Patented June 3, 1913.

Application filed January 17, 1911. Serial No. 604,489.

To all whom it may concern:

Be it known that I, GREENHOW JOHNSTON, a citizen of the United States, and a resident of Richmond, in the county of Henrico and State of Virginia, have made certain new and useful Improvements in Aeroplanes, of which the following is a specification.

My invention relates to improvements in aeroplanes and it consists in the constructions, combinations and arrangements herein described and claimed.

An object of my invention is to provide means to insure the safety of the device. These means consist of a series of pivoted wings which may be so manipulated as to provide a resisting surface in case of sudden descent either forward or backward. The wings also serve as means for restoring the device to its normal position when it is tipped and may, therefore, be used in lieu of the ordinary ailerons or wing warping devices.

A further object of my invention is to provide novel means for operating the series of pivoted wings. These means involve the use of two sets of devices which perform the same functions, so that if one set should be accidentally put out of commission the other set could be used.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application, in which,

Figure 1 is a front view of the device, Fig. 2 is a section along the line 2—2 of Fig. 1, looking in the direction of the arrows, Fig. 3 is a plan view of the device, Fig. 4 is a detail view of a portion of the propeller blade on the line 6—6 of Fig. 3, Fig. 5 is a sectional view of the device from front to rear, Fig. 6 is a sectional view showing in detail the mounting of the steering device, Fig. 7 is a sectional detail view showing the construction of the main supporting planes, Fig. 8 is a diagrammatical view showing the manner in which the pivoted guide wings are operated.

In carrying out my invention, I provide a frame consisting of a series of front uprights 1, rear uprights 2, bracing wires 3, and longitudinal strips 4. Upon the top of the frame is secured the upper main sustaining plane 5, and to the lower part of the frame is secured a lower main sustaining plane 6. These planes are formed preferably as shown in Fig. 7. Thus in Fig. 7 I have shown a section of the main plane 5. It is provided on its under side with a series of inclined portions 5^a connected together by curved surfaces 5^b. The advantages gained by this construction will be described later.

Extending rearwardly from the central portion of the device is a frame consisting of the uprights 7, the top and bottom members 8 and 9 respectively, and stay wires 10. To the rear uprights 7 is pivotally connected a rudder R, which consists of a rectangular plane r (see Fig. 3) pivoted to move on a horizontal axis, and being provided with vertically arranged fins r^2 extending above and below the horizontal plane r.

Referring again particularly to Figs. 1, 3 and 5, I have shown therein a series of guide wings, which I will denote in general by W. These guide wings are mounted on the upper side of the upper main sustaining plane and on the lower side of the lower main sustaining plane. Each wing is pivoted at its forward edge w. The normal position of these guide wings is in a direction parallel to that which the machine is headed, so as not to offer resistance to the progress of the machine. The wings are arranged in sets, those on either side of the machine being pivoted to swing together, and those on the left-hand side being mounted to swing independently of the set on the right-hand side. The means by which this is done will be explained later.

In order to propel the device, I arrange two engines E and E′ side by side above the lower plane, and below the upper one. The engine E is connected with the front propellers P^y and P^x, while the engine E′ is connected with the rear propellers P^t and P^s. In Fig. 5, I have shown the means by which the propeller shafts are supported. It will be observed that the shaft p of the propeller P^y terminates on the interior of a sleeve 11 on one side, and the shaft p' of the propeller P^s terminates on the interior of the same sleeve on the other side. The

sleeve 11 forms a bearing for the shafts, but the latter have no connection with each other. The front propellers may, therefore, be driven entirely by the engine E, while the rear propellers are driven entirely by the engine E'. If one engine should be put out of commission, the other can be used.

At S, I have shown the seat of the device. As it will appear from Figs. 5 and 8, the seat is mounted on a universal joint s, so as to have a movement in any direction. The seat post 12 is carried by a cross bar 13 mounted on a forwardly extending support 14.

Upon the forwardly projecting supporting member 14 is located the steering post which I have denoted in general by T. This post is mounted on a ball t in a socket on the supporting member 14, a plate 14^a being provided with an opening to permit forward and backward and also side movement of the post. The steering post T is provided with two openings T^x and T^y (see Fig. 1) in which are located pulleys T^z, such as that shown in Fig. 8. On the rear side of the post is a cross bar 28, which is securely fastened to the post, and which will, therefore, partake of its motion. At the top of the post are pivoted two levers 29^x and 29^y (see Figs. 1, 2 and 5). A second cross bar 30 is pivotally mounted on the supporting member 14 at the front end thereof, and to this cross bar is securely connected the bearing for the swiveled wheel 31.

Fig. 8 is a diagrammatic view showing the means for manipulating the various parts. Let us consider first the seat S. This seat as has been stated has a movement from side to side. In Fig. 8, it is shown as being tipped to the right. On one side of the seat is a flexible conductor 32, which extends to the end guide plane W of the set on the left. On the opposite side of the seat is a cord 33 which extends to the plane W' of the set on the right of the machine. When the seat is tipped toward the left the cord 32 will be pulled thereby swinging the guide plane W against the adjacent plane. At the same time a cord 34, which is fastened to the left side of the seat, and which passes downwardly and underneath of the machine and is fastened to the plane W^2, pulls the latter in the position shown in Fig. 8 against its adjacent guide wing. The movement thus effected by tilting the seat S to the left has the following result: A pocket a is formed between the upper left hand wing W and its adjacent wing, while a similar pocket a' is formed between the lower right hand wing w^2 and its adjacent wing. The pressure of the wing therefore will be against the plane W on the upper side and against the plane W^2 on the under side. This will counteract any tilting of the machine toward the right. Since one naturally leans toward the left when the machine tips toward the right the tilting of the end wings at the opposite ends of the upper and lower sustaining planes respectively will be accomplished automatically. The cords 33 and 35 on the opposite side of the seat accomplish the same result with the end wings W' and W^3, but, of course, the tendency in this case is to reverse the pressure so as to counteract any tilting in the opposite direction.

Attached to one end of the lever 29^y is a series of flexible cords, which I have denoted in general by b. These cords, as will be seen from the diagram, pass around pulleys and are secured to the outer sides of the wings far enough from their pivotal points w to manipulate them. The opposite end of the lever 29^y is connected by means of a series of cords which are denoted in general by c to the inner sides of the wings. It will be apparent that when the end of the lever 29^y nearest the seat is pushed upwardly (see Fig. 5) it will draw on the cords b (see Figs. 5 and 8) and will thereby tend to pull the wings W outwardly, so that these wings will lie transverse to the direction in which the machine is going, as shown in dotted lines in Fig. 11. Obviously when the lever 29^y is shifted in the opposite direction, the guide wings will be pulled back into their normal position. The lever 29^x is similarly provided with cords b' and c', which control the set of wings on the left side of the device in precisely the same manner. In addition to the cords which run to the outer sides of the guide wings on the upper plane, there is a series of cords b^y and c^y which control the wings on the right side of the lower plane, while the cords b^x and c^x control the lower wings on the left side in the same manner. The purpose of this may be readily understood when it is stated that a great many accidents occur from the sudden dashing of the machine to the ground, either in a forward or a backward direction. By manipulating the levers 29^x and 29^y, however, the wings W may be thrown transversely of the direction of flight, so as to offer a very appreciable resistance to the forward or backward motion of the device, thereby eliminating to a certain extent, the chance of a precipitous forward or backward descent.

I have thus far described how the wings may be moved, presenting the same resistance on each side of the device to the air on the upper and lower sustaining planes, and how the opposite upper and lower wings may be turned to counteract the tilting effect. In order to provide against contingencies, as for instance if the cords connected with the seat should break, I provide connections on the cross member 28. Thus the

cords d and e are shown attached to the member 28, and to the upper right-hand and to the lower left-hand wing, while similar cords d^x and e^x are attached to the upper left-hand and the lower right-hand wing respectively. Each of these end wings is provided with a spring f for returning the wing to its normal position. This cross member 28 is designed to be manipulated by means of the feet of the operator. The appearance of the device with the upper right-hand wing, and the lower left-hand wing in their operative positions, and of the rest of the wings in their inoperative positions, is shown in Fig. 1. Referring now to Fig. 5, it will be seen that to the front of the seat S is attached a cord 40, which passes downwardly around a pulley 41, thence rearwardly around a pulley 42, thence upwardly around a pulley 43 on the top member 8 of the rearwardly extending frame, thence rearwardly around a pulley 44, and down to the upper side of the rudder plane r. Also there is a cord 45 attached to the front of the steering post T, which passes through a sleeve 46, thence rearwardly around the pulley 42, thence upwardly around the pulleys 43 and 44, and to the upper side of the rudder plane r. It will be apparent that if the forward end of the aeroplane should dip down too suddenly, the involuntary motion of the operator in tipping the seat backwardly and in pulling backwardly on the steering post will cause a pull on the cords 40 and 45, and, therefore, will shift the horizontal portion of the rudder R upwardly and cause the plane to swing into a more horizontal position. On the rear sides of the seat S and of the steering post T are similar cords 47 and 48, respectively, which extend rearwardly around the pulley 49 on the lower frame member 9, and thence to the under side of the rudder plane r. When the front part of the plane, therefore, is suddenly lifted the involuntary tipping of the seat and seat post forward will cause the machine to be brought into a more nearly horizontal position. These acts, it will be observed, are largely unconscious on the part of the operator. In case either of the cords from the seat or the seat post to the rudder should become broken the other set can be depended upon to perform the operation desired.

I desire to call particular attention to the shape of the propellers. This is best illustrated in Figs. 3 and 4. Owing to the fact that the propeller blades are twisted, the parts near the hub tend to exert an outward pressure on the air, thus driving it in a radial direction along the propeller blade, and off the end thereof. This results in a loss of power, and in order to counteract this tendency, I provide the blades with end flanges like that shown at p^t in Fig. 6. This counteracts the movement of the air off from the end of the blade, so that it has to be forced rearwardly, thus adding to the propelling effect.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. In starting the device the operator takes his seat and reaching forward grasps the lever L. A few pulls of this lever is sufficient to start the engine. I have spoken of the engine, but it will be understood that a similar device might be applied to either of the engines.

The rotation of either set of propellers is sufficient to drive the machine forward. If the aviator wishes to turn to the right, he may do so by moving the set of guide wings on the right (the left-hand set of guide wings when facing the machine) so that they will exert a drag on that side of the device. The machine will be guided accordingly. Similarly when he wishes to turn in the opposite direction, the upper and lower wings of the opposite set of the device are shifted in the manner already described. In case the machine tips too far to one side, as when going around corners or from a sudden gust of wind, the wings on the opposite ends of the upper and lower planes are manipulated to form pockets which will cause the righting of the machine. When the aviator wishes to rise he pulls the steering post toward him, and when he wishes to descend he pushes it from him, when the rear rudder will be manipulated in the manner described. In case one set of propellers should break and be rendered useless, the other set may be immediately brought into commission. In case connections from the seat to the end planes are broken then the foot lever 28 may be used and vice versa. It will be noted that the front wheel 31 will be turned according as the foot lever 28 is moved by means of the cross piece 30, which is connected to the cross piece 28 by means of the cords 60.

I desire to call particular attention to the shape of the sustaining planes, as set forth in Fig. 7. It will be noted that the upper side of the plane is a flat surface. At the forward side of the plane is a downwardly and rearwardly extending surface 5^c. Adjacent to it is the curved surface 5^b, which connects with the rearwardly inclined surface 5^a, as already explained. The operation of the plane is as follows: When the machine is going forwardly through the air, in the direction indicated by the arrow, the surface 5^c drives the air downwardly. As the machine passes forward the air so driven forms an eddy, which passes upwardly against the curved surface 5^b and also against the inclined surface 5^a. At the end of the inclined surface 5^a there is another

eddy which passes into the second pocket formed by the surface 5^b. This action tends to exert a far greater sustaining effect than that attained by merely forming the sustaining plane in a curved form from front to rear.

Another feature that deserves special mention is the fact that when the upper and lower guide wings are in their normal position they prevent the aeroplane from "skidding," *i. e.*, from tilting downwardly on one side, and then being dashed to the ground in a direction parallel with the length of the sustaining planes. It will be noted that with the guide wings in their normal position, such a movement would carry them directly against the air. The resistance of the air against these guide wings tends to right the aeroplane. This action of the guide wings has been determined many times by actual experiment.

I claim:

1. In an aeroplane, a main sustaining plane, a series of guide wings pivotally supported on axes perpendicular to the main sustaining plane above said main sustaining plane, a similar series of pivoted guide wings below said main sustaining plane, and means for turning certain wings of each series independently.

2. In an aeroplane, a main sustaining plane, a series of guide wings disposed above said main sustaining plane, a series of guide wings disposed below said main sustaining plane, each of said guide wings being pivoted at its forward edge on an axis perpendicular to said main sustaining plane, means for simultaneously turning the upper and lower guide wings on one side of the center of the aeroplane, and independent means for simultaneously turning the guide wings on the opposite sides.

3. In an aeroplane, a main sustaining plane, a series of guide wings pivoted at their forward edges above said main sustaining plane, a similar series of guide wings pivoted below said main sustaining plane, the normal position of said guide wings being parallel with the longitudinal axis of the aeroplane, and means for simultaneously turning an end guide wing above the main sustaining plane on one side of the center of the aeroplane, and the end guide wing below the sustaining plane on the opposite side of the center.

4. In an aeroplane, a main sustaining plane, a series of guide wings pivoted at their forward edges above said main sustaining plane, a similar series of guide wings pivoted below said main sustaining plane, the normal position of said guide wings being parallel with the longitudinal axis of the aeroplane, and means for simultaneously turning an end guide wing above the main sustaining plane on one side of the center of the aeroplane and the end guide wing below the sustaining plane on the opposite side of the center, said means comprising a seat having a universal movement, and a series of flexible connections between said seat and each of said upper and lower end guide planes.

5. In an aeroplane, a main sustaining plane, a series of guide wings pivoted at their forward edges above said main sustaining plane, a similar series of guide wings pivoted below said main sustaining plane, the normal position of said guide wings being parallel with the longitudinal axis of the aeroplane, and means for simultaneously turning an end guide wing above the main sustaining plane on one side of the center of the aeroplane and the end guide wing below the sustaining plane on the opposite side of the center, said means comprising a seat having a universal movement and a series of flexible connections between said seat and each of said upper and lower end guide planes, a steering post and a second set of flexible connections from said steering post to said end guide planes.

6. In an aeroplane, a main sustaining plane, a series of guide wings disposed above said main sustaining plane, a series of guide wings disposed below said main sustaining plane, each of said guide wings being pivoted at its forward edge on an axis perpendicular to said main sustaining plane, means for turning the upper and lower guide wings on one side of the center of the aeroplane, said means comprising a post, a lever pivoted thereon, and flexible connections between said lever and said guide wings, and an independent lever and connections for the wings on the opposite side of the aeroplane.

7. In an aeroplane, a main sustaining plane, a series of guide wings disposed above said main sustaining plane, a series of guide wings disposed below said main sustaining plane, each of said guide wings being pivoted on an axis perpendicular to said main sustaining planes, a seat having a universal movement, a steering post in front of said seat having universal movement, said steering post also being rotatable about its longitudinal axis in any position of the post, connections between said seat and certain of said guide wings for operating the latter when the seat is tilted, and connections between the same guide wings and said steering post for operating the said guide wings through the rotation of the steering post about its longitudinal axis.

8. In an aeroplane, a main sustaining plane having a flat top, and a series of pockets on its under side, said pockets extending longitudinally of said main sustaining plane and transverse to the direction of movement of the plane, each pocket

having a rear side extending rearwardly and downwardly, and a curved forward side.

9. In an aeroplane, a main sustaining plane having a flat top, and a series of pockets on its under side, said pockets extending transversely of the direction of motion, and the lower edges of the pockets lying in a common plane parallel to the plane of the top.

GREENHOW JOHNSTON.

Witnesses:

L. A. STANLEY,

SOLON C. KEMON.