UNITED STATES PATENT OFFICE.

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AEROPLANE FLYING-MACHINE.

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To whom it may concern:

Be it known that I, HENRY ZIEMSS, Jr., a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Aerialw Machine, of which the following is a specification.

One of the objects of this invention is to so construct the planes of the machine as to increase the sustentation capacity of the planes by adapting the rear portion of the planes to the disturbed condition of the air caused by the forward portion of the planes.

Another object is to provide improved means for steering, braking, and for maintaining lateral and longitudinal stability of the machine.

A further object is to provide means for varying the wing area of the machine.

In the accompanying drawings, Figure 1 is a plan view of a flying machine embodying the features of my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical section along the line 3 3 of Fig. 1. Fig. 4 is a section along the lines 4 4 of Figs. 1 and 3. Fig. 5 is a section along the lines 5 5 of Figs. 1 and 3. Fig. 6 is a skeleton view of a portion of the operating mechanism shown in Fig. 3.

For the purpose of illustrating my invention I have herein shown a monoplane, although certain features of the invention are equally applicable to a biplane.

The machine comprises the framework 10 and the carriage 11, a right-hand plane 12, a left-hand plane 13, the propeller 14, the rudder 15 and the engine 16.

In the present machine I have provided, in addition to the ordinary supporting wheels 17, the skids 18. To cushion the machine when landing, I have provided in addition to the rubber tires 19 of the wheels, buffers 20 placed between the ends of the uprights 21 and the base beams 22 of the framework. For a similar purpose I have provided rubber buffers 23 between the skids 18 and the base beams 22; and I have formed the ends 24 of the base beams into leaves in order to give a greater resilient effect to the skids and to the rear wheels.

While it is not particularly difficult for a trained operator to manipulate a flying machine when the air is calm and no undue amount of speed is attempted, yet frequently great difficulty is met with because of the constantly varying and the frequently unknown condition of the atmosphere. When the machine is controlled by tipping the planes as a whole, or even when manipulating the elevators, not only is it difficult to arrange for mechanism for making such changes, but the magnitude of the plane surface affected is so great that slight changes sometimes so materially affect the conditions that the changed conditions will be worse than if no change had been made. This is largely due to the fact that it is difficult to make the adaptation of the new conditions sensitive enough to meet the needs. For these and other reasons I have provided herein improved means for controlling the machine. These means comprise what may be called fins or vanes attached to the framework of the machine, and adapted to be inclined with reference to the machine, so that proper steering and breaking and maintaining of the equilibrium of the machine may be carried on by the manipulation of these vanes.

Each plane may be regarded as divided into four sections, 25, 26, 27 and 28. The framework of each plane comprises the longitudinal ribs 29, which run from the front to the rear of the planes, connecting the various sections, and the transverse ribs 30, which may be regarded as the limiting ribs between the sections, together with the transverse strengthening ribs 31. These transverse ribs extend from the outer edges of the planes to the carriage. On the under side of the sections 25, 26 and 27 the vanes 34, 35 and 36 are pivoted to the framework, at the points 31, 32 and 33 respectively; and on the upper side of the forward section 25 the vane 37 is pivoted, at the point 31. These vanes thus become parts of the respective sections. Each of these vanes extends transversely from the outer edge of the plane to the carriage and each is actuated by the adjacent cams 38, 39 or 40. These cams are mounted on shafts 41 which may be operated...
in any suitable manner, as for example by means similar to that hereinafter described for operating the panels 49. When the machine is in motion the 5 vanes are in contact with the bars 42, which are attached to the vanes, and are held in contact by the air pressure acting on the lower surfaces of the vanes. As the vanes are rotated downwardly the vanes are forced downward, the down- 10 ward limiting position being shown in dotted lines in Fig. 3. Some suitable flexible fabric 42 attached to the ribs 30 and to the vanes prevent further downward movement of the vanes when the machine is at rest and the air pressure is not effective in holding them up. When the cam 38 is rotated upward the vanes 37 are forced upward, the highest position of these vanes being shown also in dotted lines in Fig. 3.

20 It will be apparent that when the machine is moving forward, tilting the vanes 34 downwardly will cause the front end of the machine to tend upward with reference to the rear portion of the machine. And this will be so whether or not the plane is as a whole tilted upward or downward, or is horizontal. When vanes 36 are tilted downward the contrary effect will be produced. As the vanes 35 are located substantially over the center of gravity and of pressure the tilting effect of these vanes will be less than that of the others, and will depend upon whether the machine is tilted forward or backward. When tilted forward the tilting effect will be similar to that of vanes 34, but to a less extent, and when tilted backward the effect will be similar to that of vanes 36. So that if a material effect is desired, the forward rear vanes may be operated, and if a slight effect only is desired, the central vanes may be operated.

30 Raising of vanes 37 will be similar in effect to lowering of vanes 36. So that the simultaneous use of vanes 37 and 36 will accentuate the tendency to tilt the forward end downward; while simultaneous use of vanes 34 and 37 will produce a braking effect only, as the tilting effects of each will be neutralized by the other. And the simultaneous use of the forward and rear lower vanes or all of the lower vanes will produce an elevating effect so that upward speed may be increased, or greater weight may be carried.

35 The operation of the vanes on one side of the carriage only will tend to tilt the machine laterally; for instance, lowering of all of the lower vanes on one side will tend to raise that side; so that either side may be tilted to maintain lateral balance.

40 It will thus be seen that the vanes constitute means for maintaining or altering longitudinal or lateral balance, for vertically steering and braking the machine, and for increasing its sustention capacity. By this means the tilting of the entire planes is avoided, and the forward elevator here- 45 fore commonly used is dispensed with.

50 It is well understood that a plane moving through the air, especially when tilted, leaves the air in a disturbed condition. A certain amount of kinetic energy is imparted to the air by the planes and this energy is used, after the passing of the plane, in heating the air and restoring it to its normal position. So that as far as the plane is concerned, the energy is wasted. By the use of the plane in the manner described, and by means of the construction which I shall now describe, I am able to take advantage of much of this energy which is ordinarily wasted.

55 It will be seen that each of the lower vanes whether in the lowered or raised position acts as an upwardly inclined plane when the machine is substantially horizontal. So that air is disturbed by each section in the same manner as if the planes were continuous; but in the latter case the disturbed air will be at the rear of the entire plane, while in this case the energy imparted to the air by each section becomes advantageously effective upon the succeeding section. As the vane 34, for instance, passes through the air, the air below is condensed by the downwardly inclined rear portion and, if the 95 plane is inclined upward at all, as it usually would be, the air above is rarefied. Hence the section 26 passes into space in which there is increased air pressure below and reduced air pressure above. The condensed air below expanding will thus give an up- 100 ward impulse to the section, and the reduced pressure above allows the impulse to have greater than normal effect. The air thus striking upward against the lower side 105 of the section 26 rebounds therefrom, and is thus compressed again by its own elasticity while assisting rather than hindering the section. Similarly, the mass of condensed air passes to section 27 and then to section 28. So that the buoyancy of the machine is thereby materially increased by the use of a large portion of the kinetic energy which the forward portion of the machine imparts to the air and which is ordinarily wasted. 110 As the action of the air on the lower surfaces of the plane becomes thus rhythmical or vibratory, it is evident that the best effect will be arrived at when the speed of the machine, the distance between the sections 120 and the elasticity of the air are such that each succeeding section will be in the best position to receive the upward impulse of the air.

120 In order to increase the buoyant effect due to the action of the vanes on the air I may provide openings 43 immediately in the rear of each of the vanes, the walls 44 of said
openings being inclined upwardly toward the rear.

The openings 43, as shown in Fig. 1, extend from the carriage to the outer edges of the planes, and are inclined forwardly toward the outer ends. As a result of this arrangement the rear walls of the openings constantly tend to prevent air from escaping on the sides and to force the air inwardly toward the carriage, and thus increase the density, and hence the sustentation capacity of the air which supports the machine. And the similar inclination of the vanes assists in accomplishing this result.

In the rear of each of the two forward openings 43 I have provided means whereby the effective surfaces of the planes may be varied at will. Any suitable means may be used for this purpose, but herein I have provided the openings 43 extending transversely across the planes. These openings are closed by the sliding panels 46, each of which extends from the outer edge of the plane to the carriage. The panels consist of the sections 47, Fig. 4, each section closing the opening between two adjacent ribs 29. Attached to the ribs 29 are plates 48 which prevent upward motion of the panel sections. Over these sections and plates may be stretched suitable fabric such as the canvas 49, Fig. 1.

The adjacent edges of the sections are connected by means of the brackets 50; and the brackets rest upon the plates 48 and prevent downward motion of the panels.

When it is desired to vary the sustaining surface of the plane either of these panels may be slid independently of the other toward the rear so as to uncover the openings 45 as much as may be desired.

Any suitable means may be provided for sliding the panels. Herein I have provided endless chains 51. The ends of each of these chains are attached to a bar 52, which forms the forward edge of the panel, and from this bar the chain passes forward over one of the pulleys 53 fixed to the shaft 54 or 55 as the case may be. Each chain also passes from the bar 52 in the other direction over one of the loose pulleys 56 on a shaft 55 or 57 Fig. 6, as the case may be. The shafts 54 and 55 may be rotated by means of the chains 58 passing over the pulleys 59 and 60 and operated by the arms 61. Or any other suitable or desired means for operating the shafts may be used. These adjustable openings may be used to lessen the total wing or plane area, and thus facilitate descending. They may also be used for lateral balancing by uncovering the openings or a portion only on one side of the machine, or for longitudinal balancing by uncovering the rear or forward openings alone, or more than the other openings. And they will also materially affect the action of the condensed air beneath by increasing the opening through which the air above may affect the air below, or by reducing, if desired, the area upon which the impulse is effective.

In order to more clearly illustrate the various features of my invention I have described with some particularity the structure used, but it is to be understood that various modifications therein may be made by those skilled in the art without departing from the spirit of the invention.

The embodiment herein shown is merely illustrative, and changes in form, size, or proportion of the parts may be made to suit requirements.

I claim as my invention:

1. An aeroplane comprising a plurality of transverse sections positioned one in the rear of the other and spaced apart, vanes pivoted at the front edges of and below said sections, and means for operating said vanes independently of each other.

2. An aeroplane comprising a plurality of transverse sections, a vane pivoted on the lower surface and at the front edge of each of said sections except the rear section, means for operating said vanes, and openings between the said sections immediately in the rear of each of said vanes.

3. An aeroplane comprising a series of transverse sections spaced from each other, the series extending rearwardly from the front of the machine, vanes pivoted on the lower surfaces and at the front edges of a plurality of said sections, said vanes being normally inclined downwardly toward the rear, and means for giving a greater inclination to any one of said vanes than to the others.

4. An aeroplane comprising a plurality of sections spaced rearwardly from each other, a vane pivoted on the lower surface of the front edge of each of certain of said sections, and a vane pivoted to the front edge and above the forward section, and means for operating said vanes independently of each other.

5. An aeroplane flying machine, comprising a plane, a transverse movable vane positioned beneath said plane near the forward portion thereof, a transverse movable vane positioned beneath said plane substantially at the center of pressure thereof, and means for operating said vanes independently of each other.

6. An aeroplane comprising a plurality of transverse sections, the lower surface of certain of said sections being swingingly attached to the front edge of such sections, said plane having an opening therethrough immediately in the rear of each of said swingingly attached surfaces, the walls of said openings being inclined rearwardly and upwardly, said plane having a second open-
ing in the rear of each of said first mentioned openings, and means for closing each of said second openings.

7. In an aeroplane a transverse vane pivoted to the lower surface of said aeroplane, said aeroplane having an opening immediately in the rear of said vane, and having a second opening immediately in the rear of said first mentioned opening, and means for closing said second opening.

In testimony whereof I affix my signature in the presence of two witnesses.

HENRY ZIEMSS, Jr.

Witnesses:

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