

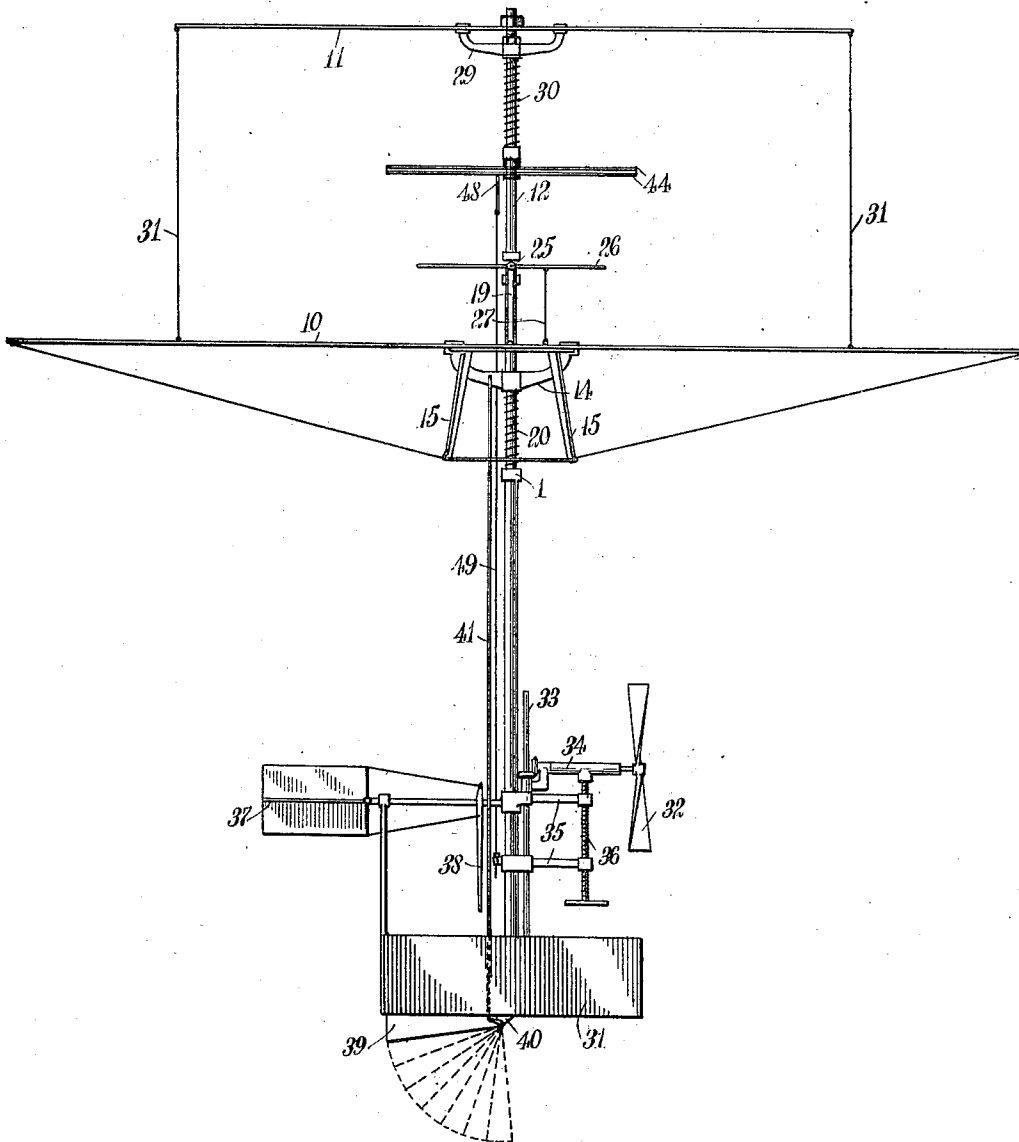
C. H. DUNCAN.
AEROPLANE.
APPLICATION FILED AUG. 23, 1910.

1,004,559.

Patented Oct. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

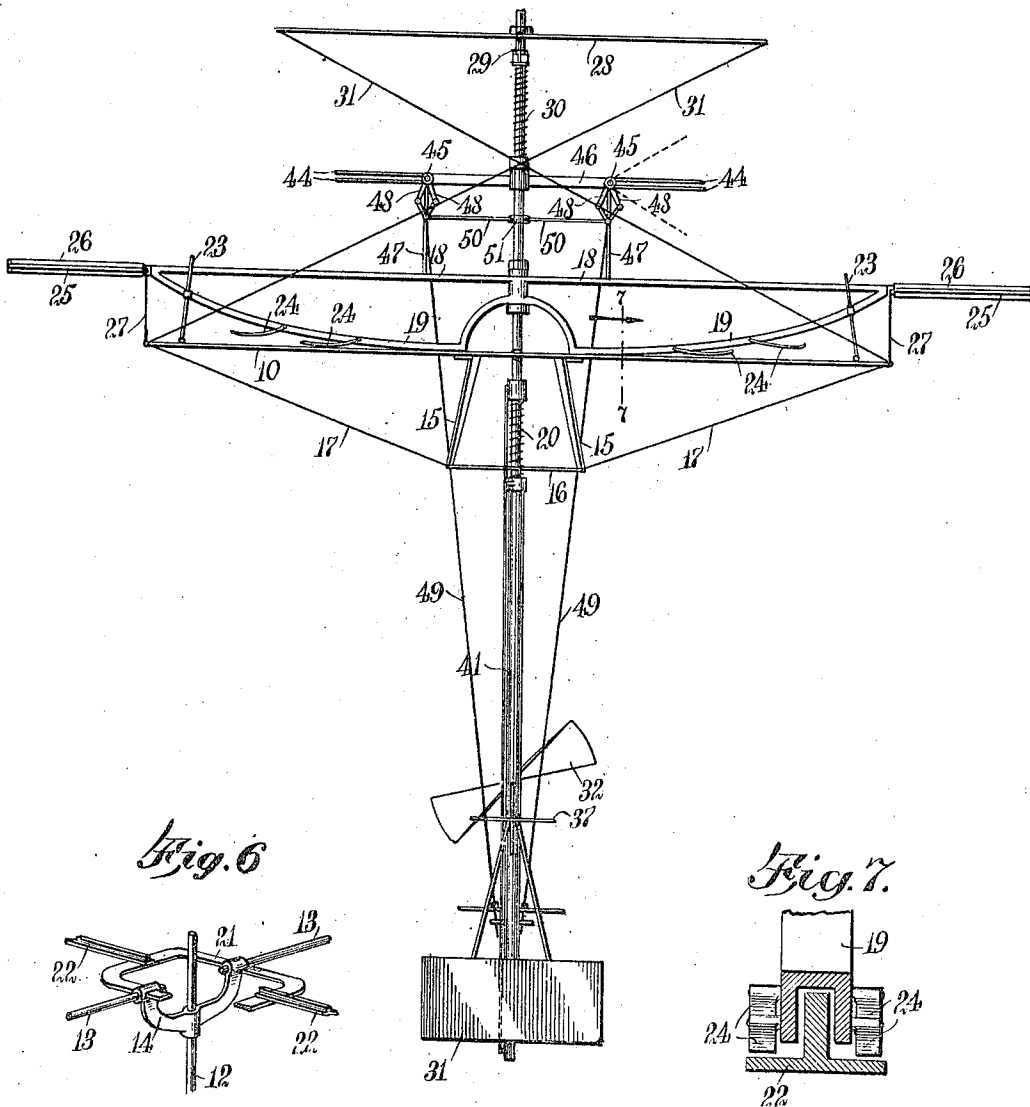


Fig. 6

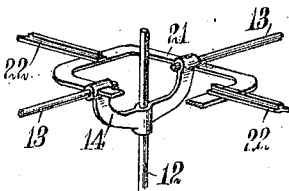
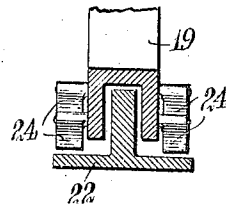


Fig. 7



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3 SHEETS—SHEET 3.

Fig. 3

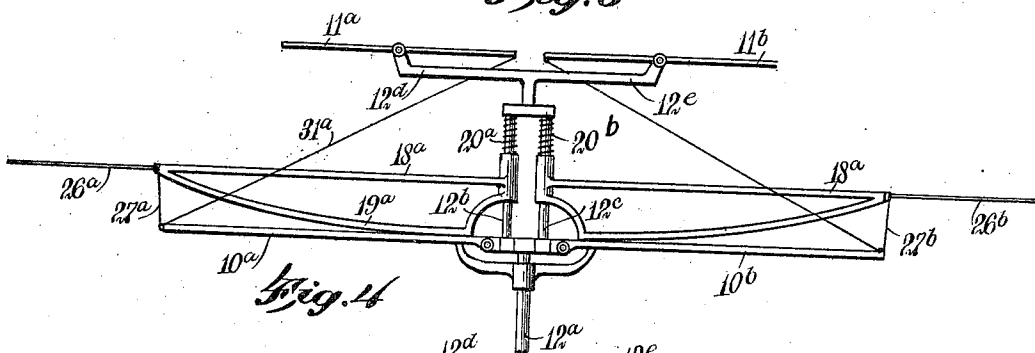


Fig. 4

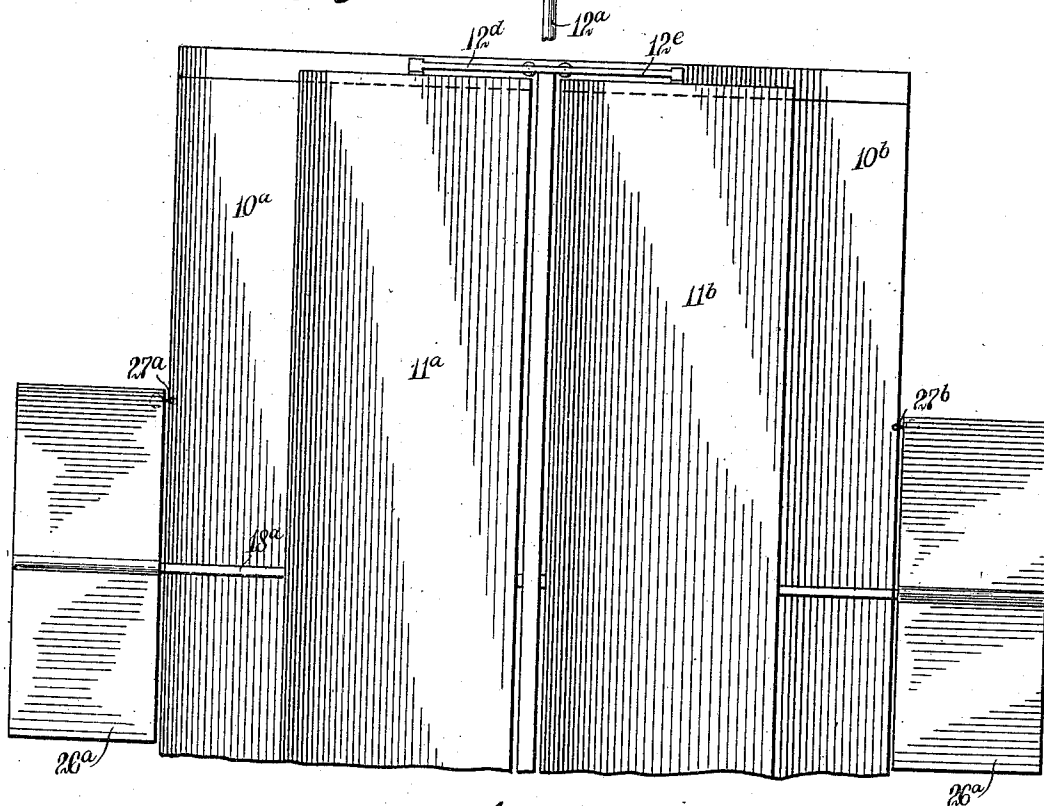
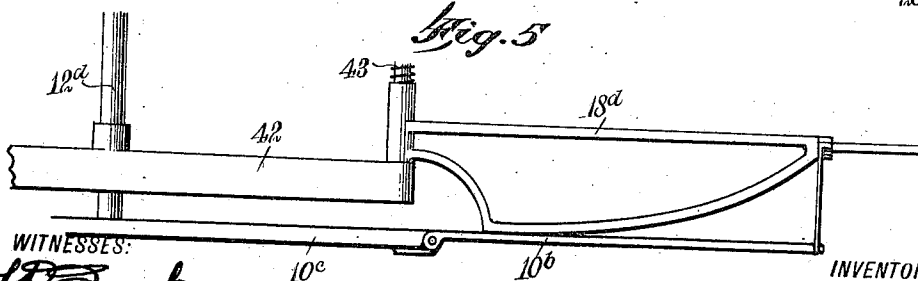


Fig. 5



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AEROPLANE.

1,004,559.

Specification of Letters Patent.

Patented Oct. 3, 1911.

Application filed August 23, 1910. Serial No. 578,504.

To all whom it may concern:

Be it known that I, CHARLES H. DUNCAN, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Aeroplane, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in aeroplanes, and more particularly to an improved means for automatically maintaining the equilibrium of the machine in variable winds.

Certain features of my present invention constitute improvements over the machine disclosed in my prior application, Serial No. 544,388, filed February 17, 1910.

One important feature of my present invention is the controlling of ailerons by the tilting of the main plane, so that the ailerons will automatically operate to right the machine when its equilibrium has been disturbed by a sudden gust of wind.

A further important feature involves the relative adjusting of the load, main plane or planes, and the propeller, so as to vary the center of gravity and the point of thrust in accordance with the weight of the load or the strength of the wind.

Another important feature of my invention relates to the means employed for preventing the machine from drifting sidewise under the action of adverse wind currents.

My improved construction embodies many other features of importance, which will be pointed out more particularly hereinafter, and defined in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is a side elevation of a machine constructed in accordance with my invention; Fig. 2 is a front elevation; Fig. 3 is a front elevation of a slightly modified form in which the planes are each formed of separate sections; Fig. 4 is a top plan view of a portion of the construction illustrated in Fig. 3; Fig. 5 is a view of a portion of the structure shown in Fig. 3, but on a larger scale; Fig. 6 is a perspective view of the connecting means between the plane and the central rod or mast; and Fig. 7 is a central detail on the line 7—7 of Fig. 2.

The specific construction illustrated in

Figs. 1 and 2, is designed somewhat along the same general lines as the aeroplane illustrated in my previous application above referred to; that is, there is employed a main plane 10 and an upper plane 11, both of which are connected to a vertical mast or rod in such a way that both may tilt, and the two planes are connected in such a way that they tilt in opposite directions. One of the planes is caused to rock upon a spider presenting a curved surface, and the load is suspended from the lower end of the mast or rod, so that it acts substantially as a pendulum. In my present form, the planes instead of being circular, are rectangular, and instead of having a universal movement in respect to the mast, they are free to tilt only in a lateral plane.

As illustrated, the main plane 10 is connected to two forwardly and rearwardly-extending rods 13, 13, which act as braces, and these rods are connected to a spider 14, which is free to slide vertically on the mast, as is shown particularly in Fig. 6. The rods 13 serve as forward and rear reinforcements and prevent the front and rear edges of the planes from raising or lowering, but they also act as an axis about which the planes may tilt laterally. For reinforcing and bracing the plane and to prevent relative movement of one portion in respect to another, the plane adjacent its center portion may have depending arms 15, connected to a ring 16, which latter may be connected to the edges of the plane by tie bars or guy ropes 17.

Mounted above the plane is a spider having outwardly-extending side arms 18, and outwardly-extending and upwardly-curved arms 19, which are connected to the arms 18 at their outer ends. The arms 19 constitute rockers upon which the main plane 10 may tilt. The spider and plane have relative movement lengthwise of the mast, and both are held against rotation in respect thereto. As shown, the spider is rigid upon the mast and the plane at its center may slide down the mast. A suitable spring 20 normally tends to hold the center portion of the plane up against the curved arms 19, so as to be tangent to the latter. To facilitate the rocking of the plane on the spider arms 19, the spider 14 may have a rectangular frame 21, provided with outwardly-extending reinforcing members 22, which are in the form of inverted T-irons. The rocker arms 19 may be in the form of

inverted channels, the main leg of the T-iron fitting in the channel, as indicated particularly in Fig. 7. To additionally prevent any rotation of the plane in respect to the spider, the plane may carry guide rods 23 at its outer end, which may slide through sockets or spider arms, and the spider arms may carry springs 24, which engage with the side flanges of the T-irons, as illustrated in Fig. 7, so as to normally hold the two in the position indicated in Fig. 2. As the plane tilts in either direction, the T-iron rocks along on the curved spider arm, and the pivotal center moves outwardly and upwardly, while the center of the plane moves downwardly. The springs 24 cushion this movement, and tend to return the parts to their normal position.

The spider 14 extends outwardly in opposite directions from the mast, so as to control the lateral tilting of the plane. The spider acts to prevent the forward or rearward tilting. The upper arms 18 of the spider extend outwardly beyond the ends of the main plane 10, so as to constitute spindles or axles 25 for auxiliary planes constituting ailerons 26. These ailerons are free to tilt forwardly or rearwardly, and are so connected to the main plane as to be automatically operated by the tilting of the latter. As shown, the main plane is provided with upwardly-extending rods 27, at each side edge, which rods at their upper ends are connected to the adjacent edge of the ailerons. The rods are at one side of the center of movement of the ailerons, so that when one side edge of the main plane moves downwardly, it will pull down the rear edge of the aileron. This will raise the front edge of the aileron, and the forward movement of the machine will tend to lift the machine at that edge. At the same time, the raising of the opposite edge of the main plane will raise the rear edge of its adjacent aileron, which will tend to depress the machine at that edge and restore equilibrium. Thus, the lateral tilting of the main plane operates the ailerons in such a way as to counteract the said tilting.

As a further means for counteracting the tilting, I provide an upper plane 28 connected to a spider 29 in such a way that it may tilt laterally in the same manner as does the main plane 10. The spider 29 is held up by a spring 30, and the two planes are connected together by diagonally-disposed tie rods or guide rods 31, acting to cause one plane to tilt in the opposite direction to the other. When one edge of the main plane 10 is raised, the guys or stays 31 will pull down the opposite edge of the upper plane, so as to bring the two planes at an angle to each other and counteract the tilting of the main plane and return both planes to normal position. The controlling

of one plane by the other is substantially the same as illustrated in my previous application above referred to, except that in the present instance, the planes are prevented from tilting in other than a lateral direction.

The passengers, aviator, or load, is carried in a basket or car 31 supported at the lower end of the mast or rod 12. Within this car is a suitable member, not shown, for operating the propeller 32.

One important feature of my invention involves the varying of the relative positions of the supporting plane, the car and the propeller, so as to vary the center of gravity, and the center of thrust. As illustrated, a shaft 33 operated by the engine, extends vertically adjacent the mast, and the propeller shaft is supported in a bearing 34 extending substantially at right angles to the shaft. A bevel gear is keyed to the shaft 33 and free to move vertically thereon and intermeshing with a bevel gear on the propeller shaft. A bracket 35 is secured to the mast and has outwardly-extending arms, within which is mounted a vertically-movable screw 36, one end of the latter being connected to the sleeve 34. By rotating the screw 36, the sleeve 34, constituting the bearing of the propeller shaft, may be raised or lowered in respect to the car and the supporting plane. The bevel gear on the shaft 33 is so mounted that it travels with the propeller shaft, and remains in engagement with the bevel gear on the latter. Opposite to the propeller is any suitable form of rudder or guiding means 37, controlled in any suitable manner by any appropriate form of mechanism, for instance, a lever 38. This part of the device constitutes no essential portion of my invention.

Below the car, I mount a keel 39, formed of a plurality of pivoted sections adapted to move relatively to each other in the same manner as the parts of a fan. The several sections of the keel 39 are normally raised to a position closely adjacent the under side of the car, as is illustrated in solid lines in Fig. 1, but may be spread out downwardly, as indicated in dotted lines. The sections are connected by a rod 41 to the spider 40, so that as the spider is forced downwardly by the tilting of the plane 10, the sections of the keel will be spread out and come into operation. Thus, when a sudden gust of wind strikes the plane and tends to tilt it laterally, the keel automatically comes into operative position, so as to resist the swinging or lateral tilting of the car 32.

For additionally preventing the lateral drifting or skidding of the machine while turning a sharp curve, I preferably employ members normally disposed in a horizontal plane, so as to offer no lateral resistance, but movable toward a vertical position whenever

desired. In the specific form of this construction, I employ two pairs of leaves 44, 44, mounted at any suitable point, but preferably between the main plane and the upper plane. The two leaves of each pair are hinged together, and their pivots 45 are mounted horizontally and parallel to each other and extend in the general direction of movement of the machine. The two pivots are held rigid in respect to each other by one or more transverse braces 46 and they are supported by suitable rods 47 extending up from the main spider. The two leaves of each pair are connected to two separate levers 48, 48, and these are connected by links to a vertical rod 49. By pressing upwardly on the rod, the links serve to spread the arms 44 apart and thus separate the leaves, for instance to the position indicated in dotted lines at the right-hand side of Fig. 2. This forms a laterally facing pocket to catch the air as the machine drifts laterally. There is a separate rod for each pair of leaves, so that the two leaves of either pair may be spread apart, and these two rods preferably extend down to a position adjacent the car, where they may be manually operated. If desired, they may be connected to the keel 39, so as to be automatically opened upon the opening of the latter. The upper ends of the rods may be connected together by a transverse brace made up of separate links 50, and a collar 51 slidable on the mast.

In the specific form illustrated in Figs. 3, 4 and 5, I embody a few changes in the mechanical construction of the parts, and particularly, I form both the upper and lower planes of separate relatively-movable sections. The lower or main plane is illustrated as being formed of two sections 10^a and 10^b, each pivotally connected to an intermediate section 10^c. Instead of mounting the plane to move vertically I form the spider of two separate sections, each having an upper horizontal arm 18^a and a lower curved arm 19^a. The main mast or rod 12^a of the machine has two separate parallel sections 12^b and 12^c, upon which the two sections of the spider are independently movable vertically. Two separate springs 20^a and 20^b normally press the two spider sections down against the corresponding plane sections. The two spider sections carry the two ailerons 26^a and 26^b in exactly the same manner as in the form first described. The two ailerons are controlled in their movement by corresponding rods 27^a and 27^b, which tilt the ailerons to restore the equilibrium of the machine when the edges of the balancing plane are forced downwardly or upwardly.

The mast 12^a, at its upper end above the two sections 12^b and 12^c is provided with

outwardly-extending branches 12^d and 12^e, upon which are pivotally mounted two separate planes 11^a and 11^b. These two planes 11^a and 11^b are normally in alinement with each other, but are free to tilt independently. Each of the upper planes is connected to its corresponding section of the lower plane by a brace or guy rope 31^a, so that when the outer edge of one plane moves upwardly, the outer edge of the corresponding section of the main plane will move downwardly, and vice versa. This permits the counterbalancing action to take place at one side of the machine independently of any action at the opposite side of the machine.

In Fig. 5 I have illustrated a slightly different mounting of the spider, in which the main mast 12^d has an outwardly-extending bracket 42, having an upwardly-extending post 43 at its outer end, upon which the spider section 18^d may move vertically.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. A flying machine, having a main plane, a spider upon which said plane may rock, and an aileron carried by said spider.
2. A flying machine, having a main plane, a spider upon which said plane may rock, and an aileron carried by said spider and controlled by the rocking of said main plane.
3. A flying machine, having a main plane, a spider upon which said plane may rock to vary the elevation of a portion of the plane in respect to the remainder of the machine, and a balancing plane carried by said spider.
4. A flying machine, having a main plane, a transversely-extending track curving upwardly at its outer ends and upon which said plane may rock, and springs carried by said track for controlling the rocking movement.
5. A flying machine, having a plane mounted to tilt laterally, a laterally tiltable auxiliary plane connected thereto to tilt simultaneously in the opposite direction, and a balancing plane controlled by the movement of one of said first-mentioned planes.
6. A flying machine, having a plane, a curved guide upon which said plane may rock, and a series of springs coming into operation successively, for resisting said rocking movement.
7. A flying machine, having a main plane formed of a plurality of independently-movable sections, an upper plane formed of a plurality of independently-movable sections, and connections between the sections of one plane and the corresponding sections of the other plane, for insuring their simultaneous movement in opposite directions.
8. A flying machine, having a main plane

tiltable in respect to the remainder of the machine, and a keel movable into operative position upon the tilting of said plane.

9. A flying machine, having a main plane 5 tiltable in respect to the remainder of the machine, and a keel formed of a plurality of movable sections and movable automatically into operative position upon the tilting of said plane.

10. A flying machine, having a main supporting plane and a means adjacent thereto 10 and normally disposed in a horizontal plane and movable to form a pocket facing laterally to prevent the lateral drifting of the machine when rounding a curve.

11. A flying machine having a main plane, a superposed plane, a pair of leaves between 15 said planes, said leaves being hinged together and normally disposed adjacent each other, and means for spreading said leaves apart to offer a lateral resistance to skidding of the machine.

12. A flying machine having means for resisting the lateral movement of the machine, said means comprising two leaves 20 pivoted together and adapted to be separated to form an air pocket facing laterally in the direction in which the machine tends to skid.

13. A flying machine having a supporting 30 plane, an extensible keel at the lower portion of the machine for affording resistance to the lateral movement of said lower portion and a member movable to present a laterally facing pocket adjacent the upper portion 35 of the machine to resist the lateral movement of said upper portion.

14. A flying machine having a main plane, a spider upon which said plane may rock, an aileron carried by said spider, the edge 40 of said plane being movable toward and from said aileron and operative connections between said plane and said aileron for tilting the latter upon the rocking of the main plane. 45

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

CHARLES H. DUNCAN.

Witnesses:

CLAIR W. FAIRBANK,
PHILIP D. ROLLHAUS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."