C. J. LAKE.

AERIAL MACHINE.

APPLICATION FILED MAR. 18, 1909.

1,008,479.

Patented Nov. 14, 1911.

2 SHEETS—SHEET 1.

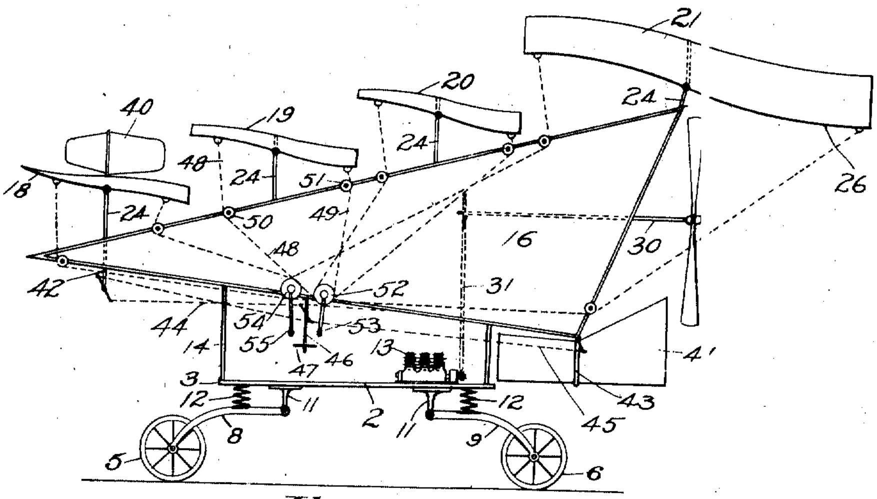

Fig. 1.

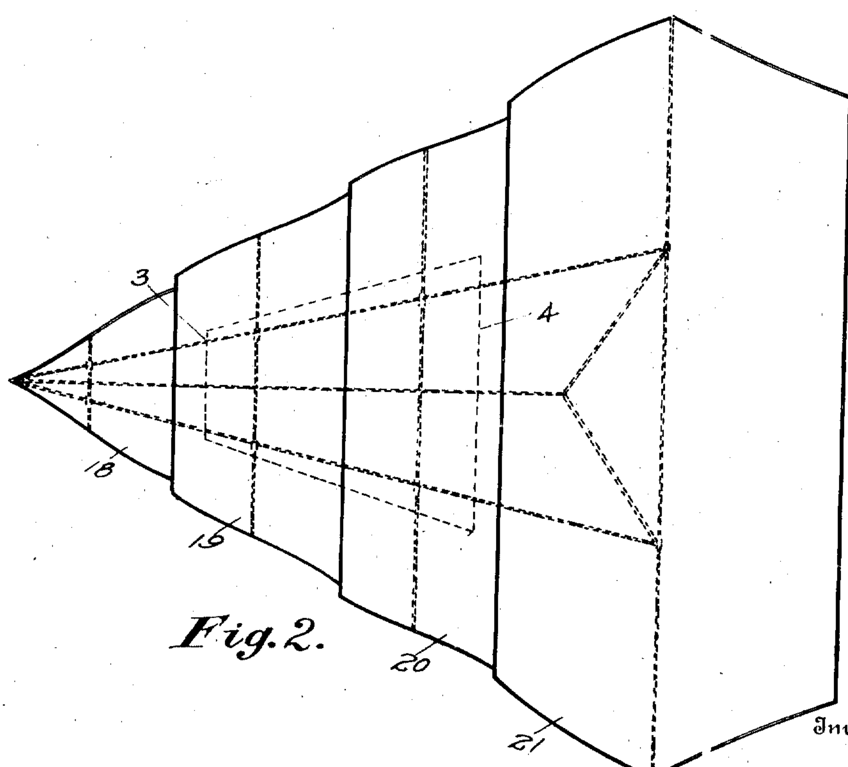

Fig. 2.

Witnesses

M. E. Jones Jr.

L. M. Borick

Inventor

Christopher J. Lake.

By Spencer Heath

Attorney

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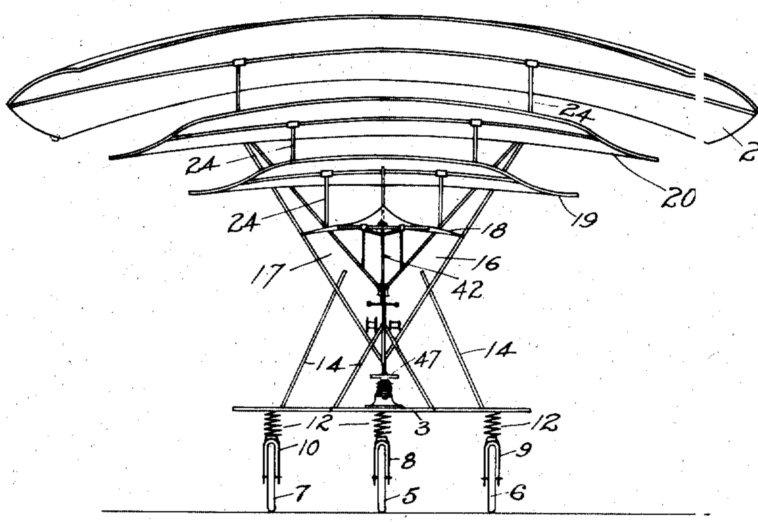

Fig. 3.

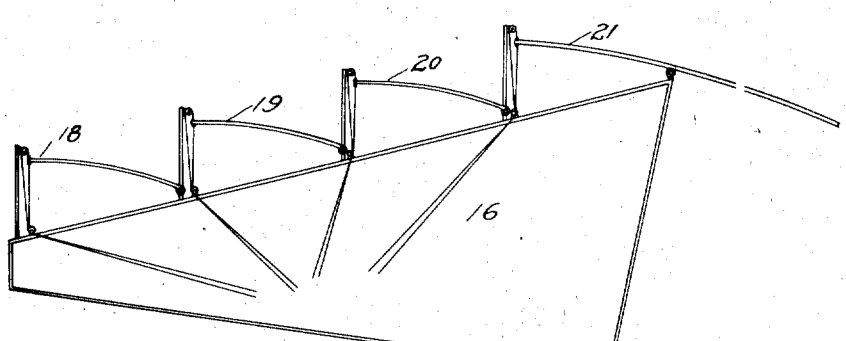

Fig. 4.

Witnesses
M. E. Jones Jr.
L. M. Dorrick

Inventor
Christopher J. Lake,

By Spencer Heath
Attorney

UNITED STATES PATENT OFFICE.

CHRISTOPHER J. LAKE, OF BRIDGEPORT, CONNECTICUT.

AERIAL MACHINE.

1,008,479. Specification of Letters Patent. Patented Nov. 14, 1911.

Application filed March 18, 1909. Serial No. 484,299.

To all whom it may concern:

Be it known that I, CHRISTOPHER JOHN LAKE, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Aerial Machines, of which the following is a specification.

My invention relates to means for navigating the air and has special reference to that class of machines for this purpose which are heavier than the air which they displace and are supported by the pressure of the air upon surfaces arranged for that purpose.

The principal object sought to be obtained by means of the peculiar form and arrangement of parts employed is to produce a machine which, in addition to the usual advantages sought in machines of its class, will be safe and stable under all conditions affecting it—a machine that will depend neither upon constant manipulation to hold it in its normal position nor upon the action of so-called "automatic" devices, but will possess an inherent tendency to keep an even keel or upright position in the air and to return to that position whenever, from any cause, its balance or equipoise is disturbed.

The successful accomplishment of the above objects depends upon the employment of certain principles which may be given effect by means of apparatus differing greatly in appearance from that which I shall describe, but the best mode in which I have contemplated applying these principles is illustrated upon the accompanying sheets of drawings which form a part of this specification and in which,

Figure 1 is a side elevation. Fig. 2 is a top view. Fig. 3 is a front elevation. Fig. 4 is a diagram representing, in side view, an alternative construction.

Similar reference numerals designate corresponding parts throughout.

The main portions of the machine are constructed of light but rigid frame-work covered with a light but stout fabric. These portions form surfaces for the action of the air and will be hereinafter referred to as planes or surfaces, and whenever any of these are described as being concave or convex, it is the under or working side that is referred to.

The base of the machine is a deck or platform 2, narrow at the front 3 and wide at the rear 4. The platform is mounted on three wheels 5, 6 and 7, the wheel 5 being at the front of the platform and 6 and 7 at the rear. The wheels are carried in the forks of curved levers 8, 9 and 10, which are hinged to the deck by the hangers 11 and provided with springs 12. The deck 2 carries the engine 13 and necessary operating mechanism. It is surmounted by a superstructure held in position by struts 14 and consisting mainly of frame-work covered with thin material to form surfaces for the action of the air. The main body of the superstructure is formed of two planes 16 and 17, joined along their lower edges and diverging upward to form an open double keel which acts also as a pair of dihedral wings. These planes may be of any convenient size and shape, but I find a triangular form, as of Fig. 1, preferable and most convenient. The keel-planes 16 and 17 are arranged in combination with a series of slightly inclined lifting or supporting surfaces, which may be variously connected with reference to the keel-planes but which I prefer to mount above them, as shown in Figs. 1 and 3. These supporting surfaces 18, 19, 20 and 21 are arranged in a gradient series along the inclined upper edges of planes 16 and 17. The surfaces may be either straight or of simple or compound curvature in any direction but I prefer to make each of them of compound or reverse curvature from front to rear, as shown in Fig. 1, and of simple transverse, concave curvature, as shown in Fig. 3, but I deem it also good practice to give part or all of the surfaces simple, longitudinal, concave curves, as shown in Fig. 4. The surfaces may be of any number and mounted in any manner, but I prefer to use from three to six in the series and to hinge or pivot part or all of them on their transverse axes, with means for altering or adjusting their angle of inclination. The surfaces may be pivoted on posts 24 to their mid-portions, as shown in Figs. 1 and 3, or they may be pivoted at or near their front or rear edges. Fig. 4 shows an arrangement with the three forward surfaces pivoted at their rear edges. With this manner of mounting the surfaces upright members are provided near the forward edge of each surface for the attachment of the necessary pulleys or other suitable mechanism for raising and lowering them. The shape of the surfaces in plan view may be variously modified, but I prefer to make them as shown in Fig. 2, in which the forward surface 18 is of triangular form, the two intermediates, 19 and 20, are of increasing width from front to rear and the rearmost surface 21 has its greatest width through its mid-portion, the entire series of surfaces together being approximately triangular in outline, which form possesses certain advantages referred to in my application for Patent Serial No. 455,537, filed September 30, 1908. Whatever be the shape of the surfaces, I deem it especially desirable that each succeeding surface from front to rear shall be of greater transverse dimensions than the one before it, as is clearly shown in Fig. 2. Viewed from the front or the rear, each of the surfaces 18, 19, 20 and 21, presents a distinctly concave form in transverse directions, as shown in Fig. 3. When the surfaces are arranged above a pair of diverging keel planes, as shown, this transversely concave form is believed to be of great advantage to prevent spreading and spilling of the air which comes under the surfaces and to form a reservoir-like concavity in which to concentrate the pressure of the air which flows upward from the diverging keel-planes. This is believed to be a chief factor in giving the machine great transverse stability. Several other features insure longitudinal stability. The triangular form of the combined supporting surfaces places and maintains the center of air pressure well toward the rear and the gradient arrangement of the surfaces distributes and equalizes the disturbing effects which variations of wind or in speed always produce on single planes, and especially upon planes which have a forward edge of great length. The convex form of the extreme rear surface, as shown at 26 in Fig. 1, gives a steadying effect with smooth and easy release to the air which has passed through the machine and prevents the machine from tilting on end backward when it descends in case of the engine stopping.

Power to drive the machine originates in the engine 13 and is conveyed to the propeller shaft 30 by the chain-and-sprocket gearing 31. The propeller 32 is located at the rear beneath the after portion of the surface 21 and is placed high enough to give its thrust directly along the center-line of forward resistance and thus avoid all turning moments about any transverse axis, however great the propulsive power applied. In this way the resultants of the forces of propulsion and of gravity are caused to intersect at a point which may be called the dynamical center of the machine.

The horizontal steering of the machine is effected by two vertical rudders 40 and 41. The forward rudder 40 is placed in the front of the machine as high as it can be conveniently arranged above the center-line of propulsion and above the center of lateral drift of the machine, and the rudder 41 very much lower than these centers. Upon their vertical swivel posts 42 and 43 the rudders have cross-arms connected by two pairs of cords 44 and 45 with a similar cross-arm on the steering-post 46, which has a wheel or handle 47 to be grasped by the operator. The cords connecting the rudders with the steering-post are so arranged, by crossing one pair of them, that the rudders rotate in opposite directions about their respective axes, and this gives the machine a like turning moment at both ends. The arrangement of the forward rudder high and the rear rudder low results in a peculiarly advantageous mode of operation, in that the wind against the rudder not only turns the machine to the right or left but cants it over promptly to the lateral inclination toward the center of curvature which the machine must assume before it can turn.

Control of the course of the machine in vertical directions is effected by varying the angle of inclination of some or all of the surfaces 18, 19, 20 and 21. Each of these, as 19, for instance, is held in position by cords 48 and 49 attached at its front and rear and passing over guide sheaves 50 and 51 to a drum 52 having a pendant turning handle 53 within convenient reach of the operator. The cords from the surfaces 19 and 20 are operated by the same drum 52 and the cords from the surfaces 18 and 21 are, in like manner, operated by the drum 54 and the handle 55. There may, however, be a separate drum and handle for each surface and, if preferred, all the drums may be mounted on one fixed shaft with means for locking them to it or to each other, so that the planes can be adjusted either singly or in groups of two or more at the same time.

Having now described one of the forms in which my invention may be embodied, what I claim is:

1. In an aerial machine, a gradient series of pivotally mounted supporting surfaces extending upward toward the rear, each of said surfaces being of variant transverse dimensions and being pivoted upon an axis approximately coincident with the line of greatest transverse dimension of the surface.

2. In an aerial machine, a gradient series of pivotally mounted supporting surfaces extending upward toward the rear, each of said surfaces being of variant transverse dimensions and being pivoted upon an axis approximately coincident with the line of greatest transverse dimension of the surface, the rearward surfaces being of greater area than the others.

3. In an aerial machine, a gradient series of pivotally mounted supporting surfaces

extending upward toward the rear, each of said surfaces being of variant transverse dimensions and being pivoted upon an axis approximately coincident with the line of greatest transverse dimension of the surface, the areas of the surfaces increasing progressively from the front to the rear.

4. In an aerial machine, a gradient series of pivotally mounted supporting surfaces extending upward toward the rear, said surfaces being transversely curved in concave form and the rearward surfaces being of greater area than the others.

5. In an aerial machine, a gradient series of pivotally mounted supporting surfaces, said surfaces being transversely curved in concave form and the rearward surfaces being of greater transverse dimensions than the others.

6. In an aerial machine, a gradient series of pivotally mounted supporting surfaces, the transverse dimensions of the surfaces increasing progressively from the front to the rear and said surfaces being transversely curved in concave form.

7. In an aerial machine, a gradient series of pivotally mounted supporting surfaces extending upward toward the rear, said surfaces being transversely curved in concave form and the rearward surfaces being of greater transverse dimensions than the others.

8. In an aerial machine, a gradient series of pivotally mounted supporting surfaces extending upward toward the rear, the transverse dimensions of the surfaces increasing progressively from the front to the rear and said surfaces being transversely curved in concave form.

9. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and nearly horizontal supporting surfaces surmounting the keel-planes.

10. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and nearly horizontal concave supporting surfaces surmounting the keel-planes.

11. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces, the rearward surfaces being of greater transverse dimensions than the others.

12. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

13. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces extending upward toward the rear, the rearward surfaces being of greater transverse dimensions than the others.

14. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces extending upward toward the rear, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

15. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes, the rearward surfaces being of greater transverse dimensions than the others.

16. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

17. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear, the rearward surfaces being of greater transverse dimensions than the others.

18. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

19. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces, the rearward surfaces being of greater transverse dimensions than the others.

20. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

21. In an aerial machine, in combination,

a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces extending upward toward the rear, the rearmost surfaces being of greater transverse dimensions than the others.

22. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces extending upward toward the rear, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

23. In an aerial machine, in combination, a pair of triangular keel-planes jointed at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes, the rearward surfaces being of greater transverse dimensions than the others.

24. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

25. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear, the rearward surfaces being of greater transverse dimensions than the others.

26. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear, the transverse dimensions of the surfaces increasing progressively from the front to the rear.

27. In an aerial machine, in combination, a pair of diverging keel-planes joined at their lower edges to form an open passage for air, their upper edges rising toward the rear and a gradient series of supporting surfaces.

28. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward and a gradient series of supporting surfaces extending upward toward the rear.

29. In an aerial machine, in combination, a pair of diverging keel-planes joined at their lower edges and their upper edges rising toward the rear and a gradient series of supporting surfaces surmounting them.

30. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward and a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear.

31. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces surmounting them, said surfaces being transversely curved in concave form.

32. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward to form an open passage for air and a gradient series of supporting surfaces extending upward toward the rear, surfaces of transversely curved concave form being included in the series.

33. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward, a nearly horizontal supporting surface surmounting the keel-planes and projecting beyond the rear thereof and a propeller located at the rear of the keel-planes beneath the projecting supporting surface.

34. In an aerial machine, in combination, a pair of diverging keel-planes joined at their lower edges and their upper edges rising toward the rear, a gradient series of supporting surfaces surmounting the keel-planes and projecting beyond the rear thereof and a propeller located at the rear of the keel-planes beneath the projecting supporting surface.

35. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward, a gradient series of supporting surfaces surmounting the keel-planes and projecting beyond the rear thereof and a propeller located at the rear of the keel-planes beneath the projecting supporting surface.

36. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward, a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear and a propeller located in such manner as to draw air between the supporting surfaces in the series.

37. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward, a gradient series of supporting surfaces surmounting the keel-planes and extending upward toward the rear and a propeller located in such manner as to draw air between the supporting surfaces in the series.

38. In an aerial machine, in combination, a pair of keel-planes joined at their lower edges and diverging upward and a propeller

situated at the rear of the keel-planes in line with the open space between them in such manner as to draw air through said open space.

39. In an aerial machine, in combination, a pair of triangular keel-planes joined at their lower edges and diverging upward and a propeller situated at the rear of the keel-planes in line with the open space between them in such manner as to draw air through said open space.

40. In an aerial machine, in combination, one or more supporting surfaces, a keel located beneath said surfaces, a rudder located at the rear of and below the keel, another rudder located above the front portion of the keel and combined means for turning said rudders oppositely on their axes.

41. In an aerial machine, in combination, a series of nearly horizontal supporting surfaces, a propeller located at the same elevation as the center of forward resistance of the surfaces, a vertical rudder located above the front portion of the machine and another vertical rudder located below the rear portion of the machine.

CHRISTOPHER J. LAKE.

Witnesses:

M. D. BLONDEL,

C. E. ADAMS.