No. 844,771. PATENTED FEB. 19, 1907.

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AERIAL NAVIGATION.

APPLICATION FILED SEPT. 7, 1906.

2 SHEETS—SHEET 1.

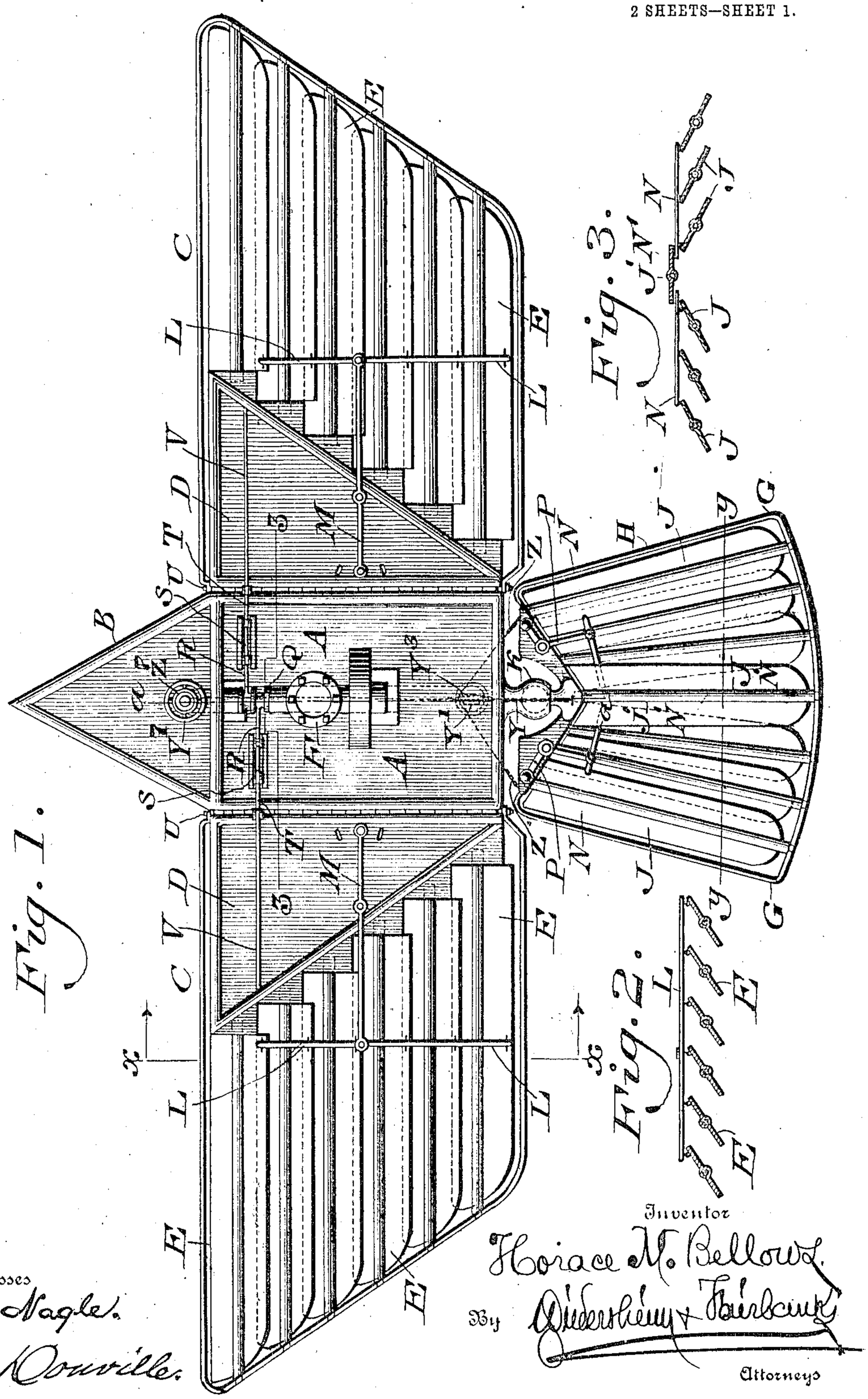


Fig. 1.




Fig. 3.




Fig. 2.

Witnesses

P. F. Nagle.

L. Douville.

Inventor

Horace M. Bellows.

By Wilkerson & Fairbanks

Attorneys

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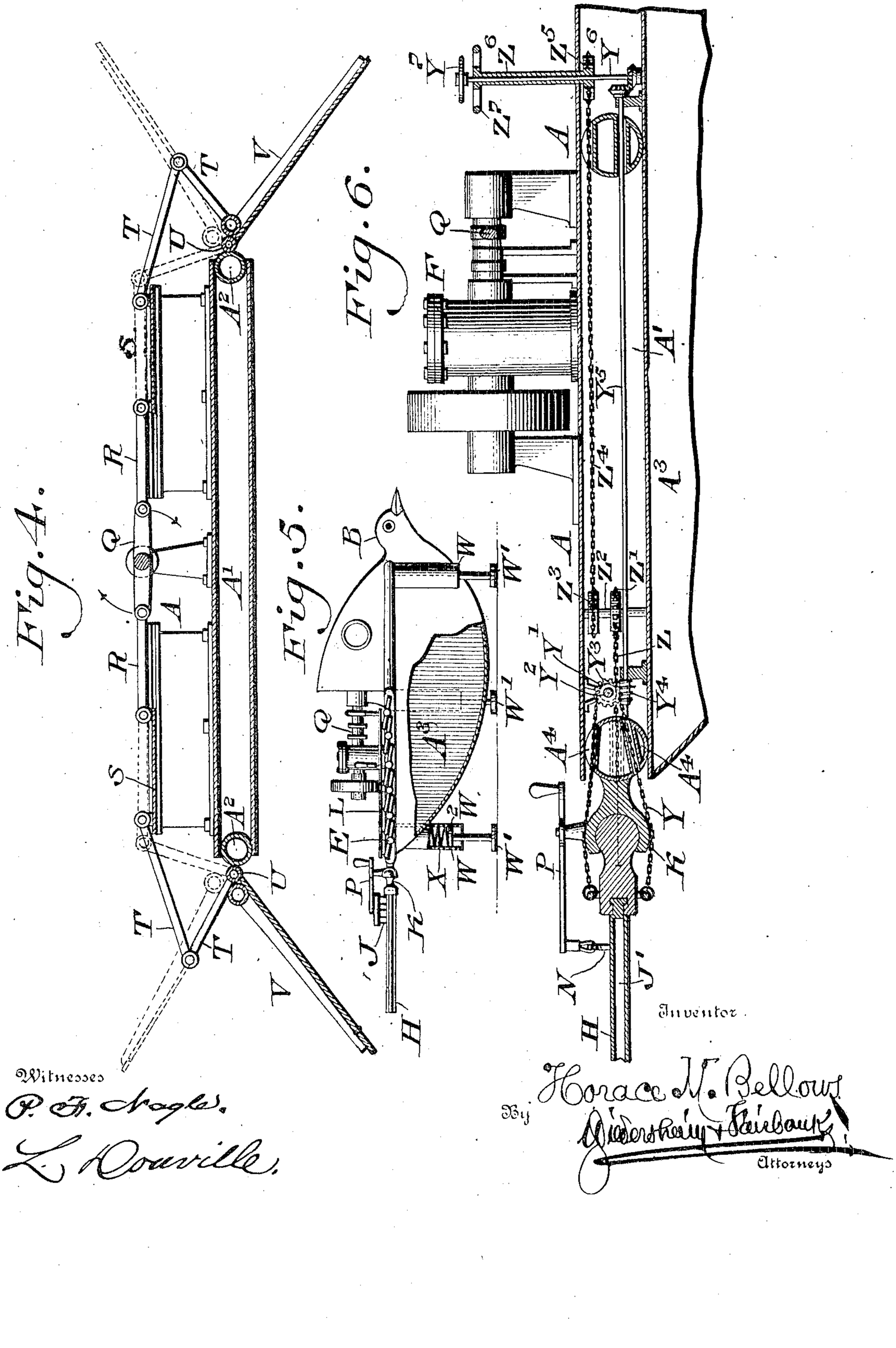

# UNITED STATES PATENT OFFICE.

HORACE M. BELLOWS, OF HUNTINGDON VALLEY, PENNSYLVANIA.

## AERIAL NAVIGATION.

No. 844,771. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed September 7, 1906. Serial No. 333,682.

*To all whom it may concern:*

Be it known that I, HORACE M. BELLOWS, a citizen of the United States, residing at Huntingdon Valley, in the county of Montgomery, State of Pennsylvania, have invented new and useful Improvements in Aerial Navigation, of which the following is a specification.

My invention relates to an improvement in aerial navigation, and consists in providing a device for such purpose in form similar to a bird, as light as possible, with wings composed of blades or aeroplanes, which are placed parallel to each other at an angle to the air, that by the up and down movements imparted to said wings, making their parallel blades or aeroplanes impinge with force against the air at an angle downward and upward, forward motions are imparted to the device in the line of flight, and thus propulsion of the latter is effected, similar to birds, who fly, as I have discovered, by the use of the primary feathers of their wings in this manner.

It also consists in providing the device with a tail or rudder, composed of blades or aeroplanes capable of being disposed at an angle parallel to each other from the sides to the center, so as to steady the device, assist in its propulsion, and also serving to steer the same.

It also consists of means for rendering the device light in construction and presenting a large surface, so as to support the device after the manner of a parachute, assist it in soaring, and also causing it to float in case of its descent upon bodies of water.

It also consists of novel means for operating the wings of the device.

It also consists of novel means for operating the tail or rudder for steering and steadying the device.

It also consists of novel means for operating the tail to raise and lower the same, or to turn it to the right or left, so as to provide more or less resistance in order to regulate the rapidity of flight and controlling the device.

Figure 1 represents a plan view of a device for aerial navigation embodying my invention. Fig. 2 represents a longitudinal section on line *x x*, Fig. 1. Fig. 3 represents a transverse section on line *y y*, Fig. 1. Fig. 4 represents a transverse section of a portion on line *z z*, Fig. 1, on an enlarged scale. Fig. 5 represents a partial side elevation and partial vertical section on an enlarged scale. Fig. 6 represents a partial side elevation and partial longitudinal vertical section of a portion on line *a a*, Fig. 1, on an enlarged scale.

Similar letters of reference indicate corresponding parts in the figures.

Referring to the drawings, A designates the body of the device, the same having a beak or prow B in front thereof and wings C on the sides thereof, said wings being composed of the frames D, made of hollow aluminium pipes, filled with hydrogen gas, hermetically closed, said frames being covered with duck or aluminium plates to make them as light and strong as possible, also transversely-extending aluminium blades or aeroplanes E.

The frame of the body A is made of large aluminium pipes B and $A^2$, filled with hydrogen gas and closed hermetically, covered above and below with ash or spruce boards and constituting means for occupation of machinery, storage, &c., and the large cylindrical body $A^3$, Fig. 5, made of aluminium plates, hard rolled, attached to lower floor, which body is filled with hydrogen gas and hermetically closed for the purpose of lightness, while also adding buoyancy to the device should it descend into bodies of water.

The body A is preferably of the form of a parallelogram, and its top forms a floor of ash or spruce boards, on which is superimposed the motor F for operating the wings C, as will be hereinafter more fully described, also with ash or spruce boards below, strongly fastened to the upper floor and to which the aluminium cylinder $A^3$ is firmly attached.

G designates the tail of the device, the same consisting of the frame H and longitudinally-extending blades or aeroplanes of aluminium J, said frame being pivotally connected by a ball-and-socket joint K, whereby the tail may be changed in variable directions, as required for steering, presenting more or less face to the wind, folding, &c., said frame and ball-joint to be composed of aluminium filled with hydrogen gas and hermetically closed.

The areoplanes E are adapted to have their angles changed by means of rods L, which are freely connected with the same and

engaged by the levers M, the latter being pivoted on the frame of the wings C. The aeroplanes J are adapted to have their angles changed by means of rods N, which are freely connected with the same and engaged by levers P, the latter being mounted on the frame of the tail H at Z. The handle ends of said levers M P are within convenient reach from the body A, or they may be operated by electricity from the neighborhood of the steering wheel or engine.

In order to impart rising and lowering motions to the wings, I employ the double crank-shaft Q, to which rotary motion is imparted by means of the engine or motor E, the cranks of said shaft having mounted thereon the oppositely-extending links R, with which latter are pivotally connected the slides S, to whose outer ends are pivotally connected the toggle-levers T, which are mounted on the bolts or axes U of the hinges of the wings C, the outer limbs of said levers having connected with them the elbows or arms V, the latter being rigidly secured to the frame of the wings C, it being evident that when power is communicated to the shaft Q motion is imparted to the links R, slides S, toggle-levers T, and arms V, whereby the wings are operated upwardly and downwardly, thus causing forcible traction of the blades or aeroplanes E against the air, as will be hereinafter more fully described.

In order to cause the device when descending to alight easily and prevent shocks thereto, the body A is provided with the legs W, each formed of members W′ W², telescopically fitted to each other, the movable members contacting with springs X as cushions or buffers, the effect of which is evident.

In order to raise and lower the tail, which, as has been stated, is connected with the body A by the ball-and-socket joint K, there are attached to the upper and lower sides of the frame of the tail the cords or chains Y, which extend forwardly from the same and pass around the pulley Y′, with whose shaft Y² is connected the worm-wheel Y³, with which engages the worm Y⁴ on the shaft Y⁵, this latter being geared with the shaft Y⁶, which is provided with the hand-wheel Y⁷, said shafts being properly mounted on the body A, the latter being chambered, as at A′, to receive certain members of the mechanism, just described, it being evident that when the wheel Y⁷ is turned the motion thereof is communicated to the frame of the tail, and thus the latter may be raised or lowered, thus presenting more or less surface to the air for steadying and regulating or adjusting the swiftness of the flight of the device.

In order to steer the device, I employ the ropes or chains Z, which are connected with the tail of the device and passed around the sprocket-wheel Z′, whose shaft Z² carries the sprocket-wheel Z³, around which passes the rope or chain Z⁴, which also passes around the sprocket-wheel Z⁵ on the shaft Z⁶, the latter being tubular and freely containing the shaft X⁶ and being provided with the hand-wheel Z⁷, said shafts Z² Z⁷ being properly mounted on the body A and certain of the connected mechanism occupying the chamber A′, it being evident that when the wheel Z⁷ is turned the motion is communicated to the tail either right or left, thus effecting the steering of the device, as is evident.

Attention is especially directed to the blades or aeroplanes of the wings, which at time of flight occupy a position at an angle or obliquely and parallel to each other, whereby they present inclined planes to the air both in the longitudinal and horizontal directions, and thus when the wings are operated said planes receive upward and downward motions, impinging against the air with force at an angle, which induces motion in a direction between the two at a tangent or in a direction to the line of flight, and this is communicated to the body of the device, thus propelling the latter, the body, as is evident, being steadied at the same time by the tail and its aeroplanes, arranged at parallel angles to the right and left, said tail being adapted to be adjusted in vertical and right and left directions, as has been stated. Again, all the blades or aeroplanes of the device are composed of aluminium plates stiffened lengthwise with a mid-rib composed of an aluminium tube filled with hydrogen gas and hermetically closed.

The central blade or plane N′ of the tail H is stationary, the movable blades or aeroplanes J being on the sides of the same and capable of being placed parallel at an angle, thus serving to steady or balance the machine.

The base of the movable members of the legs W are provided with feet W′, on which the device may stand, said members having heads W², acting as pistons, which occupy the interior of the stationary members of the legs and bear against the springs X or the air-cushion in said stationary members, thus permitting the device to alight without abruptness and assisting it in its ascent when the latter is again occasioned.

In Fig. 5, attached to the beak of the body is the form of the head of a bird, which is made by an extension of the aluminium plates of the body, the effect of which is not materially different from the angular beak shown in Fig. 1, and is pointed so as to cleave the air in front, and thus impede its movements as little as possible.

The centers of the aluminium aeroplanes are formed of hollow tubes to stiffen and strengthen them, filled with hydrogen gas

and closed hermetically to render the same light to assist in increasing the buoyancy of the device, the same as other parts hereinbefore referred to.

The ropes or chains Z are passed through sleeves or tubes $A^4$, which serve to guide and guard the same.

Attention is also directed to the fact that the aeroplanes when placed at an angle to the air receive motion and impinge upon the air with forcible resistance in a direction that will produce motion at a tangent thereto, thus accomplishing flight, it being a well-known fact that force applied at an angle through a liquid or gaseous medium produces motion at a tangent to the force and resistance or in opposite directions.

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

1. Mechanism for flight simulating that of birds embodying wings with blades thereon, the latter being adapted to be operatively open to each other at angles to the air, and to be forced against the same in said position, producing motion in the direction of desired flight.

2. Mechanism for flight simulating that of birds, embodying a guiding-tail, with side and central blades thereon, the side blades being adapted to be operatively open to each other at angles to the air in each direction to the right and left from the central blade.

3. Mechanism for flight simulating that of birds, embodying wings with blades thereon, said blades being adapted to be operatively open to each other at angles to the air and to be forced against the same in said position producing motion in the direction of desired flight and a guiding-tail with side and central blades, the side blades adapted to be operatively open at angles in each direction to the right and left from the central blade.

4. In aerial navigation, blades or aeroplanes capable of being disposed parallel at angles to the air with which they are caused to impinge at the time of flight.

5. In aerial navigation, a device provided with movable wings having aeroplanes which are disposed at parallel angles to the air, at the time of flight and thus produce motion thereby at a tangent thereto or in the line of flight.

6. In aerial navigation, a light body, movable wings thereon, aeroplanes mounted on the latter capable of being placed parallel at angles to the air and means for adjusting said angles.

7. In aerial navigation, a body, movable wings mounted thereon and aeroplanes on said wings and means for imparting rising and lowering motions to said wings consisting of a crank-shaft, a motor therefor, slides, connections between the slides and the crank-shaft, and toggle-levers connecting the slides with the pivots of the wings.

8. In aerial navigation, a body, wings and a tail thereon and aeroplanes on said tail, said planes capable of being disposed at parallel angles to the air each way.

9. In aerial navigation, a body, a tail thereon, aeroplanes on said tail, said planes being disposed at parallel angles to the air and means for adjusting said angles.

10. In aerial navigation, a body, a tail thereon and having aeroplanes, means for changing the angles of said aeroplanes and means for raising and lowering said tail to present more or less resistance to the air.

11. In aerial navigation, a body, a tail thereon having aeroplanes adapted to be operatively open to each other at angles to the air in each direction to the right and left from the center, a movable joint connecting said tail and body, and means connected with said tail whereby it may be raised and lowered and moved laterally.

12. In aerial navigation, a body, a movable tail thereon having aeroplanes adapted to be operatively open to each other at angles to the air in each direction to the right and left from the center, connections with said tail to turn it to the right or left, or to raise and lower the same, and means for operating said connections.

13. In aerial navigation, a body, aeroplanes thereon, a movable tail, aeroplanes thereon adapted to be operatively open to each other at angles to the air in each direction to the right and left from the center and steering mechanism, for said tail, consisting of gearing, means for operating the same up and down or to the right or left, and connections for said gearing and tail.

14. In aerial navigation, a body, wings thereon, aeroplanes mounted on said wings capable of being placed at parallel angles, and frames carrying said members, said members being formed in part of hollow bodies filled with some suitable gas and hermetically closed, made as light as possible.

15. In aerial navigation, a body, wings thereon, aeroplanes mounted on said wings, a tail and aeroplanes mounted thereon and adapted to be operatively open to each other at angles to the air in each direction to the right and left from the center and frames carrying said members, being formed in part of hollow bodies hermetically closed, and some suitable gas contained in said bodies, adding buoyancy to the device for purposes of flotation and lightness.

16. In aerial navigation, a body, wings with aeroplanes thereon, adapted to be operatively open to each other at angles to the air and to be forced against the same in said

position, producing motion in the direction of the desired flight, a movable tail thereon, also furnished with aeroplanes made of light material and adjusting mechanism so that the device will act as a parachute, in soaring, descending and floating, should it alight upon a body of water.

17. In aerial navigation, a device constructed with parallel aeroplanes at an angle to the air which when in motion are adapted to impinge upon the air with forcible resistance thereof in the direction that will produce motion at a tangent thereto, thus accomplishing flight.

HORACE M. BELLOWS.

Witnesses:
JOHN A. WIEDERSHEIM,
WM. CANER WIEDERSHEIM.