G. M. FOWLER.

AERIAL APPARATUS.

APPLICATION FILED NOV. 3, 1909.

981,185. **Patented Jan. 10, 1911.**

4 SHEETS—SHEET 1.

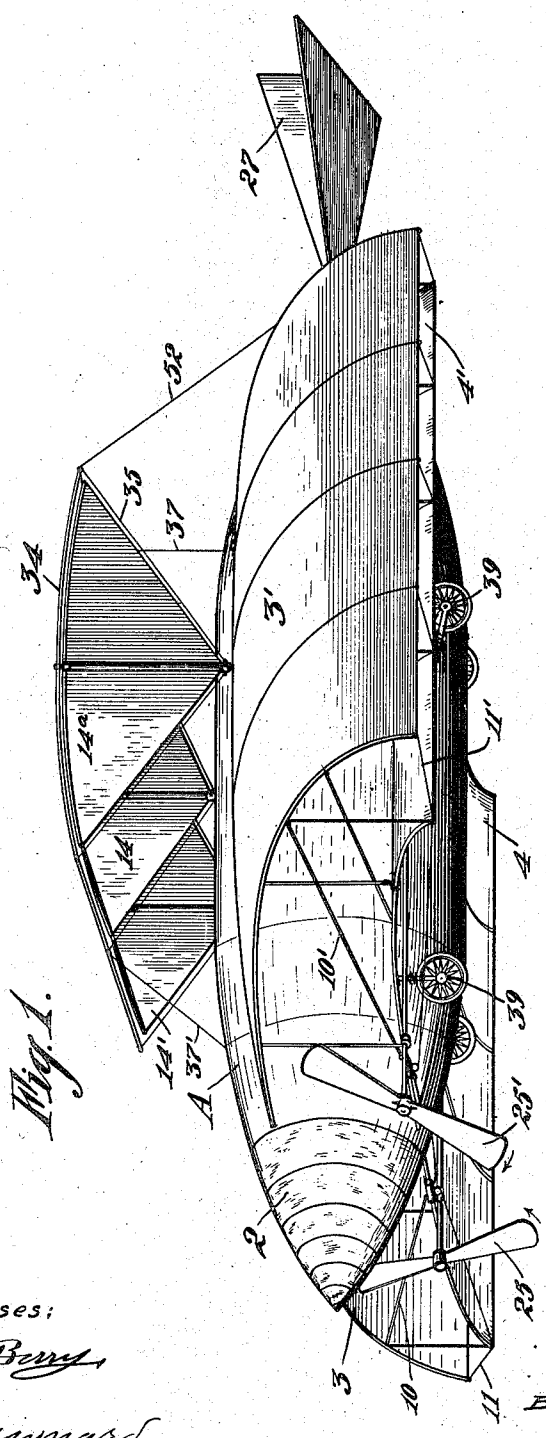

Fig. 1.

Witnesses:

R. S. Berry

F. E. Maynard.

Inventor

Gates M. Fowler

By G. H. Strong

His Attorney.

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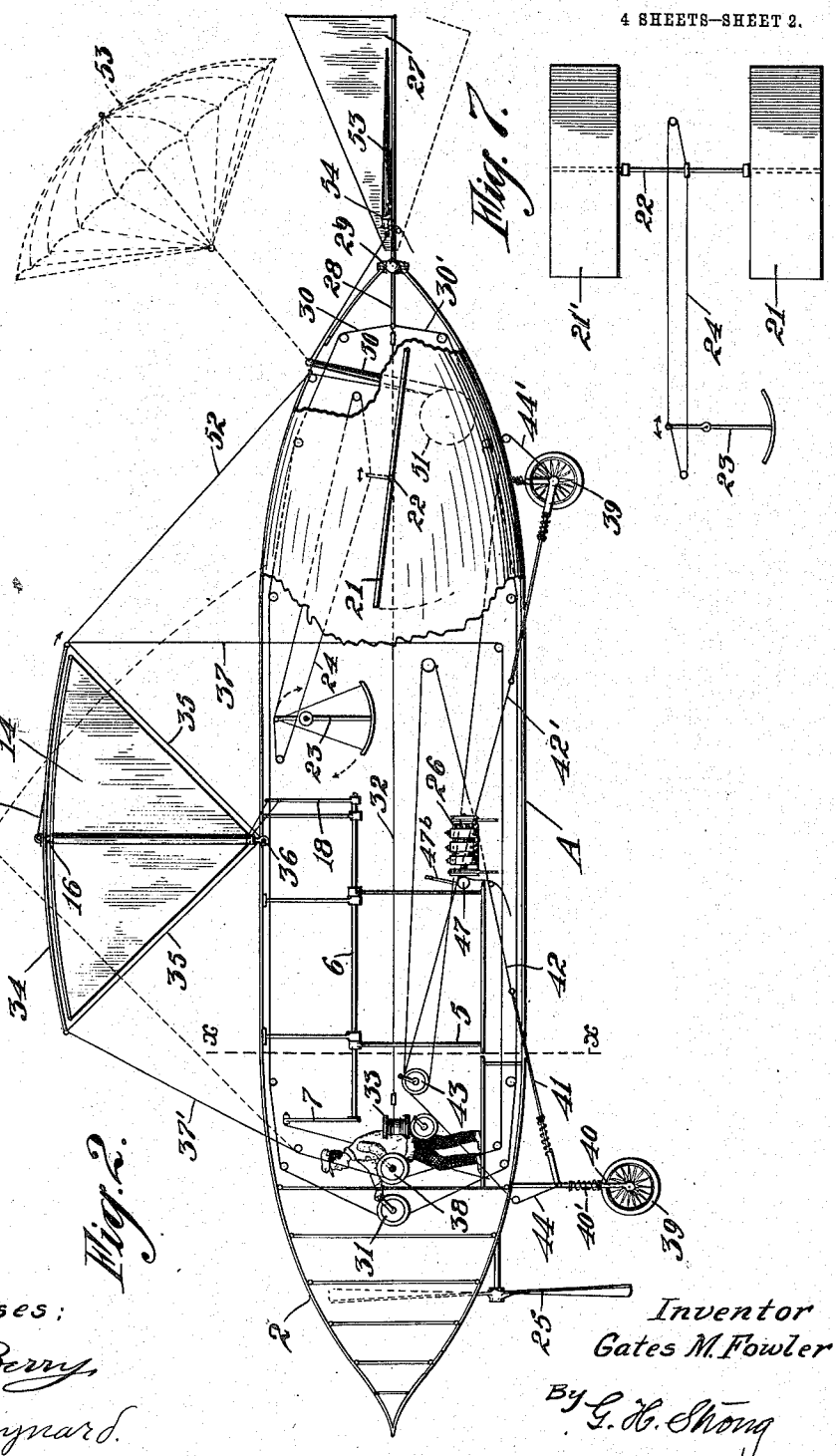

Fig. 2.

Fig. 1.

Witnesses:

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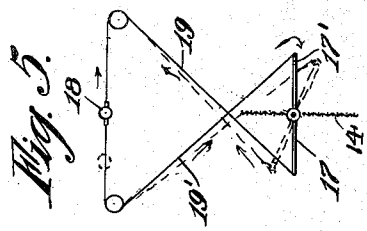

Fig. 5.

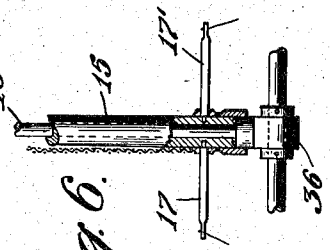

Fig. 6.

Fig. 3.

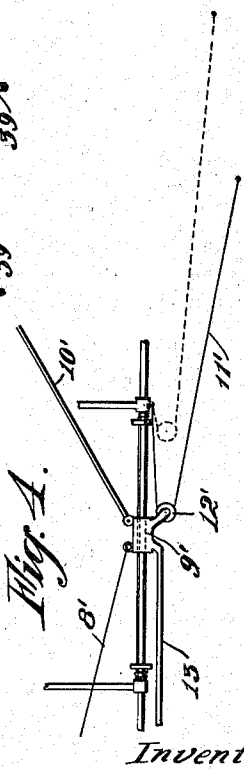

Fig. 4.

Witnesses;

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F. E. Maynard.

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4 SHEETS—SHEET 4.

Fig. 8.

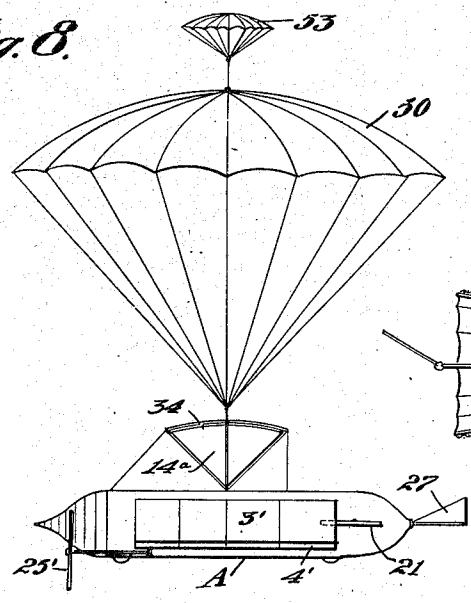


Fig. 9.

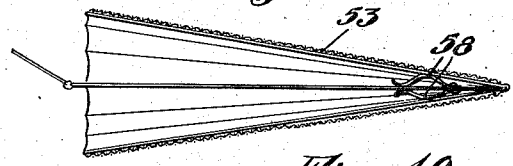


Fig. 10.

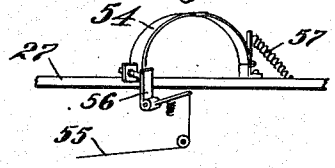


Fig. 11.

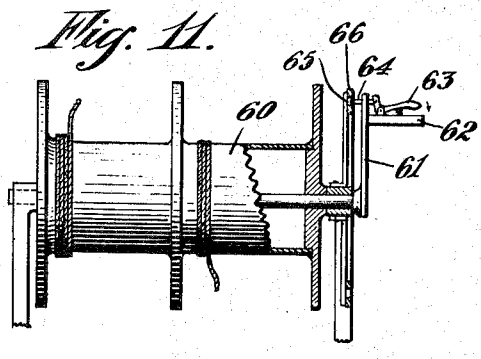


Fig. 12.

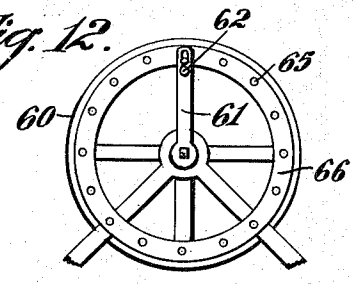


Fig. 13.

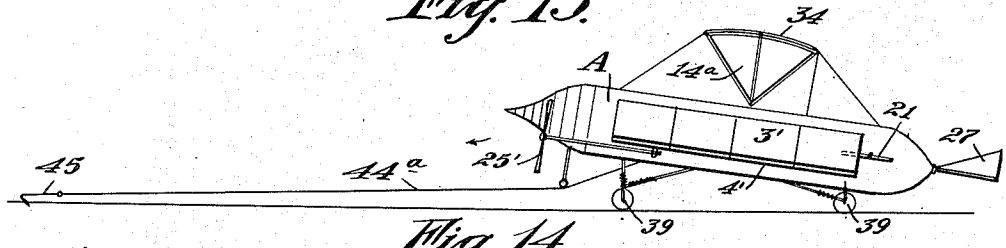
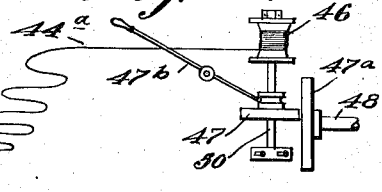


Fig. 14.



Witnesses:

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UNITED STATES PATENT OFFICE.

GATES M. FOWLER, OF SAN FRANCISCO, CALIFORNIA.

AERIAL APPARATUS.

981,185. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed November 3, 1909. Serial No. 526,021.

To all whom it may concern:

Be it known that I, GATES M. FOWLER, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Aerial Apparatus, of which the following is a specification.

This invention relates to a self-propelled flying-machine of the heavier than air type, which is dependent, like the bird, upon its own power and the resistance of the air for its motion and support.

It is the object of this invention to provide an air-ship or flying machine which is dirigible, and which may be navigated through the air at the will of the operator, and in which means are provided for automatically retaining the apparatus on a even keel.

Another object of this invention is to provide an air-ship which is self-starting, and which is fitted with an emergency parachute to insure safe landing, and to be used in case of accidents to machinery.

This machine is designed to simulate the movements of a soaring bird in flight, and the several planes, acting as wings, are automatically operated so as to balance the machine in unequal air currents. The hull or body of the machine is inclosed for the purpose of protecting the aviator and passengers from the weather.

The invention consists of the parts, and the combination and construction of parts as hereinafter more fully described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a perspective view of the invention in flight. Fig. 2 is a longitudinal section partly in elevation, showing the operating wires in diagram. Fig. 3 is a transverse section on the line *x*—*x*, Fig. 2, showing the pendulum control of the plane tips. Fig. 4 is a detail of a sliding block showing the relative movement of the sleeve, and the plane tips. Fig. 5 is a diagram in plan showing the pendulum control of the vertical veering vanes. Fig. 6 is a detail of the lower end of the tilting plane support, and the veering vane mechanism. Fig. 7 (Sheet 2) is a diagram in plan showing the pendulum control of the intermediate side planes. Fig. 8 is a side elevation in outline showing the parachute in the open position. Fig. 9 is a sectional view of the parachute releasing umbrella. Fig. 10 is a detail in perspective of the releasing clamp. Figs. 11 and 12 are details of the winding drum and its crank handle. Fig. 13 is an outline view showing the method of starting. Fig. 14 is a detail of the friction drive and starting device.

In the drawings, A is the shell or body of my flying machine, which is substantially "cigar-shaped" in form, and is constructed of silk or other suitable fabric stretched over a light skeleton or frame of any desired material. The interior of the shell A is designed to contain the driving machinery, freight, etc., together with the aviator and passengers. The forward portion 2 of the shell A is preferably covered with a transparent material such as celluloid, or the like, to permit the aviator who occupies the position shown in Fig. 2, to have an unobstructed view in all directions forward of the areoplane, thus enabling him to avoid obstructions during flight and when landing. Laterally projecting curved planes 3—3′ extend longitudinally of the shell A, and are rigidly mounted near the top and on each side thereof, as shown in Fig. 3. The outer portion of these curved planes is flexible, the tips *a*—*b* being bent downward so as to form an air pocket, the area of which is automatically regulated as later described. Lower horizontal planes 4—4′ extend from the bottom of the shell A parallel to the curved planes 3—3′. These lower planes are rigidly secured to the shell A and project outwardly to a point of approximately two-thirds the span of the upper planes, and are connected thereto by suitable brace rods and wires. The tips *c*—*d* of the lower planes are also flexible and are slightly curved downward as shown in Fig. 3. These lateral planes 3—3′—4—4′ are constructed of a light fabric stretched over flexible ribs, and are shaped to normally stand in the position shown in full lines in Fig. 3, and are adapted to be expanded or contracted at their tips so as to increase or decrease their projecting area. This operation of the plane tips is automatically controlled by means of a pendulum 5 mounted within the shell A.

The pendulum 5 is preferably so constructed as to carry freight, fuel, or passengers, and is rigidly mounted on a shaft 6, suspended from the top and extending lengthwise of the shell A, the shaft 6 being free to turn in its bearings, and acting as the pivotal point of the pendulum 5. An

upwardly projecting arm 7 on the shaft 6 is connected by cables 8—8′ to sliding sleeves 9—9′ which ride upon the inner ends of the ribs of the lower planes 4—4′. There may be as many arms 7 on the shaft 6, and corresponding sleeves 9—9′ as will be found necessary to operate the plane tips the length of the machine, preferably one set to each plane rib. Connecting rods 10—10′ extend from the sleeves 9—9′ to the upper planes 3—3′ and are pivotally connected at each end. Cables 11—11′ have one end secured to the plane tips *a*—*b*, and pass around sheaves 12—12′ on the sleeves 9—9′, the other ends being secured to the ribs of the lower planes 4—4′.

The operation of the lateral plane control is as follows: The natural position of the pendulum 5 and arm 7 is perpendicular to the axis of the shell A. If the shell should tip or rock on its axis so as to raise or lower the curved edges of the lateral planes out of their normal position, movement is imparted to the sleeves 9—9′ through the cables 8—8′ by reason of the pendulum 5 and arm 7 remaining stationary. This action produces the following results:

Referring to Fig. 3, assume that the planes 3—3′ —4—4′ are tipped out of the horizontal position shown, so that the planes 3 and 4 on the left hand side are elevated in the direction of the arrow Z. This causes the pendulum 5 to exert a pull upon the cable 8 and slack the cable 8′, thus pulling the sleeve 9 toward the shell A, and by reason of a connecting rod 13 between the sleeves 9—9′ the latter is moved outward and takes up the slack in cable 8′. The inward movemnt of the sleeve 9 pulls down on the plane 3 through the rod 10, and draws the tip *a* into the position shown in dotted lines at *e* thus contracting the projecting area of plane 3; the outward movement of the sleeve 9′ through the rod 10′ forces the plane 3′ upward into the position indicated at *f*, thus increasing the projecting area of plane 3′. This action of reducing the spread of plane surface on the high side of the machine, and increasing the spread of plane surface on the low side, tends to restore equilibrium and maintain the aeroplane on an even keel laterally. If the direction of tip is opposite that just described, the operation will be reversed, so that whichever side of the machine tends to rise, the spread of plane surface on that side is automatically decreased.

Vertical veering vanes 14—14′—14ª are disposed above the shell A and planes 3—3′. These vanes 14—14′—14ª normally extend lengthwise of the shell A, and each is mounted on a tubular shaft 15 (see Fig. 6) which incloses and is free to rotate, *i. e.* move from side to side, upon a normally vertical support 16. These vanes 14, etc., are subject to the action of the pendulum 5, and are connected to the latter in the following manner:

The central tubular shaft 15 is provided at its lower end with laterally projecting arms 17—17′ each of which are connected to the opopsite sides of an upwardly projecting arm 18 on the shaft 6, by means of cables 19—19′ as shown in diagram in Fig. 5, and in such manner that as the body A tips upwardly on either side, a pull is exerted on the arm 17 or 17′ on the opposite side of the shaft 15 so as to direct the forward ends of the vanes 14—14′—14ª toward the high side, the vanes 14′ and 14ª being connected to vane 14 so as to move therewith. For illustration, referring to Fig. 5, as the apparatus tilts upward in the direction of the arrow Z, Fig. 3, the pendulum arm 18, pulls upon the cable 19 in the direction of the arrows, Fig. 5, and thus throws the vertical veering vane 14 into the position indicated in dotted lines, with the front end of the vane 14 toward the high side. The connection between the outer vertical veering vanes 14′—14ª and the central vane 14, consists of wires 20, which connect the tips of the several vanes both in front and rear, so that the outer vanes respond to the slightest movement of the inner vane 14. The object of these vertical veering vanes is to aid the horizontal planes in maintaining the balance of the aeroplane under all circumstances.

In addition to the horizontal planes and vertical vanes which act only to maintain the aeroplane in lateral balance, a pair of side or intermediate planes 21—21′ (Figs. 2—7) are provided, which tend to retain the machine in longitudinal balance. These planes 21—21′ are mounted at their centers upon a shaft 22 extending across the body of the machine, and project from the sides of the body A, at a point near the rearward end. The shaft 22 is adapted to be acted upon by a swinging pendulum 23 in such manner that for instance, as the front end of the aeroplane drops downward, the pendulum 23 pulls upon a cable 24 so as to throw the forward ends of the planes 21—21′ downward at a greater angle than that of the aeroplane body A, thus tending to lower the rear portion of the body A to a level with the forward end. The planes 21—21′ are acted upon by the slightest tilt of the machine lengthwise, and thus exert an influence to maintain the aeroplane in balance longitudinally.

The driving or propelling mechanism of this aeroplane consists of twin propellers 25—25′ which are rotated in opposite directions, by a motor 26 of any suitable construction. The propellers are situated at the forward end of the body A, one on each side thereof, and are connected to the motor 26, in any suitable manner.

The steering apparatus consists of a tri-

bladed "tail" 27 supported on a shaft 28, and mounted in a ball and socket bearing 29 at the rearward end of the body A. The inner end of the shaft 28 is connected by cables 30—30′ to a drum 31 located convenient to the aviator in the forward end of the shell A in such manner that as the drum 31 is rotated, one cable winds thereon while the other unwinds, the detail of which will be later described. The cables 30—30′ are for operating the "tail" 27 up and down, while similar cables 32—32′, only one of which is shown (see Fig. 2), are secured to the shaft 28, and extend at right angles to the cables 30—30′, then pass to a drum 33 convenient to the aviator, for the purpose of reciprocating the tail from side to side. The tail is so constructed that as it is lowered, the nose of the aeroplane will be deflected downward, or vice versa, and as it is moved to one side the machine will be directed in the same direction. The flexibility of the frame-work of the shell A, permits of the necessary contractions to allow the deflection of the stationary cable during the movement of the other.

A horizontal tilting plane 34 is rigidly mounted on the shaft 16, and extends over the vertical veering vanes 14—14′—14ª and is held in position at right angles to the shaft 16 by guy wires 35. The lower ends of the shafts 16 are pivotally mounted, as at 36 Fig. 6, so that the horizontal plane 34, and veering vanes 14—14′—14ª can be tilted backward on the shell A, and thus present a broad expanse of plane surface crosswise of the aeroplane, to retard its forward progress at the moment of landing. The tilting plane 34 is operated through cables 37—37′ and a drum 38, in a manner such as described in relation to drums 31—33.

A running gear, consisting of spring-cushioned wheels 39, four in number, is provided for starting and landing purposes, and is adapted to be drawn upward into or along the side of the body A during flight so as to not offer a resistance to the air and impede the forward movement of the aeroplane. Each wheel 39 is mounted on an arm 40 pivoted to the shell A, consisting of a double shaft, one sliding upon the other and connected by a buffer spring 40′. A similar brace shaft 41 extends from the shaft 40 to the interior of the shell A, and is connected by cables 42—42′ to a drum 43, the cables being wound on the latter, draw the wheels 39 up in the shell A. Opposed cables 44—44′ connect to the opposite sides of the arm 40, and connect with the drum 43 by which the wheels 39 are lowered to the position shown in Fig. 2.

The starting mechanism consists of a cable 44ª, see Figs. 13–14, having a tri-pronged anchor 45 at its outer end, and its inner end wound upon and secured to a drum 46 operated by a friction drive 47 from the engine 26. To make a start with this device, the anchor end of cable 44ª is unwound from the drum 46 and carried some distance forward of the aeroplane, and the prongs of the anchor 45 firmly driven into the soil or other surface. The engine 26 being started at full speed would cause too great a pull or jerk upon the cable, at the start, hence the variable speed friction device shown in Fig. 14 is employed. This device consists of a disk 47ª mounted on the engine shaft 48 and rotatable therewith, and a friction disk 47 connected with the drum 46, through a shaft 50 and slidable longitudinally thereon. The disk 47 is thrown into contact with the disk 47ª by means of a lever 47ᵇ in the usual manner, the speed of its revolutions being increased as it is brought nearer the edge of the driving disk 47ª. In this manner, the operator increases the speed of the winding drum, and thus through the forward movement of the aeroplane, due to the winding of the cable 44ª, gains sufficient momentum that by the time the anchor 45 is reached the aeroplane will leave the ground, and start on its flight, the anchor being released by the upward pull.

As a means of insuring a safe landing, and in the event of accident or emergency during flight, a parachute 50 is provided. This parachute is normally wound on a drum 51 within the rear end of the shell A, a cable 52 connecting its lower end to the top of the center shaft 16, the cable 52 being wound on the drum 51 with the parachute 50, so that as the parachute is unwound the cable 52 will unwind simultaneously. A releasing umbrella 53 is connected to the upper end of the parachute 50, and normally lies folded upon the horizontal plane of the tail 27, and retained thereon by means of a spring clamp 54 (see Fig. 10). This clamp 54 is so constructed that by pulling upon a string 55, which extends forward to a point near the aviator, a spring latch 50 releases the clamp 54, which is drawn backward by a spring 57. This disengages the releasing umbrella, which is caused to open by spring 58 (Fig. 9); thus expanding it so as to catch the air. This causes the umbrella to raise, kite fashion, thus exerting a pull upon the upper end of the parachute 50, unwinding it from the drum 51, and bringing it into the operative position shown in Fig. 8. The winding drums 31, 33, 38 and 43 are constructed as shown in Figs. 11–12.

The drum body 60 is supported in any suitable manner, and each pair of operating cables wound thereon in opposite directions so that as one cable winds up, the other unwinds. The drum 60 is revolved by means of a crank 61 mounted on the drum shaft. The crank 61 is provided with a handle 62 on which is mounted a spring latch 63, at-

tached to a pin 64 which normally projects into holes or notches 65 in a fixed plate 66.

In operating the drum, the aviator grasps the handle 62 and latch 63, thus releasing the pin 64 from the plate 66, so that the drum 60 can be rotated in either direction. On releasing the handle 62 and latch 63, the pin 64 drops into a hole 65 on the plate 66, and thus retains the drum 60 in a fixed position.

The operation of the invention is as follows: When it is desired to make a flight, the starting mechanism is employed as before described. The propellers 25—25 are rotated at the same time the starting cable 44^a is being wound on the drum 46, thus impelling a volume of air beneath the planes 4—4′, which are slightly inclined as shown in Fig. 13, thus tending to elevate the aeroplane from the ground. The pendulum control operates as before described to retain the machine in balance, at starting and during flight. The aviator guides and directs the flight of the machine by means of the tail 27 which is operated by means of the drums 31—33. When it is desired to make a landing, the machine is directed downward by the downward tilt of the tail 27, and the tilting plane 34 is tipped backward by operating the drum 38, so as to retard the forward movement of the aeroplane, and cause the aeroplane to alight on its rear wheels. The action of the propellers 25—25′ at the moment of alighting is to form an air cushion beneath the planes 4—4′, thus allowing the aeroplane to settle easily to the ground. The running-gear being previously brought to its lowermost position through the drum 43, such shock as may result from contacting the ground being taken up by the shock-absorbing springs 40.

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

1. An aerial apparatus consisting of a closed body having a conical front composed of transparent material, a pair of propellers revoluble at the front of the machine, curved planes transverse to the body, a single rudder with universal joint, a swinging platform within the body, connections between the platform and the planes for operating the latter, and a motor located within the body.

2. The combination in an aerial apparatus, of a shell or body, curved transversely projecting planes having flexible tips, and automatic means for simultaneously raising one and lowering the other tip to increase the spread of the plane surface on the low side of the machine and reduce the spread of the plane surface on the high side of the machine when said machine is tipped out of a horizontal position.

3. The combination in an aerial apparatus, of an inclosed shell, transversely extending planes having the inner edges fixed, the outer edges curved downwardly, supplemental planes located beneath the first mentioned planes, and connections whereby both sets of planes may be moved in unison to increase the spread of the plane surface on the low side of the machine and reduce the spread of the plane surface on the high side of said machine when the machine is tipped out of horizontal position.

4. The combination in an aerial apparatus, of a shell or body, a pair of propellers located at the front, laterally projecting planes having their inner edges fixed, and the outer edges flexible and curved downwardly, other planes of smaller area beneath the upper planes and approximately parallel therewith, said planes having flexible downwardly curved tips, a swinging pendulum weight located within the shell, and connections between said weight and the tips of the planes whereby the latter are raised and lowered automatically to counteract side tilting movements of the apparatus.

5. In an aerial apparatus, a shell or body, a pair of propellers located in the front, and a motor therefor within the shell, laterally projecting planes having the inner edges fixed, the outer edges flexible and curved downwardly, other planes of smaller area similarly fixed beneath the first named planes, a weighted pendulum suspended to swing within the shell, cords connecting said pendulum with the planes so that the transverse tilting of the machine acts to straighten the curvature of the planes upon one side, and correspondingly increase the curvature of the planes upon the opposite side.

6. The combination in an aerial apparatus, of a shell or body, propellers located at the front, and a motor within the shell, curved planes projecting laterally from the sides of the apparatus, a longitudinally journaled shaft in the upper portion of the shell, a platform adapted to carry weights, said platform suspended from and swinging freely below the shaft, arms fixed to and radiating from the shaft, cords connecting one of said arms with the plane tips, and direction pulleys over which said cords pass.

7. The combination in an aerial apparatus, of a shell or body, a pair of propellers located at the front, and a motor within the shell, transversely extending curved planes superposed in pairs upon opposite sides of the shell, a pendulum consisting of a weighted platform, a longitudinally disposed shaft from which said platform is suspended, upwardly projecting arms carried by the shaft and movable in unison with the swinging movements of the pendulum, flexible cords

or cables connected to one of said arms, slidable sleeves with which said cords are connected, and connections between said sleeves and the movable planes, and connections between the pairs of planes upon either side whereby they are moved in unison.

8. The combination in an aerial apparatus, of a shell or body, a pair of propellers located in front, steering mechanism in the rear, and a motor contained within the shell, a suspended pendulum-like platform adapted to swing from side to side within the shell, superposed substantially lateral planes upon each side of the shell having their inner edges fixed, the outer edges flexible and curved, connections between said planes and the pendulum platform whereby the normal position of the planes is maintained, while the apparatus is substantially horizontal, said connections serving to relatively and automatically raise the planes upon one side and depress them upon the opposite side to restore equilibrium if the apparatus tilts to one side or the other.

9. The combination in an aerial apparatus, of a shell or body, a pair of propellers located at the front, a motor contained within the body, transverse laterally superposed planes having curved flexible tips, a swinging pendulum platform within the shell, connections between said platform and the planes whereby those upon opposite sides are automatically moved in opposite directions to maintain an equilibrium, vertically disposed vanes located above the shell and turnable with relation thereto, and connections between said vertical vanes and the pendulum body.

10. The combination in an aerial apparatus, of a shell or body, propellers at the front and steering rudder at the rear, and a motor contained within the shell, laterally projecting planes having downwardly curved tips superposed in pairs upon each side of the shell, a shaft extending longitudinally through the upper part of the shell, a swinging pendulum platform connected with said shaft, and arms projecting upwardly from the shaft, flexible connections between one of said arms and the planes whereby the latter are moved in opposition to maintain the equilibrium of the apparatus, vertically disposed connected vanes above the shell, a shaft having laterally projecting arms, flexible connections between the two last named sets of arms and one of the arms on said pendulum shaft whereby the vertical vanes are moved in unison with the lateral planes by the automatic action of the pendulum when the apparatus is thrown out of equilibrium transversely.

11. The combination in an aerial apparatus, of a shell or body having laterally projecting pairs of planes, with downwardly curved flexible tips, upwardly extending longitudinally disposed vanes above the shell, a suspended swinging pendulum platform within the shell, flexible connections between the above named planes and vanes, and the platform, whereby a transverse equilibrium of the apparatus is maintained, other planes mounted at the rear of the apparatus, a second pendulum mechanism with which said supplemental planes are connected, said planes being tiltable toward the front and rear, and automatically movable to control the upward and downward movements of the apparatus.

12. The combination in an aerial apparatus, of a shell or body, lateral superposed pairs of planes having downwardly curved flexible tips, vertical longitudinally disposed vanes extending upwardly from the shell, a weighted swinging pendulum-like platform located within the shell, flexible connections between said pendulum and the planes, a substantially horizontal plane having a transverse axis about which it is movable to raise and depress the front and rear ends, a supplemental pendulum movable by the upward and downward tilting of the apparatus in the direction of its length, and connections between said pendulum and the last named plane.

13. The combination in an aerial machine, of a shell or body having laterally extending planes, pendulums and flexible connections between the pendulums and said planes whereby the latter are moved automatically to maintain equilibrium of the apparatus, a pair of propellers located in front of the apparatus, a motor and connections by which the propellers are rotated, a steering apparatus consisting of a tri-bladed rudder, a ball and socket bearing therefor, connections between said rudder and the pilot-house whereby the aviator may control the same.

14. The combination in an aerial machine, of a shell or body having laterally extending planes, and vertical vanes, pendulums and flexible connections between said pendulums and planes, and vanes whereby the planes and vanes are moved automatically to maintain the equilibrium of the apparatus, a substantially horizontal plane fixed across the top of the superposed vertical vanes, and means by which said plane may be tilted to stand at an angle to give greater lifting power, or backwardly to retard the forward progress of the apparatus during the flight or in landing.

15. The combination in an aerial machine, of a shell or body with laterally extending planes and vertical vanes, pendulums and flexible connections between the pendulums and said planes and vanes whereby the latter are moved automatically to maintain an equilibrium of the apparatus, propellers located in front of the apparatus, and a steering device, a motor and connections by which the

propellers are rotated, means for starting the apparatus, said means including an anchor adapted to be secured at a point in advance of the apparatus, a winding drum, a cable connecting the anchor therewith whereby the turning of the drum will wind the cable and impel the apparatus toward the anchor, said anchor being turnable to break its hold when the apparatus is contiguous to it.

16. The combination in an aerial machine, of a shell or body, balancing lateral planes and vertical vanes, propellers, a motor, and steering mechanism, means for starting the apparatus, said means including an anchor adapted to be fixed in the ground in advance of the apparatus, a winding drum connected with the anchor, and means for gradually increasing the speed of the drum after the start has been effected.

17. The combination in an aerial machine, of a shell or body, balancing lateral planes and vertical vanes, propellers, a motor and steering mechanism, means for starting the apparatus, said means including an anchor adapted to be fixed in the ground in advance of the apparatus, a winding drum connected with the anchor, means for gradually increasing the speed of the drum after the start has been effected, said means including frictional disks revoluble at right angles, and means for moving one of said disks radially with relation to the other with which its periphery contacts.

18. The combination in an aerial machine, of a shell or body, balancing lateral planes and vertical vanes, and a pendulum connected therewith, propellers, a motor and steering mechanism, a parachute connected with the apparatus, means for holding the parachute when not in use, and means for releasing and placing the parachute in a vertical position, ready to be distended.

19. The combination with an aerial machine provided with a tail, of a parachute, a cable connecting it with the aerial machine, a drum upon which the parachute is coiled and stored when not in use, a releasing umbrella connected to the upper end of the parachute, and normally held in the horizontal plane of the tail, a holding and releasing means whereby the umbrella is allowed to act to extend the parachute and place it in a vertical position.

20. The combination with an aerial machine provided with a tail, of a parachute, a cable connecting it with the aerial machine, a drum upon which the parachute is coiled and stored when not in use, a releasing umbrella connected to the upper end of the parachute, and normally held in the horizontal plane of the tail, a holding and releasing means whereby the umbrella is allowed to act to extend the parachute and place it in a vertical position, said releasing means including a clamp, and a cord extending therefrom to the position of the aviator, and a spring latch actuated by the cord to release the clamp.

21. The combination in an aerial machine, of a shell or body, lateral and vertical adjustable planes, a pair of propellers located in front of the apparatus, a steering mechanism in the rear, a motor by which the propellers are driven, and means for tilting certain of the planes in the direction of movement of the apparatus whereby a blast of air from the propellers may act upon the lower surfaces of the planes to assist in raising the apparatus from the ground.

22. The combination in an aerial machine, of a shell or body, laterally adjustable superposed planes, a pendulum mechanism by which the planes are automatically adjusted to maintain equilibrium of the apparatus, other planes tiltable about the horizontal axis to change their angle with relation to the line of travel of the machine, propellers located in front of the apparatus, and a motor, an anchor adapted to be fixed in the ground at a point in advance of the apparatus, a winding drum with speed varying connections, a cable connecting said drum with the anchor, the propellers acting to force a blast of air beneath the inclined planes during the forward movement of the apparatus toward the anchor, and producing a joint action to impel and raise the apparatus from the ground.

23. The combination in an aerial apparatus, of a shell or body, a suspended pendulum platform, and a motor located therein, superposed pairs of laterally extending planes connected with the pendulum and automatically movable to maintain transverse equilibrium, other planes tiltable forward and backward with relation to the longitudinal axis of the machine, propellers connected with the motor and producing a blast of air toward the apparatus, said blast acting against the inclined lower surfaces of the planes to assist in raising the apparatus from the ground, and similarly acting upon said first-named planes to form an air cushion to assist in the easy alighting of the machine.

24. The combination in an aerial apparatus, of a shell or body, lateral flexible planes and vertical veering vanes, a weighted pendulum contained within the shell, and connections between the pendulum and the planes and vanes whereby they co-act to maintain the apparatus in equilibrium.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GATES M. FOWLER.

Witnesses:
GEO. H. STRONG,
CHARLES A. PENFIELD.