(No Model.) 4 Sheets—Sheet 1.

E. P. JOHNSTON.

AIR SHIP.

No. 383,889. Patented June 5, 1888.

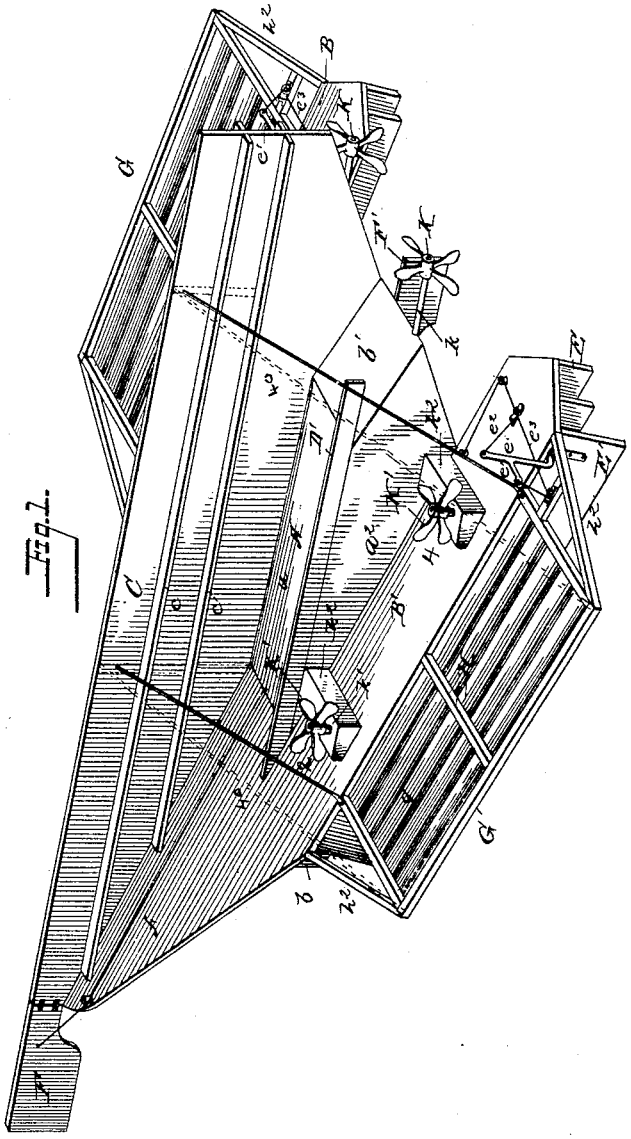


Fig. 1.

Attests:
John G. Hickel Jr
Wm. A. Harries

E. P. Johnston,
Inventor:
by
Foster & Freeman.
Attys

(No Model.) 4 Sheets—Sheet 2.

E. P. JOHNSTON.

AIR SHIP.

No. 383,889. Patented June 5, 1888.

Fig. 2.

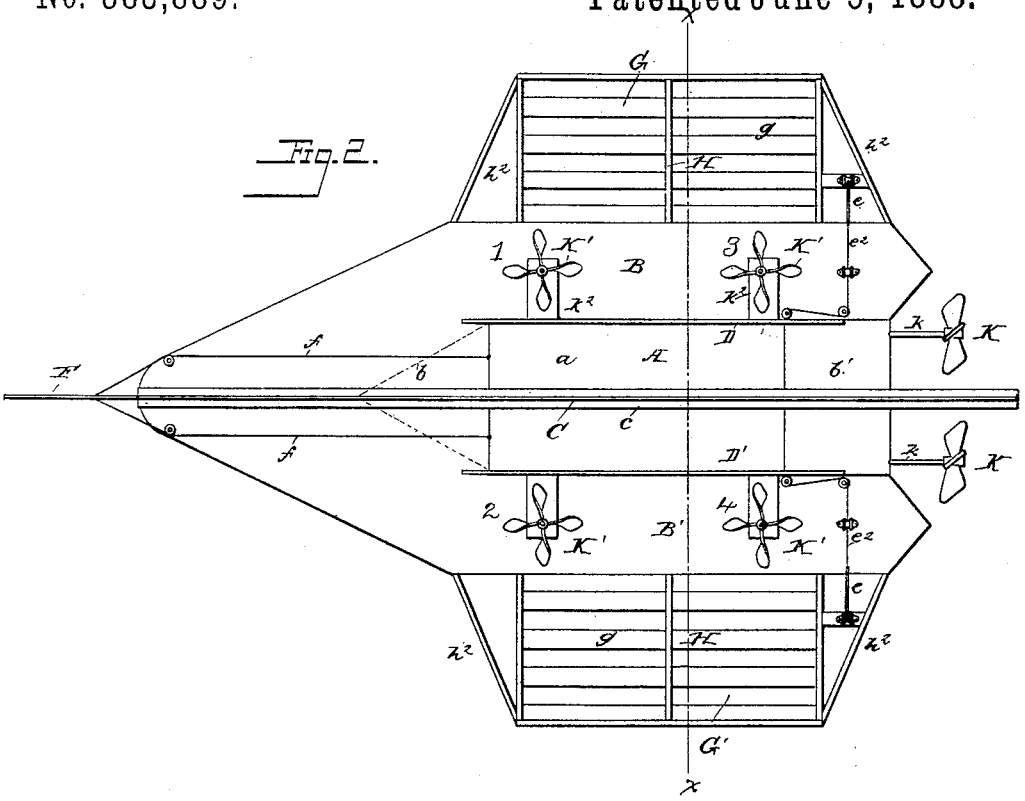
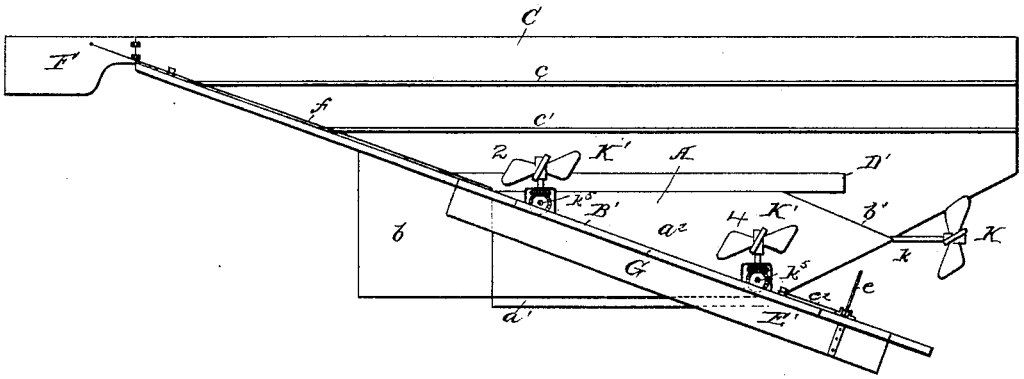


Fig. 3.



Attests:
John C. Hinkel Jr.
Wm. A. Harries

E. P. Johnston.
Inventor.
by Foster & Freeman.
attys.

(No Model.) 4 Sheets—Sheet 3.

E. P. JOHNSTON.

AIR SHIP.

No. 383,889. Patented June 5, 1888.

Fig. 4.

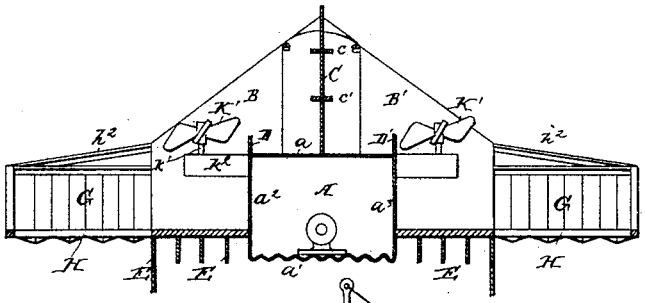


Fig. 5.

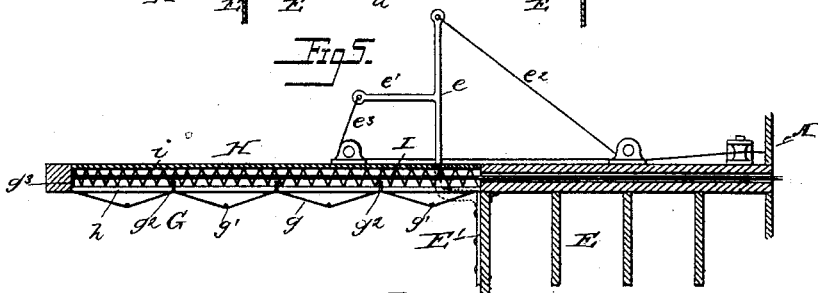


Fig. 6.

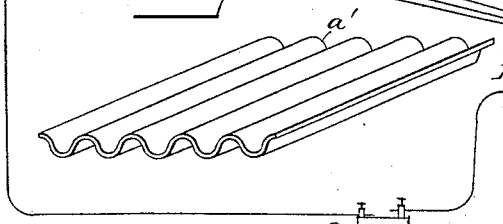


Fig. 7.

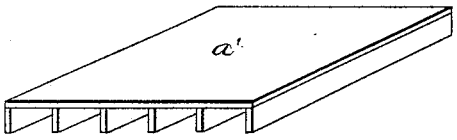


Fig. 8.

Attests:
John G. Hinkel Jr.
Wm. A. Harries

E. P. Johnston.
Inventor:
by Foster & Freeman.
Attys

(No Model.) 4 Sheets—Sheet 4.

E. P. JOHNSTON.

AIR SHIP.

No. 383,889. Patented June 5, 1888.

Fig. 12.

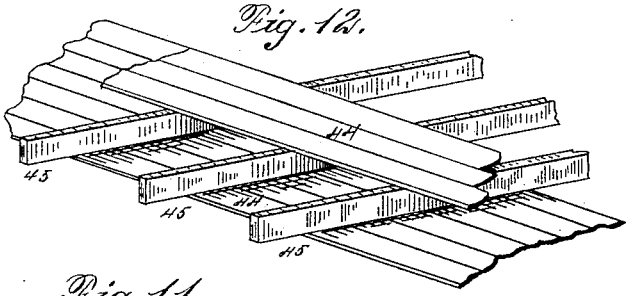


Fig. 11.

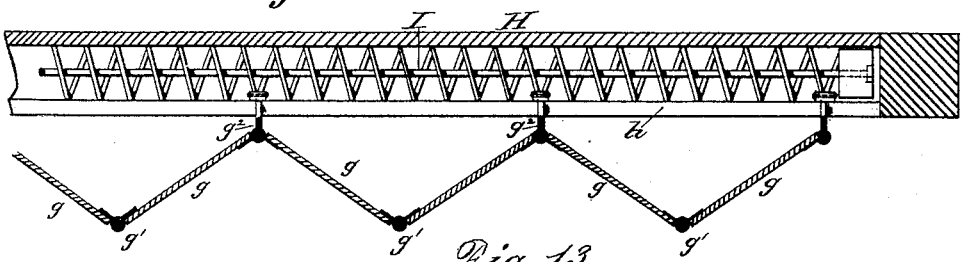


Fig. 13.

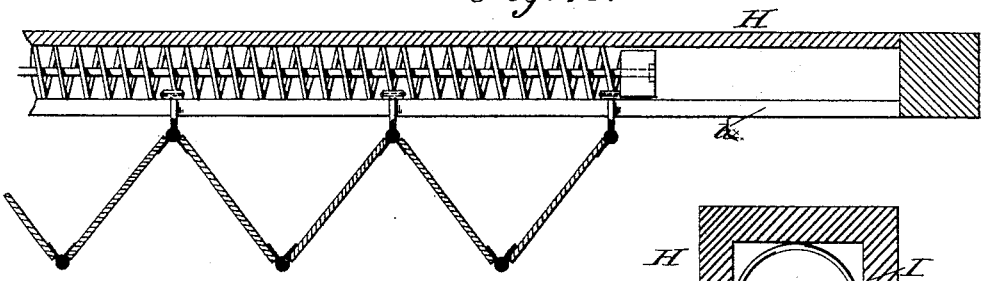


Fig. 9.

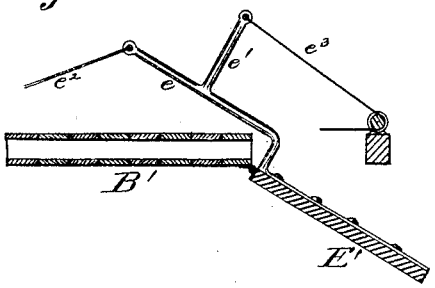
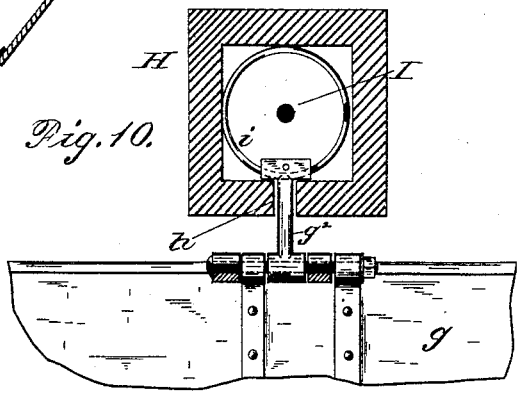


Fig. 10.



Witnesses.
Charles P. Lincoln
Frank G. Mattingly.

Inventor.
Edward P. Johnston

By his Attorneys
Whittlesey & Wright

UNITED STATES PATENT OFFICE.

EDWARD P. JOHNSTON, OF DECATUR, ALABAMA.

AIR-SHIP.

SPECIFICATION forming part of Letters Patent No. 383,889, dated June 5, 1888.

Application filed May 5, 1886. Serial No. 201,226. (No model.)

To all whom it may concern:

Be it known that I, EDWARD P. JOHNSTON, a citizen of the United States, and a resident of Decatur, Morgan county, Alabama, have invented a new and useful Improvement in Air-Ships, of which the following is a specification.

My invention relates to improvements in air-ships, having for its objects the provision of means whereby a ship of the class named may be caused to ascend to different desired elevations, to be maintained in horizontal position as regards the earth's surface while in operation, to be propelled in a forward direction or held in stationary position, and to descend at the will of the operator.

To the accomplishment of the above ends the invention consists in an air ship having fixed inclined sections laterally projecting therefrom and provided with movable sections, propellers that control the movement of the ship in upward, forward, and downward directions, and means, substantially as hereinafter described, for operating said propellers.

The invention further consists in means whereby the ship may be automatically maintained in proper horizontal position while in operation, and in means whereby its variation from such position may be instantly made known to the operator.

The invention further consists in means for holding the ship to any predetermined course and for changing such course when desired; and, finally, the invention consists in the construction, arrangement, and combination of the several parts for service, substantially as hereinafter described, and specifically pointed out in the claims.

In the drawings, Figure 1 represents in perspective an air-ship constructed in accordance with my invention. Fig. 2 is a top plan view thereof. Fig. 3 represents a side elevation of the ship as it appears when in operation. Fig. 4 is a transverse sectional view taken on the line *x x* of Fig. 2. Fig. 5 is an enlarged detail sectional view of one of the wings and its attachments detached from the ship. Fig. 6 represents an enlarged detail perspective view of a portion of the corrugated bottom of the ship. Fig. 7 represents a modified form of the parts shown in Fig. 6. Fig. 8 represents an elevation of the device for automatically maintaining the ship in equilibrium. Figs. 9, 10, 11, 12, and 13 are detached detail views of parts of the structure and operative mechanism.

Referring to the drawings, in which similar letters of reference denote similar parts, A designates the hull or body of the ship, having top *a*, flanged or corrugated bottom *a'*, and sides a^2, formed of suitable material, properly supported and extending for the greater part of their length in planes parallel and at right angles with each other. (See Figs. 2 and 3.) The opposite ends of the hull terminate in wedge-shaped portions *b b'*, formed at the forward end, *b*, by the converging forward ends of the sides a^2 and at the rear, *b'*, by the converging rear ends of the top and bottom *a a'*.

B B' designate inclined sections which are rigidly secured to and project outwardly from the opposite sides of the hull, and extend forward from the front of the same in planes parallel with the transverse end at an angle with the longitudinal axis thereof to form an inclined plane at the front and at each side of the hull, which plane, being propelled against the atmosphere, in the manner hereinafter described, will, through the upward pressure which is thus produced against said inclined plane, assist to sustain the ship while in the air. The upper and under surfaces of the sections B B' are formed of narrow strips or plates 44, of suitable material, securely fastened to ribs or timbers 45, (see Fig. 12,) which extend outwardly from the hull between said strips, and the outer edges of said sections converge at the forward end of air-ship, as shown in Fig. 12.

C designates an upwardly-projecting guide plate or blade that extends from front to rear, and is secured at its lower edge to the upper surfaces of the hull and forward part of ship upon a line equidistant from the side edges thereof. Flanges, as *c c'*, may, if desired, be secured to and project outwardly from the opposite sides of the guide-plate C, extending from end to end in planes parallel with the top of hull, for a purpose hereinafter described.

D D' designate additional guide plates or blades that project upwardly from the top *a* at each side thereof to operate in conjunction with the central guide-blade, C, as will be presently explained.

E designates flanges rigidly secured at their upper edges to and projecting downward from the lower surfaces of the sections B B' in planes

parallel with the side edges thereof. The bottom of the hull A may also be provided with similar flanges, although in the drawings the bottom of said hull is shown as corrugated, it being understood that wherever rigid flanges E are shown corrugations similar to those shown in Fig. 6 may be used interchangeably with said fixed flanges E.

E′ designates similar but wider flanges that are hinged to the lower surfaces of said fixed inclined sections B B′ at the outer edges thereof, and provided with upwardly and laterally projecting arms *e e′*, (see Figs. 7 and 9,) to which are secured cords e^2 e^3, which extend over pulleys to an operating-wheel in the interior of the ship, by which said flanges E′ may be swung from their normal vertical position upward into the plane of said sections B B′, or downward to a vertical position, as shown. The fixed flanges E, or their equivalents, operate in conjunction with the movable flanges E′, when in vertical position, in giving steadiness and permanency of direction to the air-ship.

The movable flanges E′ are hinged to the outer edges of the fixed inclined sections B B′, and when swung outward into the plane of the fixed sections increase the area of the inclined lifting surface. This feature comes into play when the ship is accidentally careened to one side or the other by reason of sudden air-currents or other causes. The movable flange E′ on the side of the ship that is lower is then to be swung outward and upward, and by the increased inclined surface which the air will then have to press against on that side the ship will be quickly righted again.

F designates a rudder that is hinged to the forward end of the air ship and is operated by a wheel in the interior of the ship by means of the cords *f*, that extend thence to the rudder, as shown.

F′ designates a similar rudder hinged to the rear end of the hull and operated in a similar manner from the interior of the ship.

The sections G G′, Figs. 2, 4, and 5, each consist of a series of slats, *g*, which are hinged together at their edges *g′*, (see Fig. 11,) and provided at each alternate joint with upwardly-projecting studs g^2, that are secured to the hinges and extend thence through slots *h*, formed in the hollow supports H, and are within said supports provided with T-shaped ends. (See Fig. 10.) The studs g^3 are within the hollow supports each connected with the coils of springs *i*, which keep these movable sections extended, except when drawn in, (for purposes hereinafter set forth,) by means of rods I, which extend from the outer ends of said springs to the interior of the ship. (See Figs. 5 and 10.) The supports H may be braced in any desired manner—as, for instance, by braces h^2, that extend from the fixed sections B B′ to the outer end of the forward and rearward supports—and also, if desired, by iron rods extending from the ends of supports H on each side of air-ship to the top of guide-blade C, with perpendicular supports under the points of junction, as shown by dotted lines 40 in Fig. 1.

I will now proceed to describe the means whereby my improved ship is caused to ascend, to move forward or remain stationary in the air, and to descend therefrom at the will of the operator. To these ends I employ a series—preferably six in number—of propellers, K K′, two of which I mount at the rear of the ship upon horizontal rotatable shafts *k*, journaled in bearings within and near the sides thereof. The remaining propellers K′ are mounted upon vertical shafts *k′*, journaled in bearings k^2, secured to the upper surfaces of the fixed sections B B′ at points equidistant from the sides of the ship and the outer edges of said section near the opposite ends of the hull of air-ship. For convenience of description, I will hereinafter designate the lifting-propellers K′ as 1, 2, 3, and 4. Said propellers may be operated by any desired mechanism—as, for instance, in the manner shown in the drawings, which consists in providing the shafts *k′* below the propellers with bevel gear-wheels and operating the same by similar gear-wheels mounted upon rotatable shafts k^5, that project from the hull A.

I have not deemed it necessary herein to show any particular means for imparting motion to the shafts *k k′*, inasmuch as any desired motor may be employed for such purpose. Each propeller is provided with an independent motor.

I provide for the automatic maintenance of the ship's equilibrium by causing any inclination of said ship from its normal horizontal position to set in motion mechanism whereby additional force and consequent increased speed is imparted to the lifting-propellers on that side or end of air-ship which may be temporarily depressed, thereby restoring equilibrium. This I accomplish in and by the following-described manner and means, viz:

L, Fig. 8, designates a suitable support having a top, *l*, provided at its middle with an aperture, *l′*, and at its rear side with an upwardly-projecting back, l^2.

M designates a rod hung upon suitable pivots, *m*, within the aperture *l′*, so as to move freely to the right or left by the force of gravitation when the air-ship is inclined in either of these directions. Below the top *l* at m^8 the rod M moves freely on pivots m^{11}, placed at right angles with pivots *m*, but is confined on each side by the parallel plates or guards m^9, so that while the lower part of rod M can move freely upon said pivots m^{11} at right angles with the plane of motion of the upper part of the rod, yet when moved in the same plane of motion as said upper part it is held by the guards m^9, so that the upper part of rod M must move with it. Rod M may either be jointed, as described, or entire. This rod is provided at its lower end with a pendulum, *m′*, and near its upper end with a cross head or bar, m^2, that

is provided at its opposite ends at equal distances from the rod M with upwardly-projecting arms m^3 m^4, upon which is secured, above proper insulators m^5 m^6, circuit-closers N N', preferably of iron, and connected by conductors *o o'*, with means Q for controlling one of the motors that operates the propellers—as, for instance, if a steam-engine be employed, said conductors would connect with mechanism for operating the throttle-valve S thereof.

P P' designate insulating-blocks which are secured to the back l^2 in the track of the circuit-closers N N' and provided with a series of metallic contact-plates, *p p'*, adapted to be engaged by said circuit-closers, and each of said contact-plates is connected by a conductor, p^2 or p^3, with an electro-generator, R. As will be understood, deviation of the ship from its normal position and in the direction shown by arrows 50 and 51, in which the pendulum swings, will, through the movement of said pendulum, bring one or the other of the circuit-closers N N' into contact with one or more of the metallic plates *p* or *p'*, thus throwing into circuit one or the other of the conductors *o* or *o'*, thereby causing the motor-controlling mechanism to which the conductor so in circuit is attached to operate with greater or less force, according to the number of plates *p* or *p'*, and the consequent battery force in contact with the circuit-closers, and by which any one or more of the propellers 1, 2, 3, or 4 may have increased speed and consequent elevating power imparted thereto.

As the rod M has a swinging motion in but one direction—viz., parallel to the face of the support, as shown by the arrows 50 and 51—two or more devices similar to that above described will be required to fully control variation of both the longitudinal and transverse axes of the ship. From their proper normal position said devices are set so that the plane of motion of their respective pendulum-rods shall be at angles each with the other. The regulator whose pendulum swings crosswise of the ship will control the two groups of propellers 1, 3, and 2, 4. The regulator whose pendulum swings lengthwise of the ship will control the two groups of propellers 1 2, and 3 4.

The upper end of the rod M above the cross-head moves upon the face of a graduated curved plate, m^1, secured to a block, m^5, projecting from the back l^2, for the purpose of showing the distance the ship has moved from its normal position. To show any deviation of the rod M itself from the vertical plane, I provide a level, m^{10}, Fig. 3, securing the same to the middle of the cross-head m^2, as shown.

The operation of my improvements is as follows: Power is first applied to the lifting-propellers 1, 2, 3, and 4 for the purpose of raising the ship to the required elevation. Power is then applied to the rear propellers, K, to move the ship in a forward direction, which power is gradually increased until the ship is principally or wholly supported in the air by the pressure of the atmosphere against the inclined lower surfaces of the fixed sections B B', and the power applied to the lifting-propellers is correspondingly reduced. As hereinbefore stated, the lifting-propellers 1, 2, 3, and 4 may be operated independently, and consequently an excess of force may be applied to any one or more of them for the purpose of maintaining the equilibrium of the ship. To aid in the accomplishment of this, the movable sections G or G' on the elevated side of the ship may be reduced in extent, so as to oppose less lifting surface to the upward pressure of the atmosphere by drawing in the rods I, and thereby contracting the springs *i* and partially or wholly folding together the hinged slats *g*, as illustrated in Fig. 13. The result of this reduction of surface is to lessen on that side of the ship the amount of upward sustaining-pressure due to the resistance of the inclined surface to the air, and the ship immediately careens toward that side. It will be noticed that the effect of reducing the surface of the folding sections G G' is just the opposite of that produced by swinging outward the movable flanges E'. These two features of construction may therefore be regarded as alternative arrangements, though both can be used with advantage and a combined effect obtained. By thus increasing the inclined surface on one side of the ship and reducing it on the other, or vice versa, the equilibrium of the machine can be easily maintained independent of the control given by the independent lifting-propellers 1 2 3 4.

It will be observed that the longitudinal corrugations or flanges upon the under surface of the hull and fixed sections, and also the central guide-blade, C, and side guide-blades, D D', serve to give steadiness to the air-ship and to aid the rudders in holding the ship in any predetermined course.

To descend, the speed of the lifting-propellers is gradually increased and at the same time that of the driving propellers is gradually decreased, until the ship is wholly supported by said lifting-propellers and becomes stationary, at which time the speed of said lifting-propellers is slightly diminished for the purpose of causing the ship to descend to the earth.

Without limiting myself to the particular construction of parts shown and described herein, I claim—

1. An air-ship having a vertical central blade, C, and parallel vertical guide-blades D D', secured to the top of the hull on each side thereof, in combination with fixed inclined sections B B', propellers K, for propelling said inclined sections against the opposing atmosphere, and propellers K', for lifting the ship, substantially as set forth.

2. An air-ship provided with fixed inclined sections B B' and movable guide-flanges E', hinged to the lower surface of the outer edges of the inclined sections and operated substantially as described, in combination with means for propelling said inclined sections against

the opposing atmosphere, and a series of lifting-propellers, substantially as described.

3. An air-ship consisting of a hull, A, having top and bottom and sides extending in parallel planes, oppositely-converging ends, and outwardly-projecting fixed sections B B′, extending at an angle with the longitudinal axis of the ship, in combination with a series of lifting-propellers, substantially as described.

4. An air-ship consisting of a hull, A, having a longitudinally-extending blade, C, secured to the top thereof and forward part of the air-ship, outwardly-projecting sections B B′, secured permanently to and projecting beyond and at an angle to the longitudinal axis of said hull, and provided with a series of depending fixed flanges, E, and movable flanges E′, and means, substantially as described, for operating said movable flanges, in combination with a series of propellers mounted on vertical shafts and another series mounted on horizontal shafts, substantially as described.

5. An air-ship having fixed inclined sections, in combination with inclined sections composed of movable portions, and means, substantially as described, for propelling the same against the atmosphere and elevating the ship, substantially as described.

6. An air-ship having a hull, A, provided with outwardly-projecting permanently-fixed sections B B′, that extend at an angle to the longitudinal axis of the hull, in combination with sections G G′, provided with movable slats *g*, and a series of propellers for operating the ship, substantially as described.

7. An air-ship consisting of a hull, A, having oppositely-converging ends, a vertical guide-blade, C, secured to the top of said hull and the forward part of the air-ship, outwardly-projecting sections B B′, secured permanently to and extending beyond said hull at an inclination to its longitudinal axis, and having sections G G′, provided with movable slats *g*, in combination with propellers K, operating in the vertical plane to move the ship in a forward direction, and propellers K′, operating in the horizontal plane to move the ship in an upward direction, substantially as described.

8. An air-ship consisting of a hull, A, having outwardly-projecting inclined sections B B′, permanently secured thereto, in combination with sections G G′, consisting of a series of narrow strips, *g*, hinged together and capable of being folded together by means of outwardly-projecting longitudinally-moving rods I, operating within suitable supports, substantially as described.

9. An air-ship consisting of a hull, A, having fixed inclined sections B B′, secured thereto and projecting therefrom, said sections being provided with outwardly-projecting hollow supports H, in combination with sections G G′, consisting of narrow slats *g*, hinged together, rods I and springs *i*, arranged within the supports H and connected with the slats *g*, substantially as described.

10. An air-ship consisting of a hull, A, having oppositely-converging ends, vertical guide-blades C D D′, and outwardly-projecting sections B B′, provided with sections G G′, consisting of movable slats *g*, in combination with a series of propellers, K K′, and rudders F F′, substantially as described.

11. An air-ship having one or more lifting-propellers on each side of its longitudinal axis and each provided with an independent motor having means for controlling it, a pendulum suitably supported to swing in a plane transverse to the longitudinal axis of the ship, and connections between the pendulum and the means controlling the motors, substantially as described.

12. An air-ship provided with a series of parallel fixed flanges or corrugations extending longitudinally along the bottom of the same, a set of lifting-propellers, and an automatic regulator connected with said propellers for maintaining the equilibrium of the air-ship, substantially as described.

13. An air-ship provided with fixed inclined planes and means for propelling the same against the atmosphere, in combination with an automatic regulator for maintaining the equilibrium of the air-ship, substantially as described.

14. In an air ship, the combination of fixed inclined planes provided with movable portions and an automatic regulator for maintaining the equilibrium of the ship, substantially as described.

15. In an air-ship, the combination of one or more lifting-propellers, each provided with an independent motor having means for controlling the same, and a device moved by the force of gravitation connected with and operating the means for controlling the motors for the purpose of maintaining the equilibrium of the air-ship, substantially as described.

16. An air-ship having, in combination with the operating-propellers thereof, a pendulum, a support therefor, circuit-closers secured thereto and connected by suitable conductors with the motor for operating the propellers, substantially as described, for causing the inclination of the ship from its normal position to automatically transmit currents of electricity to said motor to counteract said inclination, as and for the purpose set forth.

17. An air-ship having, in combination with the operating-propellers thereof, a series of metallic plates, *p p′*, suitably supported and adapted, as described, to receive and transmit currents of electricity, circuit-closers, conductors, electric motors *v v′*, suspended rod or pendulum M, and lifting-propellers.

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

E. P. JOHNSTON.

Witnesses:
J. HARRY WILLS,
C. S. BUNDY.